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SECTION VARIA

IMPACT OF STRESS FACTORS ON CARDIOVASCULAR FUNCTIONAL STATUS

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ABSTRACT

Stress is one of the leading factors for the occurrence of Cardiovascular Diseases (CVD) and is treated by all levels of the healthcare system as a significant and serious mechanism for their development. The presence of numerous professional, psychological and social stressors in work activities reduces the body's adaptive capabilities and affects the cardiovascular functional state. The aim of our study was to determine the impact of stress factors related to work activity on the functional state of the Cardiovascular System (CVS). The functional state of the CVS was examined by Heart Rate Variability Analysis and Arterial Systolic and Diastolic Blood Pressure in 45 employees of the Bulgartabac Holding, and in a control group consisting of 43 individuals working in scientific institutes. Workload causes a significant decrease in the mean value of cardio intervals (X) when comparing employees from the Bulgartabac Holding with the control group of individuals. Workload does not change Frequency-Domain Index (FDI), Mental Stress and Health Risk. Prolonged exposure to mental workload could cause chronic stress impact on cardiovascular function. Chronic stress could cause functional disorders in cardiovascular control mechanisms. The study and control of cardiovascular regulatory mechanisms are of paramount importance for early diagnosis of somatic diseases triggered by stress and the impact of mental workload.

Key Words: Stress factors; Heart Rate Variability; Systolic and Diastolic Blood Pressure; Functional State

INTRODUCTION

The examination and registration of early deviations in the functional state is an important task of cardiovascular preventive medicine, as it facilitates and contributes to reducing the risk of CVD, Cerebrovascular Disease and mortality. The study of the functional state of the CVS with non-invasive functional diagnostic methods as Heart Rate Variability (HRV) analysis is a current topic of health prevention and a focus of medical research, since it is aimed at determining the impact of mental strain, psychosocial stress, the impact of environmental factors on cardiovascular function, as well as for assessing work-related health risk and performing CVD screening [1-4].

The work of the personnel working at Bulgartabac Holding is characterized by pronounced stress, mental workload, high concentration and distribution of attention when performing work activities, nervous and emotional tension, and high responsibility when performing work activities.

The aim of our study was to determine the impact of stress factors related to work activity on the functional state of the CVS.

MATERIAL AND METHODS

A study of HRV and Systolic and Diastolic Blood Pressure was conducted in 45 employees of the Bulgartabac Holding with an average age of 45.74±10.15 years (group I), and in a control group: 43 individuals working in scientific institutes with an average age of 45.39±10.93 years (group II).

1. A non-invasive functional diagnostic method was applied to study the functional state of the CVS: HRV Analysis [5, 6].

1. 1. Time- and frequency-domain based measures of HRV and HRV indices from the following functional tests were analyzed: cardiotachogram, histogram, scattergram, spectral analysis of HRV, Physical and Mental Stress, Health Risk.

1.1.1. Time-domain based measuress of HRV: mean value of cardiac intervals (X) (msec), resp. mean value of heart rate (b/min)

1.1.2. Frequency-domain based measures of HRV: Frequency-Domain based Index (FDI) (arb.un.)

1.1.3. HRV Indices: Health Risk (HR) (%), Mental stress (MS) (arb.un.).

2. Computerized method for detection of Supraventricular and Ventricular Extrasystoles.

The determination of the type of Supraventricular and Ventricular Extrasystoles was performed by applying a computerized method for detection of Supraventricular and Ventricular Extrasystoles in HRV recordings [5].

3. Examination of Systolic and Diastolic Blood Pressure.

Systolic (SBP) and diastolic (DBP) blood pressure were examined with a Riester sphygmomanometer.

4. Data Analysis.

HRV measures and indices, and SBP and DBP were calculated and presented as mean values±standard deviation. Differences between mean values of HRV measures and indices, and SBP and DBP between the experimental and control groups of subjects were calculated using the Student-Fisher t-test for independent variables.

RESULTS

The mean values of the time- and frequency-domain based measures and indices of HRV, heart rate, SBP and DBP in both groups of individuals are presented in Table 1.

Workload causes a significant decrease in the mean value of cardio intervals (X) when comparing employees from the Bulgartabac Holding (I Group) with the control group of individuals (II Group). Workload does not significantly change the FDI and the HRV indices: MS and HR when comparing employees from the Bulgartabac Holding with the control group of individuals (Table 1).

Table 1. Mean values (X±SD) and significance level (p) of the time- and frequency-domain based measures of HRV and the HRV indices, heart rate, SBP and DBP in the studied groups of individuals.

INDICES	I Group (X±SD)	II Group (X±SD)	P (I – II)
Age (yr)	45.74±10.15	45.39±10.93	ns
Heart rate (b/min)	79,41 ± 9,87	75,53 ± 9,56	ns
Systolic BP (mmHg)	134,62 ± 15,07	123,69 ± 14,64	ns
Diastolic BP (mmHg)	86,73 ± 12,31	79,67 ± 11,83	ns
X (msec)	734,83 ± 19,57	831,46 ± 19,61	0.01
FDI (arb.un.)	35,7 ± 2,17	31,73 ± 1,93	ns
MS (arb.un.)	-0,37 ± 0,31	-0,47± 0,53	ns
HR (%)	39,76 ± 7,69	31,81 ± 6,41	ns

We did not find a significant number of supraventricular and ventricular extrasystoles in studied groups.

DISCUSSION

Workload associated with the prolonged effect of stress factors related to work activity has a significant impact only on the mean value of the consecutive series of cardio intervals. Our results indicated that work load associated with the work process and work environment does not have a significant effect on the mean values of the FDI and HRV indices: MS, and HR, as well as on the mean values of arterial SBP and DBP and heart rate.

A characteristic trend in our country is the prolonged exposure to work-related stressors: professional, psychological and social. This pattern may cause a strong stressogenic effect on the cardiovascular functional state. Prolonged exposure to this stressogenic factor could induce functional deviations in autonomic cardiovascular control. An expression of this effect is the significant reduction in the variability of cardiac intervals - X.

In the case of individuals from the Bulgartabac Holding, we believe that it is advisable to periodically monitor autonomic cardiovascular control assessed with HRV, and blood pressure, since, without being statistically significant, a tendency towards an increase in the mean values of the indicated indicators is observed.

The results we have established have shown that screening for early dysfunctional deviations in autonomic cardiovascular control helps to register early deviations in the CVD status [7-9]. Timely detection of early forms of CVD helps to reduce the risk of CVD in individuals of working age.

CONCLUSION

Autonomic cardiovascular control studied non-invasively, through the indices of HRV, is applied in occupational medicine as a predictor for determining cardiovascular morbidity and mortality, as well as other diseases whose etiological factor is an imbalance of the Autonomic Nervous System (a result of exposure to factors of the work process). Screening of specific workplaces (in field studies) through HRV is applied to determine the impact of stress factors of the work process and environment on the

functional state of CVD, to register early forms of CVD and to assess whether individuals with CVD can continue their work activity [10-11].

For these reasons, early detection and prevention of CVD under stress is a current problem in our country, as it ensures not only the good health of workers, but also the performance of work activity, occupational safety and the organization of the work process.

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DIMENSIONS OF BURNOUT IN TEACHERS: ASSOCIATIONS WITH HEALTH COMPLAINTS DURING DISTANCE LEARNING

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ABSTRACT

Burnout among teachers is a global issue that compromises their health and reduces the quality of their teaching.

Purpose: This study aims to assess the relationships between the dimensions of burnout – emotional exhaustion, dehumanization, and work capacity – and the frequency of various health complaints among teachers during distance learning..

Methods: A cross-sectional study was conducted among 1077 teachers from the Bulgarian secondary education system between April 2024 and January 2025. The Maslach Burnout Inventory and a questionnaire for self-assessment of health status and work-environment risk factors were used.

Results: The findings indicate that nearly all the complaints analyzed are associated, to varying degrees, with heightened levels of emotional exhaustion and dehumanization. There is a particularly notable decline in work capacity among individuals experiencing back, arm, and leg pain, as well as those with hearing difficulties and respiratory impairments. Furthermore, the frequency of these health complaints significantly influences various aspects of burnout. This highlights the important need for targeted interventions to prevent burnout and provide adequate support for educators operating in distance-learning contexts.

Keywords: Burnout; Occupational stress; Health complaints; Teachers; Distance learning

INTRODUCTION

The teaching profession is among the most demanding in terms of psychosocial aspects, involving constant emotional interactions, high cognitive engagement, and demands for adaptability, which significantly increase the risk of professional burnout [12]. The COVID-19 pandemic has prompted a rapid and prolonged shift to distance learning, which has consequently heightened exposure to various stressors, altered workloads, and led to a notable rise in health-related concerns among educators. The literature from this period indicates a notable increase in musculoskeletal pain, specifically in the lower back [1, 5] and upper limbs [7]. Additionally, there has been a rise in the incidence of vocal disorders associated with intense vocal strain [11] and visual fatigue resulting from prolonged use of digital devices [4]. Furthermore, symptoms such as headaches and dizziness have become increasingly reported [3].

The empirical evidence demonstrates the complex effects of distance learning on the physical and mental health of educators. However, there is still a limited understanding of how these health challenges relate to the different dimensions of burnout experienced by teaching professionals. The present study seeks to address the existing gap by evaluating the dependencies among emotional exhaustion, dehumanization, work capacity, and the frequency of various health complaints reported by educators during the period of distance learning. This analytical approach establishes a critical foundation for identifying key vulnerability factors and for formulating targeted prevention and support strategies for teachers operating within a dynamically evolving educational environment.

Purpose: This study aims to assess the relationships between the dimensions of burnout – emotional exhaustion, dehumanization, work capacity – and the frequency of various health complaints in teachers during distance learning.

MATERIALS AND METHODS

From April 2024 to January 2025, a cross-sectional study was conducted involving 1,077 teachers within the Bulgarian secondary education system. Data were collected using the Maslach Burnout Inventory (MBI) and a questionnaire designed to assess health status and work-environment risk factors. The findings presented are part of a comprehensive research initiative focused on evaluating the health status of teachers participating in distance learning formats.

The Maslach Burnout Inventory (MBI) was successfully adapted and validated for the Bulgarian teaching population through a pilot study conducted by our research team [13]. The questionnaire comprises 22 statements, categorized into three key dimensions: emotional exhaustion, dehumanization, and work capacity. The responses are rated on a 7-point frequency scale (0 – "never" to 6 – "every day"). The resulting scores are summed to calculate indices for each dimension. The second questionnaire has five parts: demographic characteristics, assessment of the influence of work environment factors in both forms of teaching – distance and face-to-face, assessment of material security, data on chronic diseases, and includes 19 questions for each of the two forms of teaching, covering typical complaints and health problems related to the teaching profession. The responses are measured on a 5-point Likert scale, with (1) meaning "I have never had any complaints" and (5) "I have had complaints extremely often".

Statistical methods: In our analysis of burnout syndrome indices, we used the median as the measure due to non-normality, as confirmed by the Kolmogorov–Smirnov test. To examine the relationships between the derived burnout indices and the frequency of health issues, we utilized the Kruskal–Wallis test. Furthermore, we evaluated the direction of these relationships by analyzing the mean ranks of the indices based on self-reported frequencies of health complaints. We assessed the direction of the dependencies using the mean ranks of indices calculated from the self-assessment of the frequency of health complaints.

RESULTS

The average levels of Burnout indices vary considerably depending on the frequency of diverse health complaints among educators. The analysis is categorized according to indices of three primary dimensions: emotional exhaustion index (EI), dehumanization index (DI), and work capacity index (WI). For each dimension, the medians of the indices corresponding to the categories of all examined complaints are presented, along with the statistical significance of the identified dependencies..

Emotional exhaustion (EI)

The medians of the EI show a direct proportional increase with the frequency of all complaints. For eye strain, the median EI increases from 17 ("never") to 30 ("extremely often"), for neck and shoulder pain from 17 ("rarely") to 31 ("very often"), and for back pain from 19 ("rarely") to 31.5 ("very often"). Low back pain is associated with a median EI of 19 ("never") to 31 ("extremely often"), headache from 18 to 32, and hand and wrist pain from 13 to 34.5. Voice strain shows an increase in the median of the EI from 20 to 32; leg pain – from 20 to 32; hearing problems – from 21 to 30; and difficulty breathing due to dust – from 22 to 31. The analysis shows that across all studied complaints, a direct proportional relationship holds: as symptom frequency increases, the medians of the EI increase, indicating higher emotional exhaustion ($p < 0.0001$ for all health problems).

Dehumanization (DI)

The medians of DH also increase with the frequency of reported complaints. For instance, the median DI for eye strain increases from 1 ("never") to 3 ("often"). A similar trend is observed for neck and shoulder pain, as well as for back pain, where the median DI rises from 1 to 3. In cases of lower back pain, the median DI spans from 1.5 ("never") to 3 ("often"). The median DI for headaches increases from 1 to 2, while for arm and wrist pain, it ranges from 1 to 3. In cases of voice strain, the median DI increases from 2 to 3. With respect to leg pain, the median DI also elevates from 1 to 3; for hearing problems, it increases from 2 to 3; and for breathing difficulties due to dust exposure, the median reaches 6 ("extremely often"). This analysis indicates that as the frequency of each complaint increases, dehumanization increases significantly as well. Notably, the most pronounced relationship is observed regarding difficulty in breathing ($p < 0.0001$). At the same time, significant but more moderate effects are present for the other complaints ($p < 0.01$).complaints, the effect is significant but more moderate ($p < 0.01$).

Work capacity (WI)

The medians for Work capacity index (WI) showed diverse trends, with some instances demonstrating inverse relationships and others showing no significant relationships. Specifically, for eyestrain, the median WI values ranged from 38.5 for individuals who reported "never" experiencing this condition to 36 for those who reported "often." Similarly, for neck and shoulder pain, the median WI values decreased from 38.5 to 36, and for back pain, the median dropped from 38 to 35; however, these changes did not reach statistical significance ($p > 0.05$). Conversely, the relationship concerning low back pain was significant, with the median WI decreasing from 38 for "never" to 36 for "often" ($p < 0.05$). Headache scores ranged from 36 to 38, yet this relationship was not statistically significant ($p > 0.05$). Noteworthy findings included a reduction in hand and wrist pain, with median WI values declining from 39 to 37 ($p < 0.01$). Additionally, leg pain decreased from 38 to 35, that was also statistically significant ($p < 0.05$). For voice-overstrain, the median WI values ranged from 36 to 38, and no significant difference was observed. Significant associations were identified for hearing problems (from 38 to 35; $p < 0.05$) and breathing difficulties (from 38 to 35; $p < 0.01$). Collectively, these findings indicate a reduction in work capacity among educators who frequently report complaints, with the most significant impact noted for back pain, arm and leg pain, hearing impairments, and breathing difficulties. For other complaints, the relationships did not achieve statistical significance.

DISCUSSION

The present study demonstrates that the increased occurrence of health complaints in teachers during distance learning is associated with a significant increase in burnout levels, mainly emotional exhaustion and dehumanization. These results are consistent with international data, which indicate that burnout among teachers is associated with physical and somatic complaints such as headaches, voice problems, and reduced overall physical health [8]. Empirical evidence is provided for the most common health problems among teachers related to occupational exposure in face-to-face teaching: musculoskeletal disorders due to work-related stress and voice disorders resulting from vocal overload [9, 2]. Furthermore, a study conducted among Finnish teachers found that burnout mediates the effects of high job demands on poor health [6].

CONCLUSIONS

The present study shows a significant associations between the frequency of health complaints experienced by teachers during distance learning and different dimensions of burnout. Specifically, emotional exhaustion and dehumanization increase, along with symptoms of eye strain,

musculoskeletal pain, headache and dizziness. Conversely, work capacity is significantly reduced, combined with back, arm and leg pain, as well as hearing impairment and respiratory difficulties. These results highlight the detrimental impact of prolonged interaction with digital technologies on the mental and physical well-being of educators, with the additional stress of physical distance from their workplaces constituting a significant challenge in the teaching profession. Therefore, there is an urgent need for organizational interventions aimed at reducing workload, optimizing ergonomic conditions and promoting the mental well-being of teachers working in both hybrid and online educational environments.

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FALLS IN OLDER ADULTS – RISK FACTORS AND METHODS FOR PREVENTION

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ABSTRACT

Introduction: Falls are usually associated with muscle weakness, balance and vision deficits, cognitive decline, metabolic disturbances, and vestibular dysfunction. Their prevention relies on risk stratification, as outlined in the CDC's STEADI framework, and is most effective when multicomponent interventions are applied. Physiotherapy plays a central role, with structured exercise programs such as the Otago Exercise Program, Multi-system Physical Exercise, and Tai Chi shown to improve strength, balance, and confidence. Complementary approaches like vestibular rehabilitation and virtual reality training enhance sensory integration and adaptive responses, significantly reducing fall incidence and improving functional independence.
Purpose: To reveal the impact of physical therapy interventions on falls in older people.
Materials and Methods: A retrospective literature review on the topic was conducted. Analyses, summaries, and conclusions were drawn from the reviewed scientific publications and expert studies.
Results: Physical therapy provides significant improvement in muscle strength, balance and posture in older people. Its systemic application is associated with gait stabilization and reduced falls risk.
Conclusion: Early evaluation of older adults at elevated risk of falls facilitates the implementation of targeted exercise interventions and contributes to the prevention of falls and related adverse outcomes.

Key words: Falls, Prevention, Physical therapy, Older people

INTRODUCTION

Falls are a significant cause of morbidity in older adults. They are characterized with multifactorial etiology that includes age-related declines in muscle strength, balance, vision, cognition, and neuromuscular function. Moreover, a substantial proportion of patients present with conditions like osteosarcopenic obesity and vestibular dysfunction, which further impair both the mechanical and sensory components of postural control [1;2;3].

Prevention requires risk stratification (e.g., CDC STEADI) and tailored interventions ranging from education and physical activity promotion to comprehensive, multidisciplinary programs. Evidence indicates that multicomponent strategies integrating exercise, environmental modification, psychological support, vision care, and optimized medical management are most effective [4;5].

Physical therapy plays a central role, with structured programs combining strength, balance, aerobic, and functional training significantly improving mobility, postural control, and confidence. Evidence-based interventions such as the Otago Exercise Program, Multi-system Physical Exercise, Tai Chi, vestibular rehabilitation, and virtual reality–based training enhance gait stability, cognitive-motor integration, and functional independence, thereby reducing fall incidence in older adults [6;7;8;9;10].

MATERIALS AND METHODS

A retrospective literature review on the topic was conducted. Analyses, summaries, and conclusions were drawn from the reviewed scientific publications and expert studies.

RESULTS

Falls are a major public health concern, particularly among older adults. Over 25% of individuals aged ≥65 experience at least one fall annually, with incidence rising alongside age and frailty [11]. Falls are a leading cause of injury, disability, loss of independence, and mortality in this population, accounting for significant healthcare costs and reduced quality of life. Their etiology is multifactorial, involving both intrinsic factors - such as age-related physiological decline, visual deficits, gait and vestibular disturbances, muscle imbalance, and cognitive impairment—and extrinsic environmental hazards [12].

Gluteal muscle strength and neuromuscular control are essential for gait efficiency, pelvic stability, and postural alignment. Their decline is linked to slower gait speed, increased double-support time, and greater mediolateral sway. Gluteal tendinopathies, affecting the gluteus medius and minimus are characterized by excessive hip adduction, reduced contralateral pelvic rise, and altered pelvic mechanics—kinematic changes that further increase falls risk [13;14].

Neurological conditions may further contribute to muscle weakness. Lumbar spinal stenosis is often associated with significant gluteus medius atrophy, particularly in patients presenting with unilateral buttock pain [15]. Similarly, lumbosacral radiculopathy leads to impaired weight distribution, increased postural instability, and somatosensory disturbances—all factors that heighten fall risk [16].

Osteosarcopenic Obesity (OSO) is a multifactorial syndrome characterized by concurrent bone, muscle, and adipose tissue dysfunction. Predominantly driven by aging and hormonal alterations, it is highly prevalent among postmenopausal women. The elevated fallc risk in OSO patients arises due to the combined impact of its components on the stability of the musculoskeletal system [3;14].

Vestibular dysfunction accounts for over half of falls in older adults, as age-related degeneration of vestibular structures and reduced neural processing lead to dizziness, impaired spatial orientation, and compromised balance [17].

Falls prevention

From biomechanical perspective, falls are considered as two-step process: a disturbance of dynamic balance, followed by an inability to successfully restore that equilibrium [18].

To effectively manage and prevent falls, patients should be stratified into different risk categories. For this purpose the CDC (Centers for Disease Control and Prevention) designed the STEADI (Stopping Elderly Accidents, Deaths, and Injuries) algorithm. It follows a 3-step framework consisting of screening, assessment and management of the patient. According to it the patients are divided into low, intermediate and high risk groups [5].

Physiotherapeutic methods for falls prevention

Physical therapy is essential in preventing falls among older adults. Isolated interventions (e.g., stretching or education alone) show limited impact, whereas multicomponent strategies that include various combinations of physical exercises, home or environmental modifications, psychological support, education, vision management and proper medication and supplementation prescription consistently reduce the risk of falls [4].

Most kinesiotherapy interventions integrate muscle strengthening, balance, aerobic, and functional training components [19]. Strong evidence from a 2020 systematic review and meta-analysis indicates that structured exercise significantly enhances static and dynamic balance, postural control, and reduces both fear of falling and fall incidence in individuals aged ≥65 years [20]. Furthermore, gait adaptability training has been shown to decrease falls and fall-related fractures by 42% and 81%, respectively, in adults over 60 [21].

The Otago Exercise Program (OEP) and Multi-system Physical Exercise (MPE) are validated multicomponent interventions that improve gait stability, lower limb strength, postural control, cognitive function, and reduce fear of falling in older adults [6;10]. Moreover, Tai Chi has been

confirmed as an effective balance training modality, with benefits—including improvements in timed up-and-go, Berg Balance Scale, single-leg stance, and gait speed—enhanced by longer duration and higher frequency of practice [22].

Vestibular rehabilitation therapy (VRT) is a targeted intervention designed to improve gaze and postural stability, reduce vertigo, and enhance daily function [23]. It combines head–eye coordination, balance training, and integrated movements, alongside graded exposure to vertigo-inducing stimuli, promoting central compensation and functional recovery [24].

Virtual reality (VR) – based exercise uses immersive exergames to safely train balance, postural control, and dual-task performance. By providing task-specific, multisensory input, VR enhances coordination, gait, and dynamic balance. Evidence indicates that VR interventions improve postural stability and gait speed while reducing fall risk through enhanced cognitive–motor integration [25;26].

CONCLUSION

Falls in older adults result from a complex interplay of musculoskeletal weakness, sensory deficits, cognitive decline and metabolic disturbances. Effective prevention relies on risk assessment and tailored interventions, ranging from education and lifestyle modification to intensive programs for high-risk individuals. Physiotherapy, including multicomponent exercise programs, vestibular rehabilitation and virtual reality training, improves strength, balance, gait, and cognitive function. Together, these evidence-based strategies reduce fall incidence, prevent complications and help maintain functional independence in older adults.

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ADVANCEMENTS IN LASER THERAPY FOR PAIN CONTROL WITH CLINICAL INSIGHTS

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ABSTRACT
Laser therapy is widely used worldwide for pain management in patients with various chronic conditions. Recent developments have produced multiple modalities, including low-level, high-intensity, and multiwave locked system laser therapies, applied alone or in combination with other conservative treatments. Clinical evidence from systematic reviews, meta-analyses, and randomized trials demonstrates that laser therapy can significantly reduce pain, improve functional outcomes, and enhance quality of life across musculoskeletal, neuropathic, and postoperative conditions. The use of standardized reporting parameters enhances reproducibility and supports consistent clinical application. Overall, laser therapy represents a versatile, safe, and effective tool in modern pain management.
Keywords: laser therapy, pain, high-intensity laser therapy, low-level laser therapy, multiwave locked system

INTRODUCTION

Pain management in chronic musculoskeletal and neuropathic conditions remains challenging, and non-pharmacological approaches such as laser therapy have gained attention due to their efficacy and safety [1, 2]. Low-level laser therapy (LLLT) has been shown to reduce pain, stiffness, and improve function in fibromyalgia and osteoarthritis, particularly when combined with exercise [3, 4]. High-intensity laser therapy (HILT) demonstrates effectiveness in spinal radiculopathy, lumbar disc herniation, and knee osteoarthritis, decreasing pain and disability [5, 6]. Multiwave locked system (MLS) laser therapy, delivering synchronized multi-wavelength light, offers rapid pain relief and functional improvements in chronic low back pain, knee osteoarthritis, diabetic neuropathy, and post-surgical rehabilitation [7, 8, 9]. Standardized reporting of laser parameters is recommended to ensure reproducibility and scientific rigor [10]. Overall, laser therapy represents a safe and versatile tool for pain control with growing clinical evidence supporting its use. The **aim** of the present concise review article is to discuss the recent achievements of the foreign and Bulgarian authors in the rapidly advancing field of laser therapy.

Clinical effectiveness of low-level laser therapy

A narrative review of 14 meta-analyses and six controlled trials found that LLLT improved visual analogue scale (VAS) pain scores in patients with knee osteoarthritis, spinal, and cervical disorders [11]. A network meta-analysis of 13 Randomized Controlled Trials (RCTs) (673 patients) showed that LLLT using laser and/or LED at 904–905 nm was superior to sham therapy for knee osteoarthritis pain relief [12]. Similarly, a meta-analysis of 22 placebo-controlled RCTs (1,063 patients) reported significant pain reduction with LLLT both immediately and up to 12 weeks post-treatment, using 4–8 J at 785–860 nm or 1–3 J at 904 nm per site [13]. In a double-blind RCT of 47 patients, 808 nm LLLT led to greater gains in knee extensor strength than 660 nm or sham, while flexor strength and other functional measures improved across all groups [14].

For lumbar disc herniation, a systematic review and meta-analysis of five RCTs from 12 databases confirmed LLLT's efficacy and safety, showing significant reductions in leg pain and low back pain compared to placebo or sham therapy [6].

In diabetic foot ulcers, a randomized double-blind trial in Brazil evaluated continuous HeNe 660-nm, 20 mW LLLT at 4, 8, or 12 J/cm² twice weekly for 10 weeks, showing significant ulcer size reduction

over time ($p<0.0001$). Energy densities of 8–12 J/cm² led to 50% wound area reduction regardless of wavelength [15].
For diabetic peripheral neuropathy, 10.6-µm laser therapy thrice weekly for 12 sessions in 68 patients improved neuropathy and quality of life compared to sham therapy, with significantly lower Michigan Neuropathy Screening Instrument ($p<0.01$) and Diabetes-Specific Quality of Life scores ($p<0.001$) [16].
Low reactive-level laser therapy may provide small to moderate short-term relief in chronic neck and low back pain, slight functional improvement, and short-term improvement of pain and non-pain symptoms in fibromyalgia [2].

Clinical effectiveness of high-intensity laser therapy

A systematic review and meta-analysis of 18 RCTs up to July 1, 2025, including 1,095 patients with spinal radiculopathy, demonstrated that HILT significantly reduces pain intensity on the VAS, both alone and in combination with physical therapy, compared to placebo. HILT also decreases disability when applied alone, with physical therapy, or with exercise [5].
In a single-blind RCT in Amman, Jordan, 52 women with fibromyalgia were randomly assigned to two groups of 26 patients each. The intervention group received HILT plus a six-week exercise program (low-impact aerobics and stretching three times per week), while the control group performed the exercise program only [17]. Baseline scores for the Fibromyalgia Impact Questionnaire-Revised, VAS pain intensity, SF-36 quality of life, and pain pressure threshold were comparable. After six weeks, the HILT group showed statistically significant improvements across all measures ($p<0.001$).

Clinical applications of low- and high-intensity laser treatment

A systematic review and meta-analysis of ten studies up to December 31, 2019, evaluated low- and high-intensity laser therapy combined with rehabilitation exercises for knee osteoarthritis. LLLT plus exercise was used in six studies, HILT plus exercise in three, and both methods in one, all showing effectiveness in reducing pain, stiffness, and functional limitations [3].
A network meta-analysis of 139 RCTs including 9,644 knee osteoarthritis patients and 12 conservative treatments up to December 10, 2023, confirmed that both LLLT and HILT provide significant pain relief, with efficacy second only to hydrotherapy. LLLT additionally appears as a primary treatment option for various musculoskeletal pain conditions [18].
Standardized guidelines for reporting high- and low-level laser therapy in medical research have been proposed to enhance clarity, reproducibility, and scientific rigor [10]. Key parameters include wavelength, power density, energy, energy density, and beam characteristics. A structured checklist supports systematic documentation of treatment protocols, covering laser settings, irradiation, and therapy parameters.

Clinical applications of multiwave locked system laser therapy

A thorough analysis of scientific literature summarizes the clinical uses and results of MLS laser therapy, which delivers synchronized multi-wavelength light, across different pathological conditions, integrating current evidence on its therapeutic effects [7].
In a randomized double-blind trial in Ahvaz, Iran, 30 patients with chronic low back pain were assigned to receive either MLS therapy twice weekly (n=15) or exercise therapy (n=15). After six weeks, the MLS group showed a statistically significant reduction in total pain intensity measured by the VAS compared to the exercise group [8].
Another study compared MLS therapy with sham laser in 45 patients with chronic non-specific low back pain over eight sessions. Both groups experienced significant improvements in pain and disability immediately after treatment and at one-month follow-up. However, one month post-treatment, the MLS group reported significantly lower VAS pain scores than the sham group (2.2 ± 2 vs. 3.6 ± 2.4; $p<0.05$) [19].

A single-blind, randomized, placebo-controlled trial of 69 patients with diabetic sensorimotor neuropathy (41 receiving MLS laser therapy, 28 placebo) showed significant improvements across multiple measures [9, 20, 21]. After nine sessions over three weeks, the laser group exhibited a sustained increase in vibration sense at all sites up to day 90 ($p<0.05$), along with enhanced nerve conduction velocity and amplitude most notably in the sural nerve. Pain intensity (McGill questionnaire) decreased by 63.2% post-treatment and remained 56.1% lower at day 90 ($p<0.001$). Improved touch sensation on the 10-g monofilament test was also evident at days 21 and 90, correlating with sural nerve electrophysiological gains, confirming that MLS laser therapy effectively improves both sensory function and pain in diabetic neuropathy.

Recent applications of laser therapy combined with other treatment methods

In knee osteoarthritis, two groups of 19 patients each received either HILT with mechanical traction or HILT alone over ten sessions in two weeks, with the combined therapy group showing significantly greater VAS improvement [22]. Similarly, a one-year rehabilitation program following medial patellofemoral ligament reconstruction in 35 patients combined with MLS therapy led to significant pain reduction on the VAS [23].

A meta-analysis of nine RCTs involving 325 fibromyalgia patients found that LLLT, alone or combined with exercise, significantly improved Fibromyalgia Impact Questionnaire scores, pain, tender points, fatigue, stiffness, depression, and anxiety versus placebo [4].

In another study, 30 of 60 women with primary fibromyalgia received a 20-week rehabilitation program combining laser therapy and transcutaneous electrical nerve stimulation, leading to notable improvements in pain, fatigue, quality of life, and questionnaire scores [24].

In a single-center RCT in Uttar Pradesh, India, 40 patients with classical trigeminal neuralgia were treated either with carbamazepine alone or combined with 810 nm low-level diode laser therapy. The laser group achieved significantly greater pain reduction on the numerical rating scale after three weeks [25]. Finally, a double-blind RCT in 90 knee osteoarthritis patients comparing HILT and LLLT combined with exercise therapy showed significant VAS improvement in both groups at two and six weeks, with HILT producing significantly lower VAS scores at week six [26].

CONCLUSION

Laser therapy, including low-level, high-intensity, and multiwave locked system modalities, is a safe and effective approach for pain management across a wide range of chronic conditions. It consistently reduces pain, improves function, and enhances quality of life, especially when combined with rehabilitation or conservative treatments.

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THE IMPACT OF OBESITY ON SPINAL BIOMECHANICS AND THE DEVELOPMENT OF LUMBAR DISC DISEASE

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ABSTRACT

Introduction: Obesity is a complex multi-etiological disease characterized by excessive accumulation of adipose tissue. It represents a global issue, turning into an unprecedented epidemic. Lumbar disc disease is a socially significant problem that negatively affects the psychological and emotional state and motor activity of those affected. In recent years, an increasing number of studies have confirmed the impact of overweight and obesity as risk factors for the onset and development of lumbar disc disease. The mechanisms underlying this relationship are associated with mechanical loading of the spine, impaired biomechanics, and the activation of inflammatory processes in the discs.

Aim: To reveal the impact of obesity on spinal biomechanics and its role in the onset and development of lumbar disc disease.

Materials and methods: A retrospective literature review on the topic was conducted. Analyses, summaries, and conclusions were drawn from the reviewed scientific publications and expert studies.

Results: Obesity is a proven risk factor for the development of numerous diseases, including lumbar disc disease. A higher BMI is directly associated with the biomechanical loading and the degree of damage to the intervertebral discs.

Conclusion: Early prevention of obesity is crucial in reducing its negative mechanical and biochemical effects on the intervertebral discs.

Keywords: Obesity, Lumbar Disc Disease, Spinal Biomechanics, Proinflammatory Factors

INTRODUCTION

Obesity is a multifactorial disease marked by excessive fat accumulation, affecting over 650 million people globally [1,2]. It increases the risk of metabolic disorders, some types of cancer, type 2 diabetes, cardiovascular diseases, and mechanical complications such as osteoarthritis and sleep apnea. These conditions collectively lead to higher mortality rates and a significant reduction in both quality of life and life expectancy [3;4].

Low back pain (LBP) is a major global health problem and a leading contributor to disability, affecting individuals physical abilities, psychological well-being, and social participation [5]. Clinically, it manifests as local or radicular pain, increased paravertebral muscle tone, restricted mobility, weakness, and peripheral neurological symptoms. Disc degeneration progresses through dehydration, fissuring, neovascularization, and bony changes, eventually compromising annular integrity and potentially causing nucleus pulposus herniation under stress [6;7].

In recent years, numerous studies have demonstrated the influence of excess weight and obesity as risk factors for the development and progression of lumbar disc disease. The mechanisms underlying this relationship involve mechanical strain on the spine, altered biomechanics, and activation of inflammatory processes within the discs [8;9;10].

MATERIALS AND METHODS

A documentary method was used, consisting of a retrospective literature review on the topic. Analyses, summaries, and conclusions were drawn based on reviewed scientific publications and expert research.

RESULTS

For years, obesity was viewed as a purely mechanical risk factor for lumbar disc disease and low back pain [11;12]. However, the white adipose tissue as a metabolically active, secretes hormones, cytokines, growth factors, and matrix proteins that influence musculoskeletal health [13]. Modern methods allow precise assessment of body composition, including fat distribution, muscle mass, total body water, and bone mineral density, though BMI remains the most accessible measure (kg/m^2) [14]. Overweight and obesity associated with the accumulation of adipose tissue in the upper body induces biomechanical changes in the lumbosacral region, increasing load on the spine, which normally balances bodyweight support and mobility [15]. It has been established that individuals with a BMI >30 kg/m^2 experience higher stress on intervertebral discs compared to normal-weight individuals, contributing to reduced disc height, spinal stenosis, articular-ligamentous damage, and low back pain [16;17].

In abdominal obesity, visceral fat shifts the center of gravity forward, inducing compensatory lumbar hyperlordosis that asymmetrically compresses intervertebral discs, disrupts trophic support, and accelerates degeneration, increasing herniation risk [18]. Moreover CT and MRI studies reveal higher rates of facet joint degeneration which is the major cause of low back pain in hyperlordotic patients [19]. Elevated intra-abdominal pressure further compresses the spine, reducing disc blood supply and impairing regeneration [20;10].

In obese individuals, intervertebral disc load can reach 2.5 times body weight during daily activities and up to 5–6 times during lifting or sudden movements, markedly increasing lumbar disc disease risk. Conversely a 10% bodyweight reduction can lower spinal load by 25% [21]. Obesity limits spinal flexibility and affects everyday activities. Sedentary lifestyle is associated with weaker paravertebral muscles and a greater risk of lumbar disc disorders. Goniometric and gait analyses reveal restricted thoracic extension, lumbar flexion and extension, increased thoracic kyphosis, and altered thoracic flexion range, reflecting paravertebral muscle weakness and rigidity, which contribute to pain and functional limitations [22].

Recent research highlights the biochemical role of obesity in lumbar disc disease. Visceral fat–derived adipokines such as leptin, resistin, and adiponectin contribute to a chronic low-grade systemic inflammatory state, which accelerates intervertebral disc degeneration through multiple molecular pathways. [12]. Proinflammatory cytokines, including TNF-α, IL-1β, IL-6, and CRP enhance catabolic signaling cascades, stimulating the expression of matrix metalloproteinases (MMPs) and aggrecanases (ADAMTS). The higher activity of these collagen-degrading enzymes is associated with reduced strength and load resistance of the discs. Leptin directly affects nucleus pulposus and annulus fibrosus cells by inducing oxidative stress, mitochondrial dysfunction, and premature senescence, thereby disrupting anabolic repair and promoting apoptosis and autophagy. [8;23].

Obesity also promotes pathological vascularization and neoinnervation of the normally avascular intervertebral disc through upregulation of vascular endothelial growth factor (VEGF) and nerve growth factor (NGF). These changes enhance nociceptor infiltration and hypersensitivity, linking metabolic inflammation to discogenic pain even in the absence of overt structural damage [24]. Type 2 diabetes mellitus (T2DM) often accompanying obesity is the cause of the accumulation of advanced glycation end-products (AGEs), altering extracellular matrix integrity, inducing oxidative stress, and activating receptor for AGE (RAGE)–mediated inflammatory cascades, collectively exacerbating disc cell apoptosis, senescence, and matrix degradation [25]. Excess mechanical loading from increased

body weight compounds these effects, establishing a self-perpetuating cycle of inflammation, structural stress, and biochemical degeneration that accelerates lumbar disc disease progression.

CONCLUSION

Obesity is a prevalent risk factor for numerous health conditions, often first manifesting as musculoskeletal problems. Early prevention and targeted patient education by specialists—orthopedists, physiatrists, and neurologists—are essential. Obesity contributes to lumbar disc disease through mechanical, biochemical, and pathokinesiological mechanisms, leading to pain, reduced mobility, and diminished quality of life, which further hinder weight reduction. Effective management requires a multidisciplinary approach involving medical specialists, psychologists, and dietitians, alongside public health initiatives, such as school-based campaigns promoting healthy nutrition, physical activity, and awareness of obesity's long-term consequences.

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WORK ENVIRONMENTAL FACTORS AND THEIR IMPACT ON BURNOUT INDICES AMONG TEACHERS DURING DISTANCE LEARNING

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ABSTRACT

The transition of teachers to remote teaching during the COVID-19 pandemic has generated new sources of stress related to adverse work environment factors. This shift has led to increased emotional and mental strain and the development of burnout.

Purpose: To analyze how workplace factors affect burnout syndrome in teachers during distance learning.

Methods: A cross-sectional study was conducted among 1077 secondary school teachers in Bulgaria, using an adapted version of the Maslach Burnout Inventory and a questionnaire on health status and risk factors.

Results: The emotional exhaustion index is reported at a moderate frequency among all surveyed teachers, while dehumanization levels remain low, and work capacity is rated as moderate. Notably, as the impact of various work environment factors – such as noise, dust, temperature, lighting, vocal strain, poor posture, computer use, and both mental and emotional stress – increases, a significant rise in the average ranks of emotional exhaustion is observed. Additionally, the dehumanization index is influenced by temperature, lighting, and standing posture, whereas work capacity is affected by noise, lighting, and vocal strain.

Keywords: Burnout; teachers; distance learning; work environment; Maslach Burnout Inventory (MBI)

INTRODUCTION

Teachers are particularly at risk of burnout, which is the result of chronic, poorly managed workplace stress. This condition often includes emotional exhaustion, depersonalization, and decreased professional effectiveness [16] and is directly related to mental and emotional strain [1]. The shift to distance learning has led to the generation of new sources of stress. Computer use is a major risk factor in the working environment of teachers, as prolonged screen time leads to visual and cognitive strain, which increases mental and physical strain [4, 9]. Inappropriate ergonomic practices in a home working environment (such as positioning screens at the wrong height, maintaining an incorrect head posture, having chairs set at improper heights, and neglecting regular breaks) can lead to a range of health issues. These may include joint problems, fatigue, diminished work capacity, visual disturbances, and an overall decline in quality of life. Additionally, some educators may encounter voice fatigue and increased stress as a consequence of these factors [3, 8, 15]. Home office workers typically prefer natural daylight for reading and writing [2], and they believe that insufficient lighting can heighten the risk of depressive symptoms, sleep disturbances, and decreased cognitive function [11].

Purpose: To analyze how work environment factors impact burnout syndrome in teachers during distance learning.

MATERIALS AND METHODS

A cross-sectional study was conducted involving 1077 teachers in the Bulgarian education system from April 2024 to January 2025. The study used an adapted Maslach Burnout Inventory and a questionnaire to evaluate teachers' health status and identify risk factors in their work environments. The results presented are part of a large-scale study focused on assessing the health conditions of teachers participating in distance learning.

Instrumentation: The adapted Maslach Burnout Inventory (MBI) [6] was validated for Bulgarian teachers through a pilot study by the research team [14]. The questionnaire contains 22 statements, distributed in three dimensions: emotional exhaustion (9 questions), dehumanization (5 questions), and work capacity (8 questions). The answers are assessed on a 7-point frequency scale (0 – "never" to 6 – "every day"). The points obtained are summed to calculate the indices for each dimension. The second questionnaire has five parts for: demographic characteristics, self-assessment of health, data on chronic diseases, assessment of material security and includes 11 questions each for assessing the influence of work environment factors in both forms of teaching – distance and face-to-face, the answers to which are measured on a five-point Likert scale, with (1) meaning it doesn't have impact and (5) it has a significant impact.

Statistical methods: To describe the distribution of work environment factors, we used relative proportions. For the burnout indices, we employed medians due to deviations from normality, as confirmed by the Kolmogorov-Smirnov test. We analyzed the relationships between the calculated burnout indices and work environment factors during distance learning using the Kruskal-Wallis test. The direction of these relationships was assessed by examining the index's mean ranks, based on how work environment factors impacted teachers.

RESULTS

The study population, consisting of Bulgarian teachers, exhibited moderate levels of emotional exhaustion and work capacity while displaying low levels of dehumanization. The findings indicated that the average emotional exhaustion index (EI) for all teachers studied was 24, the average dehumanization index (DI) was 2, and the average work capacity index (WI) was 37.

We classified the factors of the work environment in distance learning: the most significant is a computer work – 82.7%, followed by mental overstrain – 78%, sitting work posture – 75.3%, emotional overstrain – 72.5%, voice overstrain – 62.7%, insufficient natural lighting – 49.5%, standing posture – 42.7%, increased noise level – 41.8%, decreased temperature – 29%, increased temperature – 25.7% and increased dustiness – 24.5%.

Computer work is one of the main occupational risk factors in the work environment. A statistically significant directly proportional relationship was established between computer use and EI: with increasing time spent in front of the computer, the frequency of emotional exhaustion increases ($p < 0,0001$).

Mental strain during distance learning also had a significant effect on EI ($p < 0.0001$), with the average ranks showing a directly proportional relationship.

Sitting work posture and emotional strain significantly affected EI ($p < 0.0001$), as the dependencies are directly proportional.

We found that voice overstrain during distance learning has a statistically significant impact on EI ($p < 0.0001$) and WI ($p < 0.01$). As voice overstrain increases, the average EI rank increases. In WI, the highest ranks are observed for the answers "does not have an impact at all" and "has an extremely significant impact".

We have proved that insufficient natural lighting has a statistically significant impact on EI ($p < 0.0001$) and on DI and WI ($p < 0.05$). The relationships between insufficient natural lighting and the three dimensions are directly proportional.

Standing posture, non-specific to distance learning, significantly affects EI and DI ($p < 0.01$), with directly proportional dependencies for both dimensions

The results showed that increased noise levels significantly affect EI ($p < 0.01$) and WI ($p < 0.05$). As noise impact assessment increases, the average EI ranks increase. In the WI subscale, the highest ranks are observed for the answers “it has an impact”, “does not have an impact at all”, and “has a significant impact”.

We found that reduced temperature had a significant impact on EI and DI ($p < 0.0001$), stronger than the impact of increased temperature ($p < 0.01$), and the dependencies were directly proportional in both cases.

Increased dust significantly affects only EI ($p < 0.05$), with the highest average ranks observed for the responses "has a significant impact", "does not have an impact", and "neutral".

DISCUSSION

The results of our study confirm the links between adverse physical factors and the manifestation of burnout among pedagogical staff, as already described in the literature. In this sense, similarities are found with the systematic reviews of [7, 13], which represent the factors associated with an increased risk for MSDs and the psychosocial and physiological consequences of adverse factors. Participants in our study often reported discomfort from prolonged sitting, insufficient lighting, and visual strain. These observations overlap with the analysis of [5], which highlights the disadvantages of home-based work environments for online teaching. In addition, our data confirm the findings of [10, 2] that factors such as noise, extreme temperatures, and insufficient natural light have a significant impact on teachers’ mental well-being and musculoskeletal health. In contrast to the results of [12], which describe distinct manifestations of depersonalization and emotional exhaustion among teachers, our data do not support such trends. While our study found a statistically significant relationship between vocal strain and two burnout indices, [3] considered vocal fatigue as a secondary complaint in online teaching.

CONCLUSIONS

Against the background of existing significant occupational risk factors influencing the mental state in the studied population of Bulgarian teachers, moderate levels of emotional exhaustion and work capacity, and a low level of dehumanization were found, indicating relatively preserved mental resilience.

Computer work, mental and emotional overstrain, and sitting work posture are identified as significant factors that significantly increase the incidence of emotional exhaustion. Voice overstrain and insufficient lighting have a statistically significant impact on emotional exhaustion and work capacity, with insufficient lighting also being associated with dehumanization. Additional factors such as standing work posture, increased noise levels, extreme temperatures, and increased dustiness have a significant impact, with their effect on emotional exhaustion being directly proportional.

The results highlight the intricate interaction between workplace factors and burnout levels, emphasizing the necessity for targeted interventions to mitigate risk factors and enhance working conditions in distance learning environments. Improving the work environment, such as ensuring proper ergonomics, managing lighting, noise, and temperature, and preventing overexertion, can help reduce emotional exhaustion and enhance teachers' capacity to work effectively.

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STUDY WITH ANALYSIS OF SICKNESS ABSENCES IN RELATION TO OVERHEATING MICROCLIMATE CONDITIONS

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ABSTRACT

The glass industry is characterized by production processes taking place under a specific overheating microclimate and infrared radiation in the working environment, a prerequisite for increased heat stress on the health and working capacity of the staff. **Purpose:** The present study aims to investigate the interrelationships between the overheating microclimate, the characteristics of the labor process and sickness absence among workers in the glass industry. **Methods:** Documentary and statistical methods were applied to collect and process 1103 hospital lists issued to 657 workers. The indicators of temporary disability for the period 01.01.-31.12.2023 were used, compared with indicative-normative groups according to the Batiks-Lekarev statistical system. **Results**: A significant relationship was established between the unfavorable overheating microclimate and the very high "Frequency of work losses" (Kt) - 1,281.52 per 100 workers, as well as the high indicator for "Relative share of frequently and long-term sick people" - 11.92 and "Average duration of one case" - 17.45 days. The results of the study justify the need to implement targeted technical, organizational and medical measures to limit heat stress, optimize work and rest regimes and dynamic medical monitoring.

Keywords: Overheating microclimate, Glass industry, Sick absence, Temporary incapacity, Working conditions

INTRODUCTION

The overheating microclimate has a complex physiological effect, including disorders in thermoregulation, in the function of the cardiovascular system, exacerbation of musculoskeletal and other chronic diseases, and reduced work capacity.

The available scientific evidence confirms that prolonged exposure to an overheating microclimate (in furnaces more than 1200 °C), with medium-duty physical labor and limited opportunities for effective heat release, characteristic of glass production, are a prerequisite for significant levels of temporary disability [2,3,5].

In this context, temporary morbidity is seen as a sensitive epidemiological indicator of the impact of the working environment on staff health. [1]. Its analysis allows to identify the main risk factors related both to the production overheating microclimate and to the specifics of labor operations, labor organization and individual characteristics of workers. The integration of indicators of temporary incapacity and production characteristics of workplaces will contribute to a deeper understanding of the mechanisms by which heat stress affects the health and working capacity of workers.

PURPOSE

The present study includes an analysis with an assessment of the health status of workers in a glass factory on the territory of the Republic of Bulgaria, through morbidity with temporary disability for a one-year period, and a comparative analysis for the assessment of the leading nosological groups, critical organs and systems in workers, with the approaches of personalized medicine.

MATERIALS AND METHODS

Documentary and statistical methods have been applied to collect and process the necessary health information. The assessment of indicators of temporary disability is carried out by comparison with indicative-normative groups according to the Batiks-Lekarev statistical system, which refer to the period 01.01 – 31.12.2023. The frequency indicators of the alternative analysis were used, both per 100 workers - intensity and per 100 patients - extent. Mean magnitudes are subject to the variational analysis at a confidence interval of less than 5%. Sources of information are 1103 primary hospital sheets containing a comprehensive characteristic for each disease: type of hospital sheet, duration in calendar days, year and reason for issuance, ICD diagnoses 10.

RESULTS

The results obtained show the existence of a statistically significant association between exposure to an overheating microclimate and the incidence of temporary disability. The study included 1,656 workers from a glassware plant on the territory of R. Bulgaria. The analysis is based on the 2023 issue of a total of 1,103 hospital lists with 19,242 days of temporary incapacity for work issued to 657 workers.

According to the indicator "Incidence of cases", cases predominate in three groups of diseases, a total of 62.00%: diseases of the respiratory system with 34.00%, diseases of the bone-muscle system and connective tissue with 17.00% and diseases of the nervous system with 11.00% of all common cases.

In first place for 2023, according to the indicator "Severity of cases", are diseases of the musculoskeletal system, with a registered total of 3835 days of temporary incapacity or 20.00% of all labor losses days. In second place are diseases of the respiratory system with 2994 labor loss days, followed by a class of newly educated with 11.00% of all labor loss days. Diseases of the nervous system with 1961 days of temporary incapacity or 10.00% of all labor losses days are in fourth place, followed by class „Injuries, poisonings and some other consequences of the impact of external causes" with 1530 days or 8.00% of all labor losses days.

In general, the actual morbidity with temporary incapacity for work according to routine indicators (table 1 and 2) for the studied one-year period - 01.01. until 31.12.2023 is within the limits of:

Table 1. Intensity indicators: measured in units

Incidence rate per 100 employees (HR)	Frequency of lost days per 100 employees (Kt)	Medium duration of per case (K pr)

very low - up to 60 low (60-80) medium (80-100) high (100-120) very high (over 120)	very low - up to 600 low (600-800) medium (800-1000) high (1000-1200) very high (over 1200)	10 days (according to literature)

Table 2. Extensive (relative) indicators: measured in percentages

For frequent and long sick	**For the short-term /up to 3 days/**	**For the primary disability**
low - up to 3% medium - 3-6% high - over 6%	low - up to 40% medium - 40-60% high - over 60%	very low - up to 3 per 1000 low - 3-4 per 1000 medium - 4-5 per 1000 high - 5-6 per 1000 very high - over 6 per 1000

- Low for case frequency – 73.46 cases per 100
- Very high for labor loss rate (Kt) – 1,281.52 per 100 workers
- The average duration of a case is 17.45 days/case – above the average. The accepted guide value for the average duration of one case with HF - 10 days.
- Relative share of frequently and long-term patients – 11.92 - high indicator.
- Relative share of short-term temporary incapacity – 43.76 – average indicator.

DISCUSSION

The results obtained from the present study confirm the existence of a significant relationship between the conditions of an overheating microclimate and the indicators of sickness absence among workers in the glass industry, with data from similar studies in industries with intense heat load [7,8]

Data from ILO, EU-OSHA as well as national statistics from the EU show that in hot industries they have between 30–60% higher short-term morbidity than the industry average. Typical values in glassworks 11–18 days of absences per year/worker, highest values in furnace and moulding sections, most absences during the summer months. Absences due to heat stress in furnace industries are 37% higher than the average for the manufacturing sector. For the glass industry, health problems are cited in addition to heat stress, a high frequency of respiratory problems, cuts, burns, which are part of the

main causes of short-term sick absence. The results of a number of studies show a 30–40% higher short-term morbidity than the average in the glass industry due to heat stress and physical exertion [4,6,9]

CONCLUSIONS

The 2023 incidence of temporary incapacity shows very high indicators for "Severity" of diseases, for „Relative share of frequent and long-term patients", and for „The average duration of one case".

In the conditions of glass production, where heat load is an inevitable element of the production process, systematic monitoring and interpretation of data on sickness absence acquire particular importance both for the assessment of occupational risk and for the optimization of preventive measures.

The results of the analysis can serve as a basis for developing scientifically based recommendations aimed at minimizing risk and improving working conditions in the sector.

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MECHANISMS AND CLINICAL EFFECTS OF ACUPUNCTURE IN FIBROMYALGIA MANAGEMENT

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ABSTRACT:
Acupuncture (ACU) is increasingly acknowledged as an effective integrative therapy for pain management. In fibromyalgia (FM), a chronic condition marked by persistent pain and reduced quality of life (QoL), ACU offers a complementary approach that alleviates pain and related symptoms beyond conventional medication. The **aim** of this review is to summarize the current evidence on the clinical effectiveness of acupuncture-based interventions in patients with FM, comparing their outcomes with other conservative and complementary therapies. **Materials and Methods:** A documentary research approach was applied, integrating data from systematic reviews, meta-analyses, and clinical trials, sourced from diverse international and Chinese databases to ensure comprehensive global coverage. **Results:** Evidence shows that ACU effectively reduces pain, fatigue, depression, and anxiety, while improving sleep, physical function, and quality of life in FM patients. Electroacupuncture (EA) and laser acupuncture (LA) further modulate central pain pathways and enhance brain connectivity. Comparative studies indicate that ACU often outperforms conventional drug and physiotherapy treatments, and when combined with massage or vibration exercise, it leads to greater improvements in pain, balance, and well-being. Treatment response is linked to baseline pain intensity, tender point count, negative cognitive patterns, and temporal summation. Mechanistic research demonstrates that ACU regulates afferent pain pathways and activates descending inhibitory mechanisms through molecular targets such as ASIC3, Nav1.7, Nav1.8, and TRPV1. **Conclusion:** Current evidence supports ACU, EA, and LA as effective, safe, and sustainable interventions for managing FM symptoms. These therapies offer both peripheral and central analgesic effects and can serve as core or adjunctive treatments within integrative management strategies.
Keywords: fibromyalgia, acupuncture, electroacupuncture, laser acupuncture, integrative therapy

INTRODUCTION

ACU is a growing component of integrative health care. In the US, its use for pain management increased from 1.1% in 2002 to 2.2% in 2022 [1]. FM, a common condition marked by chronic pain and reduced quality of life, shows variable ACU utilization. A Korean study of 31,059 FM patients (2011–2018) reported a significant decline in ACU use, from 52.03% to 30.83%, alongside higher prescriptions of nonsteroidal anti-inflammatory drugs and serotonin–norepinephrine reuptake inhibitors, and a rise in internal medicine visits from 11.3% to 22% [2]. ACU alleviates pain and other FM symptoms [3], and the Hokushin-kai style is applied in early-phase treatment [4].

AIM

To present survey of the recent foreign literature is to summarize the current evidence on the clinical effectiveness of ACU-based interventions in patients with FM, comparing their outcomes with other conservative and complementary therapies.

MATERIALS AND METHODS

A documentary research methodology was used, drawing on multiple systematic reviews, meta-analyses, and clinical trials. Relevant studies were identified from a wide range of international and Chinese scientific databases, ensuring comprehensive coverage of both Western and Eastern research sources.

RESULTS

Clinical Effectiveness of Acupuncture in Fibromyalgia Patients

A growing body of evidence supports ACU as an effective therapy for FM. A scoping review covering studies published between 2005 and 2018, including randomized clinical trials and systematic reviews, demonstrated that ACU improves pain, QoL, range of motion, fatigue, depression, anxiety, and reduces medication use [5].

An umbrella review of 11 systematic reviews and meta-analyses involving 8,399 patients up to December 2023 confirmed significant benefits of ACU on pain, physical function, sleep quality, and fatigue [6]. Similarly, a network meta-analysis of 13 trials (715 patients) showed that both individualized and standardized ACU protocols produced notable pain relief and improved well-being, with sustained benefits observed at follow-up [7].

Further evidence from 24 randomized controlled trials, including 312 patients, found that both ACU and dry needling effectively reduced pain, stiffness, fatigue, anxiety, depression, and sleep disturbances, improving overall QoL in both the short and long term. When combined with other therapies, these approaches decreased adverse effects and treatment costs [8].

Mechanistic studies reveal that ACU alleviates FM symptoms by modulating afferent pain pathways and enhancing descending inhibitory mechanisms through molecular targets such as ASIC3, Nav1.7, Nav1.8, and TRPV1 [9].

Bibliometric analyses of 868 publications (2000–2021) and 280 publications (1990–2022) show a steady global increase in ACU research, with the USA and China as leading contributors. The most productive institutions include the University of Michigan and China Medical University, while major research topics focus on long-term efficacy, EA, and animal models [10,11].

Individual randomized trials have provided additional insights. A Spanish study involving 96 patients demonstrated that dry needling of the infraspinatus muscle significantly improved pressure pain thresholds compared to sham and control groups [12]. A randomized controlled trial conducted in Ann Arbor, Michigan, with 65 participants found that baseline pain thresholds influenced analgesic response differently in real versus sham ACU, indicating the importance of individual pain profiles [13].

A prospective study in Turkey involving 51 female FM patients revealed that real ACU significantly increased antioxidant levels and improved pain, depression, and QoL compared to sham treatment [14].

Furthermore, a randomized crossover study in Beijing with 38 patients sensitive to cold found that warm ACU significantly reduced cold sensitivity, pain, and overall symptom distress with minimal adverse effects [15].

Clinical Effectiveness of Electroacupuncture and Laser Acupuncture in Fibromyalgia Patients

Electroacupuncture, a modern form of ACU using electrical stimulation, has shown promise in enhancing therapeutic outcomes in FM [16].

A pilot randomized trial in Alfenas-MG, Brazil, involving 18 patients, evaluated systemic EA combined with auricular ACU. While no significant change was found in pain scores, significant improvements were observed in the total Fibromyalgia Impact Questionnaire (FIQ) score, as well as in pain and anxiety domains [17].

Another pilot study assessed LA at Ryodoraku points in 20 patients aged 40–78 years. The treatment group demonstrated significant reductions in pain, symptom severity, and overall FM impact compared with a control group attending educational lectures [18].

Functional MRI studies in 76 patients indicated that EA with somatosensory input reduced pain severity and enhanced primary somatosensory network connectivity, suggesting central nervous system modulation as a mechanism of effect [16].

A single-center, sham-controlled trial in USA, with 76 patients found that EA significantly reduced clinical and nociplastic pain. Baseline temporal summation predicted analgesic response, highlighting its potential role in guiding treatment [19].

A non-randomized trial in Japan in seven drug-resistant FM patients showed that combined EA and electroscalp ACU significantly decreased VAS pain scores and improved QoL measured by the Japanese FIQ [20].

Comparison Between Acupuncture and Other Conservative Methods in Fibromyalgia Patients

A systematic review and network meta-analysis of 41 studies including 2,877 FM patients examined 19 complementary and alternative medicine (CAM) interventions [21]. External CAM therapies were generally more effective than conventional treatments, particularly for pain relief and mental health. According to SUCRA rankings, the most effective interventions were ACU combined with massage for pain, umbilical ACU for reducing tender points, EA for improving sleep, and abdominal ACU for alleviating depression and enhancing mental well-being. All treatments were safe and well-tolerated.

An analysis of ten systematic reviews comparing ACU with pharmacotherapy, physiotherapy, and placebo found a mean benefit of ACU in pain (–1.30 cm), functional status (–10.18 points), depression (–6.28 points), and fatigue (–0.18) [22]. Predictive factors for poor response included tender point count, pain magnification, VAS pain scores, and catastrophizing and helplessness subscales [23].

A network meta-analysis of 23 trials with 1,409 patients showed that ACU provided the greatest improvement in QoL and significantly reduced pain and depression compared with sham or placebo [24]. Cochrane reviews also confirm patient-reported improvements in pain with non-pharmacological treatments, including ACU [25].

A literature review of 57 studies up to March 2023 supports ACU as a core therapy for FM, showing significant reductions in pain and fatigue and improvements in sleep quality, mood, and overall well-being [26].

A randomized pilot study in Saudi Arabia with 86 patients found that combining vibration exercise with ACU improved pain, balance, and overall well-being more than ACU alone, although both interventions were effective [27].

CONCLUSION

Current evidence supports ACU, EA, and LA as effective, safe, and sustainable interventions for managing fibromyalgia symptoms. These therapies offer both peripheral and central analgesic effects and can serve as core or adjunctive treatments within integrative management strategies.

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CHRONIC DISEASE AS A STATE OF DISTRIBUTED RESPONSIBILITY IN THE DIGITAL SOCIETY: A CONCEPTUAL MODEL FOR HEALTH CARE OF THE AGING POPULATION

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ABSTRACT

Purpose: The increasing prevalence of chronic diseases in aging populations, combined with the growing digital traceability of health states, challenges traditional care-oriented models in health systems. The purpose of this study is to propose a novel conceptual framework that interprets chronic disease not merely as a clinical condition, but as a state of distributed responsibility among health systems, health care professionals, and patients within the context of digital society. **Material/Methods**: The study is based on a conceptual and theoretical analysis of contemporary literature on chronic disease management, digital health, accountability in health systems, and ethics of care. A comparative analytical approach was applied to examine the limitations of classical chronic care models and to synthesize a new responsibility-based framework adapted to digitally mediated health care environments. **Results**: A conceptual model of chronic disease as a state of continuous, distributed, and conditional responsibility is proposed. The model defines three interdependent responsibility domains: institutional responsibility of the health system, professional responsibility of health care providers for continuity and interpretation of health data, and shared responsibility of patients based on access to information and capacity for participation. Digital traceability is identified as a key factor transforming care from episodic intervention into accountable longitudinal management. **Conclusions**: In the digital society, chronic disease requires a shift from care-centered approaches toward responsibility-based models of health care organization. The proposed framework offers a theoretical basis for rethinking chronic care policies, professional roles, and patient participation, particularly in aging populations, and provides directions for future empirical research and health system reforms.

Keywords: chronic disease, accountability, digital health, healthcare models, aging population

INTRODUCTION

Population aging and the increasing prevalence of chronic non-communicable diseases represent a major challenge for contemporary health systems. Chronic conditions dominate the health status of older populations and require long-term management rather than episodic medical intervention. Under these conditions, health care systems are increasingly confronted with the need to ensure continuity, coordination, and accountability of care over extended periods of time.

The rapid expansion of digital health technologies has reshaped the management of chronic disease. Electronic health records, disease registries, telemonitoring, and predictive digital tools enable continuous observation of health states and early identification of risks. As a result, chronic disease is no longer confined to discrete clinical encounters but becomes a longitudinally traceable condition. This transformation raises normative questions regarding responsibility and accountability that are insufficiently addressed in traditional care-oriented models.

Existing chronic care frameworks primarily focus on service organization, multidisciplinary collaboration, and patient education. While valuable, these approaches often leave responsibility implicit, particularly in situations where health risks are known and digitally documented. In digitally mediated environments, the absence of timely action cannot be explained solely by lack of information or access but must be examined in relation to responsibility allocation.

Aim of the study: To develop a conceptual model that reconceptualizes chronic disease as a state of distributed responsibility in the context of digital society.

Tasks of the study:

- To conceptualize chronic disease as a long-term, traceable condition requiring continuous responsibility.
- To analyze the impact of digital traceability on accountability in chronic disease management.
- To propose a responsibility-based theoretical model applicable to aging populations.

MATERIALS AND METHODS

The study is based on a conceptual and theoretical analysis of contemporary literature on chronic disease management, digital health, accountability in health systems, and ethics of care. Peer-reviewed articles, monographs, and international policy documents were identified through searches in PubMed, Scopus, and Web of Science. The analysis applied a comparative and synthetic approach, examining how responsibility is addressed in classical chronic care models and how digital traceability modifies accountability relationships. The outcome of the analysis is the development of an original conceptual model defining chronic disease as a state of continuous and distributed responsibility.

RESULTS

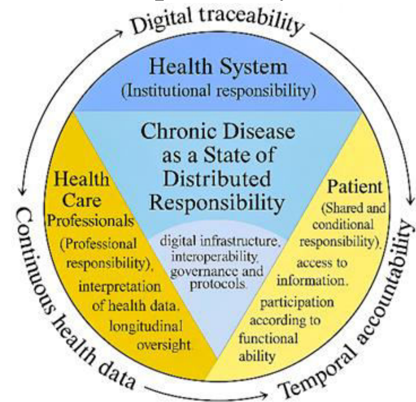
Chronic disease in the context of digital traceability. The conceptual analysis demonstrates that in digitally mediated health care environments chronic disease can no longer be adequately understood as a condition managed through episodic clinical encounters. Continuous health data generation and digital traceability transform chronic disease into a longitudinally observable state, characterized by predictability of risk and the possibility for timely intervention. In this setting, the absence of action cannot be attributed solely to information gaps but must be examined in relation to responsibility allocation.

Definition of chronic disease as a state of distributed responsibility. Based on the analysis, chronic disease is defined as follows:

In the digital society, chronic disease represents a state of continuous, distributed, and conditional responsibility among the health system, health care professionals, and the patient, determined by access to health information and capacity for action. This definition shifts the analytical focus from care provision toward accountability and establishes responsibility as the central organizing principle of chronic disease management.

Triadic model of distributed responsibility. The figure illustrates chronic disease as a longitudinal state of shared accountability among the health system, health care professionals, and the patient. Responsibility is distributed according to access to health information and capacity for timely action, with digital traceability enabling continuous oversight and accountability.

Figure 1. Model of distributed responsibility in chronic disease management



Institutional responsibility of the health system. Health systems bear structural responsibility for ensuring digital infrastructure, interoperability of information systems, and clear protocols for response to identified health risks. Without such structures, responsibility cannot be meaningfully distributed or operationalized.

Professional responsibility of health care providers. Health care professionals involved in long-term follow-up hold functional responsibility for interpreting health data, recognizing clinically relevant changes, and initiating appropriate responses. In digitally traceable environments, professional responsibility extends beyond direct clinical encounters to include longitudinal oversight of chronic disease trajectories.

Shared responsibility of the patient. Patients assume shared responsibility based on access to information, health literacy, and capacity for participation. Digital tools enable self-monitoring and engagement; however, patient responsibility remains conditional and cannot replace institutional or professional obligations, particularly in aging populations.

Digital traceability as a mechanism of accountability. Digital traceability reduces uncertainty and limits unobserved periods in chronic disease progression. Therefore, responsibility becomes temporally anchored and attributable, redefining the boundaries between acceptable delay, justified inaction, and omission within chronic disease management.

DISCUSSION

The proposed conceptual model reframes chronic disease management by shifting the analytical focus from care delivery to responsibility allocation in digitally mediated health care environments. Unlike traditional chronic care frameworks, which emphasize coordination and patient education within a service-oriented paradigm, this model explicitly addresses accountability as a central organizing principle shaped by continuous health data availability.

Digital traceability fundamentally alters normative expectations in chronic disease management. When health risks are known, predictable, and documented, the absence of timely intervention cannot be explained solely by structural barriers or patient behavior. Instead, it necessitates examination of how responsibility is distributed among institutions, health care professionals, and patients. In this context, digital technologies function not as solutions per se, but as mechanisms that expose gaps in accountability.

The model also brings into focus the evolving role of health care professionals in chronic disease management. Beyond episodic clinical tasks, professionals assume responsibility for longitudinal oversight, interpretation of health data, and coordination of care processes over time. This expanded role is particularly relevant for aging populations with multimorbidity, where fragmented care poses significant risks.

Patient responsibility is conceptualized as shared and conditional, reflecting variations in health literacy, functional capacity, and access to digital tools. This approach avoids the ethical pitfall of shifting systemic responsibility onto individuals, particularly older patients, and balances accountability in realistic capacities for participation.

The primary limitation of this study lies in its conceptual nature. The proposed model requires empirical validation across diverse health system contexts to assess its applicability, feasibility, and impact on care outcomes.

CONCLUSIONS

In the digital society, chronic disease management necessitates a transition from care-centered models toward responsibility-based conceptual frameworks. Continuous health data availability transforms chronic disease into a longitudinally observable state in which responsibility can no longer remain implicit.

By defining chronic disease as a state of continuous, distributed, and conditional responsibility, the proposed model provides a theoretical basis for clarifying accountability among health systems, health care professionals, and patients. This framework contributes to contemporary debates on chronic care organization and digital health governance and offers directions for future empirical research focused on aging populations.

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IDENTIFICATION OF KEY DETERMINANTS INFLUENCING ATTITUDES TOWARD THE KETOGENIC DIET AMONG WORKERS AND STUDENTS IN BULGARIA

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ABSTRACT

Background: The ketogenic diet has attracted considerable scientific attention due to its potential health benefits. However, the understanding of knowledge and attitudes towards this dietary regimen remains insufficiently explored within the Bulgarian population, particularly among various social groups, such as workers and students.

Purpose: To identify the key determinants influencing attitudes towards the ketogenic diet among a Bulgarian population, including working people and students.

Methods: A cross-sectional survey was conducted among 341 Bulgarian citizens aged ≥18 and above, employed and students at the time of the study. Data were collected using an electronic version of a pre-validated instrument and its assessment protocol.

Results: The comparative analysis of the factors that have a statistically significant influence ($p < 0.05$) on attitudes towards the ketogenic diet in the two studied groups reveals distinct profiles of determinants. Among the employed, the significant predictors are gender, education, and following a ketogenic diet on a doctor's recommendation ($p < 0.05$). For students, the influence is exerted by age, employment status, and health status ($p < 0.05$). The reasons for following the ketogenic diet and the observed effects of it are significant determinants of attitudes in both groups ($p < 0.05$).

Conclusion: The present study highlights the need for targeted educational initiatives to raise awareness and support informed decision-making regarding dietary practices in the Bulgarian population.

Keywords: Ketogenic diet; perception; university students; knowledge and attitudes

INTRODUCTION

Various dietary strategies, including ketogenic diets (KDs), have attracted scientific attention due to their potential to improve metabolic parameters and induce remission of type 2 diabetes mellitus. Some meta-analyses have reported an association between the ketogenic diet and improvements in body weight, blood lipids, and glycemic parameters, thereby recommending it as effective. Unfortunately, meta-analyses on KDs may be subject to "confounding factors" and "methodological pitfalls" that may lead to erroneous conclusions [6,7].

Existing clinical trials on ketogenic diets have various limitations [4] and emphasize the need for further research focusing on long-term safety. As a result, some authors conclude that the arguments in favor of the ketogenic diet may be misleadingly strong, despite claims from other fields of medicine that this dietary approach may lead to harmful effects [7].

Consequently, the public and even professionals may not be able to apply their knowledge without potential adverse consequences [6]. Therefore, in the present study, we aimed to identify the key determinants influencing attitudes towards the ketogenic diet among both working and university students. Knowing the significant predictors is crucial, as these groups may play a key role in shaping public opinion. Therefore, identifying the determinants influencing attitudes towards the ketogenic diet provides valuable information for future research and health interventions in the context of KD.

Purpose: This study aims to identify the key determinants influencing perceptions towards the ketogenic diet among a Bulgarian population, including working people and students.

MATERIALS AND METHODS

A cross-sectional survey was conducted among 341 Bulgarian citizens aged ≥ 18 years, working (N=170) and students (N=171) at the time of the study.
The data from the study were collected using a questionnaire adapted from a previously validated instrument published in a dissertation entitled "Knowledge, Perception, and Use of the Ketogenic Diet in College Students at a Midwestern University" in May 2019 [3].
The survey includes 51 questions, divided into the following sections: demographics, general, knowledge, and perception. Ten questions measure the respondents' perception of the KD. The answers are based on a 5-point Likert scale, where response (1) means strongly disagree and response (5) means strongly agree.
The survey was implemented using Google Forms and distributed via email and social networks. Parametric (t-test and ANOVA) and nonparametric (Kruskal-Wallis and Mann-Whitney) tests were used to examine the relationships between attitudes towards KD and the studied factors among working people and students.
These findings constitute a segment of a comprehensive study that investigates the knowledge and perceptions surrounding the ketogenic diet among citizens of Bulgaria.

RESULTS

The data analysis shows that the study population demonstrates mostly moderate attitudes towards the ketogenic diet (KD). The proportion of respondents with high attitudes is less than 1%, and no respondents reported low attitudes, indicating an overall moderate attitude towards this diet.

Attitudes towards the ketogenic diet among working individuals

In the working group, several factors were identified that significantly influenced attitudes towards the regime. Men exhibited more positive attitudes compared to women (p=0.026). Additionally, individuals with less than a master's degree (specifically those with a secondary, bachelor's, or professional bachelor's degree) tended to have more favorable attitudes towards the regime (p=0.015). Previous experience with popular weight loss diets was associated with a more positive attitude toward KD (p=0.045). Significantly higher levels of attitudes were also found among respondents who were currently following a ketogenic diet (p=0.008), as well as among those who had started the regimen on a doctor's recommendation as part of a therapeutic approach (p=0.018). Participants who had achieved and maintained weight loss after following a KD also exhibited higher levels of attitudes (p=0.023).

Attitudes towards the ketogenic diet among students

Among students, age, employment status, health status, motives for starting KD, and its outcomes have a statistically significant influence on attitudes. The most favorable attitudes are observed in the age group from 26 to 35 years (p=0.004). Working students demonstrate higher levels of attitudes than non-working students (p=0.049).
Students who self-identified as having poor health also showed more positive attitudes towards the diet (p=0.016). Increased attitudes were found among participants who started the diet for personal experimentation or under the influence of a popular trend (p=0.038), as well as among those who achieved and maintained a beneficial effect on body weight (p=0.041).

Comparison between groups of students and workers

No statistically significant differences were found between the student group (N=171) and the worker group (N=170) in attitudes towards KD (p=1.00).

The comparison between working medical students and practicing medical professionals who are not students shows no statistically significant difference in their attitudes towards KD (p=0.133).
Additionally, no statistically significant difference was observed in the factor "currently following a course of study" between students and employees (p>0.05).

Comparison of factors influencing attitudes towards CP by respondent groups

Comparison of significant factors reveals different patterns of influence in the two groups.
Among employed individuals, significant predictors (p<0.05) included gender, education, prior dieting experience, current nutritional status, motivation for starting the regimen, and reported effect.
In students' age, employment, subjective health status, motives for following the KD, and its effect, significant influences are exerted (p < 0.05).
Common to both groups are the motives for starting the KD and the real effect of following it (p<0.05), which emphasizes the role of personal experience as a universal factor, regardless of age or professional status.

DISCUSSION

Our results show that moderate attitudes towards the ketogenic diet prevail among the Bulgarian working and student population; the share of respondents with “high” attitudes is below 1%, and “low” attitudes were practically not registered. These findings suggest relative caution and moderate interest in the diet. A similar moderate to average perception towards the KD has been documented in an extensive cross-sectional study among Arab adults: the authors report that most participants’ perceptions and knowledge about the KD are “moderate to good”, with only a fraction having a high degree of positive perceptions [1].
In the current sample, within the working group, male participants demonstrated significantly higher levels of positive attitudes towards KD (p = 0.026). This gender disparity is not uncommon; a cross-sectional study conducted among adults in Saudi Arabia revealed that men exhibited more favorable attitudes towards KD compared to their female counterparts [2]. These findings are consistent with a study from Hungary [6] and show partial alignment with the research conducted by [3].
One of the principal findings of our study indicates that personal experience, motivation to initiate the diet, and perceived outcomes (such as weight loss and maintenance) are positively correlated with more favorable perceptions toward ketogenic diets (KD). A comparable relationship was also observed in a study conducted by [1].
Among the student population, significant determinants of positive attitudes included age (specifically individuals aged 26–35 years), employment status, poor self-rated health, motivation (including experimentation with “fad” diets), and perceived effects of the diet. These findings suggest that, within younger age groups, motivational and psychological factors, along with subjective perceptions of health and results, are more influential than traditional demographic characteristics. A similar trend was evident among college students, where the primary motivation for adopting a ketogenic diet (KD) was weight loss [5].
In our overall comparison between students and employees, we found no significant differences in general attitudes or in the factor of "current adherence to the diet." This result indicates that individual motivations and experiences have a greater impact than professional or social status. This conclusion is further supported by a study that examined both students and academic staff, which found that awareness of the KD (presumably a specific diet) was low in both groups. Additionally, acceptance of the diet did not appear to be directly linked to education level or demographic profile [6].
In conclusion, our study contributes empirical data on attitudes towards dietary intake in a Bulgarian population. It shows that personal experience, motivation, and dietary outcomes play a key role in shaping a positive attitude. This conclusion is consistent with the international literature. It emphasizes

that, when designing interventions and recommendations on dietary intake, it is important to consider individual characteristics rather than rely solely on demographic predictors.

CONCLUSIONS

The findings of the empirical study demonstrate that attitudes toward the ketogenic diet among Bulgarians remain relatively low, despite its potential benefits. Both student and worker populations display similar average attitudes toward the diet; however, the analysis identifies distinct patterns of influence within each group. These results underscore the importance of implementing targeted initiatives to raise public awareness, grounded in scientific evidence and tailored to specific demographics.

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PHYSIOTHERAPY INTERVENTIONS FOR EFFECTIVE PAIN CONTROL IN FIBROMYALGIA

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ABSTRACT: Fibromyalgia (FM) is a chronic condition marked by widespread pain and fatigue. Its management remains challenging, with physiotherapy recognized as an effective non-pharmacological approach to improve pain, function, and quality of life. The **aim** of this review is to summarize the most recent scientific evidence regarding the efficacy of various physiotherapeutic and rehabilitative modalities in managing pain associated with FM. **Materials and Methods:** A documentary research approach was applied, involving a retrospective review of systematic reviews, meta-analyses, and randomized controlled trials, from recent years, identified through major international scientific databases, focused on the use of common non-pharmacological interventions for the management of FM-related pain. **Results:** Active physiotherapy interventions, especially exercise, are strongly linked to pain reduction in individuals with FM. Practices such as yoga, aerobic, resistance, and aquatic training yield moderate to substantial improvements, with yoga demonstrating the greatest clinical benefit. Safe and effective protocols include approximately 90 minutes of regular weekly physical activity and resistance training twice weekly over several weeks. Aquatic exercise offers the most significant short-term pain relief, whereas resistance training provides lasting long-term benefits. Other beneficial active approaches include Tai Chi, Qigong, Pilates, and virtual reality–based exercises. Among passive therapies, manual therapy, connective tissue massage, kinesiotaping, photobiomodulation, and transcutaneous electrical nerve stimulation (TENS) have shown considerable pain-reducing effects. Combining vibration exercise with needle therapy enhances outcomes compared to needle therapy alone. **Conclusion:** Current evidence supports physiotherapy and rehabilitation as effective for FM pain, with combined exercise and complementary approaches providing a safe, comprehensive means to improve function and quality of life.
Keywords: fibromyalgia, pain, physical therapy, exercises, TENS

INTRODUCTION
FM is a chronic condition of increasing socio-medical importance, marked by widespread pain and fatigue [1]. Effective management remains challenging, requiring individualized, multidisciplinary approaches [1]. Non-pharmacological strategies, particularly physiotherapy, have gained recognition for reducing symptoms, improving function, and enhancing long-term health and quality of life in patients with FM [2–6].

AIM
To summarize the most recent scientific evidence regarding the efficacy of various physiotherapeutic and rehabilitative modalities in managing pain associated with FM.

MATERIALS AND METHODS
A documentary research approach was used, involving a retrospective review of systematic reviews, meta-analyses, and randomized controlled trials (RCTs), from recent years, identified from major international scientific databases, focusing on non-pharmacological interventions for managing fibromyalgia-related pain.

RESULTS
A systematic review of 33 full-text studies published between January 1, 2010, and June 30, 2023, evaluated the effectiveness of active and passive physiotherapy interventions in the medium- and long-

term management of adult FM. The findings indicate that both types of treatment produce beneficial effects on fibromyalgia-related pain [1]. Active approaches include movement and body awareness therapies such as stretching, tai chi, yoga, and Pilates, as well as hydrotherapy, aerobic or physical exercise, and multidisciplinary interventions. Passive approaches comprise manual therapy, repetitive transcranial magnetic stimulation, hyperbaric oxygen therapy, vibration therapy, virtual reality therapy, TENS, and acupuncture.

A 2024 systematic review and meta-analysis of nine studies found that various exercise modalities modestly reduce pain in FM patients, with yoga showing the greatest clinical impact. Resistance training, combined aerobic-resistance exercise, aquatic therapy, and aerobic exercise alone also produced meaningful improvements, although only combined aerobic-resistance exercise reached statistical significance ($p = 0.046$) [2].

Additionally, analysis of 33 trials demonstrated that even a relatively small amount of aerobic exercise (≈50 minutes per week) significantly decreases pain, with optimal benefits observed at approximately 90 minutes per week [3].

A systematic review of 16 studies, published up to April 2021, assessed resistance training for pain management in women with FM [4]. Performing resistance exercises twice weekly at 40–80% of one-repetition maximum for 4–24 weeks was found to be a safe and effective non-pharmacological approach for pain reduction.

A systematic review and network meta-analysis of 51 RCTs involving 2,873 patients, evaluated the effectiveness of therapeutic exercises on pain intensity in women with FM, [5]. The analysis found that aquatic exercise provided the greatest short-term pain relief, while resistance training yielded the most significant long-term benefits. Overall, multiple exercise modalities, including aerobic, functional, Pilates, dance, and virtual reality–based programs, demonstrated improvements in pain and functional outcomes, highlighting the importance of tailored exercise interventions in FM management.

The effects of the home-based physical exercise interventions on FM patient's pain and the characteristics of the protocols used are analyzed within a systematic review of seven randomized clinical trials [6]. The aerobic exercise is the most common treatment modality and pain improvement is established.

A systematic review and meta-analysis of 22 RCTs with 1,722 adults (18–60 years) with FM, published up to October 2022, found aquatic therapy to be an effective adjunct for pain management [7]. Interventions lasted 11–20 weeks, with short-term (<8 weeks) improvements in Fibromyalgia Impact Questionnaire scores and superior mid-term VAS pain outcomes in 11 trials involving 671 participants compared with controls.

A study conducted in Turkey, compared connective tissue massage and kinesiotaping in 34 fibromyalgia patients [8]. Both interventionsq massage three times weekly and kinesiotaping twice weekly for four weeksq significantly reduced pain (VAS) and improved pain characteristics (McGill Pain Questionnaire; $p<0.05$) with large effect sizes, but no differences were observed between groups ($p>0.05$).

A triple-blind, RCT in Málaga, Spain, investigated whole-body photobiomodulation versus placebo in 42 women with FM [9]. Participants received treatment three times per week for four weeks, with follow-up up to six months. Significant pain reduction was observed post-treatment and sustained at two weeks and six months, while pain-related negative thoughts improved only at the six-month follow-up.

A single-blind, randomized controlled trial in A Coruña, Spain (February–March 2016), compared aquatic and land-based therapy for pain reduction in 40 women with fibromyalgia (mean age 50 ± 9 years; median symptom duration 11 years) [10]. Participants completed 60-minute sessions three times

weekly for 12 weeks. After six weeks of follow-up, the aquatic therapy group showed significantly greater improvements in pain intensity and sleep quality than the land-based group.
A 2023 observational study in Spain with 53 women with FM (aged 33–69) found that a six-week telerehabilitation program (two 45-min sessions/week) improved pressure pain thresholds and conditioned pain modulation, with significant pain reduction only in the intervention group [11].
A pilot RCT in Alkharj, Saudi Arabia, examined the effects of combining vibration exercise with needle therapy versus needle therapy alone in 86 patients with fibromyalgia aged 60–67 years [12]. Over 12 weeks, the combined group received vibration training twice weekly and acupuncture once weekly, while controls received only acupuncture. Both groups showed significant pain reduction, with superior outcomes in the combined therapy group.
A pilot RCT in Bari, Italy (2018–2021) tested a 12-week supervised home-based multicomponent exercise program in 34 women with FM (mean age 51.5 ± 11.88). Participants were assigned to the multicomponent program or a control group performing general aerobic exercises. Both groups showed significant improvements in pain-related disability (Brief Pain Inventory Pain subscore) [13].
A RCT in São Paulo, Brazil, with 82 women with fibromyalgia, showed that a 14-week functional exercise program (45 min, twice weekly) significantly reduced pain compared to a flexibility program ($p = 0.002$) [14].
A Turkish study evaluated the effects of combining clinical Pilates with connective tissue massage on pain in women with FM [15]. Fifteen participants received the combined therapy and 17 performed Pilates alone, three times weekly for six weeks. The combined group showed a significant reduction in painful regions ($p = 0.007$) and achieved better outcomes than the Pilates-only group ($p = 0.023$).
A retrospective cohort study from Fort Worth, USA, analyzed 64 FM patients (mean age 51.2 ± 11.8 years; 58 women, 6 men) from a national pain registry between 2019 and 2023 [16]. Treatments included exercise, spinal manipulation, massage, cognitive behavioral therapy, yoga, and acupuncture. The mean pain intensity was 6.6, with a significant reduction in pain interference over 12 months. Evidence from multiple studies supports the potential of TENS and related multisite electrical stimulation devices in reducing pain in FM, although outcomes vary depending on dosing, device type, and patient response. Meta-analyses indicate that TENS can significantly reduce pain intensity, particularly when applied as a standalone therapy, with optimal results observed with higher session numbers (ten or more), high or mixed frequency, and high-intensity stimulation [17,18]. In a large RCT in Iowa City, USA, active TENS did not significantly alter pressure pain thresholds or conditioned pain modulation compared with placebo or no treatment; however, participants who experienced clinically meaningful improvements in movement-evoked pain (≥30% reduction) showed significant increases in pressure pain thresholds [19]. More recently, a crossover, double-blind, randomized sham-controlled trial evaluated the Exopulse Mollii Suitq a multisite electrical stimulation device, in 33 patients with FM (mean age 51.33 ± 8.99 years) [20]. Pain measured by the VAS was significantly reduced following active treatment (pre-active: 6.9 ± 1.4; post-active: 5.9 ± 1.8) compared with the sham condition (pre-sham: 6.8 ± 1.4; post-sham: 6.6 ± 1.5).

CONCLUSION

Current scientific evidence supports the effectiveness of physiotherapy and rehabilitation interventions in managing pain associated with fibromyalgia. The integration of various physical exercises and complementary methods offers a comprehensive, safe, and evidence-based approach that enhances functional capacity and quality of life in affected patients.

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BULGARIAN ADAPTATION AND PSYCHOMETRIC EVALUATION OF THE NURSING CLINICAL REASONING SCALE (NCRS)

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ABSTRACT

Introduction. Clinical reasoning is a key nursing competence essential for safe and effective care, yet no standardized tools exist in Bulgaria. **Aim.** To adapt and validate the Nursing Clinical Reasoning Scale (NCRS)(Liou et al., 2016) for Bulgarian nursing students and professionals. **Methods.** Following international and validation standards (Beaton et al., 2000; WHO, 2016), the process included forward-backward translation, expert review, and cognitive interviews. A total of 368 participants were surveyed; 67 completed a two- week test–retest. Psychometric evaluation included EFA, CFA, reliability (α, ω), test–retest, and criterion validity against the Clinical Competence Questionnaire-Bulgarian version (CCQ-BG). **Result.** The NCRS-Bg showed excellent internal consistency (α = 0.973; ω consistent), a one-factor structure expaining 72.9% of variance, and good model fit (CFI=0.95; RMSEA=0.06). Test–retest reliability (r=0.89, p<0.001) and criterion validity (r=0.516, p<0.001) were confirmed. **Conclusion.** NCRS-Bg is a reliable, valid, and culturally appropriate tool for evaluating clinical reasoning in bulgarian nursing education and practice.

Keywords: clinical reasoning, nursing education, psychometric validation, reliability, validity

INTRODUCTION

Clinical reasoning is a core nursing competence that integrates knowledge, experience, and reflection to guide decision-making in complex and dynamic healthcare environments (Higgs & Jones, 2008; 2024). It involves the cognitive and metacognitive processes that enable nurses to interpret clinical situations, evaluate options, and take appropriate actions that ensure safe and effective care (Cervero, 1988; Harris, 1993). As patient safety and quality standards continue to rise, nurses are expected to demonsrate high levels of professional judgment, ethical sensitivity, and adaptability across various contexts- hospital, community, and home care (WHO, 2018; Miteva, 2010; Bacheva & Stoyanova, 2023; Obreykova, 2023). The literature describes two complementary perspectives on clinical reasoning:cognitive models, which emphasize hypothesis testing, pattern recognition, and knowledge integration (Barrows & Feltovich, 1987; Elstein et al., 1978; Schmidt et al., 1990; Boshuizen & Schmidt, 1992); and interactive models, which focus on contextual, ethical, and collaborative reasoning in the clinical team and with patients (Mattingly & Fleming, 1994; Edwards et al., 1998; Barnitt & Pertridge, 1997). This duality reflects the real-world practice in which nurses reason both *in action* and *on action* (Schön, 1983; Bleakley et al., 2003).

Errors in reasoning often stem from cognitive biases, limited reflection, or poor communication and teamwork, which can negatively affect patient outcomes (McGinnis et al., 2010; Almutairi et al., 2015;

Repo et al., 2017). Therefore, developing and assessing clinical reasoning skills among nursing students and professionals is a priority in nursing education and quality management (Stoyanova, 2007; Stoyanova & Peneva, 2014). However, in Bulgaria, no standardized tool currently exist to measure this competence objectively.

To address this gap, the present study aimed to translate, culturally adapt, and psychometrically validate the Nursing Clinical Reasoning Scale (NCRS) (Liou et al., 2016) for the Bulgarian context (*NCRS-Bg*). The adaptation process was aligned with the Unified State Requirements for nursing education and Ordinance No. 1/08.02.2011. ensuring conceptual equivalence and cultural relevance. The validated Bulgarian version provides a reliable and valid instrument for assessing and developing clinical reasoning in both educational and clinical settings, contributing to improved decision-making competence and higher quality of nursing care.

METHODS

A methodological design was applied to translate, culturally adapt, and validate the NCRS. The process included forward-backward translation, expert panel review, and cognitive interviews with nursing students to ensure clarity and equivalence. Adjustments reflected Bulgarian clinical training contexts (Shift work, teamwork, diverse units).

A total of 368 participants were involved- 63 in the pilot and 305 in the main phase. The final sample (n = 238; 82% students, 18% professionals; age 18- 53, 97.5% women) exceeded factor-analysis standards (KMO = 0.94; Bartlett's $p<0.001$). Participation was voluntary and anonymous. Data confidentiality was ensured, and completion of the survey implied informed consent in accordance with the Declaration of Helsinki (2013).

Psychometric evaluation included internal consistency (Cronbach's α, McDonald's ω**), exploratory and confirmatory factor analyses (EFA, CFA),** test–retest reliability, and criterion validity versus the CCQ-Bg. Analyses used SPSS v.23.0 and AMOS v.23.0 ($p<0.05$).

RESULTS

The psychometric evaluation of the bulgarian version of the Nursing Clinical Reasoning scale (NCRS-Bg) demonstrated excellent reliability, validity, and structural consistency.

Internal consistency. **The NCRS-Bg showed exceptionally high internal reliability, with a Cronba**ch's α = 0.973 and a consistent McDonald's ω, confirming that all items measure the same underlying construct- clinical reasoning.

Factor structure. Exploratory Factor Analysis (EFA) indicated excellent sampling adequacy (KMO = 0.94; Bartlett's test: $p<0.001$) and revealed a clear single-factor structure explaining 72.9% of the total variance. Confirmatory Factor Analysis (CFA) further validated this unidimensional model, demonstrating satisfactory fit indices ($\chi^2/df = 2.34$, CFI = 0.95, TLI = 0.94, RMSEA = 0.06, SRMR = 0.04). These results confirm the conceptual coherence of the instrument and its alignment with findings from international adaptations.

Test–retest reliability. Temporal stability was confirmed in a two-week retest with a subsample of 67 participants ($r = 0.89$, $p < 0.001$), indicating that the scale consistently measures a stable construct over time.

Criterion validity. The NCRS-Bg correlated positively and significantly with the validated Bulgarian version of the Clinical Competence Questionnaire (CCQ-Bg). The overall NCRS-Bg score ($r = 0.516$, $p < 0.01$), as well as with its subscales ($r = 0.515$- 0.538, $p < 0.01$). These findings confirm that the NCRS-Bg captures dimensions of clinical reasoning closely linked to practical competence and professional performance.

Overall, the Bulgarian version of scale demonstrated robust psychometric properties, confirming its reliability, validity, and suitability for assessing clinical reasoning among nursing students and practitioners in both educational and clinical context (Table 1).

Table 1. Summary of psychometric indices for the NCRS-Bg

Psychometric Indicator	Value	Interpretation
Cronbach's α	0.973	Excellent internal consistency
McDonald's ω	0.97	Consistent reliability
KMO (sampling adequacy)	0.94	Excellent
Bartlett's test	$p < 0.001$	Significant factorability
Explained variance (EFA)	72.9%	Unidimensional structure
χ^2/df	2.34	Acceptable fit
CFI / TLI	0.95 / 0.94	Good fit
RMSEA / SRMR	0.06 / 0.04	Good fit
Test–retest (r)	0.89	High temporal stability
Criterion validity (r with CCQ-Bg)	0.516**	Significant positive correlation
($p < 0.01$)		

DISCUSSION

The Bulgarian version of the Nursing Clinical Reasoning Scale (NCRS-Bg) demonstrated robust psychometric performance, aligning with international studies (Liou et al., 2016; Gözüm et al., 2016) Its unidimensional factor structure and high internal consistency confirm that the instrument reliably measures a coherent construct of clinical reasoning. These findings support its applicability in both educational and clinical environments, providing an evidence-based approach for assessing reasoning competence among nursing students and professionals.

The significant correlation with the Clinical Competence Questionnaire (CCQ-Bg) supports the theoretical link between reasoning and professional competence. By integrating NCRS-Bb into nursing curricula and workplace evaluation, educators can systematically identify learning need and track professional growth, thereby contributing to modernizing nursing education and ensuring alignment with European quality standards.

CONCLUSION

The NCRS-Bg is a reliable and valid instrument for assessing clinical reasoning among Bulgarian nursing students and professionsls. It provides an objective measure of a core nursing competence, supporting curriculum development, professional evaluation, and quality improvement in nursing careq and facilitating international comparability in nursing research .

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JOB ANALYSIS OF HEALTHCARE PERSONNEL

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ABSTRACT:

Job analysis is a method that defines the basic work operations, and studies the impact of physical, cognitive and psychological demands of work, automated systems and the work environment on functional status. Determining the relationship with health status and occupational safety demonstrates its functional role and importance. The aim of our study is to determine the functional role and significance of the occupational medicine method for analyzing work activity on the health status and safety at work of healthcare personnel working in a pulmonology department. Job analysis was conducted in the Pulmonology Department of the UMHAT "St. Ivan Rilski" EAD with 30 working physicians and nurses. We provide a comprehensive analysis of work activities in pulmonology departments, differentiating the roles and task profiles of physicians and nurses, and examining occupational risk factors that affect staff safety and well-being. Detailed job and work-activity analyses in pulmonology departments clarify role expectations for physicians and nurses and identify specific occupational risks. The analysis of work activity helps to identify intensively acting psychological and occupational risk factors in the workplace and determine the relationship with occupational health and safety.

Key Words: Job analysis; Health and Safety at Work; Pulmonology Department; Physicians; Nurses

INTRODUCTION

In the professional life cycle of an individual, the analysis of work activity is a dynamic process that is applied in practice to characterize each structure composed of the influence of the elements: work environment; job requirements; and the working individual (1-3). The analysis conducted helps to determine the exposure to basic psychological and occupational risk factors associated with the mental and physical demands on workers. Risk factors could generate changes in the functional state of the body and affect the physiological and mental health status of working individuals: Central Nervous System; visual and auditory analyzer; cardiovascular and respiratory systems; musculoskeletal system; mental activity; safety at work - accidents, incidents; social activity.

Job analysis shows that pulmonology departments provide a wide range of activities: outpatient clinics for chronic respiratory disease management, inpatient care for acute exacerbations, pulmonary function testing, interventional bronchoscopy, and pulmonary rehabilitation. Understanding the work activities of clinicians - physicians and nurses - is essential for workforce planning, competency-based training, patient safety, and occupational health. This manuscript draws on society training guidelines, systematic reviews, and recent empirical studies to outline task domains and occupational hazards in modern pulmonology practice.

The aim of our study is to determine the functional role and significance of the occupational medicine method: Job analysis on the health status and occupational safety of healthcare personnel working in a pulmonology department.

MATERIAL AND METHODS

Job analysis was carried out at UMHAT "St. Ivan Rilski" EAD in the Pulmonology Department with 30 working health professionals: physicians and nurses. Job analysis was performed and included: conducting an interview with the employer, heads of departments and workers - physicians and nurses; monitoring the work and performance of work tasks; measuring the frequency and duration of work tasks; requirements when performing the activity and tasks related to a change in body position; studying the conditions provided by the working environment for performing the activity; studying the psychosocial conditions at the workplace. In our work, we were guided by the principles defined in the methodology for Job analysis of the workplace [4].

RESULTS

1. Work activity of physicians

Pulmonologists provide diagnostic evaluation (history, physical examination, interpretation of imaging and pulmonary function tests), acute care (management of respiratory failure, ventilator adjustments), longitudinal care of chronic diseases (Chronic Obstructive Pulmonary Disease - COPD, asthma, interstitial lung disease), and lead multidisciplinary teams. Interventional pulmonologists perform bronchoscopy, endobronchial ultrasound (EBUS), transbronchial biopsies, airway stenting, and rigid bronchoscopy - procedures that require specialized training, sterile technique, and team coordination.

2. Work activity of nurses

Pulmonology nursing roles vary from outpatient clinic nurses and case managers to bronchoscopy-suite procedural nurses and specialist respiratory nurses. Core nursing activities include patient assessment, oxygen and inhalation therapy administration, preparation and monitoring during procedures (including sedation monitoring and recovery), device and equipment management (nebulizers, ventilators), patient education (inhaler technique, self-management), and participation in pulmonary rehabilitation programs.

3. Task Analysis: Typical Task Clusters

Clinical assessment and diagnostic decision-making; Procedural preparation, intra-procedural support, and post-procedural care; Respiratory therapy and ventilatory support; Infection prevention and equipment decontamination; Patient education and rehabilitation; Documentation, administrative duties, and multidisciplinary coordination.

4. Occupational Risk Factors

Pulmonology practice contains several categories of occupational hazards that affect both physicians and nurses: biological, ergonomic/physical, chemical/radiation, and psychosocial risks.

4.1. Biological Hazards: Aerosols, Infectious Agents, and Bronchoscopy

Bronchoscopy, airway suctioning, and noninvasive ventilation are associated with potential aerosol generation. Recent quantitative studies measuring bioaerosol concentrations during bronchoscopy demonstrate detectable bacterial and viral particles in procedure suites, underscoring the need for robust infection-control measures.

4.2. Ergonomic and Physical Risks

Procedural tasks (long cases, patient repositioning, repetitive fine-motor work during endoscopy) and manual handling (moving immobile patients) increase risks for musculoskeletal injury among nurses and physicians. Time-motion studies in procedural suites show prolonged standing, awkward postures, and forceful exertions during instrument handling - factors associated with back, neck, and upper-limb disorders. Ergonomic interventions (adjustable procedure tables, anti-fatigue mats, manual handling training, and use of transfer devices) reduce injury risk.

4.3. Chemical and Radiation Risks

Exposure to anesthetic gases and procedural disinfectants, as well as ionizing radiation during fluoroscopically guided bronchoscopies, represents occupational exposure hazards. Regular monitoring, scavenging systems, appropriate Personal Protective Equipment - PPE, and ALARA (as low as reasonably achievable) principles for radiation protection are recommended.

4.4. Psychosocial Risks and Burnout

High emotional demands, heavy workload, moral injury when caring for chronically ill patients, shift work, and work stressors substantially increase the risk of burnout among pulmonology clinicians. Prevalence of burnout symptoms was observed among respiratory physicians, nurses, and respiratory therapists, with organizational factors (workload, staffing, leadership support) playing key roles.

DISCUSSION

The emphasis in the work of healthcare staff in the Pulmonology Department is the neuro-psychological workload, as well as work related to a very high level of responsibility in most cases carried out in a short time. The stress at work is very high: life-saving manipulations are of short duration; surgical interventions are associated with a very high workload and responsibility, which is an indicator of the occurrence of burnout (5). Another significant emphasis in their work is permanent activity related to exposure to biological, chemical and ergonomic agents, which contributes to the induction of infectious and occupational diseases, and injuries to the musculoskeletal system (6-8).

CONCLUSION

Detailed job and work-activity analyses in pulmonology departments clarify role expectations for physicians and nurses and identify specific occupational risks. Applying mixed-method job analysis, adopting layered risk mitigation, and implementing organizational support systems are central to protecting staff and ensuring high-quality patient care.

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FACTORS INFLUENCING THE ASSESSMENT OF TEACHER RESOURCE PROVISION IN DISTANCE EDUCATION DURING THE COVID-19 PANDEMIC

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ABSTRACT

The COVID-19 pandemic has necessitated a swift transition to distance learning, compelling educators to rapidly acquire new digital, pedagogical, and technological competencies essential for effective engagement in an online educational environment.

Purpose: To explore the factors that influence the availability of resources for teachers during distance learning in the context of the COVID-19 pandemic, with particular emphasis on the effects of gender, age, and professional experience.

Methods: A national cross-sectional survey was conducted among 1077 teachers in Bulgaria's secondary education system. Resource availability was assessed using six indicators and a 5-point Likert scale. Pearson's Chi-Square (χ^2) and Linear-by-Linear Association (linear χ^2) were used.

Results: Most teachers assess the provision of resources for distance learning as high or very high across all the indicators studied. No significant gender differences were found in the provision of online classrooms, software, and hardware. However, in terms of training, retraining courses, and teaching materials, men more often give higher marks ($p < 0.05$). A linear relationship is observed by age: the proportion of "high" scores increases with age, while "very high" scores decreases ($p < 0.05$). A relationship has also been established with general and special work experience: more experienced teachers more often give high, but less often very high grades ($p < 0.05$).

Keywords: resource availability; digital resources; distance learning; teachers; COVID-19

INTRODUCTION

The results of a study by the Institute for Educational Research show high commitment and adaptability of teachers in emergencies, but also the need for systematic support – both through resource provision and through increasing digital and pedagogical competencies, in order to ensure a sustainable and equitable educational environment in distance learning [2].

Purpose: To explore the factors that influence the availability of resources for teachers during distance learning in the context of the COVID-19 pandemic, with particular emphasis on the effects of gender, age, and professional experience.

MATERIALS AND METHODS

A national cross-sectional survey was conducted among 1077 teachers in Bulgaria's secondary education system. Resource availability was assessed using six indicators and a 5-point Likert scale, with (1) meaning "very low availability" and (5) "very high availability".

To describe the assessment of resource availability, we use a relative proportion (absolute frequency). For comparisons by gender, we use the Pearson Chi-Square (χ^2), and to study dependencies, we use the Linear-by-Linear Association (linear χ^2).
These results are part of a larger study focused on educators in online teaching.

RESULTS

The analysis concentrates on responses from the positive end of the scale, as negative ratings account for a negligible proportion and fail to demonstrate statistically significant differences based on gender, age, or work experience.

Availability of online classrooms

The results show that 35.4% (381) of the teachers assessed the provision as high, and 34.1% (367) as very high. For 18.2% (196), it is both low and high (medium level of resource provision). Only 10.4% (113) share that they assess the provision of online classrooms during distance learning as low or very low.
The distribution by gender does not show a statistical difference (men: 40.9% - high assessment, 32.9% - very high; women: 35.6% and 34.7%, respectively; $p > 0.05$).
A linear dependence is observed between the scores on this indicator and the age of the teachers (linear $\chi^2 = 9.46$, $p = 0.002$): with increasing age, the proportion of teachers who gave a high score increases (from 32.5% in the group up to 35 years old - to 43.2% in those over 55 years old), while very high scores in these age groups decrease (from 45.3% to 27.4%).
The relationship with general and occupational work experience is also significant (linear $\chi^2 = 8.961$, $p = 0.003$; linear $\chi^2 = 7.398$, $p = 0.007$), and with experience the proportion of high grades increases (from 32.1% for over 25 years to 41.7% for up to 5 years of general work experience and from 34.1% to 38.8% for exceptional work experience).

Availability of software products

The results demonstrate: 38.6% (416) of the teachers assess the provision as high, and 29.0% (312) as very high. For 20.1% (217), the level of software provision is average, while 10.6% (114) give a low or very low assessment of the provision of software products during distance learning.
There are no statistically significant differences by gender ($p > 0.05$). However, men rate security slightly higher than women on this indicator (46.3% of male teachers and 38.4% of female teachers rate the provision as high or very high).
There is a linear significant dependence with age (linear $\chi^2 = 4.67$, $p = 0.031$). With increasing age, the relative proportion of teachers who rated their security as “high” increases (from 34.2% in the group up to 35 years of age, to 48.4% for those over 55 years of age), while with increasing age, the proportion of those who rated their security as very high decreases (from 38.5% for those under 35 years of age to 22.1% for those over 55 years of age).
A similar connection is observed with work experience – both general and occupational (linear $\chi^2 = 4.955$, $p = 0.026$; linear $\chi^2 = 4.022$, $p = 0.045$). With increasing experience, the probability of giving a “high” rating increases (from 35.3% for teachers with up to 5 years of general work experience, to 42.1% with over 25 years; respectively, from 34.6% of teachers with occupational work experience of 6-10 years, to 41.9% – those with over 25 years).

Hardware provision

The results demonstrate that 36.0% (388) of the teachers give a high rating for hardware provision, 32.1% (346) – very high, 16.7% (180) – average, and 13.0% (141) – low or very low rating.
No differences were found by gender and work experience ($p > 0.05$). Only the dependence on age was significant (linear $\chi^2 = 7.319$, $p = 0.007$): with increasing age, the proportion of very high scores decreased (from 37.6% among those under 35 to 26.2% among those over 55).

Providing training for online teaching
The majority of participants expressed a positive evaluation regarding the training provided for online teaching. Specifically, 36.5% (393) rated the training as high, while 23.3% (251) classified it as very high. Additionally, 21.3% (229) rated the training as medium, and 16.3% (175) indicated it as low or very low.
A statistically significant difference was observed between genders ($\chi^2 = 13.001$, $p = 0.011$). Specifically, 50% of men and 35.7% of women provided a high rating, while 16.2% of men and 24.9% of women gave a very high rating. Additionally, there was no dependence found with age or work experience ($p > 0.05$).

Provision of retraining courses
A total of 32.4% (349) of respondents assigned a high rating, while 19.0% (205) provided a very high rating. An average rating was given by 21.8% (235), and 23.9% (257) indicated either a low or very low rating. Analysis revealed a significant difference in ratings based on gender ($\chi^2 = 11.028$, $p = 0.026$): high ratings were assigned by 41.9% of male respondents compared to 32.1% of female respondents, and very high ratings were given by 10.8% of males and 20.8% of females. No significant association was observed with respect to age or work experience ($p > 0.05$).

Availability of learning materials
The results demonstrate that 33.1% (356) of the respondents assessed the provision of educational materials as high, 19.5% (210) – very high, 23.3% (251) – medium, and 21.6% (233) – low or very low.
The difference by gender is statistically significant ($\chi^2 = 10.649$, $p = 0.031$). The distribution shows that 44.6% of men rated security as high, and 12.8% rated it very high. Among women, the absolute frequencies are 32.2% with a high assessment and 21.1% with a very high assessment.
The analysis reveals a statistically significant dependence with age groups (linear $\chi^2 = 10.977$, $p = 0.001$). As age increases, the percentage of teachers who perceive the provision of this indicator as "very high" decreases. Specifically, 27.8% of educators aged 35 or younger report a "very high" level of provision, compared with only 16.6% of those aged 55 or older. This trend indicates that younger teachers are more inclined to rate the availability of teaching materials as "very high", whereas their older counterparts are less likely to do so.
The analysis by work experience (general and occupational) demonstrates a similar trend (respectively: linear $\chi^2 = 11.425$, $p = 0.001$; linear $\chi^2 = 9.328$, $p = 0.002$). With increasing general and occupational work experience, the proportion of teachers who assess the provision of teaching materials as "very high" decreases: from 28.6% for the group with general service up to 5 years to 16.2% for those with over 25 years, and, respectively, from 38.8% to 31% for occupational work experience in these groups.

DISCUSSION

Our research indicates that teachers' perceptions of resource availability in distance learning differ based on gender, age, and experience. Female teachers tend to rate their sense of provision higher,

whereas older and more experienced teachers provide more moderate ratings. Additionally, online classrooms and software products are perceived as the most readily available resources for schools' provision, while retraining courses and teaching materials are viewed as less readily available.
Our results are comparable to those of another Bulgarian study [1], which found that 42.2% of teachers need training to work effectively in a virtual classroom. This finding was also confirmed in a study by [3]. About 93% of respondents stated a need for training in applying innovative methods, 18.1% lacked skills in preparing presentations, 23.3% needed training in creating text and graphic materials, and 67.2% in preparing video and audio resources [1]. Data from the Institute for Educational Research show relatively good technical and material security during the pandemic: 91% of teachers had their own computer and a stable internet connection, and 68% of schools provided equipment for teachers [2]. These results are in line with our study. A national survey on schools' digital maturity shows that 80% use e-learning systems, 86% use videoconferencing tools, and 69% use training software [4].

CONCLUSIONS

Digital tools and online platforms play a crucial role in educational practices. The findings underscore the importance of implementing targeted strategies to enhance teachers' access to resources and foster their digital competencies. This approach should also consider the impact of demographic factors such as gender, age, and work experience.

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STUDENT SATISFACTION WITH SIMULATION-BASED LEARNING IN NURSING AND MIDWIFERY EDUCATION: FINDINGS FROM THE PROJECT “IMPLEMENTATION OF BEST PRACTICES IN SIMULATION TRAINING” (RP-A6/25), SOUTH-WEST UNIVERSITY “NEOFIT RILSKI”, BULGARIA

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ABSTRACT

Simulation-based learning (SBL) provides a safe and realistic environment for developing clinical competence in nursing and midwifery. Student satisfaction and self-efficacy are key indicators of its educational effectiveness. Aim: To assess student satisfaction and perceived self-efficacy related to simulation-based learning within the project “Implementation of Best Practices in Simulation Training” (RP-A6/25). Methods: A descriptive cross-sectional study among 90 students (78.9% nursing, 21.1% midwifery) at South-West University “Neofit Rilski” (2024/2025). An online questionnaire included the Simulation Experience Satisfaction Scale (SSE), Educational Effectiveness Scale (EES), and General Self-Efficacy Scale (GES)= Results: Satisfaction was high (74.4%; $M = 2.72 \pm 0.50$). “Debriefing and Reflection” scored highest ($M = 37.73 \pm 7.80$; $p < 0.001$). Self- Efficacy was also high ($M = 40.13 \pm 7.35$; $p = 0.057$). Conclusion: SBL is effective, motivating, and confidence-enhancing and its integration supports reasoning, skills, and professional readiness.

Keywords: simulation-based learning, nursing, midwifery, self-efficacy, educational effectiveness

INTRODUCTION

Simulation-based learning (SBL) has become a cornerstone of modern health professions education, enabling students to develop clinical, technical, and communication skills in a safe, structured, and interactive environment (Issenberg et al., 2005; McGaphie et al., 2010). It bridges the gap between theory and practice, fosters active, student-centered learning, and minimizes risks to patients (Gaba, 2004; Rosen, 2008). The pedagogical foundation of SBL is grounded in experiential and constructivist learning theories, which emphasize reflection, problem-solving, and teamwork (Kolb, 1984; Schön, 1983; Salas et al., 2005**).**

A substantial body of evidence demonstrated that simulation enhances student satisfaction, confidence, and self-efficacy- key predictors of clinical competence and professional readiness (Al-Elq, 2010; Ziv et al., 2003; Zendejas et al., 2013). Systematic reviews show that incorporating structured debriefing and reflection improves decision-making, critical thinking, and overall learning outcomes (Issenberg et al., 2005; McGaghie et al., 2011; Motola et al., 2013). These advantages are evident across all fidelity levels- from basic task trainers to high-fidelity mannequins and virtual reality simulations (Lateef, 2010; Okuda et al., 2009).

In nursing and midwifery education, SBL is particularly valuable for developing clinical reasoning, ethical decision-making, and teamwork (Jeffries, 2005; Cant & Cooper, 2017).It encourages engagement, strengthens confidence in real clinical contexts, and reduces anxiety during practice placements (Bacheva, 2018; Bacheva et al., 2022). These outcomes reflect competencies emphasized by European and World Health Organization (WHO, 2018) standards for healthcare education.

In Bulgaria, SBL has gained momentum through national initiatives to modernize nursing and midwifery curricula and align them with European directives (Bacheva, 2022; Obreykova, 2023; Bacheva, 2024). Local studies confirm its positive impact on skill development, stress reduction, and perceived readiness for clinical work (Bacheva & Stoyanova, 2023; Obreykova, 2023). Yet, systematic evaluation of student satisfaction and perceived self-efficacy within simulation-based education remains limited.

This study, conducted within the project "Implementation of Best Practices in Simulation Training" (RP-A6/25) at South-West University "Neofit Rilski", *seeks to assess nursing and midwifery students'* satisfaction and perceived self-efficacy in simulation-based learning. The project introduces and evaluates standardized simulation methodologies aligned with European and international best practices in healthcare education.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted in 2024/2025 within the project (RP-A6/25) at *South-West University "Neofit Rilski". The aim was to assess satisfaction and self-efficacy after participation in structured simulation-based sessions.*

The sample included 90 undergraduate students (71 nursing, 19 midwifery), aged 19- 55 years (M = 31.7). Simulation sessions used low-, medium-, and high-fidelity mannequins and standardized scenarios under trained instructors. Participation was voluntary, anonymous, and ethically compliant with the Declaration of Helsinki (2013). Data confidentiality was ensured, and participation implied informed consent. Data were collected through an online questionnaire (Google Forms) including: 1. Simulation Experience Satisfaction Scale (SSE; Debriefing&Reflection, Clinical Reasoning, Clinical Learning), the Educational Effectiveness Scale (EES), and the General Self-Efficacy Scale (GSE) *(Jerusalem & Schwarzer, 1995)- evaluating confidence in handling challenges. Instruments were adapted for Bulgarian use (Beaton et al., 2000; Bacheva, 2024). Analyses used descriptive and non-parametric tests (Kruskal–Wallis, Mann–Whitney U, Spearman rho) in* SPSS v.23.0, ($p < 0.05$).

RESULTS

The study involved 90 students (78.9% Nursing, 21.1% Midwifery), predominantly female (100%), aged 19- 55 years (M = 31.7). All participants completed simulation sessions using standardized clinical scenarios. Overall student satisfaction with simulation-based learning was high: 74.4% reported high satisfaction, 23.3% moderate, and only 2.2% low (M = 2.72±0.50). Mean domain scores were highest for "Debriefing and Reflection" (M = 37.73±7.80; $p < 0.001$ by year), followed by "Clinical Reasoning" (M = 20.69±4.68; $p = 0.032$) and "Clinical Learning" (M = 16.78±4.05; 0.067). Differences between academic years were significant ($p < 0.001$), with first- year students scoring highest- likely reflecting the novelty and motivational impact of simulation early in training **(**Table 1.**).**

Table 1. Key outcomes

Variable	Mean ± SD	Significant difference
Overall satisfaction	2.72 ± 0.50	$p = 0.006$ (by year)
Debriefing & Reflection	37.73 ± 7.80	$p < 0.001$
Clinical Reasoning	20.69 ± 4.68	$p = 0.032$
Clinical Learning	16.78 ± 4.05	$p = 0.067$

The mean GSE score was M = 40.13 ± 7.35, showing strong perceived confidence. Second- year students had the highest self-efficacy; third-years showed a slight decrease ($p = 0.057$). Correlation analysis revealed a weak negative link between study year and satisfaction ($\rho = - 0.193$, $p = 0.069$) and a strong positive association between satisfaction and self-efficacy ($\rho = 0.653$- 0.761, $p < 0.001$).

Findings align with prior evidence that structured debriefing, reflection, and engagement enhance satisfaction and competence (Jeffries, 2005; Cant & Cooper, 2017; Bacheva, 2022; Obreykova, 2023).

DISCUSSION AND CONCLUSION

This study confirmed high satisfaction and self-efficacy among nursing and midwifery students participating in simulation-based learning. The results mirror international evidence that SBL enhances confidence, clinical reasoning, and motivation (Issenberg et al., 2005; McGaghie et al., 2011).

Differences between study years reflect evolving expectations- firs- year students valued structured reflection, while senior students used simulation to consolidate skills and decision-making. Overall, SBL proves to be an effective and well-accepted educational strategy that builds competence, confidence, and teamwork.

Expanding high-fidelity simulation resources and integrating SBL across all study years will strengthen professional preparation and alignment with European standards in healthcare education.

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DIETARY HABITS AND ATTITUDES TOWARDS HEALTHY EATING OF INTERNATIONAL MEDICAL STUDENTS

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ABSTRACT
The purpose of this study was to assess the effect of family structure and BMI category on nutrition knowledge, awareness of healthy eating, and dietary practices among international medical students from countries neighboring Bulgaria. A total of 89 students of both sexes, the majority from Turkey and Greece, were enrolled in the study. Results from the self-administered questionnaire indicated that most students were aware of the principles of healthy eating and actively practiced them, with a higher proportion originating from nuclear families. Preparing food and eating at home were associated with healthier eating behaviors and a greater proportion of students maintaining a normal BMI. These findings suggest that family structure plays an important role in shaping healthier eating patterns and keeping healthy BMI. Moreover, BMI was found to correlate positively with higher levels of nutrition knowledge and healthier eating practices.
Key words: international students, nutrition knowledge, eating practice, family structure BMI

INTRODUCTION:
Individuals, including international students, who migrate to a country with distinct cultural and traditional norms often experience behavioral adjustments and stress related to adaptation. One important aspect of this process is dietary acculturation, defined as the adoption of the host country's dietary patterns by individuals relocating for various purposes. [1] The period of tertiary education abroad represents a significant transitional phase during which unhealthy modifications in diet and lifestyle may occur. Exposure to a new food environment in the host country often leads to partial adoption of the local food culture, although some aspects of the original dietary patterns may persist. [2] Adapting to new eating patterns successfully depends on factors like the similarity or difference between home and local food traditions, individual preferences, and external factors such as finances and cultural norms. [3] Childhood eating habits strongly influence students' later dietary behaviors. Regular family meals, frequent home cooking, and consistent breakfast and dinner routines during childhood foster sustainable eating patterns that often persist after migration to another country. [4] It is generally expected that medical students demonstrate a higher level of knowledge and awareness regarding healthy lifestyles and dietary practices. [5] To date, the knowledge and attitudes toward healthy eating among international medical students in Bulgaria have not been investigated.
Aim: This study aimed to assess the knowledge and attitudes toward healthy eating among international medical students in their third and fourth years of study, with particular attention to the influence of their family background and current anthropometric status.
Material and methods: A cross-sectional survey was conducted between September and October 2024 among 89 international medical students (41 males and 48 females). The majority of them come from nuclear families (73%) with a middle income (77.5%), and only few are from a single parents and low income families family (6.8%, 3.4%). Data were collected using a structured, anonymous, self-administered questionnaire specifically designed and pre-tested for this study. The questionnaire comprised 25 items divided into two sections. The first section gathered demographic information, while the second assessed students' attitudes toward food, nutrition, and dietary practices. For the present analysis, seven questions were selected to evaluate students' knowledge, awareness, and habits

related to healthy eating. The majority of participants were from Greece (48.3%) and Turkey (40.4%), both neighboring countries of Bulgaria. The study objectives were explained to all interns, and written informed consent was obtained prior to participation. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 21.0 (IBM Corp., Armonk, NY, USA). Results are presented as frequencies and percentages for categorical variables. Comparisons between proportions were performed using the N-1 chi-squared test (MedCalc Software, Ostend, Belgium). A p-value <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

The majority of students (73%) were from nuclear families, whereas a smaller proportion belonged to extended or single-parent families. The structure of the family appeared to exert a significant influence on students' comprehension of healthy eating practices and their perception of its relevance to overall health and well-being. (Table 1).

Table 1. Dietary habits and attitudes toward healthy eating among international medical students, stratified by family structure

Questions/Answers		Nuclear family	Extended family	Single parent family	P< 0.05
What is "healthy eating"?	Nourishing and tasty food	6 (66.7%)	1 (11.1%)	2 (22.2%)	0.3330
	Well balanced and varied food intake	51 (74%)	15(21.7%)*	3 (4.3%)	0.0003
	Traditional food	8 (72.7%)	2 (18.2%)	1 (9.1%)	0.1783
Is healthy eating important for You?	Yes	55 (72.4%)	17(22.4%)*	4 (5.2%)	0.0003
	No	3 (100%)	0 (0%)	0 (0%)	-
	I don`t care	7 (70%)	1 (10%)	2 (20%)	0.2321
How would You assess Your eating habits?	Healthy	20 (83.3%)	3 (12.5%)*	1 (4.2%)	0.0107
	Almost healthy	43 (70.5%)	13(21.3%)*	5 (8.2%)	0.0017
	Unhealthy	2 (50%)	2 (50%)	0 (0%)	1
Do You prefer cooking at home or eating out?	At home	53 (78%)	12 (17.6%)*	3 (4.4%)	0.0001
	Eating out	12 (57.1%)	6 (28.6%)	3 (14.3%)	0.2674
Do You prefer your traditional dishes?	Yes	49 (70%)	17(24.3%)*	4 (5.7%)	0.0011
	No	4 (66,7%)	0	2 (33,3%)	-
	No preferences	12 (92.3%)	1 (7.6%)*	0	0.0252
Where do You usually eat?	At home	54 (74%)	15(20.5%)*	4 (5.5%)	0.0002
	At school	1 (50%)	1 (50%)	0	1
	Outside home	10 (71.4%)	2 (14.3%)	2 (14.3%)	0.1462
Where do You usually buy food?	At food market	14 (21.5%)	3 (16.7%)	1 (16.7%)	0.8565
	Small family shops nearby	7 (10,8%)	2 (11,1%)	0	0.9910
	Supermarkets	44 (67.7%)	13 (72.2%)	5 (83.3%)	0.7605

*A statistically significant difference between students from nuclear families and those from extended families ($p < 0.05$)

Among students from nuclear families, two-thirds demonstrated an accurate understanding of the concept of "healthy eating" and 72.7% acknowledged the importance of diet for maintaining health.

This substantially higher proportion supports the notion that a dual-parent household environment contributes to the development of healthier behaviors in children and adolescents, which are subsequently maintained into adulthood, as confirmed by previous research.[6] Other studies have similarly reported that adolescents living with both parents have higher intakes of fruits and vegetables and lower consumption of sugar-sweetened beverages. [7] Furthermore, awareness of a healthy diet among students from nuclear families was reflected in their eating practices, as a significant proportion reported a preference for cooking and eating at home. These students also tended to preserve family traditions by preparing traditional dishes, thereby reinforcing health-promoting behaviors within the family environment. Findings from other studies indicate that the frequency of family meals during childhood is a significant predictor of students' current eating habits and dietary traditions. [8]
When international students were stratified by BMI (kg/m^2), those in the normal BMI group demonstrated significantly higher awareness of healthy eating and healthier dietary practices compared to their overweight or obese peers. The self-assessment of their eating habits corresponded with the group's mean BMI, which fell within the normal reference range. These findings reinforce the idea that possessing adequate knowledge and consistently practicing healthy eating behaviors are key factors in maintaining a healthy body weight, even when living far from one's home country and in an international environment. [9] Our results are consistent with those reported by other authors. [10] It appears that international medical students originating from Turkey and Greece—countries geographically and culturally close to Bulgaria—exhibit more sustainable eating patterns, likely facilitated by the relative ease of dietary acculturation.

Table 2. Dietary habits and attitudes toward healthy eating among international medical students, stratified by body mass index (BMI) category

Questions/Answers		**BMI < 18,5kg/m^2**	**BMI - 18,5-24,99kg/m^2**	**BMI > 25kg/m^2**	**p-value < 0.05**
What is "healthy eating"	Nourishing and tasty food	0 (0%)	7 (77.8%)	2 (22.2%)	0.169
	Well balanced and varied food intake	4 (5.8%)	47 (68.1%)	18 (26.1%)*	0.0024
	Traditional food	0 (0%)	7 (63,6%)	4 (36,4%)	0.4066
Is healthy eating important for You?	Yes	4 (5.3%)	53 (69.7%)	19 (25%)*	0.0008
	No	0 (0%)	1 (33.3%)	2 (66.7%)	0.654
How would You assess Your eating habits?	Healthy	1 (4.2%)	19 (79.2%)	4 (16.6%)*	0.0168
	Almost healthy	3 (4.9%)	42 (68.8%)	16 (26.3%)*	0.0038
	Unhealthy	0 (0%)	0 (0%)	4 (100%)	-
Do You prefer cooking at home or eating out?	At home	3 (4.4%)	46 (67.6%)	19 (28%)*	0.0037
	Eating out	1 (4.8%)	15 (71.4%)	5 (23.8%)	0.0672
Do You prefer your traditional dishes?	Yes	4 (5,7%)	46 (65,7%)	20 (28,6%)*	0.0058
	No	0 (0%)	5 (83,3%)	1 (16,7%)	0.2154
	No preferences	0 (0%)	10 (76,9%)	3 (23,1%)	0.1008
Where do You usually eat?	At home	4 (5.5%)	46 (63%)	23 (31.5%)	0,0142
	At school	0 (0%)	2 (100%)	0 (0%)	-
	Outside home	0 (0%)	13 (92.8%)	1 (7.2%)*	0.0193
Where do You	At food market	0 (0%)	10 (55.6%)	8 (44.4%)	0.6463

usually buy food?	Small family shops nearby	0 (0%)	7 (77.8%)	2 (22.2%)	0.1692
	Supermarkets	4 (6.5%)	44 (71%)	14 (22.5%)*	0.0014

* A statistically significant difference was observed between students in the normal BMI group and those in the overweight/obese group ($p < 0.05$).

CONCLUSIONS

Most international medical students, regardless of sex, are aware of what constitutes healthy eating and recognize its importance. They generally prefer preparing their own meals, eating at home, and purchasing food from supermarkets. When stratified by BMI category, students with a normal BMI (kg/m^2) demonstrated greater familiarity with healthy eating principles and their significance. They tended to rate their diet as "almost healthy," preferred home-prepared meals, and commonly purchased food from small family-owned shops nearby.

Students originating from nuclear families were also better informed about healthy eating and its importance. They similarly rated their dietary patterns as "almost healthy" and reported purchasing food mainly from supermarkets. The findings from this small-scale study suggest that family structure is an important factor influencing eating patterns. Additionally, BMI (kg/m^2) appears to be largely a consequence of dietary eating pattern.

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OILY SKIN – DIAGNOSTIC METHODS

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ABSTRACT

Oily skin is a common dermatological condition that occurs in all age groups and is characterized by hyperseborrhea, impaired keratinization, microbiome imbalance, and increased androgen sensitivity. This condition is associated with a variety of complications, including acne vulgaris and seborrheic dermatitis, which negatively impact the quality of life and social activity of the affected individuals. This article aims to present innovative diagnostic methods for assessing sebum secretion, which support the implementation of effective therapeutic practices.

Keywords: oily skin, sebum secretion, diagnostic methods, therapeutic approaches

INTRODUCTION

Oily skin is characterized by increased sebum secretion, especially in the facial area, and it requires targeted and specific approaches. This skin type exhibits a number of clinical signs, including seborrheic shine, enlarged pores and acne lesions, which, combined with disturbances in the hydrolipidic barrier, have a significant negative impact on the dermatological and psychosocial well-being of the patients. The symptoms are often chronic and can persist throughout life[1]. The skin is a complex biological system, the structure and function of which are subject to dynamic changes under the influence of exogenous factors. Increased temperatures can induce hypersecretion of sebum, which creates the prerequisites for seborrhea and acneiform dermatoses. These physiological abnormalities can persist into old age, contributing to additional morphological and functional changes associated with skin aging[2, 3].

Lipid composition of sebum

Sebum is a viscous fluid composed of squalene (12%), wax esters (25%), triglycerides (45%), free fatty acids (10%), cholesterol esters (4%), and free sterols. It plays an important role in skin hydration and a healthy skin barrier, through the formation of glycerol[4].

Despite differences in size, shape, or position, their cellular morphology and sequence of differentiation are similar, but not necessarily identical. The term sebaceous differentiation is the ordered synthesis, segregation, and accumulation of lipid droplets, which culminate in enlarged, deformed cells that fragment to form sebum[5].

Common conditions and diagnoses for oily skin

Acne vulgaris is a multifactorial skin disease affecting the pilosebaceous follicles and usually coincides with the onset of hormonal changes in early and subsequent puberty. This is due to the stimulating effect of the increased levels of circulating sex hormones, particularly androgens, on the development of sebaceous glands and sebum production[6].

The pathogenesis of acne is complex and multifactorial, involving genetic, metabolic, and hormonal factors, in which both the skin and gut microbiota are involved[7].

Seborrheic dermatitis is a chronic, relapsing skin disease characterized by oily, peeling skin, often appearing on the scalp, face, and chest. It is a condition affecting millions of people worldwide, causing significant physical, psychological, and social discomfort[8]. Seborrheic dermatitis is often described as a bimodal condition with two distinct clinical presentations and different pathophysiological mechanisms: infantile seborrheic dermatitis and adolescent/adult seborrheic dermatitis[9].

Collection and staining of skin sebum

The sebum recovery time is the period required for the normal amount of sebum to return after its removal from the skin surface. Sebum is collected from the face with blotting papers or disinfected PVC films. A solution of Oil Red O (ORO) is used to stain sebum - it is prepared by dissolving the reagent in methanol and adding an aqueous solution of sodium hydroxide (9.2 g NaOH in 230 mL water). After filtration, the solution is stored in a dark brown bottle and remains stable for up to 8 months. The buffer solution is prepared by dissolving sodium carbonate (26.5 g) in 2.0 L of water and gradually stirring in concentrated nitric acid (70%, 18.3 mL), then it is diluted to 2.5 L and stored in the dark.

The procedure for targeted sebum staining is performed as follows: after cleaning the forehead with a cleansing tissue (about 2–3 minutes) and drying the T-zone, a 2×3 cm film is cut, placed on the forehead, and immediately removed. Using tweezers, the contact surface is placed in the center of the ORO reagent to ensure uniform staining, then removed after 3 minutes, rinsed in buffer solution for 3 minutes, and allowed to dry[10].

Innovative diagnostic approaches for controlling sebum secretion (description of methods)

Commonly used devices for measuring lipids on the skin surface include the sebumeter and the glossmeter. Measurements can be influenced by the contact area, applied pressure, and application time. They are sensitive to skin contamination and changes in atmospheric humidity[11].

Using modern imaging techniques to characterize oily skin

Biophysical techniques for skin imaging monitor the following parameters: number of pores, determining the number of sebaceous glands and the amount of sebum in the infundibulum, determining the skin microrelief, number of comedones, assessment of epidermal thickness, characterization of cells, and comedone size and their characteristics[12].

This type of skin diagnostic equipment is characterized by a device equipped with a digital camera and white LED light, designed to capture precise, high-quality images. A specialized software analyzes various dermatological parameters, including skin pores and superficial wrinkles. The images are captured from different angles, and all visible pores are marked and displayed as a percentage of the total image area[13].

Measurement of the epidermal thickness and morphological characterization of pores and comedones, including their size and cellular composition

The assessment of the epidermal thickness, cellular and tissue characteristics of the pores and comedones is performed using technology, which is a non-invasive and completely painless method of skin examination without risk to the patient, but with a resolution which could be compared to conventional histology. Macroscopic images are obtained using a digital macroscopic camera for counting comedones. The counting is performed using specialized software[14].

Determining the skin microrelief and number of comedones

For the analysis of the microrelief of the skin surface, optical profilometry methods based on camera scanning are applied to assess the surface characteristics of the skin. The obtained parameters include: roughness (Rt), texture (SEr), desquamation (Sesc), and smoothness (SEsm), which are calculated using the specialized software. The received images are used to count the comedones and identify the presence of characteristic pigment spots in the analyzed areas. For the purposes of analysis, each area is photographed in triplicate, and the number of comedones is determined by processing the images with software[15, 16].

Quantitative assessment of the lipid components of sebum with nuclear magnetic resonance

Nuclear magnetic resonance (NMR) is a spectroscopic method which allows the precise determination of individual lipid classes and components, independent of their fatty acid composition. The method is used to measure cholesterol, squalene, sterol ester pools, wax esters (WE) and triglycerides (TG) in sebum. For the diagnostics, a 600 MHz NMR machine is used in combination with cryogenically cooled high-sensitivity probes. This equipment provides sufficient sensitivity and, in certain cases, offers advantages over widely used methods such as High-Performance Liquid Chromatography (HPLC) with evaporative light scattering and mass spectrometry. The method is an effective tool for preclinical and clinical monitoring of the effect of therapeutic means which reduce sebum secretion[17].

MATERIAL AND METHODS

A documentary analysis of national and international scientific publications related to the physiology of sebum secretion and the characteristics of oily skin has been performed. Data evaluating the applicability of various diagnostic methods has been summarized.

RESULTS AND DISCUSSION

Traditional diagnostic methods provide limited information, while modern technologies allow precise measurement of sebum production and a more detailed assessment of the skin barrier function. These methods help personalize therapeutic strategies aimed at controlling sebum secretion, improving skin texture, and preventing complications.

The present study finds significant variations in the examination of sebum secretion, pores, and comedones between different facial zones. The nose shows the highest sebum production with a relatively smaller number of sebaceous glands, which suggests increased functional activity. The malar area is characterized by the largest number and size of pores, probably due to lower elasticity and a thin epidermis, while in the chin a positive correlation between sebum content, roughness, and number of comedones is observed.

The applied methods provide reliable quantitative and morphological assessment of the skin parameters, demonstrating high comparability with standard devices (corneometer, sebumeter). The results confirm the need for a regionally specific approach to the assessment of oily skin, taking into account the anatomical and physiological characteristics of different facial areas.

Currently, image analysis techniques include high-tech solutions and are relevant as a complementary or alternative dermatological clinical assessment of oily skin characteristics.

CONCLUSION

Innovative diagnostic methods are essential in the application of diagnostic approaches to oily skin. They provide an objective assessment of sebum secretion and support the selection of

individualized therapeutic approaches. Their inclusion in dermatological and cosmetic practice creates prerequisites for higher clinical effectiveness.

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REHABILITATION NUTRITION IN CLINICAL PRACTICE AND INJURY RECOVERY

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ABSTRACT

The integration of targeted nutritional care with structured rehabilitation is key to improving functional outcomes in patients recovering from acute illnesses or living with chronic disabilities. The **aim** synthesise current information on rehabilitation nutrition interventions in clinical practice and in post-traumatic recovery, with a special focus on muscle mass, strength, and functional outcomes. **Methods:** A narrative synthesis of current guidelines and systematic reviews (2019–2025) combined with clinical practice guidelines on the recent developments in rehabilitation nutrition was conducted. **Results:** The model prioritises early screening (MUST/NRS-2002), GLIM-verified malnutrition, and key functional metrics, supported by tailored energy intake (25–35 kcal/kg/day), high-quality protein, omega-3s (≥2.5 g/day), HMB (~3 g/day), creatine monohydrate, and vitamin D, together with structured exercise to improve muscle strength and physical performance. **Conclusion:** Targeted nutritional interventions promote faster recovery, reduce muscle loss, and improve functional status.
Keywords: rehabilitation nutrition; malnutrition; sarcopenia; functional outcomes

INTRODUCTION.

Ageing, surgery, and trauma often result in loss of muscle mass and function, increasing the risk of falls, hospitalisations, and dependency [1]. Initiatives such as GLIS (Global Leadership Initiative in Sarcopenia) and GLIM (Global Leadership Initiative on Malnutrition) offer standardised criteria for assessing sarcopenia and malnutrition [2]. Effective recovery from acute or chronic illness requires a combination of rehabilitation and targeted nutritional support Rehabilitation nutrition is an integrated approach to optimising nutritional status and functional recovery through systematic assessment, goal setting, intervention, and monitoring within the ICF (International Classification of Functioning) framework [3].

The objective of this review is to summarise the currently available research on the effects of basic dietary therapies on muscle mass recovery and function in adults and patients in the post-traumatic or postoperative period.

MATERIALS AND METHODS.

The review included a systematic search in PubMed, Web of Science, and Scopus (2019–2025) using keywords such as rehabilitation nutrition, sarcopenia, protein supplementation, omega-3, HMB, injury recovery, and post-operative rehabilitation. RCTs, meta-analyses, and systematic reviews in sarcopenic patients or post-hospitalisation/post-surgery patients were included. The data were assessed for quality and relevance and synthesised narratively.

RESULTS.

The concept of rehabilitation nutrition represents a systematic approach to maintaining nutritional status and supporting functional recovery [4]. The five-step model—assessment, diagnosis, goal setting, intervention, and monitoring—provides a scientifically sound framework for structuring nutritional support and integrating diagnostic thinking into clinical practice (Fig.1).

Fig. 1. Five-step model for rehabilitation nutrition [4, 5].

The first step, evaluation and diagnostic reasoning, is systematic data collection to identify the causes of malnutrition. Patients with trauma, an acute sickness, or cancer frequently demonstrate altered appetite, increased energy expenditure, and severe catabolism. Clinical assessment includes anthropometry, muscle mass analysis (bioimpedance or ultrasound), and functional strength and mobility tests, while laboratory markers—serum proteins, trace elements, and inflammatory markers—define metabolic status and nutritional support needs. The second step—diagnostics—identifies nutritional deficiencies that limit rehabilitation. In trauma patients, severe catabolism and increased energy and protein needs are observed, while oncology patients have micronutrient deficiencies and reduced intake. The GLIM criteria provide a standardised assessment with at least one phenotypic and one etiological criterion [2]. The third step is goal setting, tailored to clinical and functional status, such as maintaining or increasing body mass, optimising protein and energy intake, and recovery. In oncology patients, goals include stabilising nutritional status during treatment, limiting micronutrient deficiencies, and supporting immune function and therapeutic adherence. The next step—intervention—involves targeted nutritional strategies such as increased energy and protein intake, use of high-calorie and high-protein products, and supplementation of vitamins and minerals according to individual deficiencies. The final step—monitoring—requires regular monitoring of weight, body composition, muscle mass, functional parameters, and laboratory markers. This process allows for timely adaptation of the therapeutic plan and prevention of complications that may delay rehabilitation. RCTs and meta-analyses have shown that multi-level nutritional interventions significantly promote muscle mass, strength, and functional gains in rehabilitation (Tabl.1).

Table 1. Nutrient Targets and Key Adjunct Supplements in Rehabilitation Nutrition Interventions and Clinical Outcomes

Intervention	Recommended intake	Population	Anticipated outcomes
Energy [1]	25–30 up to 35 kcal/kg/day	Most adults post-trauma/surgery	Weight maintenance, prevention of catabolism
Protein (high quality, enriched with leucine) [1,5]	1.0–1.5 g/kg/day; 20–40 g ×2–3/day	Sarcopenia, rehabilitation	↑ muscle mass and strength, accelerated recovery and walking speed
Leucine / EAA [5,6]	Aim for ~3 g leucine/day	Sarcopenic older adults	↑ muscle mass and strength, accelerated recovery
Protein + Vitamin D [6, 7]	1.0–1.5 g/kg/day and 800–2000 IU vitamin D	Adults with deficiency	Improved muscle function and mobility

Intervention	Recommended intake	Population	Anticipated outcomes
Omega-3 PUFA (EPA/DHA) [8]	≥1–2 g/d up to >2- 2.5 g/d for muscle outcomes	Adults with inflammation/ sarcopenia	↑ strength, functional mobility, but limited hypertrophic effects
Creatine monohydrate [9]	3–5 g/day (maintenance)	During resistance training in older adults/athletes	↓ muscle loss, ↑ strength, balance, SPPB
HMB (Beta-hydroxy-beta-methylbutyrate) [1, 9]	~3 g/day	Post-hospitalisation, sarcopenia	anticatabolic effects and improves strength and function
Vitamin D [7]	Achieve 25(OH)D ≥30 ng/ml	Older adults; deficiency correction	enhances the anabolic response
Micronutrients [9, 10]	Depending on the deficiency (vitamin D, Ca, Mg)	Patients with deficiencies	Maintaining muscle and bone function

DISCUSSION.

The integrated cycle summarises current guidelines and meta-analyses showing the strongest effect when combining protein/amino acids with resistance training, especially in adults at risk of sarcopenia [5, 6, 11]. Creatine consistently improves muscle strength, while the evidence for omega-3 remains heterogeneous, with modest benefit at high doses and long-term intake [1, 8, 9]. Key challenges include variable definitions, the need for multidisciplinary training, and limited reimbursement [11, 12]. Economic evaluations suggest potential cost-effectiveness, but large-scale implementation studies are lacking. Optimal doses and timing of supplementation, methods for routine assessment of muscle quality, and health economic comparisons with standard care remain unclear [13]. Pragmatic RCTs with composite functional endpoints (SPPB, grip strength) and implementation indicators are recommended [5, 11, 13].

CONCLUSION.

The integrated rehabilitation nutrition cycle provides an evidence-based framework for synchronising nutrition and rehabilitation, supported by EHR signals and multidisciplinary processes. A multimodal approach (nutrition and exercise) yields the best results, however, the evidence is limited by heterogeneous doses, various populations, and lack of long-term data. Effective interventions include high-quality protein, vitamin D if deficient, omega-3 ≥2.5 g/day, and HMB ~3 g/day. Individualised strategies reduce muscle loss and accelerate recovery. Additional large RCTs are still needed to determine the optimal doses and combinations of nutritional strategies.

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THE EFFECTS OF INFORMATION SOURCES ON THE ATTITUDES ON DERMATO-COSMETIC SERVICES

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SUMMARY

Contemporary society places emphasis on appearance, while social media and influencers impose a variety of unattainable beauty standards. That does increase interest in dermato-cosmetic procedures but also acts in popularising some unprofessional advice, introducing hidden risks of unsuitable practices. The importance of professional skin type diagnosis for individualised case is emphasised, as incorrect self-assessment and inappropriate cosmetics can lead to unwanted skin issues. This study aims to investigate the awareness of consumers on the usage of dermato-cosmetic services.

Key words: dermato-cosmetic procedures, skin, social media, awareness

INTRODUCTION

Nowadays, a person's appearance in moving towards taking a central part in their life. Looks are considered not only an aesthetic category, but also as something directly related to an individual's identity and professional realisation. In the conditions of globalisation and mass digitalisation, appearance becomes a tool for building and perceiving a person's social status.

Driven by the pursuit of an idealised appearance, today's society demonstrates a growing interest towards dermato-cosmetic procedures. Social media and influencer culture are amongst the main factors facilitating said growth, often imposing unattainable beauty standards – filtered looks form unrealistic expectations.

Influencers are often perceived as authority, despite their lack of professional qualification. Popularising products through paid partnerships makes objective choice a difficult task, and it hides risks of inappropriate or even dangerous dermato-cosmetic procedures. Marketing research shows partnerships with the right influencers can increase a product or brand's recognisability, improve its image and significantly stimulate sales.[1] Lack of critical thinking and health awareness reinforces these processes further. Rossi et al. (2021) [2] emphasise that that trust in unqualified sources – social media, forums and ads – is increasing progressively, resulting in an increase in the risks of side effects and an undermining of trust in professional services. Professional advice from a dermatologist or medical cosmetician is necessary, as well as a set of strategic approaches to increase the level of awareness through scientific communication and ethical advertising practices. Education campaigns, directed towards the distinguishing of reliable sources and encouraging consultation with a specialist, can improve consumer culture significantly.

A key stage when choosing a dermato-cosmetic therapy is determining the skin-type. Correct diagnostic allows for an individualised approach, which can server as a good basis for prevention and treatment of existing skin conditions. Recognising the range of specific physiological characteristics of the skin and their states (e.g. sebum secretion levels, hydration and sensitivity) is one of the most important factors that will determine the safety and effectiveness of the applied products and procedures [3, 4].

Contemporary dermatological classifications of skin are becoming increasingly more detailed and take into account a range of parameters – starting from moisture content in the stratum corneum and sebum

secretion, through sensitivity, pigmentation and signs of ageing [5]. They can occur regardless of skin type and call for a specific approach when it comes to choosing cosmetic products and procedures [6].

As (Trepanowski & Grant-Kels, 2023) [7] point out, influencers, due to lack of competency, through social media, can both intentionally or not, recommend therapies, which have no proven effectiveness and have the potential to cause harm to consumers. Incorrect self-assessment and the usage of inappropriate cosmetic products can lead to skin problems and unwanted reactions.

Social media, influencers and contemporary models of consumer behavior in the cosmetic sector

Social media platforms are channels for marketing and communication with consumers. Facebook, Instagram, TikTok, YouTube, Telegram and Twitter/X stand out as the leading platforms with the widest informational and social reach. There, the cosmetic sector is often demonstrates short product reviews, hashtags, related to campaigns, and active participations in discussions, related to ethics, contents or trends. [8].

An influencer is a public figure in social media. Most often they are individuals, who maintain active profiles on platforms like Instagram, YouTube, TikTok etc. and attract a large number of followers with their content and publications. Social media influencers shape the attitude of their audience through their personal profile and have the ability to affect the opinion, attitude and behaviour of people, through its content [9]. Some influencers fail to mark their sponsored publications appropriately, which dilutes the line between personal opinions and paid promotion. This misleads consumers into thinking a recommendation is made independently, when in fact, it was a paid advertisement. This lack of transparency undermines trust and can be viewed as a form of fraudulent practice. As a result, the regulatory organs in some countries [10, 11] have issued a set of directions and rules, requiring influencers to label sponsored content as such.

Content, presented by influencers as a personal opinion, demonstrations, lessons, is perceived by consumers as more honest and reliable. The latter, are proven to be more inclined to trust the recommendations of real people, sharing their personal experience, rather than the message an advertisement brings, having been created by the brand [12].

MATERIALS AND METHODS

The underlying study was conducted in Varna, Bulgaria. It utilised a documentary method, consisting of the review of national and internation literary sources; sociological method, which aimed to explore the behaviour and attitude of consumers towards non-invasive dermato-cosmetic services. A key instrument was the survey card, which includes structured, semi-structured and open questions.

RESULTS AND DISCUSSION

Participant characteristics

In the studied sample, the majority of participants is made up of women- 53 (88.3%), while men are only 7 (11.7%). The most predominant age group is that of respondents between 36-55, represented by 34 people (56.7%), followed by the 56-65 group, consisting of 13 people (21.7%). Only 3 people from the sample are over 65. All participants, 100% of them, reside in regional cities – 2 of them are from Sofia and 1 from Burgas. More than half of the respondents hold a diploma of higher education – 42 people (70%). This suggests that people with a higher level of education display a greater interest in dermato-cosmetic services.

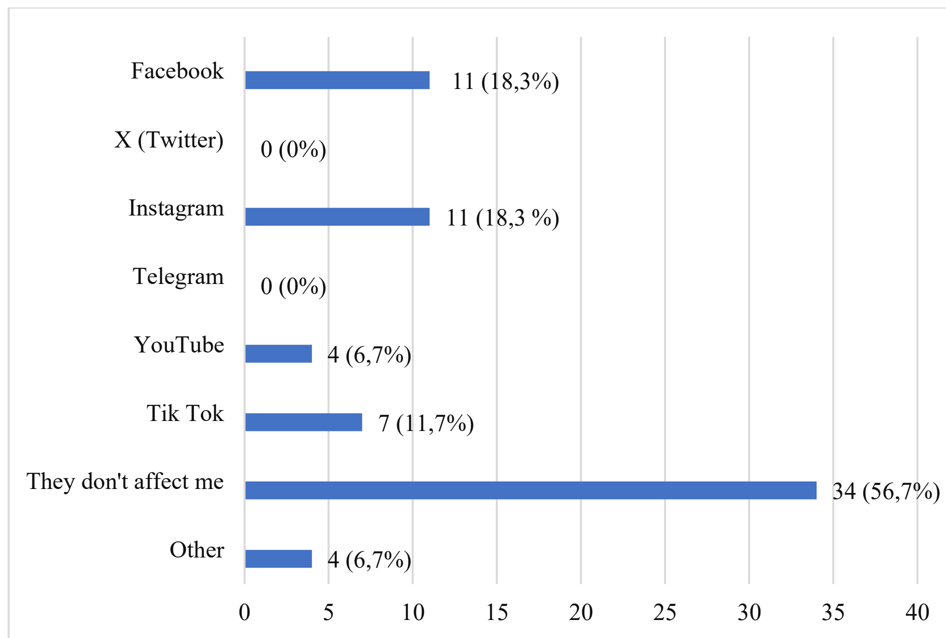
The majority of participants rate their financial situation as average – 41 individuals (68.3%), while only 6 of them (10%) define themselves as financially vulnerable. This data shows a certain level of financial stability of the examined group, which could be directly related to the higher level of

education of respondents, as well as the fact they all live in cities.

Main sources of information that influence consumer decisions

The choice of cosmetic services often relies on personal trust and recommendations by people with a similar experience. Trust in the information source is a key factor when forming decisions in the context of aesthetic procedures, especially when it comes to those relating to skin's appearance and health.

Figure 1 – Social networks as a source of information



Data from the conducted survey shows cosmeticians are the most trusted source of information, when consumers are choosing cosmetic services – chosen by 41 individuals (68.3%). Second on that trust scale our participants appointed friends and acquaintances, picked by 19 survey-takers (31.7%). This places and emphasis on the importance of personal experience when shared. Dermatologists (skin doctors) are mentioned by 16 people (26.7%) as a reliable source, while general practitioners are trusted by only 8.3% of participants. Ads in mass and social media receive only 1 individual's choice each (1.67% and 1.7% respectively). No respondent chose the 'other' option. Those results underline the need and importance of building a solid relationship based on trust and authority during consultations, in the field of cosmetic services.

Despite the wide popularity of social media, as a source of information, trust in them remains considerably lower compared to that in recommendations made by specialist and people in the consumer' immediate circle.

Results of the survey show that 34 individuals (56.7%) say social media does not influence their choice at all, when choosing a cosmetic service (Figure 1). Among others who are, in fact, affected by social media, when making decisions, the most frequently mentioned platforms were Facebook and Instagram – 11 by people each (18.3%). TikTok influences 7 survey-takers (11.7%), while YouTube – 4 (6.7%). It should be noted that none of the participants chose Twitter or Telegram as a factor when choosing cosmetic procedures.

This data shows that, although social media is an integral part of everyday life, the trust relating to the choice of cosmetic services, placed in them remains at a moderate level. A large number of consumers still choose to rely on personal contacts or professional sources of information when forming their decisions on cosmetic services.

CONCLUSION

The findings from the current study confirm the leading role of professional consultations and shared personal experience in choosing dermato-cosmetic services, while the influence of social media is still relatively limited. Despite the massive presence of online influencers and the variety of platforms available, participants in the study demonstrated a moderate level of trust towards them, placing a higher level of importance on recommendations made by qualified professionals in the field (cosmeticians, dermatologists), as well as the opinions of close friends. This trend reflects the characteristics of the studied sample, consisting mainly of middle-aged, educated women, for whom individualised skin care is of paramount importance. The need for a professional diagnostic of the skin, as well as expert opinions puts a strong emphasis on the call for an increased consumer health culture and the formation of critical thinking towards unverified information on social media. Additionally, the current study highlights the need for a more active participation of the dermatological community in informing society, in order to reduce the risk of inappropriate practices and ensure safer and more personalised dermato-cosmetic care.

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MONITORING THE EFFECT OF THE APPLICATION OF RADIOFREQUENCY THERAPY AND ACTIVE GYMNASTICS OF THE FACIAL MUSCLES ON THE GLOBAL AESTHETIC IMPROVEMENT OF FACIAL SKIN IN ADULTS

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ABSTRACT

The application of non-invasive radiofrequency lifting in combination with active gymnastics of the mimic muscles gives positive results, consisting in a significant improvement of the aesthetic vision.

The aim of the study is to monitor the effect of applying radiofrequency therapy and active gymnastics of the facial muscles on the global aesthetic improvement of the facial skin.

Materials and methods: One hundred patients were recruited and evenly assigned to a control group and an experimental group for a study on cosmetic procedures conducted over six months. The experimental group received both radiofrequency lifting and active facial muscle exercises, while the control group underwent only radiofrequency face lifting. After the eighth procedure and at the conclusion of the study, all participants were evaluated using a scale designed to measure global aesthetic improvement.

Results: A moderate positive correlation of the indicator "global aesthetic improvement after the 8th procedure" with age was established. In the experimental group, a global aesthetic improvement was observed after the eighth procedure and after the sixth month ($P<0.000$). The comparison of the results between the control and experimental groups in terms of global aesthetic improvement after the 8th procedure and at the end of the study showed a statistically significant difference ($P<0.0001$).

Conclusion: The application of non-invasive radiofrequency therapy combined with active gymnastics of the facial muscles emerge as promising techniques for the aesthetic improvement of the facial skin. Radiofrequency therapy stimulates the production of collagen and elastin, which leads to firmer and younger skin, and active gymnastics of the muscles favors the reduction of wrinkles and correction of the facial contour.

Keywords: radiofrequency lifting, active gymnastics, mimic muscles, global aesthetic improvement.

INTRODUCTION

Facial skin aging is a natural and inevitable process. It involves a gradual weakening of the biological activity of cells, a lengthening of regenerative processes and a decrease in adaptability. [1, 2] The application of radiofrequency therapy, combined with active gymnastics, has effects on facial muscle tone by increasing the density of muscle mass. [3] This increase in muscle density supports better facial expressions and overall muscle function, which is crucial for aesthetic results. [4] This dual approach not only rejuvenates the skin, but also strengthens the underlying muscle structure, with a global aesthetic improvement in the facial skin. [5]

The aim of the study is to follow the effect of applying radiofrequency therapy and active gymnastics of the facial muscles on the global aesthetic improvement of the facial skin.

MATERIALS AND METHODS

Clients' sample. Characteristics

In the preliminary phase of the study, a total of 100 patients were examined, evenly split into two groups aimed at enhancing skin condition in adulthood: an experimental group and a control group, both matched for gender and age. Study participants were selected based on the inclusion criteria of the study. The experimental group underwent active facial muscle exercises in conjunction with radiofrequency face lifting, while the control group received only the radiofrequency treatment. Participants were primarily sourced from Plovdiv, and both initial assessments and follow-up evaluations took place at the "RA DERM" aesthetic center in the same city. This prospective study spans six months and is characterized by its sample-based design.

Study design and method

Before starting the procedures, each client/patient was familiarized with the study design and an informed consent form was signed. At both the beginning and conclusion of the study, which took place at the six-month mark, participants' age and gender were assessed. A global aesthetic improvement scale was utilized during the eighth procedure and again at the study's conclusion. This scale, established in 2003, is used for application in various cosmetic procedures, including facial rejuvenation, skin tightening, and the treatment of scars and hyperpigmentation. The scale ratings are from 1 to 5: 1 corresponds to – "Extremely improved condition", 2 – "Much improved condition", 3 – "Improved condition", 4 – "Unchanged condition" and 5- Deteriorated condition [6]. The experimental group was treated with a kinesitherapy program for the facial muscles and radiofrequency face and neck lifting. The procedure debuted with the application of a kinesitherapy program. After the completion of the gymnastics for the facial muscles, radiofrequency lifting was applied, with a unipolar tip in the forehead, frown line, crow's feet, oval, cheeks, nasolabial fold, lip contour, beard and neck. Initially, 8 procedures were performed twice a week, after which the procedures continued four times a month (one procedure per week) for 2 months. In the period after the third to sixth month, two procedures were performed per month. A retest of the patients from the experimental group is carried out after the eighth procedure and at the sixth month. In the control group, only radiofrequency lifting (RF) is performed according to the above-described scheme, and after the sixth month, a retest of the patients from this group is carried out.

RESULTS

The demographic factors we examined were gender and age. At the beginning of the study, 50 women and 50 men were selected, a total of 100 participants. The average age of the participants in the experimental and control groups at the beginning of the study was 54.09±6.423 years, with the youngest being 45 years old and the oldest being 68 years old.

At the end of the study, a total of 32 participants dropped out - 11 from the experimental group and 21 clients from the control group. Of these, 15 (47%) were women and 17 (53%) were men. At the end of the study (after 6 months), 68 patients with an average age of 53.91±5.932 years were tested. There was no statistically significant difference in gender and average age of the participants at the beginning (54.09±6.423 years old) and at the end (53.91±5.932 years old) - P=0.990.

No correlation was found between gender indicators at the beginning of the study and the scale of global aesthetic improvement after the 8th procedure and at the end of the study.

A moderate positive correlation was found between the indicator of age and the scale of “Global aesthetic improvement after the eighth procedure”.

Global aesthetic improvement after 8th procedure – **Men:** 2,79±0,686 ($\bar{X}$±STD);
Women: 2,69±0,705 ($\bar{X}$±STD); P=0,744.

Global aesthetic improvement after 6th month – **Men:** 2,00±1,265 ($\bar{X}$±STD);
Women: 2,14±0,972 ($\bar{X}$±STD); P=0,564.

Applying the Wilcoxon method for two related samples, we compared the assessment on the global aesthetic improvement scale from the eighth procedure with the assessment after the sixth month. We calculated the effect size r, where $r=Z/\sqrt{N}$, N=39. It was found to be much larger than the typical effect size for the studied indicator**.**

The comparison of the results by global aesthetic improvement indicator between the control and experimental groups after the eighth procedure and at the end of the study shows a statistically significant difference.

Global aesthetic improvement after 8th procedure– **Control group:** 3,20±0,404 ($\bar{X}$±STD); **Experimental group**: 2,24±0,591 ($\bar{X}$±STD); P**<0,000.**

Global aesthetic improvement after 6th month – **Control group:** 3,07±0,593 ($\bar{X}$±STD); **Experimental group:** 1,41±0,595 ($\bar{X}$±STD); P**<0,0001.**

DISCUSSION

In our study, we found a moderate positive correlation of the indicator “global aesthetic improvement after the eighth procedure” with age. A study by Melfa et al. (2024) showed an improvement in the communicative and social aspects of life in adult patients undergoing non-surgical cosmetic procedures. [7] Analyzing the initial and final results of the application of radiofrequency therapy and active gymnastics for the facial muscles, we found a global aesthetic improvement after the eighth procedure and after the 6th month /P<0.000/. Our result is confirmed by a study by Yule et al. (2024) which states that radiofrequency therapy can produce significant improvements in the appearance of the face, contributing to overall aesthetic improvement. [8] Even when used as a single therapeutic modality, radiofrequency has shown promising results for overall visual improvement by reducing the effects of skin aging. [9] Radiofrequency therapy provides a non-invasive or minimally invasive approach to contouring the face and body. Radiofrequency works by heating collagen in the dermis, which stimulates neocollagenesis and skin tightening, or adipocytes in the subcutaneous tissue, which causes lipolysis and fat reduction. Unlike surgical interventions such as facelifts or liposuction, where results are almost immediate after a single procedure, radiofrequency effects are more modest and usually require multiple treatments, reaching peak efficacy after approximately 3 months. [2] Referring to the study by Tan et al. (2024), we argue that our results demonstrate the efficacy of applying radiofrequency therapy within the time frames mentioned in the authors' study [2].

CONCLUSION

Non-invasive radiofrequency therapy has emerged as a promising technique for improving skin quality. This therapy works primarily by heating the dermal layers, which stimulates the production of collagen and elastin, resulting in firmer, younger-looking skin. [10] When combined with active facial muscle exercises, radiofrequency therapy increases muscle tone, [11] contributing to a more lifted appearance. Radiofrequency therapy is associated with a low risk of adverse effects and requires no recovery time, making it a convenient option for patients. Cumulative effects are reduced to optimal

results, which are usually seen after multiple sessions, with maximum efficacy in our patients observed six months after treatment. [5]

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ACCESS TO DIAGNOSIS AND TREATMENT FOR PATIENTS WITH SLEEP APNEA

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ABSTRACT

Sleep apnea is one of the most common sleep disorders, affecting millions of people worldwide. Despite its significant clinical and socioeconomic consequences, the disease often remains undiagnosed. The aim of the study is to identify and analyze barriers in the diagnosis and treatment of patients with sleep apnea. An anonymous survey was conducted among patients with sleep apnea and physicians. Questionnaires were developed to identify problems in patient access to diagnosis, treatment, prevention, and awareness. The results show that a large percentage of respondents pay for the tests to diagnose the disease and the treatment devices themselves. At the same time, there is a delay in diagnosis due to poor awareness, lack of understanding of the problem, and psychological and financial difficulties. Untreated sleep apnea has serious medical and economic consequences that affect not only the individual patient but also society. In Bulgaria, the problems are related to prevention, a high percentage of undiagnosed cases, and limited reimbursement of therapy by the National Health Insurance Fund.

Keywords: sleep apnea, access to diagnosis, adherence to treatment, economic burden, prevention.

INTRODUCTION

Obstructive sleep apnea (OSA) is a respiratory disorder during sleep that affects 4% to 8% of the adult population in Europe. The condition is characterized by recurrent episodes of partial or complete obstruction of the upper airway during sleep [1, 2]. Despite its significant clinical and socioeconomic consequences, the disease often remains undiagnosed. This is a serious public health problem due to the risk of cardiovascular disease, metabolic disorders, and socioeconomic consequences related to job loss, unemployment, and disability [3].

The factors predisposing to the development of OSA are: gender, age, family history, obesity, and unhealthy lifestyle [2, 3, 4]. The clinical picture is characterized by loud snoring, apneic pauses in breathing during sleep, headaches, and daytime sleepiness. Patients complain of constant fatigue, irritability, cognitive impairment, reduced work capacity, and significantly impaired quality of life [2, 3, 5]. Diagnosis is based on polysomnography, which determines the apnea-hypopnea index (AHI). There are various screening and auxiliary tools, such as home polygraphy, which assist in the preliminary assessment of the risk of obstructive sleep apnea, but they do not replace the gold standard [1].

The aim of the study is to identify and analyze barriers in the diagnosis and treatment of patients with sleep apnea.

METHODS: An anonymous survey was conducted among 49 patients with sleep apnea and 20 physicians: neurologists, cardiologists, pulmonologists, and general practitioners. The patient questionnaire included demographic data, questions related to access to diagnostic tests, treatment, clinical manifestations, follow-up, and awareness. The physician questionnaire aimed to identify problems related to access to equipment and difficulties in following up and treating patients. The data was collected online, processed, and analyzed using IBM v.23 software. Descriptive and variation analysis, Pearson's chi-square for nominal data analysis, and a significance level of $\alpha=0.05$ were applied.

RESULTS AND DISCUSSION

The study was conducted over a period of three months in the Plovdiv region. The average age of the patients surveyed was 52.31 (SD-12.6). The majority of the sample were men (77.1%), while women accounted for (22.9%). 53.1% of respondents had a university degree, while the remaining 46.9% had a secondary education. Employment data showed that 75.5% of respondents were employed, 18.8% were unemployed, and 6.2% were retired. It is important to note that early diagnosis is established in a small number of patients. Only 8.1% say they were diagnosed within the first year of symptom onset. The largest proportion of patients, 42.9%, experienced a delay of between one and two years, while 26.5% were diagnosed at a later stage, between the second and fifth year after the onset of symptoms. For 22.5% of respondents, the delay is even longer, exceeding five years. These data show that for most patients, the diagnosis is delayed by more than a year, which actually increases the risk of complications and delays timely treatment. We asked respondents who referred them for diagnosis. The results show that for 57.1% of them, it was at the initiative of relatives or family members. A significantly smaller proportion sought help on their own (14.3%) or after a recommendation from their general practitioner (18.4%). Referrals from specialists such as pulmonologists, cardiologists, or neurologists are even more limited, which indicates the weaker involvement of specialized medical care in the early detection of the disease (Fig. 1). The results of international studies are similar, also emphasizing the leading role of the family and primary medical care [1, 6].

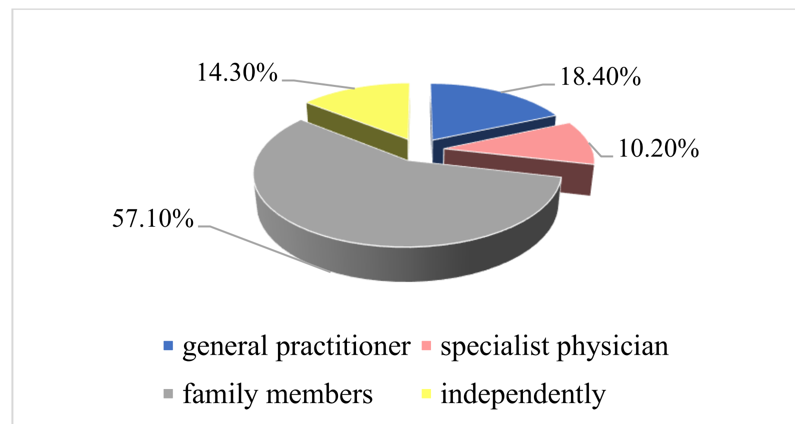

Fig. 1. Source of referral of patients for diagnostic testing

We identified several main reasons for the delay in diagnosis and treatment. Most often, patients cite financial difficulties (52.5%). Another barrier is insufficient awareness of the disease and diagnostic methods (46.9%), which often leads to underestimation of symptoms and postponement of consultation with a specialist. Another part of the participants (30.6%) share their concern about the examination itself, which shows that psychological barriers also play a role in delaying the diagnostic process (Fig. 2). The results show that financial constraints, lack of awareness, and psychological factors are the main reasons for delayed diagnosis. This can accelerate the progression of the disease, increase the likelihood of complications, and worsen quality of life.

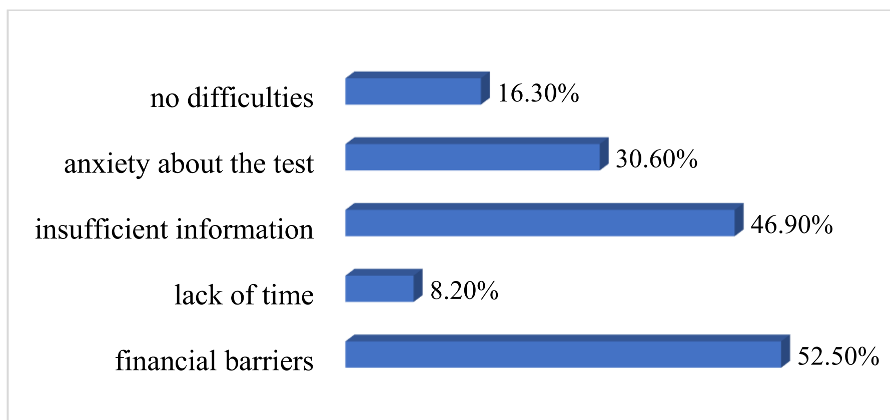

Fig. 2. Barriers to conducting a diagnostic test for sleep apnea

The majority of study participants (87.8%) paid for the test out of their own pocket. Only 4% used health insurance, and only 8.2% had access to free testing through a screening program. The results clearly show that the financial burden falls mainly on the patients themselves, which is consistent with the previously identified financial barriers as a leading factor in diagnostic difficulties. Most patients use a CPAP machine for treatment - 73.5%, while 4.1% do not use a machine.

These results correlate with the expert opinion of medical professionals. According to the doctors surveyed, the failure to diagnose sleep apnea leads to the following problems: impaired quality of life (85%), temporary or permanent loss of working capacity (85%), social isolation (40%), high number of hospitalizations (80%), increased healthcare costs due to treatment of complications (40%). At the same time, 95% of doctors believe that the National Health Insurance Fund should cover the costs of testing and treatment. Other options for controlling the disease include: involvement of healthcare specialists, more screening programs (65%); integration into the national program for chronic diseases (75%); involvement of general practitioners in prevention.

In some countries, CPAP therapy is partially or fully funded by insurance or public programs [7]. In the UK, the National Health Service (NHS) provides CPAP devices free of charge to patients with proven obstructive sleep apnea, with the therapy considered the standard of care [8]. In Germany and France, the devices are reimbursed by health insurance funds, with patients paying only a symbolic co-payment [9,10,11].

The results of our study show that 96% of patients purchased the device with their own funds, 2% received a donation, and 2% received funding from the National Health Insurance Fund. CPAP and BiPAP devices are reimbursed only for patients with neuromuscular diseases leading to chronic respiratory failure. According to Regulation No. 7 of March 31, 2021, devices for the treatment of obstructive sleep apnea are not included in the list of medical devices covered by the NHIF (12,13). The lack of reimbursement in Bulgaria shows a significant lag behind European and international practices. In this regard, patients with obstructive sleep apnea face a number of challenges. The cost of the devices ranges from BGN 1,900 to BGN 2,400, with newer models being more expensive [12,13,14]. The lack of sufficient information about the disease further contributes to underestimating the problem and delaying diagnosis.

CONCLUSION

Untreated sleep apnea has serious medical and economic consequences for both the patient and society. In Bulgaria, the problems are related to access to diagnosis and treatment, follow-up, low awareness,

and limited reimbursement. The results of the study show that a significant proportion of participants strongly support the need for the National Health Insurance Fund to cover the costs of testing and treatment. The lack of funding for CPAP therapy in Bulgaria leads to serious financial and social barriers for patients and increases the risk of complications. The inclusion of sleep apnea in national programs for the prevention of chronic noncommunicable diseases, treatment according to clinical pathways, and the involvement of medical specialists to improve control and monitoring would contribute not only to a better quality of life for patients but also to a reduction in healthcare costs.

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DIABETIC POLYNEUROPATHY: ROLE OF KINESITHERAPY AND SEASONALLY ADAPTED PHYSICAL EXERCISES IN THE REHABILITATION PROCESS — A REVIEW OF THE LITERATURE

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Abstract: Diabetic polyneuropathy is one of the most common chronic complications of diabetes mellitus and is associated with significant functional impairments, including neuropathic pain, sensory deficits, and balance disorders. These changes increase the risk of falls and the development of diabetic ulcers, which has serious health and socioeconomic consequences. Rehabilitation interventions, including kinesitherapy, strength and balance exercises, aerobic activities, and specific foot exercises, have been shown to improve functional status and reduce symptoms in patients with diabetic polyneuropathy. In addition, seasonal factors – temperature, humidity and opportunities for outdoor activity – have a significant impact on the safety, adherence and effectiveness of therapeutic programs. **Objective:** To synthesize the available evidence on the effectiveness of kinesitherapy in patients with diabetic polyneuropathy and to discuss the practical value of seasonally adapted physical programs. **Methods**: A non-random, structured review of the literature was conducted with a search in the PubMed, Scopus and Google Scholar databases. **Results:** Data from systematic reviews and clinical studies show that combined programs (aerobic, strength and balance and stability exercises) lead to improvements in muscle strength, gait, balance and in some cases – to a reduction in neuropathic pain and improved sensory function. Seasonal variations affect the level of physical activity and vascular function; adapted programs increase safety and resilience in extreme climatic conditions. **Conclusion:** Structured programs, including balance, strength and aerobic activity exercises, are a key element of rehabilitation in diabetic polyneuropathy. Incorporating seasonal adaptations increases adherence and safety, but there is a lack of randomized trials comparing seasonally adapted and standard protocols.
Keywords: diabetic peripheral neuropathy, exercise, physiotherapy, seasonal adaptation, balance training, foot-ankle exercise.

INTRODUCTION

Diabetes mellitus is a heterogeneous metabolic disease characterized by chronic hyperglycemia resulting from impaired insulin secretion or action, or a combination of both mechanisms. It is one of the most prevalent chronic diseases worldwide, with projections indicating that by 2030 the number of affected individuals will reach approximately 366 million. One of the most common and clinically significant complications of diabetes is diabetic peripheral neuropathy (DPN), which occurs in 25–50% of patients, especially those with type 2 diabetes [1,2]. Diabetic polyneuropathy involves damage to large and small nerve fibers, leading to impaired motor, sensory, and proprioceptive functions, as well as pain, changes in temperature sensitivity, and autonomic dysfunction [3]. These manifestations limit patients' daily activities, increase the risk of falls and diabetic ulcers, and lead to a reduced quality of life.

Modern treatment of DPN requires a multidisciplinary approach combining pharmacological and non-pharmacological means [4, 5]. The role of physiotherapy is supported by data showing that regular exercise improves gait, balance, muscle strength, and quality of life [6, 7]. Physical activity helps glycemic control, reduces cardiovascular risk, and contributes to weight loss [8]. Available clinical observations and experimental data suggest that temperature fluctuations can have a direct impact on peripheral nerve functions, which necessitates the adaptation of rehabilitation programs according to seasonal conditions [9].

MATERIALS AND METHODS

The present work is a narrative review aimed at systematizing the available scientific data on the effects of kinesitherapy in patients with diabetic polyneuropathy, as well as the role of seasonal factors on the functional status and safety of the exercises performed. A targeted search was performed in the following electronic databases: PubMed, Scopus and Google Scholar. The search was limited to publications in English, published until September 11, 2025.

DISCUSSION

Physical activity is a basic non-drug approach in the complex treatment of diabetic polyneuropathy, aimed at improving muscle strength, balance, gait and functional independence [8, 10, 11, 12]. A number of systematic reviews and meta-analyses emphasize that combined programs lead to significant improvement in stability and gait, as well as a reduction in the risk of falls [6, 7, 13, 14].

In addition to functional benefits, physical activity improves metabolic control, improving insulin sensitivity and glycemic control. Studies have shown that regular exercise can reduce HbA1c levels by 0.5–0.7%, which is clinically relevant for limiting the progression of neuropathic damage [15,16]. The most commonly used interventions include moderate-intensity aerobic exercise (walking, stationary bike, swimming), balance exercises (static and dynamic), and strength training targeting the muscles of the lower extremities and the foot [17]. There is evidence that specific foot exercises improve proprioception, gait, and stability, while reducing the risk of diabetic ulceration [18, 19]. Seasonal changes have a significant impact on the vascular and nervous systems, as well as on the behavior of patients with DPN. During the winter months, low temperatures cause vasoconstriction, reduce peripheral blood flow, and increase stiffness and pain sensitivity in the extremities [20]. In these conditions, an active warm-up for 8–15 minutes before exercise is recommended. A systematic review reports up to a 30% increase in the risk of falls in winter and emphasizes the need for adapted balance exercises to prevent winter injuries [19]. During the summer months, high temperatures and dehydration can worsen autonomic disorders and increase the risk of thermal overload, especially in patients with impaired vasomotor regulation [20]. During this period, it is recommended to reduce exercise intensity, ensure adequate hydration, conduct exercises in the early morning or late evening hours, include aquatic activities, and monitor signs of heat stress. Notley et al. (2019) show that adapting training to high temperatures improves tolerance to heat stress and facilitates the maintenance of glycemic control [18]. In spring and autumn, climatic conditions are more favorable for outdoor exercise, but variable temperature and increased humidity can affect thermoregulation and increase the risk of skin infections. Data from some observations indicate that during the spring-summer season, patients show higher motivation and adherence to motor activity, while during the autumn-winter period, activity decreases significantly [20, 21].

Online-based (web-based) and group rehabilitation programs are established as effective methods for overcoming seasonal restrictions. They allow better monitoring of adherence, provide social support and improve patient motivation [22].

Practical recommendations for a physiotherapy program in patients with DPN (including seasonal adaptations).

The presented recommendations are a synthesis of current guidelines, systematic reviews and clinical studies. They should be individualized according to the patient's general condition, the presence of concomitant diseases and the severity of the neuropathy.

General principles:

- Blood glucose monitoring – especially before and after more intense sessions, along with monitoring for wounds and ulcerations, with a focus on the feet.

● Neurological and functional assessment – before the start of the program and every 8–12 weeks, including sensory, motor, balance (Berg Balance Scale, Timed Up and Go test), and cardiorespiratory fitness.
● Frequency and duration of training – 3–5 times per week, combining 3–4 sessions of exercise and 1–2 sessions of light activity or walking. Each session should last 30–60 minutes, including a 5–10 minute warm-up and 5–10 minute stretch/recovery.
● Exercise intensity – moderate-intensity aerobic exercise (Rating of Perceived Exertion 12–14 or 50–70% of maximum heart rete); progressive resistance training (2–3 sets of 8–12 repetitions). For patients with pain or limited tolerance, starting with a lower intensity and gradual progression is recommended.
● Foot and shoe care – educating patients on proper shoe selection, self-monitoring for wounds and skin changes.
Composition of the training program:
• Aerobic exercises (walking, stationary bike, swimming, with a recommended average intensity of 150 minutes per week) – aim to improve blood supply, insulin sensitivity and general endurance.
• Strength exercises – aimed at increasing muscle strength, improving gait and reducing fatigue. Performed twice a week, 2–3 sets of 8–12 repetitions, with a focus on the lower extremities (m. quadriceps femoris, ischiocrural muscles, gluteal muscles). Theraband bands, devices or own weight can be used.
• Balance and proprioception exercises (single leg standing, dynamic exercises, use of unstable surfaces in advanced patients) – dynamic and static exercises to improve postural stability and reduce the risk of falls.
• Foot and ankle exercises – strengthen small muscles, support the arch and prevent deformities and ulcerations.

CONCLUSION

Kinesitherapy is an essential component in the multidisciplinary treatment of diabetic peripheral neuropathy. Data from available clinical and systematic studies show that combined programs – including aerobic exercise, strength training, balance and specific foot exercises – lead to significant improvements in motor functions, gait, balance and quality of life of patients. Seasonal climatic factors have a significant impact on the effectiveness and safety of rehabilitation interventions. Adapting rehabilitation programs to seasonal conditions is key to ensuring safety, increasing adherence and achieving optimal therapeutic results.

Abbreviations:

DPN - Diabetic peripheral neuropathy

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POTENTIAL BENEFITS OF A SHORT-TERM MOVEMENT PROGRAM FOR KNEE OSTEOARTHRITIS

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Abstract: The goal is to investigate short-term rehabilitation program effectiveness, involving therapeutic exercises. **Materials and methods:** 33 patients with gonarthritis in 2nd and 3rd radiographic stages, and 67.6±9.5 (44-87) mean age were studied. They underwent a ten-day outpatient setting rehabilitation program including a kinesitherapy complex administered by a qualified therapist. The monitored indicators were: pain (VAS), functional activity (WOMAC Index), range of motion, knee circumference, and manual muscle (m. quadriceps femoris) testing (MMT). Statistical significance level - $p<0.05$. **Results:** A reduction in pain at rest, walking, ascending/descending stairs was observed immediately after treatment and until the end of the first month ($p<0.05$), followed by an increase in the third month compared to the end of the first month ($p<0.05$). The WOMAC Index showed a significant decrease after therapy ($p<0.05$) and at the end of the first month ($p<0.05$), with no statistically significant difference at the end of the third month compared to the baseline values ($p=0.170$). Improved knee flexion range and reduced swelling (measured in centimeters) were observed after therapy and in the first month, with results deteriorating in the third month but still lower than baseline ($p<0.05$). Muscle weakness decreased significantly by the end of the first month and increased in the third month compared to the first ($p<0.05$), but remained at the level after therapy ($p=0.001$). **Conclusion:** The rehabilitation program resulted in pain and muscle weakness reduction, and functional activity, range of motion, and knee joint centimetry improvement. However, three months after the end of the therapeutic exercise course, the indicators were returning to baseline values.

Keywords: knee osteoarthritis, pain, WOMAC Index, therapeutic exercises, muscle weakness.

Introduction Knee osteoarthritis is a disease characterized by joint cartilage, subchondral bone, ligaments, and capsule damage, and periarticular muscles changes, often preceding the clinical symptoms. All those leads to chronic damage associated with pain, limited range of motion, and stiffness, which reduce daily functional activity. Over time, the disease progresses, causing chronic long-term damage not only to the musculoskeletal system but also to other systems in the body (1). These changes are probably related to daily physical activity, as low levels of activity are associated with the occurrence and development of a number of systemic disorders such as metabolic syndrome, cardiovascular, endocrine, and other diseases. The main risk factors include age, obesity, inflammation, trauma, and genetic factors. The prevalence of OA is increasing with the aging of the population worldwide (2).

The introduction of therapeutic exercise programs into treatment plans could potentially have a beneficial effect on patients with knee osteoarthritis. On the one hand, these programs can be used to slow down the process of damage and loss of joint cartilage, to reduce the effect of inflammation and changes observed in the subchondral part of the bone. On the other hand, if an effective means of influencing the pathological processes involved in joint osteoarthritis is found, this should reduce the severity or even eliminate clinical symptoms such as pain, stiffness, muscle weakness, edema, difficulty walking, descending/ascending stairs. Of course, careful selection and/or combination of therapeutic exercises must be implemented (aerobic exercises, exercises to increase muscle strength,

balance exercises, proprioceptive and neuromuscular exercises), including exercises in an aquatic environment and traditional Chinese gymnastics, in cases where this is possible.
The aim is to investigate short-term rehabilitation program effectiveness, involving therapeutic exercises.

Material and methods. 33 patients with gonarthritis in 2nd and 3rd radiographic stages, and 67.6 ± 9.5 (44-87) mean age were studied. Demographic characteristics are presented in Table 1. The inclusion and exclusion criteria are presented in Table 2. Patients underwent a ten-day outpatient setting rehabilitation program administered by a qualified therapist, including a kinesitherapy complex. The kinesitherapy program combined exercises to improve aerobic function, exercises that are performed analytically by the thigh muscles with priority m. Quadriceps femoris (medial and lateral part), relaxing exercises, exercises with increasing resistance and those that lead to an increase in the range of motion in the pathologically involved joint. Before starting the therapeutic sessions, the patients were informed about the purpose and means of this therapy and they gave informed consent in accordance with the Declaration of Helsinki.

Table 1 Characteristics of the patients

Indicators	Therapeutic group (n=33)
Age (Mean±(SD)Range)	67.6 ± 9.5 (44-87)
Gender identity (Mean±(SD)Range)	22 women 65.9±11.7(42-85) 11 men 65.9 ± 8.4(48-76)
Duration of the disease (Me(Range)) years	7(1-20) years
Duration of the current exacerbation period (Me(Range)) weeks	6.27±1.88 (3-10)
X-ray degree of Kellgren-Lawrence scale:	With II-20 (60.6%), with III -13 (39.4);
Reason for visiting a doctor	Pain 100% , difficulties while walking 28 (84.8), stiffness 11 (33.3), limited daily activity 10 (30.3).

The monitored indicators were: pain (VAS), functional activity (WOMAC Index), range of motion, knee circumference, and manual muscle (m. quadriceps femoris) testing (MMT). Results with a reliability level of $p<0.05$ were considered statistically significant.

Results: A reduction in pain at rest, walking, ascending/descending stairs was observed immediately after treatment and until the end of the first month ($p<0.05$), followed by an increase in the third month compared to the end of the first month ($p<0.05$). The WOMAC Index showed a significant decrease after therapy ($p<0.05$) and at the end of the first month ($p<0.05$), with no statistically significant difference at the end of the third month compared to the baseline values ($p=0.170$). Improved knee flexion range and reduced swelling (measured in centimeters) were observed after therapy and in the first month, with results deteriorating in the third month but still lower than baseline ($p<0.05$). Muscle weakness decreased significantly by the end of the first month and increased in the third month compared to the first ($p<0.05$), but remained at the level after therapy ($p=0.001$).
After completion of the treatment course, VAS pain decreased at months 1st and 3rd compared to baseline, pain at rest increased after 1st month, with the effect persisting until the end of 1st month and increasing at 3rd month ($p=0.002$) compared to post-treatment, and pain at rest increased at 3rd month compared to month 1st ($p<0.001$), (table.3).

Table 3. Dynamics of pain (VAS) at rest and physical activity

Pain Mean ± SD Period	Pain - at rest	Pain - walking	Pain - Descending	Pain - Climbing
Before Therapy	2.52±0.71	3.85±0.76	6.76±0.90	5.36±1.06
After Therapy	0.82±0.81	2.15±0.57	4.27±0.84	3.09±0.88
After 4 weeks	0.45±0.62	1.73±0.72	3.94±0.83	2.73±0.91
After 12 weeks	1.76±0.75	3.06±0.66	5.24±0.97	4.15±0.97

A significant reduction in pain was achieved by the end of the first month with a subsequent increase in pain at month 3rd compared to month 1st, but the pain level was lower compared to baseline values. The WOMAC Index showed a significant decrease after therapy ($p<0.05$) and at the end of the first month ($p<0.05$), with no statistically significant difference at the end of the third month compared to the baseline values ($p=0.170$), (table.4).

Table 4. Dynamics of KJ circumference, MMT, range of flexion and WOMAC Index.

Period (Mean±SD)	Circumference Knee joint	Test MMT	Range of flexion°	WOMAC Index
Before Therapy	41.3±2.3	3.13±0.39	108.6±8.4	59.0±7.2
After Therapy	41.2±2.2	3.74±0.46	117.4±7.3	49.1±6.4
After 4 weeks	41.4±2.2	3.89±0.53	117.5±6.3	46.4±7.6
After 12 weeks	41.7±2.2	3.37±0.39	113.3±5.6	56.2±7.0

Discussion: Muscle function is more closely related to joint pain than narrowing of the joint space, which makes it a potential therapeutic target because it is more susceptible to change (3). The application of appropriate, tailored to correspond to the functional state of the joint therapeutic exercises could reduce pain and improve the function of the affected joint. There is considerable evidence for the effectiveness of therapeutic exercises in knee joint osteoarthritis. A summary of large number of systematic studies, evaluate the effect of exercise and identify improvements in pain, function, and overall assessment (4). Therapeutic exercises are likely to prevent degenerative changes in cartilage, to reduce inflammatory activity and changes in the subchondral and metaphyseal areas of bone. There is growing evidence that therapeutic exercises can affect pain, stiffness, muscle weakness and joint dysfunction in KOA. Therapeutic options include exercises to increase muscle strength, aerobic exercises, neuromuscular exercises, balance exercises, proprioception, water exercises and some traditional exercises (5).

The study found that a short-term program of therapeutic exercises can have a beneficial effect on muscle function, pain, and stiffness, but discontinuing the therapeutic sessions leads to a recurrence of symptoms after the third month.

According to Yan L. et al. (2025), pain can be significantly reduced by conducting aerobic exercise sessions in a short- and a medium-term period. Exercise for flexibility, neuromotor exercise, and combined exercise have a good medium-term effect, with exercise for flexibility likely to have a longer-term effect, but this is subject to further study because the level of evidence is low (6). Improvements in functional activity are observed after the implementation of programs that include aerobic exercise

or strength-improving or mixed exercises in the medium term, with a moderately strong level of evidence. (6). Flexibility exercise have a positive effect on gait disturbances in a short-term perspective. Neuromotor and aerobic exercise can improve gait in a medium-term perspective, while mixed exercise leads to a longer-term improvement (6). Quality of life improves in a short- and medium-term follow-up after aerobic and flexibility exercises (6). Despite all of the above, according to other researchers, the duration of osteoarthritis symptoms plays an important role in the effect of therapeutic exercise sessions (7). Other factors that are also important are the type and duration of the exercises, their frequency and intensity, which suggests that before therapeutic exercise programs are developed, functional impairments and muscle weakness should be adequately tested in order to prescribe appropriate exercises. (8) Incorporating therapeutic exercises into the treatment plan improves the effect of the therapy, for which there is moderate evidence (9).

Conclusion: One of the most common and early-onset symptoms in patients with knee osteoarthritis is weakness of the joint's motor muscles. One of the most common and early-onset symptoms in patients with knee osteoarthritis is weakness of the joint's motor muscles. The rehabilitation program resulted in pain and muscle weakness reduction, and functional activity, range of motion, and knee joint centimetry improvement. However, three months after the end of the therapeutic exercise course, the indicators were returning to baseline values. In the future, the study could be expanded with the goal to objectify better the results obtained.

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CULTURALLY COMPETENT BEHAVIOR AMONG NURSES

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ABSTRACT

Introduction: Cultural competence is a key characteristic of the modern nursing profession, directly related to the quality of health care provided. Nurses encounter patients from diverse cultural, ethnic, and religious backgrounds on a daily basis, which requires adaptation of care and behavioral sensitivity.
Aim: The aim of the study is to identify culturally competent behavior among nursing students and practicing nurses, to compare its levels between the two groups, and to determine the factors influencing its development and application in practice.
Materials and methods: An online survey was conducted among 69 practicing nurses and 56 third- and fourth-year students from the Nursing program at South-West University "Neofit Rilski," Blagoevgrad. For the purposes of the study, questions were adapted from the Cultural Competence Assessment (CCA) tool developed by Schim and Miller (2003). Statistical data analysis was performed using SPSS 26.
Results: Practicing nurses demonstrated higher levels of culturally competent behavior compared to students, who showed moderate self-assessment and a positive attitude.
Conclusion: The need for targeted practical training is essential for improving cultural competence and adapting nursing care to diverse cultural groups.

Keywords: cultural competence, culturally competent behavior, nurses, students, practical training

INTRODUCTION

Cultural competence is increasingly recognized as a key characteristic of the modern nursing profession and is directly related to the quality and effectiveness of the health care provided [1, 2]. In a globalized world, nurses encounter patients from diverse ethnic, religious, and cultural communities whose values, traditions, and health practices significantly influence their perception of illness and treatment processes [3]. To ensure that care is adequate, it must be tailored to these specificities, moving beyond general knowledge toward concrete actions that demonstrate cultural sensitivity.
In this context, culturally competent behavior is viewed as the practical dimension of cultural competence. It encompasses the nurse's ability to adapt communication strategies, use resources to overcome language barriers, avoid stereotypes and prejudices, and build trust-based relationships with patients [4, 5]. The development of such behavior is a continuous process that begins during nursing education and is further strengthened through clinical experience [6].
Scientific studies show that there are differences between nursing students and practicing nurses regarding the manifestation of culturally competent behavior [7, 8, 9]. While students often demonstrate a strong willingness and positive attitudes toward implementing culturally sensitive practices, practicing nurses typically exhibit established action patterns based on professional experience. This creates opportunities for comparative analysis that can highlight the strengths of both groups and provide guidance for improving nursing education and professional practice.

AIM

The aim of the study is to identify culturally competent behavior among nursing students and practicing nurses, to compare its levels between the two groups, and to determine the factors that influence its development and application in practice.

MATERIALS AND METHODS

The data presented in this scientific report are part of a dissertation study aimed at examining and assessing cultural competence among practicing nurses and students from the Nursing program.

The study groups include practicing nurses from hospital healthcare institutions in the Blagoevgrad region and third- and fourth-year nursing students at South-West University "Neofit Rilski." Information was collected through an online questionnaire distributed via the Google Forms platform, based on adapted items from the Cultural Competence Assessment (CCA) tool developed by Schim and Miller (2003) [10]. The questionnaire consists of two subscales — cultural awareness and culturally competent behavior — with the present report focusing on the latter.

Data were quantitatively analyzed using the statistical software package SPSS 26. The Mann-Whitney U test ($p<0.05$) was applied to compare the two groups, while the Pearson correlation coefficient was used to assess the relationship between participation in cultural competence training and self-assessment.

RESULTS

The study included 69 practicing nurses and 56 Nursing students from South-West University "Neofit Rilski", Blagoevgrad. The average age of the nurses was 43,67 ± 9,62 years, while the students, in their third and fourth years of study, represented a diverse age range.

The distribution of work experience among the nurses showed that 24 (34,78%) had over 20 years of experience, 16 (23,19%) had between 11 and 20 years, 5 (7,25%) had between 6 and 10 years, 18 (26,09%) had between 1 and 5 years, and 6 (8,69%) had less than 1 year.

In terms of self-assessed cultural competence, 30 nurses (43,48%) rated themselves as "good," 23 (33,33%) as "moderate," 9 (13,04%) as "excellent," and 7 (10,15%) as "rather low," with none rating themselves as "poor." Among the students, 32 (57,14%) described their cultural competence as moderate, while 9 (16,07%) rated it as good.

The vast majority of nurses — 65 (94,20%) had not participated in any training related to cultural competence, while only 4 (5,80%) had such an opportunity. The correlation between participation in cultural competence training and self-assessment among nurses was extremely weak and statistically insignificant (r = -0,009; p = 0,940), indicating that training participation had no measurable impact on self-assessment levels.

Specific manifestations of culturally competent behavior among nurses and students are summarized in Table 1, which presents the frequency of responses for each item and the comparison between the two groups.

Table 1. Comparison of Culturally Competent Behavior Between Nurses and Students

Question	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
I seek information about cultural characteristics and needs when meeting new people in the hospital. (Mann-Whitney U = 1768,000, N = 125, p = 0,388)					

Nurses	15(21,74%)	31(44,93%)	21(30,43%)	0(0%)	2(2,90%)
Students	20(35,71%)	16(28,57%)	20(37,72%)	0(0%)	0(0%)
I have textbooks and materials that help me learn more about different cultures. (Mann-Whitney U = 1042,500, N = 125, ***p = 0,000****)*					
Nurses	60(86,96%)	9(13,04%)	0(0%)	0(0%)	0(0%)
Students	25(44,64%)	15(26,79%)	10(17,86%)	6(10,71%)	0(0%)
I consciously refrain from making generalizing assumptions or judgments about people based on their ethnic, racial, cultural, or religious background. (Mann-Whitney U = 1620,000, N = 125, p = 0,085)					
Nurses	0(0%)	0(0%)	7(10,14%)	47(68,12%)	15(21,74%)
Students	0(0%)	0(0%)	10(17,86%)	20(35,71%)	26(46,43%)
I find ways to adapt my nursing care to the cultural preferences of individual patients. (Mann-Whitney U = 1870,000, N = 125, p = 0,744)					
Nurses	0(0%)	2(2,90%)	26(37,68%)	13(18,84%)	28(40,58)
Students	0(0%)	0(0%)	20(35,71)	20(35,71%)	16(28,57%)
I use the help of people or resources for translation to facilitate communication with patients who do not speak Bulgarian. (Mann-Whitney U = 1452,000, N = 125, p = ***0,012****)*					
Nurses	37(53,62%)	2(2,90%)	30(43,48%)	0(0%)	0(0%)
Students	8(14,29%)	28(50,0%)	12(21,43%)	5(8,93%)	3(5,35%)
I make efforts to build trust with patients from diverse cultural backgrounds. (Mann-Whitney U = 1587,000, N = 125, p = 0,048)					
Nurses	0(0%)	15(21,74%)	53(76,81%)	1(1,45%)	0(0%)
Students	0(0%)	15(26,78%)	24(42,86%)	9(16,07%)	8(14,29%)
I adapt my communication style according to the cultural characteristics and preferences of the patient. (Mann-Whitney U = 1324,000, N = 125, p = ***0,001****)*					
Nurses	0(0%)	0(0%)	29(42,03%)	33(47,83%)	7(10,14%)
Students	0(0%)	16(28,57%)	16(28,57%)	24(42,86%)	0(0%)
I provide information about nursing care in a language and format that is understandable and accessible to patients. (Mann-Whitney U = 1134,000, N = 125, p = ***0,000****)*					
Nurses	7(10,14%)	21(30,43%)	17(24,64%)	18(26,09%)	6(8,70%)
Students	2(3,57%)	4(7,14%)	13(23,21%)	22(39,29%)	15(26,79%)

DISCUSSION

The results of the present study indicate that nurses demonstrate a higher level of culturally competent behavior compared to students, which is likely due to their accumulated professional experience and direct contact with patients from diverse cultural backgrounds. Similar findings have been confirmed in international studies, where practicing healthcare professionals with greater clinical experience show higher engagement and effectiveness in culturally adapted care [11].

The statistically significant differences in the use of interpreters, adaptation of communication, trust-building, and providing information in a language accessible to the patient highlight that practical experience is a key factor in the development of cultural competence. These results are consistent with international research indicating that interaction with patients from different cultures and participation in real clinical situations enhance nurses' cultural adaptation skills and behavioral competence [5, 12].

Students, despite their limited clinical practice, demonstrated moderate self-assessment and a positive attitude toward culturally competent behavior. This is also in line with the reviewed literature, which

shows that students often display knowledge and motivation regarding cultural competence but require practical training and support to develop their skills in real-life settings [13, 14].
The lack of a significant relationship between participation in training and self-assessment among nurses suggests that current educational programs do not provide sufficient practical application of knowledge. This finding aligns with other studies indicating that short or purely theoretical courses on cultural competence rarely lead to sustainable behavioral improvement unless combined with clinical experience [8].

CONCLUSION

The study confirms that cultural competence develops through a combination of professional experience and practical skills. Nurses demonstrate higher levels of culturally competent behavior, while students show a positive attitude and potential for growth. The need for targeted and practice-oriented training is crucial for enhancing the ability to adapt nursing care to diverse cultural groups.

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STUDENT AWARENESS OF ARTIFICIAL INTELLIGENCE AS A FACTOR FOR ACADEMIC AND PROFESSIONAL PREPARATION

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Purpose: In the era of digitalization and the introduction of artificial intelligence (AI) in education, student awareness of these technologies is becoming a key factor in fully utilizing their potential and avoiding the associated risks. The scientific literature highlights both the opportunities and the challenges.
Material and methods: The survey included 205 respondents, of whom 15 were in the "*physician assistant*" specialty and 190 were in the specialty of "*nurse*".
Results: Regarding their level of awareness, the majority of students indicated that they were fully aware (62.4%, 95% CI [55.4%, 69.1%]). Regarding the source of information about AI technologies, the highest relative share of participants indicated social networks as the main source (60.1%, 95% CI [52.8%, 67.1%]), while only 7% of respondents reported that this information was provided by their teachers.
Conclusion: The growing interest in the topic of student awareness of AI highlights the need for a balanced approach that includes understanding the benefits of AI, educational policies, without ignoring the risks to creativity, emotional well-being, and academic integrity.

Keywords: artificial intelligence, students, education.

Introduction: In the 1980s, education embraced AI in nursing education. Rather late and cautiously compared to other academic fields [1].

The integration of AI has a wide range of possibilities, as recent studies have shown. The scope and systematic reviews of current AI applications or user perceptions of AI implementation in nursing education show its somewhat slower development [1,2]. The implementation of AI technologies in this field is still in its early stages, which highlights the limited participation of nurses [1].

Healthcare students need to be prepared for the challenges ahead. This requires that the material on the disciplines that is taught be optimized as much as possible and that attractive conditions be offered, which will allow attracting new students [3]. The development of modern technologies is increasingly changing our way of life, and this technical progress is a direct function of the intellectual capacity of the modern person, which is built during his training, and this in turn is increasingly being carried out through information and communication technologies or an increasing part of the training process is being implemented in a virtual environment. The improvement of nursing training is in line with innovations in education and e-learning will increasingly enter the training of future nurses [4].

Incorporating AI into the learning process can significantly improve both the theoretical knowledge and practical skills of students, preparing them for the challenges of modern medicine [5].

The application of AI in medical education curricula could make students' experiences more personalized and more realistic about what they will encounter in real-world clinical situations [6,7]. AI is a strategic technology ushering in a new era of technological, industrial, and social revolution, and has a significant and far-reaching impact on the transformation of education, economic development, social progress, and the international political and economic situation [8]. A variety of

tools combined with AI have been applied in the field of education. According to Huang et al., by incorporating human intelligence, a computer system can serve as an intelligent teacher, tool, or learner, and facilitate decision-making in the educational environment [9]. The possibilities include academic article writing, language translation, interactive learning, and automatic essay grading. It can also increase the productivity of educators and can be used for personalized feedback [10]. The integration of AI in education will bring new opportunities to improve the quality of teaching and learning. AI has a wide range of applications in the field of education. On the one hand, AI recommend different learning content, such as videos [11].

Materials and Methods

This study was designed as a cross-sectional survey conducted during the academic year 2024/2025 among students of the Faculty of Public Health at the Medical University of Plovdiv. A total of 205 respondents participated, of whom 15 were enrolled in the "Physician Assistant" program and 190 in the "Nursing" program. Participation was voluntary and anonymous.

Data were collected through a structured questionnaire developed specifically for the study. The instrument included questions on demographic characteristics such as age, sex and year of study, as well as items assessing the level of awareness of artificial intelligence, the main sources of information about AI, and the types of AI tools used by the students in their academic and personal activities. The questionnaire was distributed in paper format during scheduled classes and required approximately 10 minutes to complete.

The study was conducted in accordance with the ethical standards of the Medical University of Plovdiv. Approval was obtained from the institutional leadership, and all participants provided informed consent prior to inclusion. No personal identifiers were recorded.

Data were entered and analyzed using R software (*version 5.2.1*). Descriptive statistics were applied, with categorical variables presented as absolute and relative frequencies and continuous variables as median and interquartile range. Differences between groups were assessed using the chi-square test for categorical variables and the Mann–Whitney U test for continuous variables. A significance level of $p < 0.05$ was considered statistically significant.

Results

The survey included 205 respondents, of whom 15 were in the specialty of "physician assistant" and 190 were in the specialty of "nurse". *Table 1* presents the demographic characteristics of the respondents. They were mostly girls (95.6%), with a median age of 22 years (IQR 20, 35), of whom 79 (39%) were in their first year of study.

Table 1: Demographic characteristics of the respondents included in the survey.

Characteristics	**Тотал N = 205**	**Physician Assistant N = 15**	**Nurse N = 190**
Year of study			
1st	79 (39%)	15 (100%)	64 (34%)
2nd	60 (29%)	—	60 (32%)
3rd	66 (32%)	—	66 (35%)

Gender (male)	9 (4.4%)	3 (20%)	6 (3.2%)
Years (Median [IQR])	22 [20, 35]	35 [23, 44]	22 [20, 34]

Regarding their level of awareness (Figure 1), the majority of students indicated that they were fully (62.4%, 95% CI [55.4%, 69.1%]) or partially informed (23.9%, 95% CI [18.2%, 30.3%]) about the nature of AI. Lack of any awareness was found in 13.7% (95% CI [9.27%, 19.1%]) of the respondents. The awareness of the students did not differ according to the studied specialties ($p = 0.08$), but was found to be significantly higher among students in the 3rd year compared to those in the 1st year of study ($\delta = 18.4\%$, 95% CI [4.38%, 32.4%], $p = 0.006$).

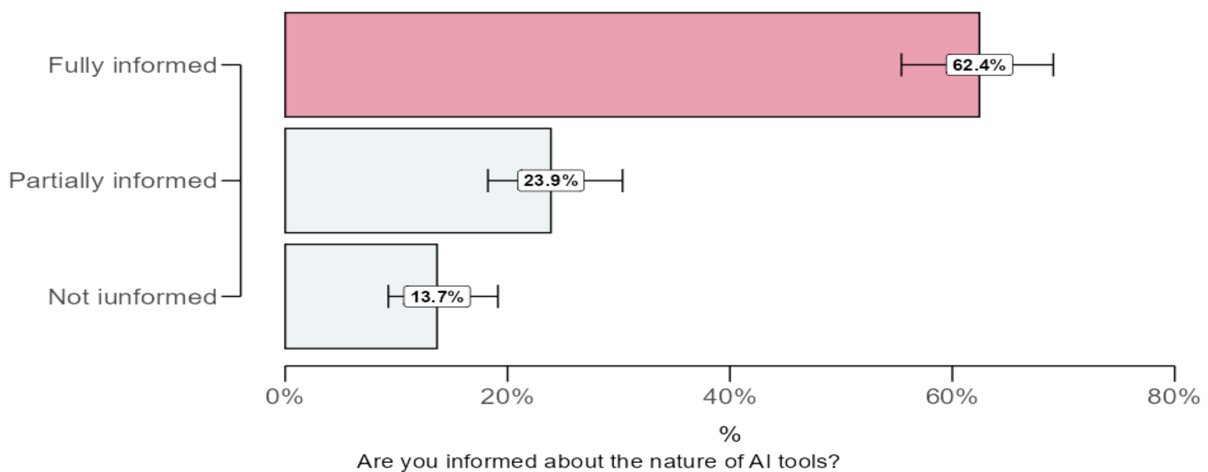

Figure 1: Distribution of participants according to their awareness of AI tools.

Regarding the source of information about AI technologies, the highest relative share of participants who indicated social networks as the main source was (60.1%, 95% CI [52.8%,67.1%]), while only 7% of respondents reported that this information was provided by teachers.

Among the individuals surveyed, the extent of use of AI technologies varied significantly (CV = 97.2%), with slightly less than half of the participants (n = 91, 44.4%, 95% CI [37.5%, 51.5%]) reporting that they do not use AI tools. Among the types of AI tools that respondents indicated they use, the chatbot "ChatGPT" has the highest relative share (86.2%, 95% CI [78.3%, 92.1%]), followed by "Gemini" (4.59%, 95% CI [1.51%, 10.4%]), and all other tools, among which "AI-fool", "Bixby", "Chatbox", "Dall-F", "Deepseek", "Murf", "Quizlet", "Stable", "Undefecfabje AI" and "Wordtune AL" are mentioned, have a cumulative relative share of 9.21% (95% CI [5.01%, 17.1%]).

Discussion:

More and more students are using AI in their learning, with a large proportion doing so on a daily or at least weekly basis [12]. Students point out a number of benefits of using AI – faster learning, feedback, references and problem solving. At the same time, they are concerned about risks such as inaccurate information, loss of critical thinking, over-reliance and violation of academic integrity [13,14]. The general conclusion is that students have a high practical but limited critical awareness of AI, which highlights the need for universities to introduce training on the responsible and conscious use of AI [15]. Learning based on digital technologies is an opportunity for the use and transmission

of knowledge. Virtual reality programs are a practical application of this process. These applications can be useful in the training of medical professionals. The continuous development of applications allows learners to effectively confront simulated real life and experience increasingly concrete situations [3].

Conclusion/s/:

Regardless of the major of the students surveyed, the majority indicated that they were informed about the nature of AI. The use of AI by students in the higher courses is significant, with social networks remaining the leading source of student awareness of the possibilities of AI.

Acknowledgments:

Gratitudes to the management of MU - Plovdiv for the support and trust in the implementation of the study.

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DIETARY PATTERN AS A RISK FACTOR FOR THE DEVELOPMENT OF OSTEOPOROSIS IN WOMEN OF BULGARIAN AND ROMA ETHNICITY

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ABSTRACT
Osteoporosis is a serious public health problem associated with progressive bone loss and an increased risk of fractures. It is a serious challenge for modern health systems worldwide, including in Bulgaria. This requires in-depth research into risk factors and prevention strategies, especially among young, active women. Eating habits, the presence of eating disorders, and the practice of restrictive diets play a significant role in both prevention and progression of the disease. The present study analyzed the relationship between dietary behavior and the risk of osteoporosis among 417 women aged 25–65 years of Bulgarian and Roma ethnicity. The results show that a significant proportion of participants in both target groups regularly consume meat, while fish intake is significantly lower among women of Roma origin. The difference is statistically significant, suggesting an increased risk of vitamin D and omega-3 fatty acid deficiency. On the other hand, following weight loss diets is more common among Bulgarian women, which can potentially lead to a deficiency of vital nutrients needed to maintain bone strength.

Keywords: osteoporosis, eating habits, eating disorders, bone health, risk factors

INTRODUCTION
Osteoporosis is a systemic metabolic bone disease characterized by progressive loss of bone mineral density and deterioration of bone microarchitecture. It is a significant public health problem worldwide, affecting millions of people. Postmenopausal women are most vulnerable due to hormonal changes leading to accelerated bone resorption. As a result of the disease, changes occur that lead to increased bone fragility and an increased risk of fractures with minimal stress and minor trauma. Symptoms are often absent for years, and the first clinical manifestation is only when an osteoporotic fracture occurs. This is why osteoporosis is often called the “silent killer” or “the thief of bone health” [1,2]
The study aimed to analyze dietary behavior as a risk factor for the development of osteoporosis among women of Bulgarian and Roma ethnicity.

METHODS
The study included 417 women of working age (25-55) of Bulgarian and Roma origin. Of these, 223 (53.48%) were women of Bulgarian origin with an average age of 43.58±10.27 years, and 194 (46.52%) were of Roma origin with an average age of 42.79±6.61 years. The majority of the interviewed Bulgarian women live in cities (81.6%) compared to Roma women. The data show significant differences in the educational qualifications of the two groups. More than half of the women of Bulgarian ethnicity have higher education (61.0%), while the majority of Roma women (32.0%) have primary or secondary education (27.8%). The level of education is closely related to the nature of work. The low education of women of Roma ethnicity leads to a significant degree of unemployment or low-skilled outdoor work at 26.8%.

The study was conducted from 2022 to 2023 through direct, anonymous individual surveys. For the study, an authors' questionnaire was developed, including closed- and semi-closed-ended questions to assess modifiable risk factors related to lifestyle-nutrition, calcium and vitamin D intake, physical activity, etc.
The collected data were processed and analyzed using IBM SPSS v.23. Descriptive and variance analyses were used, with central trends presented as mean values and standard deviations; Pearson's chi-square test for analysis of nominal data. The significance level was set at $\alpha=0.05$.

RESULTS AND DISCUSSION

Nutrition plays an important role in bone health. An important role in preventing osteoporosis is to establish proper eating habits from early childhood. The risk of osteoporosis increases with chronic dietary calcium deficiency [3,4]. The results of our study show differences in dietary habits between women in both groups. A large proportion of respondents reported regularly consuming meat. This percentage was higher among Bulgarian women (196, 87.9%) compared to Roma women (164, 84.5%). It is important to note that the relative share of women who do not consume meat is slightly higher among Roma women than among Bulgarian women. Different cultural, economic, or personal preferences can explain this.
Another important nutritional factor in maintaining bone health is the consumption of fish. It is a natural source of vitamin D and omega-3 fatty acids - nutrients that play an essential role in bone metabolism and mineralization [5, 6]. A statistically significant difference in the frequency of fish consumption was found between the two target groups ($p<0.0001$). A higher share of Bulgarian women reported consuming fish than Roma women. (Table 1). This may lead to vitamin D and essential fatty acid deficiencies, which increase the risk of bone mineral density loss and osteoporotic fractures [7]. Lower fish consumption among Roma women is a significant risk factor for bone health, especially in the context of already established socio-economic inequalities.
Eggs are a food product rich in high-quality proteins, vitamin D, phosphorus, and other important substances that can help maintain bone health [5]. Analysis of the results shows that the majority of respondents in both target groups reported regular egg consumption. At the same time, only a limited number of women indicated a lack of such a habit (Table 1). The high consumption across all participants highlights the role of eggs as an accessible and potentially beneficial dietary component, especially for bone health [6,7]. Milk and dairy products are a major source of calcium, a key mineral for bone mineral density throughout life [8,9]. The present study shows that the majority of women in both groups regularly consume milk and dairy products. This highlights the constant presence of these foods in the daily diet (Table 1). No statistically significant difference was found for this factor, indicating that ethnicity does not significantly affect this dietary habit. It should be noted that one in ten women in the sample does not consume these important products for bone health.

Table 1. *Relative share of women of Bulgarian and Roma ethnicity in terms of consumption of meat, fish, eggs, and dairy products*

	Bulgarian n (%)	**Roma n (%)**	**P**
meat	196 (87,9%)	164 (84,5%)	NS
fish	168 (75,3%)	166 (57,2%)	p<0.0001
eggs	197 (88,3%)	196 (85,6%)	NS
dairy products	201 (90,0%)	170 (87,6%)	NS

Eating disorders are a serious risk factor for the development of osteoporosis, especially in women of reproductive and postmenopausal age. Anorexia and bulimia are associated with significant caloric and nutritional deficiencies, leading to reduced bone mineral density, hormonal imbalance, and increased fracture risk [10,11,12].

Analysis of the data on eating disorders among the two target groups reveals significant differences in the distribution of responses (Figure 1). The majority of participants did not report the presence of an eating disorder. However, cases of indicating “other” eating disorders are more common among Bulgarian women. Respondents who reported cases of anorexia are extremely few and are evenly distributed between the two groups, while bulimia is noted only among women of Roma ethnicity. Despite the low frequency of specific diagnoses, the differences between the groups are statistically significant. These results can be viewed as differences in cultural attitudes towards nutrition, appearance, and access to health and social services. Although the proportion of women affected is not high, the clinical significance of this factor is significant.

Following weight-loss diets, especially restrictive ones, can have a profound impact on bone mineral density, especially in women of working age and in the perimenopausal period [13,14].

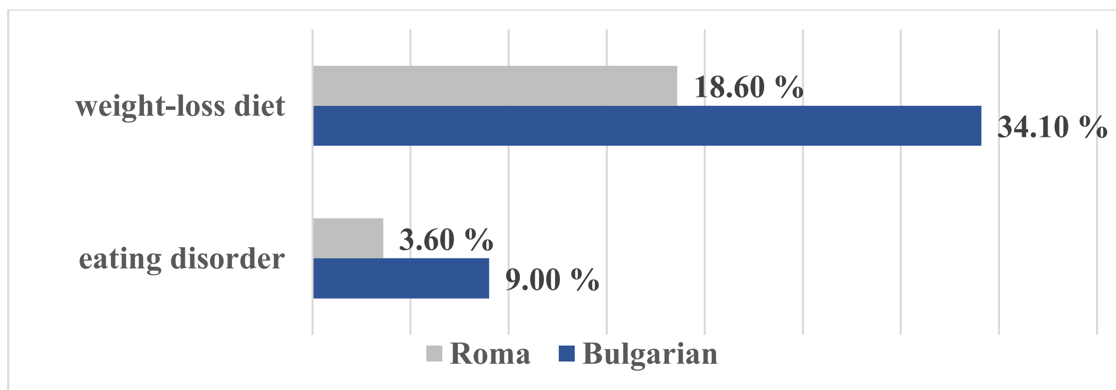

Figure 1. Relative share of women of Bulgarian and Roma ethnicity with eating disorders or following a weight loss diet.

The analysis of responses concerning dieting for weight loss shows significant differences between the two groups studied. Bulgarian women are much more likely to report that they have dieted for weight loss, while Roma women are more likely to state that they have never followed a weight loss diet. This difference is statistically significant, suggesting a relationship between ethnicity and dietary behavior. Several key factors may explain this disparity, including variations in cultural attitudes, living conditions, financial opportunities, and unequal access to information about maintaining a healthy weight and preventing issues related to unhealthy eating.

CONCLUSION

The present study highlights the significant impact of dietary habits and dietary restrictions on bone health among young Bulgarian and Roma women. Differences in consumption of essential food products between the studied groups indicate potential risks of nutritional deficiencies that may negatively affect bone mineral density. Lower fish consumption among Roma women may lead to insufficient intake of vitamin D and omega-3 fatty acids. In contrast, more frequent adherence to restrictive diets among Bulgarian women may limit the intake of key nutrients necessary for maintaining bone strength. Dietary behavior and socioeconomic status have a significant impact on

bone health. Promoting a healthy lifestyle and conducting educational campaigns among vulnerable groups are key to reducing the incidence and complications of osteoporosis.

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ANALYSIS OF THE PROSPECTS FOR HUMANITARIAN AID IN DISASTERS

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ABSTRACT

Introduction. Disasters create severe general and medical conditions, resulting in significant consequences for the population and generating a need for assistance to affected individuals. A substantial amount of additional resources is required to provide support to the population in the necessary scope and form. Examining the population's readiness to provide assistance through humanitarian actions is essential for overcoming the consequences of disasters. In Bulgaria, the organization that supports humanitarian activities and contributes to reducing disaster vulnerability is the Bulgarian Red Cross (BRC). **The aim** of this paper is to analyze societal attitudes toward providing humanitarian aid in disasters, through coordination of assistance with the activities of the BRC. **Materials and Methods**: Statistical, comparative, and descriptive methods were applied. A survey was conducted in 2015 and again in 2021 among employees of various institutions and a randomly selected segment of the general population. The total number of respondents in both periods was 559, representing different age groups, social statuses, genders, educational backgrounds, workplaces, and settlements. **Results**: Fewer than 50% of respondents are familiar with the activities of the BRC. A positive development is the increased willingness to donate blankets—rising from 27% to 50%. A decline is observed in society's inclination to provide financial support—from 26% to 16%. Assistance through clothing donations decreased significantly—from 70% to 42%. **Conclusion:** People are only partially familiar with the activities of the BRC. Humanitarian motives for providing assistance in disasters do exist, but when it comes to specific activities, the willingness to participate personally decreases. A potential solution to this issue is to expand and promote the activities of the BRC, as well as to communicate more effectively the ways in which the population can assist those affected by disasters.

Keywords: Humanitarian Aid, Bulgarian Red Cross, Disasters

Introduction: The increasing number of disasters in recent decades caused consequences of immense scale and impact, resulting in irreversible losses, disease, and significant damage to affected populations and the economy. [1] During disasters, the population becomes extremely vulnerable. Enhancing its resilience during and after such events can be achieved through coordinated and collaborative actions among the state, institutions, organizations, and citizens. [2]

One of the organizations that supports and assists the state in addressing the consequences of disasters is the Bulgarian Red Cross (BRC). The BRC is an autonomous organization that forms part of Bulgaria's Unified Rescue System, is included in the National Disaster Protection Plan, and is a member of the International Red Cross and Red Crescent Movement. [3] In addition to organizing rescue operations, the BRC supports the state in humanitarian activities aimed at protecting and strengthening public health during disasters, emergencies, and various types of accidents.

Humanitarian aid includes the collection and distribution of food products, bedding and blankets, clothing, quilts, hygiene materials, disinfectants, and other essential items, intended both for evacuated individuals and for the population affected by the disaster. [4]

The aim of this publication is to analyze societal attitudes toward providing humanitarian aid in disasters, through coordinating such assistance with the activities of the Bulgarian Red Cross. **Materials and Methods:** Statistical, comparative, and descriptive methods were employed. To achieve the stated aim, a survey was conducted in two stages. In 2015, the number of respondents was 309, while in 2021 the number was 250. The total number of surveyed individuals across both periods was 559, representing diverse age groups, social statuses, genders, educational levels, workplaces, and places of residence.

The study included employees of various institutions in the cities of Plovdiv and Pazardzhik: Regional Directorates of "Fire Safety and Civil Protection," Regional Health Inspectorates, the Bulgarian Red Cross, as well as municipal and regional administrations. The survey also included members of the general population from different settlements in Plovdiv Province, selected through random sampling.

Results and Discussion

Respondents were asked a question related to a specific type of disaster: ***"Are you familiar with the activities of the Bulgarian Red Cross (BRC) in response to flooding?"***

Fewer than 50% reported being familiar with BRC activities (36.6% in 2015 and 38.4% in 2021). The proportion of those who indicated being only somewhat familiar was also relatively small in both periods (37.2% in 2015 and 34% in 2021). The study further shows that approximately 27% of participants are not familiar at all with the activities of the BRC.

Regarding the question "In what way would the population contribute assistance?" notable differences were observed between the 2015 and 2021 responses.

Respondents were able to select among several types of assistance: donations of bedding and blankets, clothing, hygiene materials, and the much-needed financial support.

A relatively high proportion of respondents indicated that they would not assist disaster-affected individuals with bedding and blankets (72.5% in 2015 and 50% in 2021). Nevertheless, a positive trend is evident when comparing the two periods. In 2021, the number of individuals willing to donate these essential items increased, while the number of those unwilling declined, resulting in both groups becoming proportionally equal—meaning that *every second respondent* expressed willingness to donate. (Fig. 1.)

Bedding and quilts

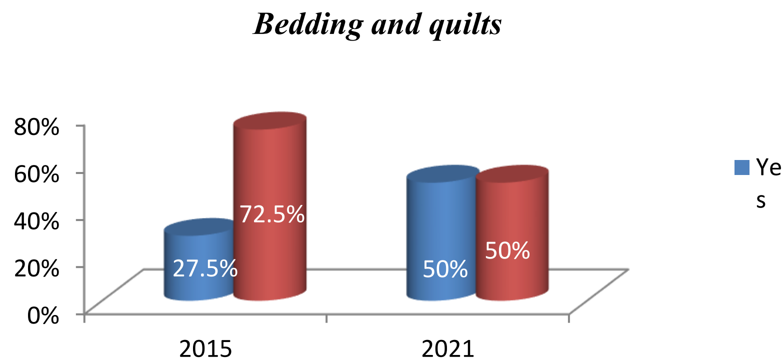

Figure 1. Percentage distribution of survey respondents willing to provide assistance by donating bedding and blankets (original survey data).

Clothing for people in disaster-affected areas is essential, as it ensures physical survival and provides psychological support through the sense of social care and solidarity. The present study shows that empathy expressed through the donation of clothing has decreased substantially—from 70.7% in 2015 to 42.8% in 2021. (Fig. 2.)

Clothing

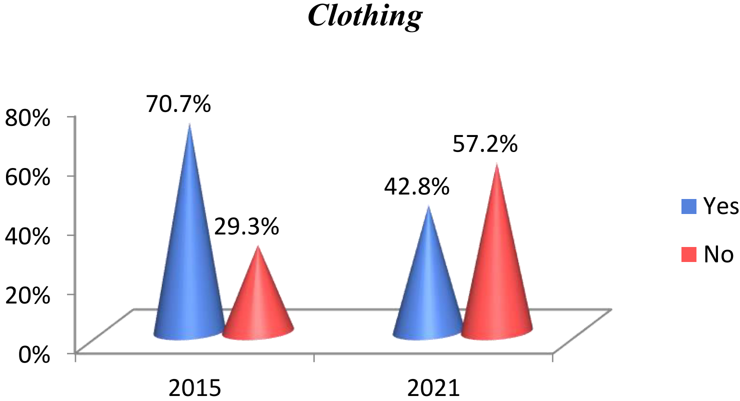

Figure 2. Percentage distribution of survey respondents willing to provide assistance by donating clothing (original survey data).

Hygiene materials are critically important during disasters for maintaining good health and cleanliness both at the individual and population levels. Figure 3 shows that more than 79% of respondents in both survey periods indicated that they would not provide the much-needed hygiene and disinfection materials.

Hygienic materials

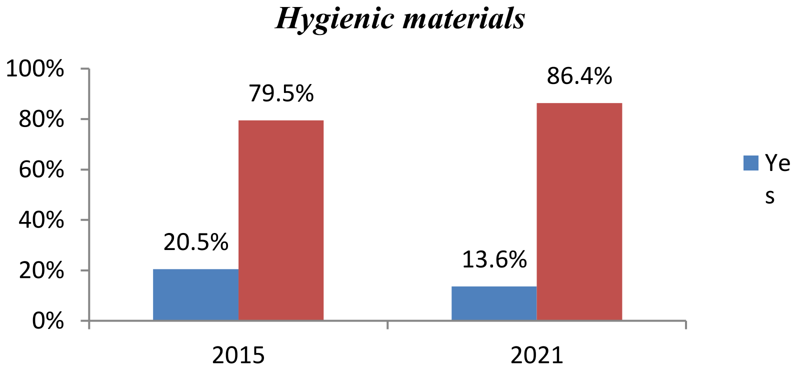

Figure 3. Percentage distribution of survey respondents willing to assist by donating hygiene materials (original survey data).

One of the fastest and most flexible mechanisms for providing financial support to disaster-affected individuals is through the Bulgarian Red Cross (BRC). The BRC maintains a financial assistance fund for disaster victims, rapidly organizes fundraising campaigns, and provides direct financial aid or vouchers for food and other essential goods. [5]

The present study revealed that a very high percentage of respondents in both survey periods (73.5% in 2015 and 83.2% in 2021) indicated that they would not contribute through financial assistance. (Fig. 4.)

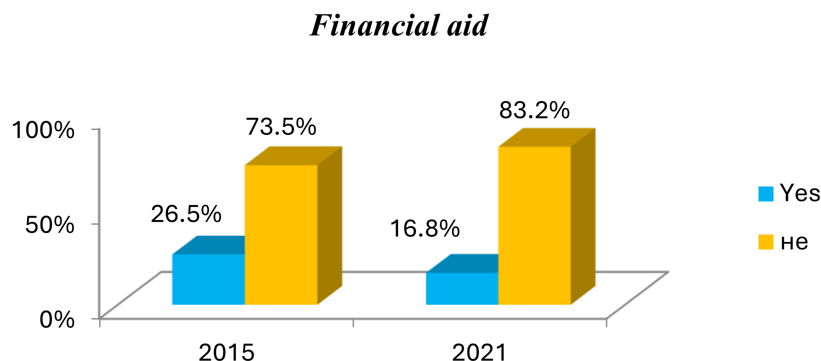

Figure 4. Percentage distribution of survey respondents willing to provide financial support (original survey data).

Conclusions:

The population is only partially familiar with the activities of the Bulgarian Red Cross. More extensive and direct communication aimed at the public is needed regarding the organization's roles and activities.

The only positive change identified is the increased willingness of people to donate bedding and blankets to disaster-affected populations. In contrast, willingness to provide financial assistance, clothing, and hygiene materials has declined.

Although humanitarian motives to assist in disasters exist among the population, when it comes to specific practical actions, the willingness to participate personally decreases. A potential solution to the issues identified in this study is to expand and promote the humanitarian activities of the Bulgarian Red Cross, thereby increasing public engagement in supporting the affected individuals.

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https://www.redcross.bg/about/about4

https://www.redcross.bg/activities/activites12/disaster_fund

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TRENDS IN VITAMIN D SERUM LEVELS AMONG HEALTHY WORKERS OVER A SIX-YEAR PERIOD

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Abstract

Purpose:
Vitamin D deficiency is recognized as a major global health issue affecting individuals of all ages and both sexes. In addition to its classical role in calcium and bone homeostasis, vitamin D functions as a hormone with multiple regulatory effects on cardiovascular, metabolic, and immune processes. The study aimed to evaluate longitudinal changes in serum 25-hydroxyvitamin D [25(OH)D] concentrations among healthy Bulgarian workers over a six-year period. **Material and Methods:** A prospective cohort study was conducted between 2017 and 2023, including 282 healthy workers (mean age 42.0 ± 6.5 years). Serum 25(OH)D was measured during the same season (summer) at three time points using a Cobas E411 immunoassay analyzer. Vitamin D status was classified according to the Endocrine Society guidelines: optimal levels (>30 ng/ml). Statistical analysis was performed using STATISTICA 12. **Results:** A dynamic shift in vitamin D status was observed throughout the study period. Between 2017 and 2019, 42.55% of participants exhibited reduced vitamin D levels compared with 26.95% in 2019-2023 ($p = 0.000$). Mean serum 25(OH)D concentrations showed a gradual decline over time, with no statistically significant differences between sexes. The part of participants with optimal vitamin D levels decreased, while mild deficiency became predominant. **Conclusions:** Suboptimal vitamin D levels remained prevalent in the Bulgarian population. A persistent downward trend of vitamin D concentrations underlined the need for regular monitoring, preventive interventions, and further longitudinal studies in the Bulgarian population.

Keywords: Vitamin D, 25-hydroxyvitamin D deficiency, longitudinal study, Bulgarian population, healthy workers

Introduction
Vitamin D deficiency is a widespread condition that affects individuals across sexes and age groups and represents a major global public health concern. In recent years, insufficient serum concentrations of 25-hydroxyvitamin D (25(OH)D) have been identified as risk factors for cardiovascular disease and as potential predictors of type 2 diabetes, various malignancies, and increased all-cause mortality [1, 2]. A high prevalence of deficiency has been reported across populations worldwide. Currently, there is a lack of prospective studies examining the dynamics of vitamin D levels in the Bulgarian population. Therefore, this study aims to investigate longitudinal changes in serum 25-hydroxyvitamin D (25(OH)D) levels among healthy workers.

Material and methods
We conducted a prospective cohort study for the period 2017-2023. The study included 282 healthy Caucasian workers (mean age 42.0 ± 6.5 years; 92.91% men). Serum 25(OH)D was measured at three

visits, starting in 2017, every other year, over a 6-year period, covering the same season (summer). Participants were stratified by degree of deficiency and sex. The serum levels of total 25-OH vitamin D were evaluated by the Cobas E411 immunoassay analyzer. We have adopted the recommendations of the Endocrine Society, as vitamin D values above 30 ng/ml are considered optimal, and deficiency at levels starts being significant below 20 ng/ml. Vitamin D status was classified based on serum 25(OH)D concentration as optimal (30–50 ng/mL), insufficient (20–29 ng/mL), mildly deficient (10–19 ng/mL), moderately deficient (5–9 ng/mL), and severely deficient (<5 ng/mL), according to Lips et al., 2010 [3]. The statistical analysis (T-test; Chi-square Test) was performed using the software package STATISTICA 12. The statistical significance threshold was at $p<0.05$.

Results

An overall gradual decline in mean vitamin D levels was observed in the total group from 2017 to 2023 (Fig. 1). The highest vitamin D levels (22.86 ±7.71 ng/mL) were recorded in 2017, while the lowest were detected in 2023 (17.88 ±6.95 ng/mL). Statistically significant differences were found in mean vitamin D levels across the study period ($p < 0.0029$).

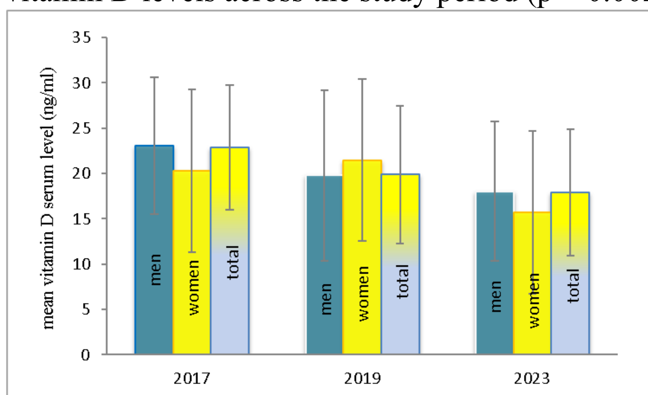

Fig. 1 Mean vitamin D serum levels (ng/ml) across three periods observed (2017-2023).

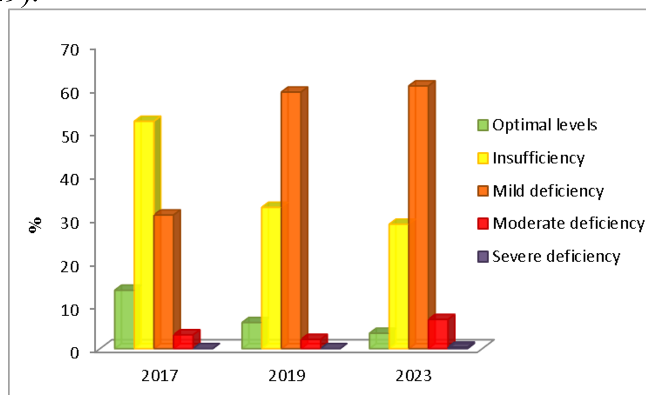

Fig. 2 Distribution by degree of vitamin D deficiency across the three consecutive study years (2017-2023).

We also found that in 2017, the largest group consisted of participants with insufficient vitamin D levels (30.85%), whereas in 2019 and 2023, most individuals belonged to the group with mild deficiency (59.22% and 60.64%, respectively). The proportion of participants with optimal vitamin D levels decreased over the years (13.48% in 2017), (6.03% in 2019), and (3.55% in 2023) while those with moderate and severe deficiency remained relatively stable (Fig. 2).

Analyzing the dynamics of vitamin D levels, according to the stage of deficiency in the period 2017-2023, we found a different trend in the period 2017-2019 compared to those of 2019-2023 (Fig. 3). The percentage of participants transitioning to a lower stage of deficiency in the first period was statistically significantly higher than the second (42.55% vs. 26.95%; OR = 2.008, 95% CI:1.41-2.859; p=0,000). Whereas participants who remained in the same stage were statistically significantly higher in 2019-2023 (45.74% vs. 58.87%, p=0.002). A limited number of individuals increased vitamin D levels and passed in low-grade deficiency (11.71% vs. 14.18% p=0.380).

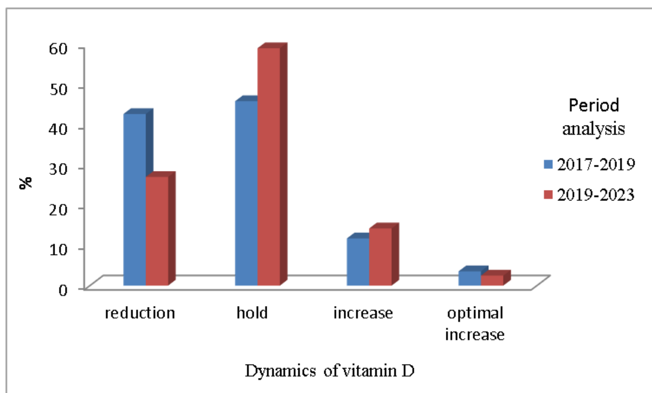

Fig. 3 Relative proportion of participants with changed stages of vitamin D deficiency during the two study periods (2017-2019 and 2019-2023).

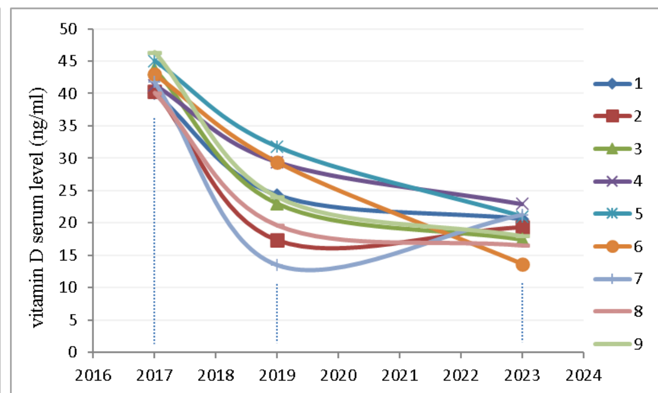

Fig. 4 Longitudinal individual changes in serum vitamin D levels (ng/ml) across the study period (2017-2023) in the group with initially normal levels over 40 ng/ml.

We monitored a group of nine individuals whose initial vitamin D levels exceeded 40 ng/ml (Fig. 4). A pronounced decrease in vitamin D levels was observed between 2017 and 2019 across all samples (42.41±2.27 vs. 23.61±6.04 ng/ml), followed by a relatively flat area from 2019 to 2023 (23.61±6.04 vs. 18.99±2.85). Serum concentrations at the end of the study period, however, remained below the initial baseline values, indicating a persistent suboptimal vitamin D status throughout the examined period. A statistically significant decrease in vitamin D levels was found in 2019 and 2023 compared with 2017 ($p = 0.000$).

Discussion

Our findings from the first assessment of vitamin D levels are consistent with data reported in other national and international cross-sectional studies and demonstrate a clearly expressed vitamin D deficiency within the investigated group [4]. Considering that serum vitamin D concentrations may vary according to season, duration of sunlight exposure, and vitamin D supplementation, the conclusions based solely on single measurements could be incomplete or even misleading.

With repeated serum measurements, our prospective design provides a more comprehensive understanding of the dynamics of vitamin D levels. Similar longitudinal studies have been conducted worldwide [1, 2]. However, there is still a lack of such data concerning the Bulgarian population. The data we obtained over three consecutive years showed decreased mean values of serum vitamin D below optimal levels. They allow us to discuss a well-pronounced trend for an increase in the degree of vitamin D deficiency in the study group.

This observation raises the hypothesis that the concentration of vitamin D lower than 30 ng/ml could be accepted as physiological. These results are in accordance with the recommendation of the Institute of Medicine (Health and Medicine Division of the National Academies), which supposes a normal range of vitamin D higher than 20 ng/ml, and according to the Mayo Clinic recommendation, the optimal levels start at 25 ng/ml [5, 6]. On the opposite side, low vitamin D levels could be the result of several factors: alimentary, metabolic, social, etc. At present it is well established that serum levels between 30-50 ng/ml are optimal for maintaining bone health [7]. Vitamin D, as a pleiotropic molecule with diverse biological effects, manifests at different serum concentration thresholds. There is currently no widely acknowledged consensus on the impact of vitamin D concentrations in various metabolic

systems. However, the optimal vitamin D levels that affect glucose metabolism and immunoregulation are still being debated [8]. This raises an important question regarding the adequacy of the commonly achieved bioavailability of vitamin D and justifies the need for longitudinal monitoring of its levels. These findings accentuate the need for broader screening and individualized supplementation strategies, particularly among populations with limited sunlight exposure. Future research should include the assessment of additional biomarkers related to the vitamin D metabolism pathway and genes associated with their regulation.

Conclusion

Suboptimal vitamin D levels remained prevalent in the Bulgarian population.
A persistent downward trend of vitamin D concentrations underlines the need for regular monitoring, preventive interventions, and further longitudinal studies in the Bulgarian population.

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EPIDEMIOLOGICAL TRENDS OF STIS IN THE VARNA REGION (2016–2024)

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INTRODUCTION

Sexually transmitted infections (STIs) constitute a broad group of diseases caused by various etiological agents viruses, bacteria, and protozoa. Despite the considerable variations in clinical manifestations, they share a common mechanism of transmission sexual contact between partners. For some of them, another possible route of transmission is via blood. Of major importance is also the vertical mechanism of infection spread transplacental and perinatal.

Sexually transmitted infections have significant me

dical and social importance globally. They represent a substantial public health problem worldwide. Their significance is determined by the high susceptibility of humans, the high contagiosity of the causative pathogens, and the lack of immunoprophylaxis (with the exception of hepatitis B). STIs most often affect individuals of sexually active age. In addition to presenting as acute infections, they may progress chronically and lead to reproductive complications, including infertility. Some of these infections are life-threatening. They may also have an impact on child health (1).

Beyond impairing individuals' quality of life, the immediate health consequences and their socio-economic impact are of great importance. STIs can impose a substantial burden on healthcare systems (3). Certain communities within the population remain disproportionately affected due to factors such as limited access to health services, lack of education, and social stigma (4).

According to the World Health Organization (WHO), more than 1 million new STIs are registered each day, underscoring the need for the implementation of effective preventive and control measures (2).

Globally, the spread of STIs is influenced by factors such as globalization, international travel, migration, and changes in sexual behavior (5).

The seven most common sexually transmitted infections include four treatable infections (chlamydia, gonorrhoea, syphilis, and trichomoniasis) and three incurable but manageable infections under contemporary medical approaches (herpes simplex virus, HIV, and human papillomavirus - HPV) (6).

MATERIALS AND METHODS

The present study represents a retrospective epidemiological analysis of the registered cases of syphilis, chlamydia, and gonorrhoea in the Varna region for the period 2016-2024. The data were extracted from the official annual reports of the Regional Health Inspectorate - Varna, the National Centre of Infectious and Parasitic Diseases (NCIPD), and publicly available epidemiological reports of the European Centre for Disease Prevention and Control (ECDC). The analyses included the absolute number of cases, incidence rates (‰), and their distribution by sex and place of residence.

Data processing involved systematization of the available annual registries and summarization of key indicators with the aim of tracking temporal dynamics and identifying structural differences between the infections. The statistical results were presented using standard epidemiological indicators and a graphical visualization of incidence, reflecting long-term trends over the study period.

RESULLTS

The analysis of syphilis, chlamydia, and gonorrhoea for the period 2016-2024 demonstrates consistently preserved differences in the demographic and seasonal structure of the infections. All three diseases show clearly expressed sex-related disproportionality, with males predominating across all years of the analysis most pronounced in syphilis (annual proportions between 64.30% and 76.20%) and gonorrhoea (values exceeding 70%), while in chlamydial infection the male predominance is more moderate but sustained (approximately 55-65%). The seasonal dynamics exhibit relative reproducibility: higher registration of syphilis and gonorrhoea is observed during the summer and early autumn months, whereas chlamydial infection demonstrates weaker fluctuations and lacks a distinct seasonal peak. Combined with the dominant urban profile over 95% of syphilis cases and virtually 100% of chlamydia and gonorrhoea cases originating from urban areas and the recorded differences in clinical forms of syphilis (with latent forms increasing to 23.80% in 2023), these parameters outline stable epidemiological patterns that reflect the influence of behavioral and socio-demographic factors on the spread of the infections.

Figure 1 illustrates pronounced interannual dynamics. In the early part of the period, higher values are registered, particularly for syphilis, where the incidence reached 17.72‰ in 2016, followed by a gradual decline to 3.83‰ in 2020. After 2021, a renewed increase is observed in most infections, with syphilis reaching 8.96‰ again in 2022 and gonorrhoea demonstrating a sharp rise to 3.71‰ in 2024. Chlamydial infection is characterized by the most significant fluctuations, including a moderate peak in the middle of the period (8.75‰ in 2017) and a marked increase to 10.21‰ in 2024. The majority of cases remain concentrated in the urban population, whereas rural areas contribute minimally. In terms of sex distribution, table 1 shows males account for the larger relative share in all infections, with the predominance being most pronounced in gonorrhoea and syphilis. Overall, the data outline a pattern of gradual decline in incidence until 2020, followed by a notable increase and stabilization at higher levels toward the end of the period.

Figure 1. Incidence of major STI's in Varna region during 2016-2024

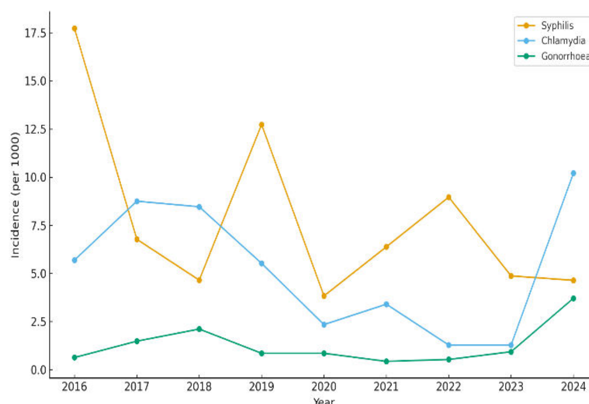

Table1. Epidemiological characteristics of selected sexually transmitted infections (STIs) in Varna Region, 2016–2024.

Disease	M/F %	Main Age	Urban cases	Rural cases
Syphilis	75/25	25-39	Mostly urban	Rare
Gonorrhea	70/30	20-29	Mostly urban	None
Chlamydia	60/40	20-29	Mostly urban	None

DISCUSSION

The trends observed in Varna demonstrate a clear parallel with those recorded across Europe during the same period. Following an initial decline associated both with public health measures during the pandemic and limited access to diagnostic services recent years show a renewed rise in bacterial sexually transmitted infections. A similar pattern has been reported in EU/EEA countries, where 41,051 syphilis cases were documented in 2023, corresponding to a notification rate of 9.9 per 100,000 population, representing a 13% increase compared to the previous year (7). This trend is part of a long-term upward trajectory, with syphilis rates in the EU/EEA doubling since 2014 (8). Substantial increases have also been reported for gonorrhoea, where the 2023 rate rose by 31% compared to 2022 and by more than 300% compared to 2014 (9). Chlamydial infection, traditionally the most common bacterial STI in Europe, likewise demonstrates an upward trend, with 230,199 cases registered across 27 EU/EEA countries in 2023 and a notification rate of 70.40 per 100,000 population (10).

These data confirm that the increase in STIs is a pan-European phenomenon, aligning closely with the trends observed in Varna. Factors identified in international analyses including the resumption of social interaction following the COVID-19 pandemic, reduced use of barrier contraception, increased sexual mobility, and changes in sexual behavior among young populations are highly relevant to the local epidemiological context (11). Furthermore, ECDC emphasizes that rising notifications reflect not only real increases in transmission but also expanded testing and improved reporting systems (12).

CONCLUSION

In this context, it may be concluded that the trends in Varna do not represent an exception but rather reflect broader European epidemiological processes. This necessitates the continuation and expansion of local screening programs, targeted interventions among high-risk groups, and strengthened community-based educational initiatives. Such measures are crucial, as European data unequivocally demonstrate the accelerated spread of bacterial sexually transmitted infections in recent years.

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FACTORS INFLUENCING THE PROFESSIONAL MOTIVATION AND CAREER DEVELOPMENT OF STUDENTS IN MIDWIFERY IN BULGARIA

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Abstract
Introduction: The midwifery profession plays a key role in healthcare, yet the motivation and career development of future specialists in Bulgaria are affected by various social, educational, and professional factors. In recent years, the profession has faced workforce shortages and negative demographic trends at the applicant, student, and practice level..
Aim: The aim of this study is to examine the factors influencing professional motivation, job satisfaction, and career aspirations among students in Midwifery specialty.
Material and Methods: A semi-structured face-to-face interview was conducted with 114 third- and fourth-year students from different universities and university branches.
Results: Nearly two-thirds of the students intend to practice as midwifery practitioners in Bulgaria after graduation, while one-third are considering working abroad. Low pay in the sector is cited as the main reason. The most important motivating factors are fair pay, a good team, working conditions, professional recognition, and career development opportunities. The most serious work environment problems reported were low wages, insufficient staffing, and high levels of stress.
Conclusion: The results of the study are consistent with earlier research and highlight the need for strategic actions and supportive policies to retain and develop midwifery practitioners within the healthcare system.

Key Words: midwife, students, professional motivation, job satisfaction, career development, work environment

Introduction

The midwife profession plays a critical role in protecting maternal and neonatal health. In Bulgaria, a continuing shortage of such specialists highlights the need to better understand what influences students' motivation and their expectations regarding future career paths. [1] Understanding these factors is important for developing strategies that support professional retention in Bulgaria and improve the quality of healthcare services and patient safety. Motivation and satisfaction with one's career choice directly affect career development and willingness for continuing education. Ongoing professional education supports career development by helping healthcare practitioners expand their knowledge and update their professional skills. [2, 3, 4, 5, 6, 7, 8].

Aim of the study: To explore what motivates or discourages midwifery students in Bulgaria, their attitudes and how they perceive their future professional realization and challanges in the work environment.

Objectives:

1. To assess whether students plan to work as midwives after completing their education.
2. To explore students' readiness to work in Bulgaria or abroad and the factors influencing this decision.
3. To analyze the factors of the work environment (e.g., pay, teamwork, working conditions, career growth) students consider important for their professional realization.
4. To examine how students perceive the current challenges faced in the work environment of midwives.

Methods

A semi-structured face-to-face interview with 114 third- and fourth-year students in the Midwifery specialty at Trakia University in Stara Zagora, the Trakia University branch in Haskovo, and the Sliven branch of the Medical University – Varna.

Results and discussion

The analysis of students' attitudes toward practicing the midwifery profession after completing their education shows that nearly two-thirds of the interviewed students 79 (69,3%) have this intention. About one-third of students (30,71%) reported that they are unsure or do not plan to work as midwifery practitioners after completing their studies. The main reason they gave was that wages in the sector are too low in relation to the level of responsibility and workload. [9]

Two-thirds of the respondents – 76 (66,67%) – expressed an intention to stay and work in Bulgaria. The remaining 38 students (33,33%) are considering working abroad. In the open-ended interview responses, they stated that the reason for this decision is the low pay in the sector. [9] Similar findings were reported by V. Dimitrova, where 36% of midwifery students expressed interest in working abroad. [10] This negative trend is also confirmed in a study by K. Miteva and Z. Atanasova. Their study found that one out of every three midwifery students is already considering professional realization abroad during their initial training. The authors conclude that the number of newly graduated midwifery practitioners entering the healthcare system is not enough to replace those who leave to work abroad. [1] According to G. Petrova, the main factors motivating midwives to seek employment abroad are healthcare system reforms and low wages in the sector. [11]

The factors that students consider important for their future work as midwifery practitioners are summarized in Figure 1. The two most frequently mentioned motivating factors are fair pay and working in a supportive team, each selected by 69 students (60,53%). A supportive team environment is strongly associated with higher motivation and greater job satisfaction. Fair and adequate pay contributes not only to motivation and job satisfaction, but also to the quality of care and retention of midwifery practitioners in healthcare institutions. The next important factor for 63 students (55,26%) is the opportunity to work in a reputable healthcare facility equipped with modern technologies and good infrastructure. Additionally, 51 students (44,74%) emphasized the importance of personal fulfillment in their work. In open comments, students expressed the expectation that their work and skills would be recognized and valued. They noted that recognition from patients and families is most meaningful to them, followed by acknowledgment from supervisors and colleagues. [9]

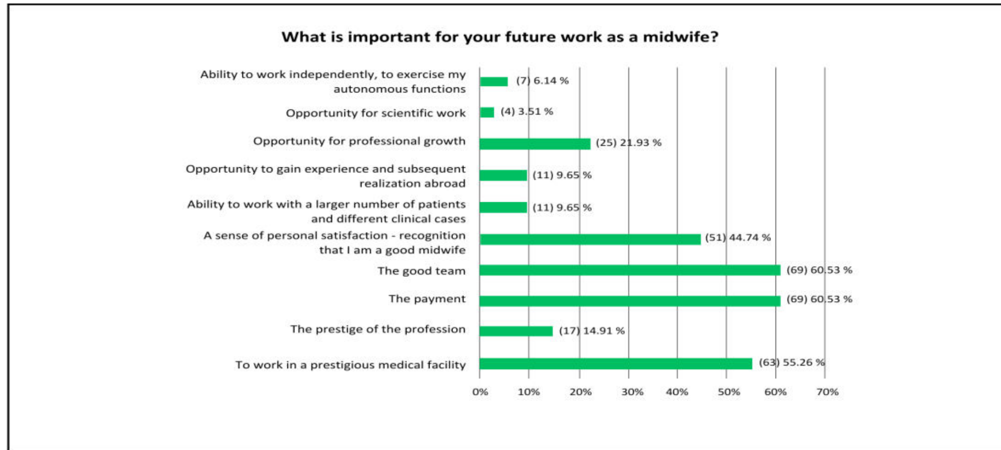

Figure 1. Distribution of students' responses regarding the factors they consider important for their future work as midwives.

Figure 2 presents students' perceptions of the main problems in the work environment of midwifery practitioners. The most frequently reported issue is low wages, identified by 98 students (85,96%) as the main problem in the profession. Students tend to avoid specialties that do not offer competitive pay. Low wages represent a major demotivating factor. [9] Similar results are observed in a study conducted by V. Dimitrova. In her study, 94,7% of the participating students reported that low pay is the most serious problem in the current work environment of midwifery practitioners. [10]
The second most important issue was the shortage of midwifery practitioners, reported by 58 students (50,88%). [9] A study by V. Dimitrova also reports similar findings. In her study, 38,7% of the students identified staff shortages as the second most significant problem in the work environment. [10]
The third most frequently mentioned issue in this study is high workplace stress, reported by 25 students (21,93%). Another concern reported by 21 students (18,42%) was the lack of respect and professional recognition for midwifery practitioners. [9]

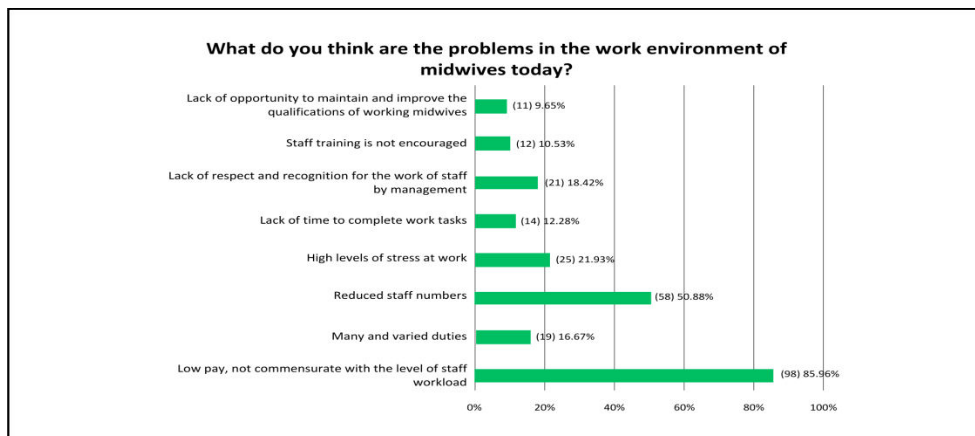

Figure 2. Distribution of students' responses on the current challenges in the work environment of midwifery practitioners.

Conclusion:

1. The majority of students – nearly two-thirds – express willingness to work as midwifery practitioners after graduation, while approximately one-third do not intend to practice, with low remuneration identified as the primary reason for this decision.
2. Low income in the sector is also a key factor contributing to a negative demographic trend, as nearly one in three students forms intentions to emigrate and pursue professional development as a midwife abroad already during their core training.
3. Fair and adequate pay, together with supportive teamwork, appear to be key motivating factors, whereas low pay, staff shortages, and high levels of workplace stress act as significant demotivators.
4. The results are consistent with previous studies highlighting inadequate remuneration and workforce shortages as persistent challenges in the profession. Strategic measures are required to improve retention and support the professional development of future midwifery practitioners in Bulgaria.

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THE ROLE OF GUT MICROBIOME IN MODULATING DYSMENORRHEA

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Abstract

Purpose: Dysmenorrhea is one of the most common gynecological complaints among women of reproductive age, associated with increased prostaglandin production leading to uterine pain, inflammation, and central sensitization. Emerging evidence suggests that the gut microbiome may modulate menstrual pain through hormonal, immune, and neuroinflammatory pathways. This review aims to summarize current evidence on the role of gut microbiome in dysmenorrhea.

Material and Methods: A narrative review (2015–2025) of PubMed, Scopus, and Web of Science explored the role of the gut microbiome in hormonal regulation, inflammation, and menstrual pain.

Results: The gut microbiome, particularly the estrobolome, regulates estrogen metabolism and systemic inflammation. Dysbiosis has been linked to altered estrogen circulation, increased intestinal permeability, and elevated pro-inflammatory cytokines such as IL-6 and TNF-α [1,5,9], and enhanced uterine prostaglandin synthesis. Clinical studies demonstrate reduced microbial diversity and specific taxa shifts in women with severe dysmenorrhea [1,17,25]. Preliminary evidence suggests that microbiome-targeted interventions, including probiotics and dietary modulation, may alleviate menstrual pain by restoring microbial balance and reducing inflammation [2,6,18,21,24].

Conclusions: The gut microbiome may influence dysmenorrhea by affecting hormonal balance, inflammation, and pain perception. Microbiome-targeted strategies, such as probiotics and dietary interventions, hold promise as non-hormonal therapeutic options and deserve further investigation in well-designed clinical trials.

Keywords: Dysmenorrhea, gut microbiome, estrobolome, inflammation, estrogen metabolism, probiotics

Introduction

Dysmenorrhea, defined as painful menstruation, is a highly prevalent condition affecting between 40% and 90% of women of reproductive age worldwide [19]. It is generally classified as primary, when it occurs without underlying pelvic pathology, or secondary, when associated with identifiable gynecological disorders such as endometriosis or pelvic inflammatory disease [3,4]. Beyond its clinical manifestations, dysmenorrhea significantly impacts women's quality of life, daily productivity, and overall well-being [19,25]. Recent evidence has introduced the concept of the "gut–reproductive axis," highlighting the role of the intestinal microbiome in modulating hormonal metabolism, systemic inflammation, and nociceptive pathways [6-8]

Materials and Methods

This narrative review included peer-reviewed articles published between January 2015 and August 2025. Literature was searched in PubMed, Scopus, and Web of Science using the terms: "dysmenorrhea", "gut microbiome", "estrobolome", "estrogen metabolism", "inflammation", "probiotics", and "menstrual pain". Only English-language studies were considered. Assessed

publications comprised original clinical or experimental studies on gut microbiota and menstrual pain, as well as reviews and meta-analyses addressing microbiome–hormone interactions or inflammatory mechanisms. Non-peer-reviewed articles, conference abstracts, and case reports were excluded. Out of 72 initially identified records, 25 studies met the inclusion criteria and were analyzed.

Results

Microbiome and Estrogen Metabolism

The gut microbiota, known as the *estrobolome*, regulates estrogen recirculation through β-glucuronidase activity, enabling deconjugation and reabsorption of estrogens [1,5,9]. Dysbiosis, characterized by reduced *Lactobacillus* and increased *Escherichia coli* and *Bacteroides*, may induce hyperestrogenism, inflammation, and worsening of menstrual symptoms. Women with dysmenorrhea often exhibit distinct microbial profiles, with decreased *Lactobacillus*, impaired barrier integrity, and increased prostaglandin synthesis, resulting in stronger uterine contractions and pain [1,5,9]. These findings suggest a central role of the gut microbiota–estrogen–inflammation axis in dysmenorrhea and its potential as a therapeutic target [1–3]. (Figure 1.)

Microbiome and Inflammation

Dysbiosis contributes to intestinal permeability by disrupting tight junction proteins (occludin, claudins, ZO-1), allowing lipopolysaccharides (LPS) to enter systemic circulation and trigger inflammation [20]. Women with severe dysmenorrhea show elevated IL-6, TNF-α, and CRP levels [1,5,17]. Animal models confirm that microbial imbalance enhances neuroinflammatory signaling and nociceptive sensitization, amplifying pain perception [2,6,18].

Microbial Diversity and Dysmenorrhea Severity

Women with moderate-to-severe dysmenorrhea have significantly reduced microbial diversity compared to healthy controls [1,17,25]. Altered phyla distribution, including an increased Firmicutes/Bacteroidetes ratio and *Prevotella* overgrowth, correlates with higher pain scores. Reduced diversity limits short-chain fatty acid (SCFA) production, compromising barrier integrity and promoting inflammation, hormonal imbalance, and nociceptive sensitization. Probiotics and dietary interventions aimed at restoring diversity may alleviate symptoms [2,6,18,21,24].

Microbiome-Targeted Interventions

Emerging evidence suggests that probiotics, such as *Lactobacillus acidophilus* and *Bifidobacterium longum*, and dietary modifications, including high-fiber and omega-3-rich diets, can reduce pro-inflammatory cytokines (IL-6, TNF-α), improve short-chain fatty acid production, and alleviate menstrual pain [2,6,18,21,24]. Although current studies are limited by small sample sizes and heterogeneous designs, these findings highlight the potential of microbiome-targeted strategies. Building on this, personalized interventions based on individual microbiome profiles could pave the way for precision gynecology, offering tailored strategies for symptom relief and improved quality of life.

Conclusions

The composition and balance of gut microbiota appear to shape the severity of menstrual pain by modulating hormonal activity, immune responses, and pain signaling. Early evidence indicates that interventions targeting the microbiome may reduce symptoms, while strategies tailored to an individual's microbial profile hold promise for personalized, non-invasive management of dysmenorrhea.

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Abbreviation	Full term
IL-6	Interleukin-6
TNF- α	Tumor Necrosis Factor alpha
SCFA	Short-Chain Fatty Acids
LPS	Lipopolysaccharides

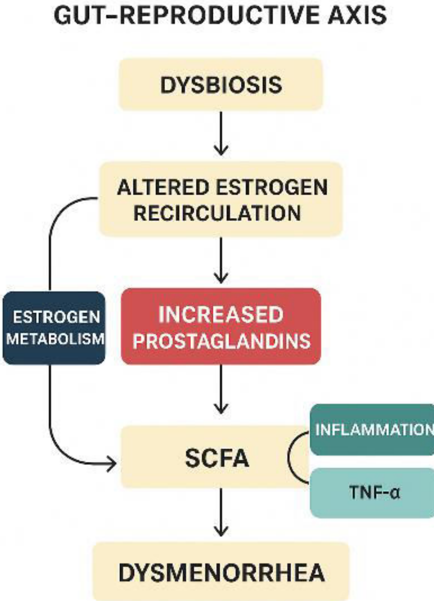

Figure 1. Gut–reproductive axis: Dysbiosis affects estrogen metabolism, inflammation, and prostaglandin synthesis, contributing to dysmenorrhea.

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DIETARY CHALLENGES IN CHILDREN WITH AUTISM: WHAT MAKES THEM DIFFERENT

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ABSTRACT:

Purpose: Autism spectrum disorder (ASD) is a neurodevelopmental condition often associated with atypical eating behaviors such as food selectivity, sensitivity to taste and texture, monotony, and food neophobia. The aim of this study is to assess the challenges and specific features of feeding in children with ASD.

Methods: In a cross-sectional study under the NutriLect project in Bulgaria, 102 children with ASD were examined. Through questionnaires, the socio-demographic profile, feeding difficulties, and eating behaviors of the children were assessed. Statistical analysis was performed using Jamovi v2.6.17.

Results: The 102 children with ASD studied were aged 2–12 years, with boys predominating (81.4%, n=83). In 24% of the children, self-feeding skills were absent ($p<0.001$). Preferences for specific textures were reported in 55.4% ($p=0.033$); about two-thirds preferred solid foods (64.8%, $p<0.001$), while 29.6% preferred pureed foods ($p<0.001$). Taste preferences were reported in 69.3% ($p=0.038$), food aversion in 62.0% ($p<0.001$), and lack of appetite in 19% ($p=0.119$). More than 45.3% preferred salty foods ($p<0.048$).

Conclusions: Studying eating behavior in children with ASD is important for establishing measures and interventions to optimize nutrition.

Keywords: children; autism spectrum disorders; nutritional challenges; selectivity; food; texture; taste

Abbreviations: ASD: Autism spectrum disorder

INTRODUCTION:

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by core deficits in social communication and restricted, repetitive patterns of behavior, interests, or activities. A significant comorbidity of ASD is the presence of atypical eating behaviors [1]. These challenges extend beyond simple pickiness, manifesting as severe food selectivity, an abnormal sensitivity to olfactory and gustatory stimuli (taste and texture), dietary monotony, and food neophobia (the unwillingness to try novel foods) [2, 3]. Given that the act of eating is a complex process integrating sensory, motor, emotional, and social elements, this process is frequently compromised in children with ASD. The inherent behavioral and physiological characteristics of ASD pose substantial risks, often leading to serious nutritional imbalances that can negatively affect a child's growth trajectory, developmental milestones, and overall quality of life [4]. Specifically, the documented sensory hypersensitivity and behavioral rigidity lead to a highly limited dietary repertoire, a finding consistently reported across studies [1, 5]. Moreover, these restrictions often result in deficiencies in essential macro- and micronutrients, which can correlate with the severity of ASD-related symptoms [4]. This article aims to explore the specific nutritional challenges encountered by children with ASD

and to establish a foundational understanding of their unique dietary needs. Integrating these findings is essential for guiding the development and implementation of targeted interdisciplinary strategies that improve nutritional status and promote better health outcomes in these patients.

METHODS:

In a cross-sectional study under the NutriLect project in Northeastern Bulgaria, conducted between August 2023 and June 2024, 102 children with ASD aged 2-12 years were included. Following approval by the Ethics Committee of the Medical University-Varna (Protocol No. 134/20.07.2023), children attending centers providing professional care for neurodevelopmental disorders were assessed for socio-demographic profile, health status, feeding difficulties, and eating behavior. Data collection was conducted through questionnaires and parental interviews.

Statistical Analysis

Data were analyzed using Jamovi (version 2.2.2). Continuous variables were expressed as mean ± SD, categorical as percentages. Group differences were assessed with Chi-square, t-test, or Mann–Whitney U test, as appropriate. Spearman correlations examined associations between variables. A p-value <0.05 was considered statistically significant.

RESULTS:

Socio-demographic characteristics

The 102 children with ASD were predominantly male (81.4%, n=83) with a mean age of 6.56 ± 2.52 years. According to disability assessment, most had moderate-to-severe impairment: 37.2% (n=29) moderate-severe, 30.8% (n=24) moderate, compared to 19.2% (n=15) mild and 12.8% (n=10) severe. Most lived in urban areas (84.3%, n=86; $p<0.001$). Mothers were aged 22-54 years (mean 37 ± 6.58), fathers 25-58 years (mean 40 ± 6.48). Higher education was more common among mothers (39.3%) than fathers (22.9%), but unemployment was higher among mothers (44.0% vs. 16.8%). Households with income below minimum wage accounted for 4.3% (p=0.835). About 34.3% of parents managed childcare without help, while 42.2% (n=43) required additional support and used a personal assistant ($p<0.001$).

Feeding characteristics

In 24% (n=43) of children, self-feeding skills were absent ($p<0.001$). Prolonged mealtimes (>30 minutes) were reported in 15.4% (n=56). Mealtimes caused stress in 14.7% of children and 32.0% of parents/caregivers. Preferences for specific textures were reported in 55.4% (n=56; p=0.033). About two-thirds preferred solid foods (64.8%, $p<0.001$), while 29.6% preferred pureed foods ($p<0.001$). Taste preferences were reported in 69.3% (p=0.038), with significant differences between boys and girls (64.6% vs. 10.5%; p=0.034). Slightly more children preferred salty foods (45.3%) compared to sweet foods (43.8%) ($p<0.048$). Food aversion was present in 62.0% ($p<0.001$). Children with food aversion consumed more non-water fluids (p=0.034). Lack of appetite was reported in 19% (p=0.119). Appetite increased with age (p=0.036). Children with higher appetite consumed more water (p=0.015). Only 24.5% consumed vegetables once per week, 16.3% consumed fruit once per week, while daily intake of vegetables and fruit was reported in only 5.1% (n=5).

DISCUSSION:

The current cross-sectional study conducted under the NutriLect project provides valuable empirical data regarding the complex feeding and nutritional landscape of children with ASD in Northeastern Bulgaria.

Socio-demographic Profile and Male Predominance

The demographic profile of the cohort, characterized by an overwhelming male predominance (81.4%), is consistent with global epidemiological data for ASD. This finding aligns directly with a systematic review and meta-analysis which confirmed the widely reported male-to-female ratio in clinical populations falls between 3:1 and 5:1 [6]. Furthermore, the observation that parental unemployment was higher among mothers (44.0%) may reflect their increased caregiving responsibilities. This is a critical variable, as elevated parental stress is known to significantly impact family dynamics and mealtime interactions, often exacerbating the child's behavioral difficulties.

Feeding Skills, Mealtime Dynamics, and Parental Stress

The high prevalence of deficits in self-feeding skills (24% lacking the skill) suggests underlying oral motor delays or skill-based impairments that extend beyond simple behavioral food refusal. The literature confirms that a significant portion of children with ASD presents with genuine oral motor skill deficits that impact mastication and swallowing [7], thereby necessitating specialized feeding therapy rather than purely behavioral interventions. The reported prolonged meal durations (>30 minutes) and the high level of associated stress (32.0%) experienced by parents/caregivers are particularly concerning. This mutual distress observed at mealtimes is a well-documented consequence of feeding problems in ASD. A systematic review by Page et al. on the subject directly links the severity of feeding difficulties, such as food selectivity, to significantly increased parental stress and anxiety [8]. The finding underscores the necessity of interdisciplinary interventions that incorporate parent education and support alongside direct child therapy.

Sensory-Driven Selectivity and Aversion

The study strongly supports the widely acknowledged link between core ASD symptomatology and atypical eating patterns. The majority of the cohort reported pronounced preferences regarding food texture (55.4%) and taste (69.3%). Sensory processing differences, specifically oral sensory issues, are strongly implicated as a direct mediator of feeding difficulties in autistic children, shaping their restricted dietary choices [7]. The high rate of food aversion (62.0%) confirms that food selection is often driven by a defensive sensory response rather than simple preference. This rigidity contributes to a restricted dietary variety, neophobia, and food refusal, with texture being the primary reason for avoidance. Interestingly, the slightly higher preference for salty foods (45.3%) over sweet foods (43.8%) challenges the common clinical assumption that restricted diets in this population are overwhelmingly sweet-driven, suggesting that the preference is linked more to the intensity and predictability of the flavor profile. This multifaceted nature underscores the necessity of a comprehensive, multidisciplinary team, including pediatricians, dietitians, occupational therapists, and behavioral specialists, to address the complex sensory, motor, and behavioral components concurrently [9].

Nutritional Risk and Micronutrient Deficiencies

Perhaps the most alarming finding is the exceptionally low intake of essential protective foods. With only 5.1% of children consuming vegetables and fruits daily, the study highlights a severe dietary monotony. This restricted consumption of fresh produce directly translates into a significant nutritional risk. Studies such as Marinov et al. report that low fruit and vegetable intake in children with ASD is associated with deficiencies in key micronutrients, including Vitamin D, folate, and B12 [10]. The finding that children with food aversion consumed more non-water fluids suggests a potential reliance on energy-dense, but nutritionally poor, liquid calories, further compounding the risk of nutritional imbalance. Given these widespread nutritional deficits, some researchers advocate for universal micronutrient supplementation in children diagnosed with ASD to potentially mitigate symptom severity [11].

CONCLUSION:

The data from the NutriLect project confirms that feeding challenges in children with ASD are systemic, involving skill deficits, sensory hyper-responsivity, and profound dietary restrictions. The observed demographic, behavioral, and dietary patterns necessitate the implementation of comprehensive, interdisciplinary intervention strategies that prioritize the establishment of oral motor skills, reduce mealtime stress, and systematically address sensory aversions to broaden the dietary repertoire, thereby mitigating the substantial risk of nutritional morbidity in this vulnerable population.

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ORAL PROCESSING IN CEREBRAL PALSY

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Introduction

Oral processing in Cerebral Palsy (CP) refers to the set of oral motor functions involved in the manipulation, preparation, and transport of food and fluids within the mouth prior to swallowing. In children with CP, oral processing is frequently impaired due to neuromuscular dysfunction affecting the lips, tongue, jaw, and cheeks. This results in difficulties with biting, chewing, bolus formation, and oral transit, as well as problems such as inadequate lip closure, persistent tongue thrust, drooling, and food spillage. (Marchand at all., 2006) (Edvinsson & Lundqvist, 2016)

Oral phase impairments are highly prevalent in cerebral palsy, with studies reporting that over 90% of preschool children with CP demonstrate some degree of oral phase dysfunction during eating or drinking, and severity increases with poorer gross motor function. Common manifestations include difficulty biting and chewing solids, inefficient cleaning of the oral cavity, and problems sipping fluids. These impairments lead to prolonged mealtimes, reduced feeding efficiency, and increased dependency on caregivers for feeding. (Benfer at all.., 2014)

The North American Society for Pediatric Gastroenterology, Hepatology and Nutrition highlights that oral motor dysfunction in cerebral palsy is a major contributor to undernutrition and correlates with the severity of motor impairment. Children with CP may require significantly longer times to chew and swallow compared to unaffected peers, and oral processing difficulties often precede the diagnosis of cerebral palsy. (Marchand и съавт., 2006). Early identification and intervention are critical to optimize nutritional status and reduce associated morbidity.

The aim of the study was to investigate oral processing in cerebral palsy using the results of the PediEat assessment.

Materials and methods

A cross-sectional study was performed between July 2023 and August 2025. It was conducted in North Eastern Bulgaria, focusing on the cities of Varna, Ruse, Dobrich, Targovishte. Recruitment took place through the Karin Dom Foundation (Varna), the Equilibrium Association (Ruse), and the Varna Home for Medico-Social Care for Children.

Children aged 2 to 12 years old with a documented diagnosis of Cerebral Palsy from a pediatric neurologist or physician were eligible. Participants were invited and screened on site. Criteria for exclusion included acute or life-threatening sickness, genetic diseases, insufficient parental understanding of study protocols, or absence during the study time.

The Pedi-Eat tool was developed to examine children's eating behaviors. It consists of 78 items separated into four subscales: physiological symptoms, problematic mealtime behaviors, selective/restrictive eating, and oral processing. The questionnaire was completed jointly by the child's parent/guardian and the research speech therapist

The study protocol received approval from the Ethics Committee on Scientific Research at the Medical University “Prof. Dr. P. Stoyanov”—Varna (protocol №134/20 July 2023).
All procedures adhered to the ethical principles outlined in the Declaration of Helsinki.

Statistical Analysis

Descriptive statistics (means, standard deviations, and frequency distributions) were computed separately for children with CP and controls. Between-group comparisons were performed using Mann–Whitney U tests, given the ordinal nature and non-normal distribution of the data. For each test, rank-biserial correlations (r**)** were calculated as measures of effect size, with values of 0.10, 0.30, and 0.50 interpreted as small, medium, and large effects, respectively. Statistical significance was defined as $p < .05$ (two-tailed).
Analyses were conducted using Jamovi v.2.6

Results

The study sample comprised 38 children, including 24 with cerebral palsy (CP) and 14 typically developing controls. The two groups were comparable in age, with mean values of 6.02 years (SD = 3.06) in the CP group and 5.86 years (SD = 3.10) among controls. Gender distribution was balanced, with boys representing just over half of participants in both groups (54.2% in CP; 57.1% in controls). Marked differences were observed in residential setting: while the majority of controls resided in big cities (78.6%), children with CP were more dispersed across urban and rural contexts, with 58.3% living in big cities, 25.0% in small cities, and 16.7% in villages. Ethnic composition was also more heterogeneous in the CP group, which included Bulgarian (71.4%), Roma (9.5%), and Turkish (19.1%) children, whereas all controls were Bulgarian (table 1).

Table 1. Descriptive characteristics of the sample

Variable	Category	Controls N (%)	CP N (%)
Gender	Boys	8 (57.1%)	13 (54.2%)
	Girls	6 (42.9%)	11 (45.8%)
Place	Big city	11 (78.6%)	14 (58.3%)
	Small city	2 (14.3%)	6 (25.0%)
	Village	1 (7.1%)	4 (16.7%)
Ethnicity	Bulgarian	13 (100.0%)	15 (71.4%)
	Roma	0 (0.0%)	2 (9.5%)
	Turk	0 (0.0%)	4 (19.1%)
Age (years)	—	M = 5.86, SD = 3.10	M = 6.02, SD = 3.06

On the 0–5 Likert scale (0 = never, 5 = always), children with cerebral palsy (CP) demonstrated multiple oral–motor difficulties of clinical relevance. The most frequently reported behaviors were chewing non-food items such as toys or clothing (M = 3.04, SD = 1.71), which occurred at the level of “often,” followed by food sticking in the mouth (M = 2.09, SD = 1.20), prolonged chewing of a single bite (M = 2.33, SD = 1.49), and sucking food to soften or moisten it instead of chewing (M = 2.48, SD = 1.56). Children with CP also required frequent reminders to chew food (M = 2.67, SD = 1.55) and were more likely to bite and hold onto utensils (M = 2.29, SD = 1.49). These patterns suggest pervasive inefficiencies in oral bolus formation and transfer, consistent with known oral–motor impairments in CP. By contrast, behaviors such as preference for smooth foods (M = 2.67, SD = 1.34), strong flavors (M = 1.50, SD = 0.59), or excessive mouth-filling (M = 1.92, SD = 1.02) were less frequent (Table 2).
Comparisons with typically developing controls highlighted that the most substantial impairments in CP are localized to the motoric and functional aspects of feeding—specifically oral clearance, bolus

manipulation, and maladaptive oral behaviors—whereas sensory-driven food preferences appear comparatively preserved. Specifically, children with CP more frequently exhibited food residue in the mouth ($U = 84.0$, $p = .005$, $r = .48$), compensatory strategies such as inserting fingers to reposition food ($U = 106.5$, $p = .030$, $r = .34$) and sucking food instead of chewing ($U = 98.5$, $p = .036$, $r = .39$), and maladaptive oral behaviors including utensil biting ($U = 110.5$, $p = .049$, $r = .34$), bruxism while awake ($U = 100.5$, $p = .013$, $r = .40$), and chewing of non-food objects ($U = 75.5$, $p = .004$, $r = .55$). Effect sizes ranged from medium ($r \approx .30–.34$; e.g., utensil biting, compensatory strategies such as sucking food) to large ($r \approx .55$; chewing of non-food objects), indicating that the magnitude of group differences varied but in several cases reached thresholds considered clinically meaningful. By contrast, behaviors related to sensory preferences—such as preference for smooth foods, prolonged chewing without swallowing, or excessive mouth-filling—did not differ significantly between children with CP and typically developing peers (Table 2).

Table 2. Group differences in oral processing behaviors between children with CP and controls

Item (behavior)	Controls M (SD)	CP M (SD)	U / Test Statistic, p	Effect size (r)
Stores food in cheeks/mouth	1.57 (1.40)	1.92 (1.06)	U = 123.0, p = .125	r = .27
Food sticks in cheeks/mouth	1.07 (0.27)	2.09 (1.20)	U = 84.0, p = .005	r = .48
Prefers smooth foods (e.g., yogurt)	2.14 (1.17)	2.67 (1.34)	U = 134.0, p = .289	r = .20
Puts too much food in mouth	2.07 (1.14)	1.92 (1.02)	U = 156.5, p = .724	r = −.07
Uses fingers to move food in mouth	1.07 (0.27)	1.91 (1.35)	U = 106.5, p = .030	r = .34
Prefers strong flavors	1.14 (0.54)	1.50 (0.59)	U = 108.0, p = .027	r = .36
Bites spoon/fork and won’t release	1.36 (0.75)	2.29 (1.49)	U = 110.5, p = .049	r = .34
Grinds teeth while awake	1.07 (0.27)	1.71 (0.91)	U = 100.5, p = .013	r = .40
Chews toys/clothes/objects	1.50 (0.94)	3.04 (1.71)	U = 75.5, p = .004	r = .55
Needs reminders to chew	2.23 (1.59)	2.67 (1.55)	U = 128.5, p = .373	r = .18
Sucks food instead of chewing	1.79 (1.81)	2.48 (1.56)	U = 98.5, p = .036	r = .39
Chews food but doesn’t swallow	1.43 (1.34)	1.65 (1.19)	U = 129.5, p = .213	r = .20
Chews one bite for long time (≥30s)	1.79 (1.42)	2.33 (1.49)	U = 125.0, p = .164	r = .26

Discussion

This study provides evidence that children with cerebral palsy (CP) exhibit clinically significant impairments in oral processing compared to typically developing peers. The most pronounced difficulties were related to oral clearance, bolus manipulation, and maladaptive oral behaviors, such as chewing non-food objects, utensil biting, food residue retention, and the use of compensatory strategies like finger insertion to move food. These behaviors reflect disrupted oral motor coordination and reduced chewing efficiency, which are core components of feeding difficulties in CP. The medium-to-large effect sizes observed for these behaviors further support their clinical relevance.

Our findings are consistent with previous reports documenting high prevalence of oral motor dysfunction in CP, with rates exceeding 90% in preschool-aged children and severity closely correlated with gross motor impairment (Benfer et al., 2014; Reilly). These oral phase impairments are not only a mechanical barrier to effective feeding but are also associated with prolonged mealtimes, increased caregiver dependency, and higher risk of undernutrition, as noted by Mei and Noritz. Importantly, our study adds to this body of knowledge by highlighting specific behavioral markers observable in routine mealtimes, which can be readily captured through structured parent-report instruments such as Pedi-EAT.

A particularly interesting finding was the absence of significant differences between children with CP and controls regarding sensory-driven feeding behaviors, such as preference for smooth textures or strong flavors. This suggests that motoric deficits may be the primary driver of oral processing difficulties in CP (Ibrahim, Weir), whereas sensory preferences may remain relatively intact (Khamis, Novak). This distinction has important therapeutic implications: interventions should prioritize enhancing oral motor control (e.g., targeted chewing exercises, adaptive utensil use, or compensatory positioning techniques) rather than modifying sensory aspects of feeding, which may not contribute substantially to the problem.

Strengths and Limitations

The use of a standardized tool (Pedi-EAT) and inclusion of a control group strengthen the interpretability of our findings. However, several limitations must be acknowledged. The sample size was relatively small, which may limit generalizability and the detection of more subtle behavioral differences. Additionally, data were collected via caregiver report, which, while ecologically valid, may be influenced by subjective perceptions. Combining behavioral observations with instrumental assessments (e.g., videofluoroscopy or clinical feeding evaluation) could provide a more comprehensive picture of oral motor dysfunction.

Clinical Implications

Early recognition of oral motor difficulties is crucial for preventing malnutrition, aspiration risk, and reduced participation in social feeding activities. Screening tools such as Pedi-EAT may be valuable in community and clinical settings to guide timely referrals and individualized intervention planning. A multidisciplinary approach involving speech therapists, nutritionists, pediatric neurologists, and caregivers is essential for optimizing feeding safety and efficiency in children with CP.

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DEPRESSION IN MIGRANT POPULATION AND SPECIFIC FACTORS AS CONTRIBUTORS

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ABSTRACT:

Recognizing mental health problems in newly arrived migrants poses a challenge. In 2024, the United Nations High Commissioner for Refugees estimated that the number of forcibly displaced people surpassed 123.2 million globally. Of these, 26.3 million are migrants displaced across international boundaries. There are various factors that could impact mental health of migrants, serving as vulnerable or protective throughout the migration journey. The process of assimilating to new surroundings and cultural practices can lead to considerable levels of stress, which in turn has been linked with the manifestation of psychiatric disorders. Approximately 1 out of 3 migrants suffer from severe depressive disorder, and depression is more frequent in migrants compared to general population, with the current prevalence of 31.5%. Some studeis highlight the fact that migrants, particularly female gender, not being married, lower educated and unemployed remain susceptible to developing depression. Migrants often experience cumulative stressfull events related to war, being tortured, being politicaly persecuted or having threats of death, makes them more succeptible to depressive disorder. Strong social support is a protective factor for depression, as well as integration in host communities, religious or cultural organisations. This highlights the necessity of applying screening methods and regular examinations that would lead to timely diagnosis and therapeutic intervention, preventing more profound deterioration in mental health.The accessibility of healthcare system is crucial in reducing psychiatric conditions and providing more supportive and appropriate care, centered on individual migrant.

Keywords: migrant, depression, stressful experiences, social support

Migration is the movement of people away from their usual place of residence to a new place of residence. In 2024 year there were 123.2 milion forcibly displaced people globaly with 26.3 milions of migrants and 8.4 milion asylum seekers. The majority of the world refugees were hosted low- and middle income countries. Refugees and migrants exposed to adversity have diverse mental health needs, shaped by experiences in their country of origin, their migration journey, their host country's entry and integration polices and living and working conditions [1].

The experience of migration can strongly affect migrants' mental health. Vulnerability factors predispose individuals to common mental disorders after migration, whereas protective factors are suppotive in obtaining good mental health, as shown in Table 1. But both of the factors could act in three different periods: before, during and after migration [2].

Table 1. Aetiological model of common mental disorders and migration

Vulnerability factors	Protective factors
Pre-migration	
Biological and psychological factors	Psychological factor such as resilience

Social skills deficit	Higher socio-economic status
Forced migration	Voluntery migration
Persecution	Preparation and adequate run-in time
Migration	
Negative life events	Strong cultural and ethnic identity
Bereavement	Social support and social networks
Post-migration	
Culture shock	Resilience
Culture conflict	Social support
Discrepancy between achivement and expectation	

High burden of mental disorders including PTSD, depression, anxiety, substance use, idioms of distress, prolonged grief disorder, psychoses, suicide are linked to cumulative traumatic circumstances in migrants [3]. The data shows that approximately 1 out of 3 migrants suffer from MDD, and that depression is more frequent in migrants compared to general population, with the current prevalence of 31.5% [4]. Prevalence of depression differs, and there is increase in prevalence rates of depression in low income countries, possibly due to the limited healthcare access. On the other hand, the situation is better in developed countries. The results reports that in Germany, depression was detected in approximately 14.5% of the migrants sample [5].The risk may increase over time, and is not only associated with individual predispositions but also by sociodemographic and contextual factors.

Socidemographic factors as contributors to depression in migrants

There are specific factors that can influence the developing of depression in migrants. The study shows that women are more prone to depression than man, while man may face stigma against emotional distress and remain undiagnosed [6]. Depressive disorder is more frequent among females in general population, while man often remain undignosed possibly due to perzistent stigmatization in expressing emotional distress [7]. Younger age may serve as a protective factor, since younger people generally adapt better to diverse circumstances in comparison with older ones [6]. Education and employment are factors that could affect the presence of depression in migrants. Low education attainment and unemployment are consistently associated with a higher risk for depression [8]. The recent studies support this fact, suggesting that lower education may be associated with limited possibilities such as language proficiency, difficulties in finding employment while higly educated migrants have better coping strategies for social integration and seeking help, which is protective for depression [9]. Marrital status is also associated with higher risk, specifically - being single, widowed, or lacking partner [10].

Stressful experiences and depression in migrants

Migration is usually associated with stressful experiences, such as war related factors, political persecutions, being victim of violence and torture, that can influence the development of depression [11]. The number, frequency and intensity of traumatic events vary accros countries and migrant populations. The study resluts shows that in Sweden approximately 90% of refugees experienced at least one stresfull experince [12]. On the other hand, in Serbia, according to previously counducted study, over 80% of refugees had approximately 10 traumatic events, and they are listed in order as lack of food and water, followed by lack of shelter, life threatened experiences and separation from the family, and support our finding of being tortured (51.5%), having threats of death (25.3%), being

forcibly separated from family members (23.6%) and lacking of food and water (22.5%) [13]. Exposure to multiple traumas („complex trauma") – creates long lasting effects on emotional regulation, trust and self-efficacy, and have 2-3 times higher odds to develop major depressive disorder Furthermore, experiencing threats of death can lead to a perceived insecurity, lacking sense of control and fundamental trust, which are significant psychological mechanisms underlying depressive disorder. This results demonstrate the essential role of providing psychological support to migrants subjected to stresfull experiences [8].

Social support and integration and depression in migrants

Strong social support is a protective factor for depression, as well as integration in host communities, religious or cultural organisations. This finding is in line with previous studies pointing out that adequate social connections are of great importance for maintaining psychological well-being in vulnerable population of migrants [14]. The lack of social support may reduce the sense of belonging, increase the experience of isolation, and diminish effective stress managing strategies related to migration and process of assetlement to a new environment [15]. However, friendships among other migrants also enable the exchange of experiences, providing emotional support and obtaining the experience of belonging , and also practical assistance in everyday life, which all together may decrease symptoms of depression [16]. Thus, severity of depression is influenced with level of social support and integration in actual environment. It is also important to consider other factors such as insecurity due to unregulated permanent status, being separated from families, having accomodation in migrant centres in transit countries on their route to highly developed counries may develop depression as a consequence [17].

CONCLUSION

The experience of migration (pre-, during, and posmigration) have a large impact on migrants mental health. Migrants faced unique, cumulative stressors that elevate their risk for depressive disorder. Being female, singe, without employment, having lower education, experiencing stressful events predispose the risk for depression. Also, lack of social support and difficulties with social integration are associated with higher risk for depression. This highlights the necessity of applying screening methods and regular examinations that will enable timely diagnosis. The approach would be to enable culturally sensitive, systematic helathcare practice in migrants, that would lead to timely therapeutic intervention, preventing more profound deterioration in mental health. The accessibility of healthcare system is crucial in reducing psychiatric conditions and providing more supportive and appropriate care, centered on individual migrant. At the community level, both risk factors (community scrutiny) and protective factors (social support) are important, indicating the need for supportive communities throughout the migrant's centers and integration process.

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PROBLEMATIC MEALTIME BEHAVIORS IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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Abstract
Introduction: Families of children with autism spectrum disorder (ASD) report difficulties during mealtimes including unacceptable eating behaviors.
Material/Methods: This cross-sectional study examined 84 children with ASD in northeastern Bulgaria between July 2023 and August 2025. Eating behaviors were evaluated using the PediEat assessment tool.
Results: Children with autism displayed primarily positive adaptive eating behaviors. The most frequent actions included opening their mouths when food was presented (M = 3.04), enjoying eating (M = 3.02), and willingness to touch food with hands (M = 2.88). Conversely, problematic behaviors like refusing to eat (M = 1.66), being bothered by food smells (M = 1.23), and showing stress during meals (M = 1.15) were reported less frequently than expected.
Conclusion: Eating behavior in children with ASD poses significant challenges for families. This study reveals that most children with ASD exhibit generally normal meal performance comparable to neurotypical peers, yet they display distinct behavioral patterns. Notably, many children with ASD show adaptive eating tendencies with favorable outcomes.

Key words: autism spectrum disorder, mealtime, behavior, eating habits

Introduction

Children with (autism spectrum disorder) ASD frequently experience feeding difficulties, which can significantly affect family mealtimes. [1,2] Families of children with ASD often experience mealtime behavior issues and stress [3]. Parents of children with ASD report various difficulties related to daily routines, behavior, and communication [4]. Family dynamics can be affected by feeding issues, which manifest as undesirable mealtime behaviors, which can cause parental concern [5].
Autism spectrum disorder is a neurodevelopmental condition characterized by repetitive behaviors, restricted interests, and difficulties in social interaction and communication [6]. Eating behaviors can be influenced by behavioral characteristics such as repetitiveness and routines, fear of novelty, inflexibility, need for consistency, and sensitivity to sensory inputs [7]. In a recent study, Malhi, assessed the mealtime behaviors of 50 children with ASD. [8] The results showed that children with ASD were more likely to scream or cry during meals, have disruptive behavior, and refuse to eat the presented food. This behavior can have negative consequences for both the children and their families, leading to increased parental concern and stress [9].

Food acceptance by children with ASD may be impacted by several features of food, including texture, consistency, color, warmth, fragrance, taste, presentation, brand, form, and combinations [7]. Children with autism are more likely to reject food, need certain utensils and meal presentation, and accept low-textured foods like pureed foods. In addition to eating substantially fewer meals from each food group, children with autism only consume a limited range of given foods, regardless of texture [10]. Research of 103 children diagnosed with ASD shows that 75% of them are not willing to try new foods. [11] Meals frequently are prolonged, and the child gets up and down from the table and returns to eat more. Instead of having mealtimes, many parents report their child is "constantly eating" [12]. Strong refusal behaviors, such as refusing to sit at the family dinner table or eat at restaurants, are more common in children with ASD. [13]

The aim of the study is to examine mealtime behaviors of children with ASD drawing on the outcomes of the PediEat assessment.

Materials and Methods

Study Design and Participants

A cross-sectional study was conducted from July 2023 to August 2025 in four cities in northeastern Bulgaria. Eighty-four children aged 2–12 years with confirmed ASD were recruited through the Karin Dom Foundation and the Equilibrium Association. Parents completed a brief screening and provided written consent.

Eligibility and Ethics

Inclusion criteria were age 2–12 years and verified ASD diagnosis. Exclusion criteria were acute illness, genetic disorders, insufficient parental understanding, or unavailability. Ethical approval was obtained from the Ethics Committee of the Medical University of Varna (№134/20 July 2023).

Data Collection

Demographic data were recorded, and feeding behaviors were assessed using the 78-item Pedi-Eat questionnaire.

Statistical Analysis

Descriptive statistics were calculated. One-sample Wilcoxon tests compared item scores to the reference value of 2 (“sometimes”). Spearman correlations explored associations between demographic factors and feeding behaviors. Significance was set at $p < .05$. Analyses were conducted in Jamovi 2.6.

Results

The study sample consisted of 84 children with a mean age of 6.9 years (SD = 2.8), predominantly boys (84.5%). Most children resided in urban areas, either small towns (45.2%) or large cities (41.7%), with fewer from villages (13.1%). The majority presented with moderate (27.9%) or moderately severe (41.2%) disabilities, while smaller proportions had mild (20.6%) or severe impairments (10.3%). In terms of ethnicity, two-thirds were Bulgarian (67.5%), nearly one-third were Turkish (28.9%), and only a few were Roma (1.2%) or of other backgrounds (2.4%).

Children with autism most often exhibited adaptive eating behaviors, with the highest ratings observed for *opening the mouth when food was offered* ($M = 3.04$, $SD = 1.64$; $W = 1625$, $p < .001$), *enjoying eating* ($M = 3.02$, $SD = 1.44$; $W = 1524$, $p < .001$), and *willingness to touch food with hands* ($M = 2.88$, $SD = 1.47$; $W = 1274$, $p < .001$). These behaviors occurred at frequencies significantly greater than the reference value of *sometimes* (score = 2), indicating that positive and cooperative feeding responses were well preserved in this population. Moderate endorsement, aligning with *sometimes*, was observed for *remaining seated during meals* ($M = 2.50$, $SD = 1.66$; $W = 1194$, $p =$

.003) and *accepting a variety of foods* (M = 2.40, SD = 1.67; W = 1046, p = .019), both of which also exceeded the normative reference. By contrast, several problematic behaviors were reported less frequently than expected. These included *refusing to eat* (M = 1.66, SD = 1.04; W = 262, p = .003), *being disturbed by food smells* (M = 1.23, SD = 1.31; W = 438, p < .001), *showing stress during meals* (M = 1.15, SD = 1.14; W = 248, p < .001), and *insistence on rigid feeding conditions,* such as requiring a specific feeder or presentation of food (p ≤ .003). Other behaviors, including *food refusal followed by later requests* (M = 1.98, SD = 1.41; W = 533, p = .933), *preference for crunchy foods* (M = 2.22, SD = 1.48; W = 931, p = .171), and *throwing food* (M = 1.90, SD = 1.29; W = 498, p = .343), did not differ significantly from *sometimes* (Table 1).

Table 1. Feeding behaviors in children with autism

Feeding behavior		N	Mean (SD)	Wilcoxon W, p-value
Needs to be reminded to continue eating		83	2.36 (1.78)	W = 1146, p = .046
Refuses food during meals but asks for it later		83	1.98 (1.41)	W = 533, p = .933
Stops eating after a few bites		83	1.99 (1.31)	W = 456, p = .833
Refuses to eat		83	1.66 (1.04)	W = 262, p = .003
Shows more stress during meals		81	1.15 (1.14)	W = 248, p < .001
Likes something one day but not the next		83	1.93 (1.41)	W = 915, p = .514
Insists food is offered in the same way		82	1.45 (1.50)	W = 728, p = .002
Insists on being fed by the same person		82	1.44 (1.42)	W = 567, p = .003
Disturbed by the smell of food		83	1.23 (1.31)	W = 438, p < .001
Throws or pushes food away		82	1.90 (1.29)	W = 498, p = .343
Prefers drinking to eating		82	1.54 (1.44)	W = 647, p = .007
Prefers crunchy foods		82	2.22 (1.48)	W = 931, p = .171
Eats better when having fun		82	2.32 (1.59)	W = 990, p = .061
Meals last more than 30 minutes		82	1.63 (1.49)	W = 642, p = .040
Needs a calm environment while eating		80	1.56 (1.45)	W = 574, p = .010
Wants the same food for >2 weeks		83	2.04 (1.75)	W = 1111, p = .632
Enjoys eating		83	3.02 (1.44)	W = 1524, p < .001
Accepts a variety of foods		82	2.40 (1.67)	W = 1046, p = .019
Wants to remain seated during meals		82	2.50 (1.66)	W = 1194, p = .003
Opens mouth when food is offered		82	3.04 (1.64)	W = 1625, p < .001
Willing to touch food with hands		83	2.88 (1.47)	W = 1274, p < .001

Note: Reference level of compassion is "sometimes"

Finding from the Spearman correlation analysis suggest that age contributes to a gradual reduction in feeding difficulties and a strengthening of adaptive eating patterns in children with autism, reflecting developmental maturation of mealtime behaviors (Figure 1). Increasing age was associated with a lower likelihood of problematic eating responses, including requiring prompts to start ($\rho = -.26$, $p = .017$) or continue eating ($\rho = -.37$, $p < .001$), stopping after only a few bites ($\rho = -.32$, $p = .003$), refusing food ($\rho = -.26$, $p = .017$), showing improvements only when entertained ($\rho = -.27$, $p = .014$), and preferring liquids over solids ($\rho = -.22$, $p = .049$). At the same time, older children demonstrated significantly greater engagement in adaptive behaviors, such as enjoying eating ($\rho = -.25$, $p = .024$), accepting a more varied diet ($\rho = -.25$, $p = .024$), remaining seated during meals ($\rho = -.25$, $p = .022$), opening the mouth when food was offered ($\rho = -.34$, $p = .002$), and willingly touching food with their hands ($\rho = -.26$, $p = .021$).

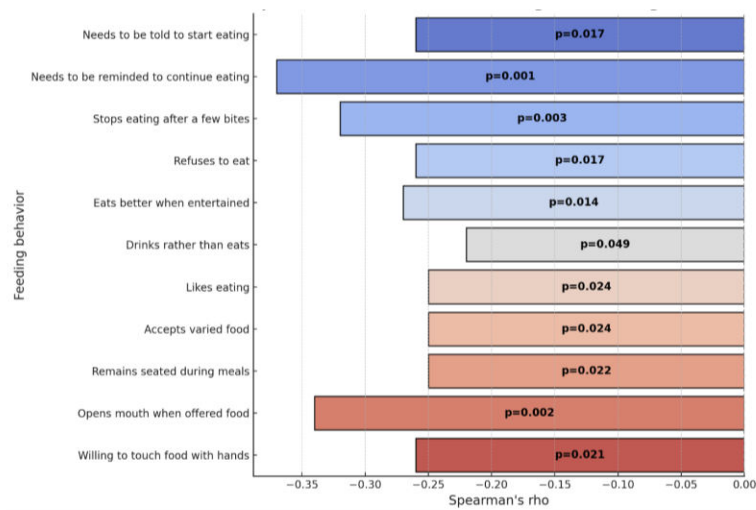

Figure 1. Age and Feeding Behaviors Correlations

Discussion

Eating behavior in children with autism spectrum disorder is considered a substantial issue for both the children and their families. This descriptive study found that the majority of children with ASD perform like neurotypical children while having a meal in general but still differ in the specifics of their behavior. Children with ASD frequently demonstrated adaptive eating patterns with positive scores. They want to eat, touch the food with their hands (M = 2.88, SD = 1.47, W = 1274, p<0.001), and enjoy eating (M = 3.02, SD = 1.44, W = 1524, p<0.001). They also accept a relatively wide variety of foods (M = 2.40, SD = 1.67; W = 1046, p = .019). However, in some cases, unacceptable behaviors such as throwing food are observed (M=1.90, SD = 1.29, W = 498, p = .343). The development of children with ASD is also a significant factor in changing their behavior during meals. Age contributes to a steady reduction in feeding difficulties and a strengthening of adaptive eating patterns in children with autism, demonstrating developmental maturity of mealtime behaviors. Children with ASD are often more sensitive to touch. Some authors refer to this as tactile defensiveness and consider that there is a link between eating and difficulties in processing sensory information [4]. Compared to their neurotypical peers, children with ASD often exhibit higher sensory difficulties [14]. Our study found that a large proportion of children with autism spectrum disorder are more likely to touch food with their hands, and are not so often disturbed by the smell of food. Previous studies have shown that children with ASD have more disruptive behaviors during mealtime compared to their neurotypical peers [8,15]. The eating behavior of children with ASD affects the quality of life of the family. An advantage of our study is that the family (parents and child) is present during the examination, which gives parents the opportunity to share how they feel and what their concerns are regarding family meals.

The huge discussion question remains about the difficulty for doctors, therapists and parents to understand whether behavioral manifestations are related to the specificity of sensory development or are related to mental processes, or perhaps both. Good decisions by the nutrition team require serious prevention and in-depth case tracking would lead to better understanding on the part of the family and specialists, as well as more effective outcomes for the child.

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TITLE: THE ROLE OF MILK TYPE IN EARLY CHILDHOOD DEVELOPMENT: INSIGHTS FROM A LONGITUDINAL ANALYSIS AT AGE 5

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Abstract
Introduction: Infant milk type—breast milk, hydrolyzed hypoallergenic formula, or standard infant formula—may influence developmental outcomes. This study investigates its role in predicting neurodevelopment at age 5.
Methods: A cohort of 92 term-born children from Varna, Bulgaria, with normal birth weight and no perinatal complications, was followed from birth to age 5 (±3 months). Infant feeding practices and demographic data were recorded. At age 5, the Neurodevelopmental Test for Five-Year-Olds (NDT5) assessed motor skills, speech, articulation, nonverbal intelligence, and behavior. Children were stratified into three groups: predominantly/exclusively breastfed (Group A), fed hydrolyzed formula (Group B), and fed standard formula (Group C). Analyses were conducted using Jamovi.
Results: Gender distribution did not differ significantly ($p = 0.849$). Articulation differed significantly across groups ($p = 0.015$), with the best outcomes in children fed hydrolyzed formula, followed by breastfed children, and the lowest in standard formula. Regression analyses indicated that total development and language were predicted by ethnicity and region; articulation by maternal education and region; and behavior by region. Infant milk type was not an independent predictor of neurodevelopment.
Conclusion: Infant milk type did not independently determine neurodevelopment at age 5 but contributed alongside stronger sociodemographic factors, particularly ethnicity, region, and maternal education. These findings highlight the combined influence of nutrition and social context on developmental trajectories.
Keywords: breastfeeding duration, infant nutrition, early nutrition, neurodevelopment, NDT5

1.Introduction

The first 1000 days are critical for growth, immunity, and neurodevelopment, with nutrition shaping long-term health and cognition [1–4]. Breast milk provides optimal nutrients and bioactive compounds, supporting immunity and brain development [5–7], and has been linked to enhanced myelination and brain volume [8]. Breastfeeding reduces risks of infections, atopy, obesity, and diabetes, and confers modest cognitive benefits [5,9], leading WHO and AAP to recommend exclusive breastfeeding for six months and continued breastfeeding for two years [1,2].
Many infants nevertheless receive formula due to maternal choice or medical reasons [10]. Standard cow's milk–based formulas approximate human milk but differ in protein composition and bioactive content [11]. Hydrolyzed formulas are intended for allergy prevention, though evidence on neurodevelopmental effects is inconsistent [12,13]. Research on long-term cognitive outcomes is mixed and often confounded by socioeconomic factors [13,14]. Comparative studies of formula types remain limited, especially in Eastern Europe, and culturally validated tools such as the Bulgarian Neurodevelopmental Test for Five-Year-Olds (NDT5) [15] are rarely applied. This study examines associations between feeding type and neurodevelopment at age five in a Bulgarian cohort, accounting for demographic and environmental confounders.

2. Materials and Methods

A prospective cohort study was conducted in Varna, Bulgaria (2017–2024). Ninety-two term-born children without congenital anomalies or major perinatal complications were followed from birth to age five (82.9% retention). Assessments were performed at 1, 2, and 5 years, including standardized neurodevelopmental testing and structured parental interviews.

The study was approved by the Ethics Committee of the Medical University of Varna (No. 60/2017; No. 115/2022; No. 121/2022). Parents provided written consent; children gave verbal assent. Demographic data included parental education, ethnicity, residence, delivery mode, and smoking. Feeding history was obtained through structured interviews and categorized as breastfed, hydrolyzed hypoallergenic formula, or standard formula.

At age five, outcomes were measured with the validated Bulgarian test NDT5, covering motor, speech/language, articulation, nonverbal intelligence, and behavior. Higher scores indicated greater impairment; scores >64 suggested neurodevelopmental disorder.

Analyses used Jamovi. Group differences were tested with Welch's ANOVA, associations with partial correlations, and predictors with regression models. Significance was set at $p < 0.05$.

3. Results

3.1. Demographic and Baseline Characteristics

Among the 92 infants, 64 were breastfed, 10 received hydrolyzed hypoallergenic formula, and 18 were fed standard formula. The proportion of males was similar across groups (50–61%, p=0.849). Paternal age did not differ significantly (36.9–39.6 years, p=0.137), while maternal age was significantly higher in the standard formula group compared with the other groups (38.2 ± 4.33 vs. 32.9 ± 3.41 and 35.0 ± 5.30 years, p=0.005).

Most families resided in urban areas and were of Bulgarian ethnicity, with no significant differences by group. Mode of birth varied (p=0.035), with Caesarean section more frequent in the hydrolyzed formula group (71.0%) compared to breastfed (38.5%) and standard formula (47.1%) infants.

Parental education differed for fathers (p=0.033) but not for mothers. Secondary education was more common among fathers in the standard formula group (77.8%), whereas a higher proportion of breastfed infants' fathers had a Master's degree. Maternal and paternal smoking showed no significant group differences, although maternal smoking during pregnancy ranged from 9.7% to 26.5% (p=0.137).

3.2. Developmental Outcomes at 5 Years

Developmental outcomes are illustrated in **Figure 1**. Lower scores indicate better performance. Across most domains, children fed breast milk or hydrolyzed formula performed better than those fed standard formula. Only articulation differed significantly among groups (p = 0.015), with hydrolyzed formula yielding the best outcomes, followed by breastfed children, and lowest in the standard formula group.

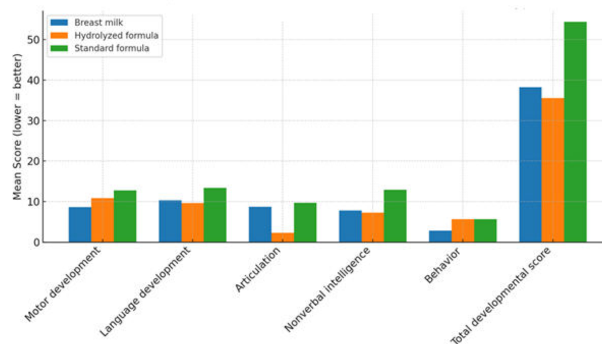

Fig. 1 Neurodevelopmental outcomes at age 5 year by milk type

Trends were noted in other domains: language scores were lowest in the hydrolyzed formula group and highest in the standard formula group; behavioral difficulties were more pronounced in formula-fed children; and overall development favored breastfed and hydrolyzed formula groups, though differences were not statistically significant.

3.3. Partial Correlations

After adjusting for potential confounders, no independent associations were found between milk type and developmental outcomes at age five.

3.4. Predictors of Developmental Outcomes

Multivariate regression analyses indicated sociodemographic factors were stronger predictors than milk type.

- **Articulation:** Model explained 28.6% of variance ($p < 0.001$). Maternal education and region were significant predictors. Children of mothers with secondary education performed worse than those with higher education ($p = 0.046$), and rural residence was associated with poorer outcomes than urban residence ($p = 0.004$). Milk type, ethnicity, smoking, and delivery mode were not significant predictors.
- **Total Development and Language:** Models explained 20.4% ($p = 0.025$) and 25.4% ($p = 0.004$) of variance, respectively. Ethnicity and region were consistently significant.
- **Behavior:** Model explained 18.0% of variance ($p = 0.057$).
- **Motor Development and Nonverbal Intelligence:** Models explained less variance and were not statistically significant.

4. Discussion

This study evaluated the influence of infant milk type on neurodevelopment at age five. Significant differences were observed only in articulation, with children fed hydrolyzed formula performing best, followed by breastfed children and those fed standard formula. These differences did not persist after adjusting for confounders, and no other domains showed significant differences.

Our findings suggest limited effects of milk type, consistent with prior research indicating modest, domain-specific benefits of breastfeeding or hydrolyzed formulas, while sociodemographic factors are stronger predictors [16–20]. Breastfeeding protects against atopic disease [12], and hydrolyzed formulas may affect motor, visual, and taste development [17,18]. In our cohort, socioeconomic factors outweighed nutritional effects.

Ethnicity, region, and maternal education consistently predicted developmental outcomes. Children from rural areas exhibited poorer articulation, language, and behavior, likely reflecting limited access to resources and structured interventions. Maternal education influenced articulation, supporting evidence that parental education provides cognitive stimulation that benefits neurodevelopment [21]. Cultural sensitivity of the NDT5 may partly explain observed ethnic differences.

5. Conclusion

Infant milk type may influence specific outcomes, such as articulation, but is not an independent predictor of neurodevelopment at age five. Socioeconomic and demographic factors are stronger determinants, highlighting the importance of considering nutrition within its broader social context. Future studies should employ larger, diverse samples and culturally sensitive tools to further explore these complex interactions.

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FUNCTIONAL GASTROINTESTINAL DISORDERS IN ANOREXIA NERVOSA: A NARRATIVE REVIEW

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Abstract
Introduction:
Anorexia nervosa (AN) is an eating disorder marked by distorted body image, self-induced weight loss, and endocrine dysregulation, often resulting in significant underweight (≥ 15% below ideal body weight or body mass index <17.5 kg/m²). These characteristics adversely affect physiological systems including gastrointestinal (GI) function, which patients frequently report as particularly distressing.
Methods:
A systematic literature search was conducted in PubMed, Web of Science, and Google Scholar to find all relevant studies examining GI problems in AN,
Results:
A wide range of GI disturbances—including delayed gastric emptying, impaired gastric accommodation, and functional dyspepsia—were highly prevalent in AN, often reversible with nutritional rehabilitation. Persistent functional GI symptoms were strongly linked to psychological comorbidities such as anxiety, somatization, body image disturbance, and disgust. Intestinal absorption and pancreatic function appeared largely intact. Findings on intestinal permeability were inconsistent, and increased stool energy loss noted after refeeding suggests possible adaptive or transient malabsorption mechanisms.
Conclusions:
GI alterations in AN are common and multifactorial, with both reversible physiological features and persistent functional components intertwined with psychological factors. Understanding these interactions is crucial, but the underlying pathophysiology remains incompletely defined, warranting further investigation.
Keywords: anorexia nervosa; gastrointestinal complaint; gastrointestinal complication; gastrointestinal symptom; gastrointestinal dysfunctions;

1.Introduction

Anorexia nervosa (AN) is a severe eating disorder characterized by self-induced weight loss, distorted body image, and endocrine dysregulation, often resulting in significant underweight. Beyond its psychological and metabolic consequences, AN frequently involves gastrointestinal (GI) disturbances, including delayed gastric emptying, impaired gastric accommodation, functional dyspepsia, and constipation. These symptoms arise from a complex interplay of reversible physiological changes, persistent functional abnormalities, and psychological factors. Although some GI alterations improve with nutritional rehabilitation, the underlying pathophysiology remains incompletely understood. The objective of this systematic review is to provide a comprehensive overview of GI problems and complications in AN, illustrating the complex interactions between the disorder's pathophysiology and GI function.

2.Methods

2.1 Search strategy

For the current review, a systematic search was conducted using the databases PubMed, Web of Science, and Google Scholar. The search was performed on 20 August 2025 using the following search terms: *Anorexia nervosa AND gastrointestinal dysfunction*, *Anorexia nervosa AND gastrointestinal motility*, *Anorexia nervosa AND gastrointestinal symptoms*, *Anorexia nervosa AND gastrointestinal complaints*.

2.2 Study Selection and Screening

A total of 600 references were identified, of which 498 were original articles. After removing 54 duplicates, 444 records were screened. Eligible studies were full-text in English, reported original data on anorexia nervosa (AN) and gastrointestinal (GI) outcomes, and included participants aged ≥12 years with clear diagnostic criteria. Studies on other eating disorders, with <10 participants, or with pre-existing GI diseases not analyzed separately were excluded. After screening, 125 records were excluded. Of 319 full texts assessed, 294 were excluded for reasons such as inaccessibility, translation issues, or lack of AN–GI association. Ultimately, 25 studies were included.

3. Results

3.1 Gastric Motility and Emptying

Multiple studies consistently report delayed gastric emptying and impaired gastric accommodation in patients with Anorexia Nervosa (AN), particularly during the underweight state [1,2,3,4,5]. Delayed gastric emptying was observed in 80% of inpatients with AN or AN with comorbid Bulimia Nervosa, improving following refeeding and weight restoration [1]. Impaired gastric accommodation in adolescents with AN was shown to normalize after nutritional rehabilitation [3]. Slower gastric half-emptying time (t50) compared to both healthy controls and individuals with obesity, along with increased postprandial fullness and visceral sensitivity, was also described; these abnormalities generally improved with weight recovery [5]. Persistent alterations in gastric physiology have been reported even in weight-restored, restricting-type AN, suggesting potential long-term or adaptive changes [2]. Slow gastric emptying in untreated AN that improved after refeeding has also been confirmed [4].

3.2 Intestinal Permeability and Function

Evidence regarding intestinal permeability in AN is mixed [6,7,8,9]. Increased urinary lactulose/mannitol ratios have been reported, indicating higher intestinal permeability in severely malnourished AN patients, without affecting appetite-regulating peptide-reactive immunoglobulins [9]. In contrast, decreased intestinal permeability compared with controls has also been described [8]. No significant impairment in intestinal absorption or pancreatic function was found, except in a patient with comorbid celiac disease [7]. Increased stool energy loss after refeeding may reflect transient malabsorption or adaptive intestinal changes [6].

3.3 Prevalence of Functional Gastrointestinal Disorders and Symptoms

AN is associated with a broad spectrum of functional gastrointestinal disorders (FGIDs) and symptoms, including functional intestinal disorders, gut-brain interaction disorders, functional dyspepsia, irritable bowel syndrome, constipation, gastroparesis, delayed gastric emptying, slow transit, pelvic floor dysfunction, defecatory disorders, vomiting, pain, gastroesophageal reflux disease, and celiac disease. Among 16 studies reporting prevalence, overall gastrointestinal disorders or symptoms ranged from 7.5% to 100%, with the highest rates (75–100%) reported for FGIDs or overall symptom burden. Specific prevalence rates were as follows: constipation 7.5–66.7%, gastroesophageal reflux disease 8.7% (objectively measured), celiac disease 10%, irritable bowel syndrome 12.1–52.6%, functional dyspepsia 29–94.7%, pelvic floor dysfunction 41.7%, postprandial distress syndrome 45%, and delayed gastric emptying 80%. Nine studies did not report prevalence data.

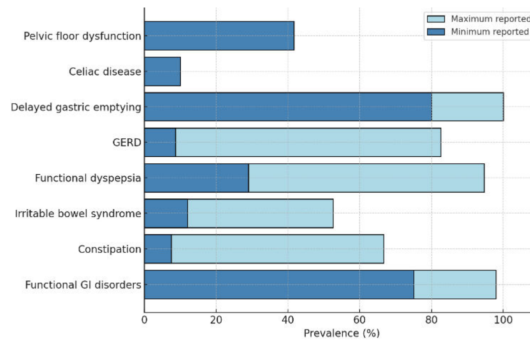

Figure 1. Prevalence ranges of major gastrointestinal disorders in anorexia nervosa.

3.4 Clinical Impact

Refeeding improves or normalizes gastrointestinal symptoms and motility abnormalities in several studies. High comorbidity, symptom burden, or overlap was noted in four studies, while two studies linked gastrointestinal symptoms to psychopathology or eating disorder pathology. Two studies reported unclear or aberrant pathophysiology. Other observations included associations with dysbiosis, altered gut permeability, increased symptom severity with longer illness duration, therapeutic complications, findings limited to comorbid cases, and lack of predictive value of symptoms for specific disorders.

4.Discussion

Functional gastrointestinal disorders and symptoms are highly prevalent in Anorexia Nervosa (AN), with contributions from both physiological and psychological factors [2,8]. They may occur throughout the entire GI tract in patients. Gastrointestinal motility abnormalities, including delayed gastric emptying and impaired accommodation, are frequently observed but largely reversible with nutritional rehabilitation [1,3,4,5]. In contrast, persistent complaints are often functional in nature and closely linked to psychological comorbidity such as somatization, anxiety, body image disturbance, and disgust [2,8]. Intestinal absorption and pancreatic function appear largely preserved [7]. The role of altered intestinal permeability remains unclear, with studies reporting increased [9], decreased [8], or no impairment [7]. Increased stool energy loss after refeeding may reflect transient malabsorption or adaptive changes [5].

5.Limitations

The evidence is limited by predominantly observational study designs, small sample sizes, heterogeneity in assessment methods, and limited reporting of management strategies and outcomes. These constraints should be considered when interpreting the findings

6.Conclusion

Gastrointestinal alterations in anorexia nervosa are highly prevalent, affecting the entire GI tract, and result from a complex interplay of reversible physiological changes, persistent functional disturbances, and psychological factors. Understanding these mechanisms is essential for effective patient management, yet the precise underlying pathophysiology remains incompletely defined, underscoring the need for further research.

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ACTIVITY OF α-HYDROXYALLENYL PHOSPHONATES WITH PROTECTED AND UNPROTECTED HYDROXYL GROUPS AS ANTIBROWNING AGENTS

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ABSTRACT:

In the present study, the inhibitory properties against tyrosinase activity of two newly synthesized α-hydroxyallenyl phosphonates were evaluated. The results show that they exhibit inhibitory activity against tyrosinase. The investigation of the degree of inhibition of tyrosinase activity indicates a stronger inhibitory effect for compound **a** with IC_{50} values for phenolase and diphenolase activity of 6,27 and 7,19, respectively. Kinetic inhibition data show that both compounds exhibit a mixed-type inhibition.

Keywords: α-hydroxyallenyl phosphonates, tyrosinase, tyrosinase inhibitor

INTRODUCTION

Tyrosinase (EC 1.14.18.1) is a copper-containing oxidoreductase enzyme that is widely distributed in nature (microorganisms, plants, and animals) [1]. Tyrosinase possesses dual catalytic activity on phenolic compounds: it catalyzes the conversion of monophenols to o- diphenols (monophenolase activity) and the subsequent oxidation of o- diphenols to o- quinone derivatives (diphenolase activity). It plays a vital role in the process of melanogenesis [2]. Melanin has an essential role in the pigmentation of the skin, hair, and eyes, and also plays a key role in protecting organisms from UV radiation [1]. Unusual loss of melanin can be a serious aesthetic and dermatological problem in humans [3]. Conversely, increased synthesis and accumulation of melanin are observed in many types of skin disorders, neurodegeneration associated with Parkinson's disease, and skin cancer risk [4].

Tyrosinase inhibitors can effectively inhibit the excessive generation of melanin for hyperpigmentation disorders and malignant melanoma, which represents a promising therapeutic strategy [1]. Furthermore, tyrosinase inhibitors are used as anti-enzymatic browning agents for fruits and vegetables and as whitening agents in cosmetics [2]. For these reasons, many natural, semi-synthetic, and synthetic inhibitors have been developed to date, but only a small fraction of them have been certified for use due to a number of safety requirements. Therefore, there is an ongoing demand for new effective and selective tyrosinase inhibitors with reduced side effects.

MATERIALS AND METHODS:

Reagents

In the present study, mushroom tyrosinase 25 KU (lyophilized, 1000 unit/mg) purchased by Sigma-Aldrich was used. All reagents utilized for the preparation of working solutions were of TLC grade. Ultrapure water, with a resistance exceeding10 MΩ, was used to prepare the solutions.

The compounds used in the study, which are presented in Fig. 1, were synthesized at the *Laboratory of Allenes Chemistry* at Shumen University [5].

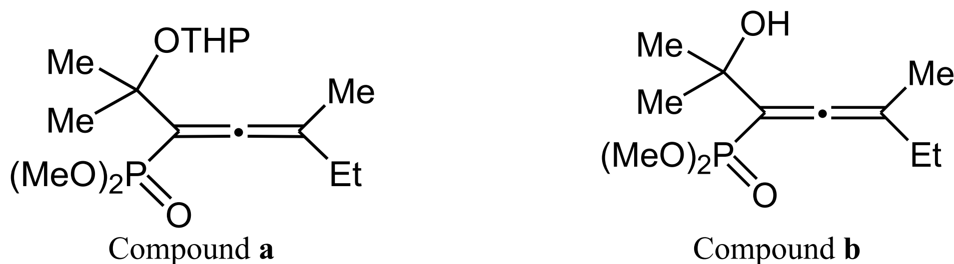


Fig. 1. Chemical structures of the studied compounds

Tyrosinase inhibitory activity assay

To determine the inhibition potency of the investigated compounds and their mechanism of interaction with the enzyme 0.01M solutions of the tested compounds were prepared in dimethyl sulfoxide. For each compound, a series of reaction mixtures containing 0.1mM L-tyrosine or L-DOPA as the substrate in phosphate buffer (pH 6,8) and various concentrations of the tested compound were prepared and incubated at 25 °C for 10 minutes, with a final volume of 0,980ml. The reaction was started by adding 20µl of tyrosinase solution (200 units) o the reaction mixture and incubating it at 25 ºC for 10 minutes. The amount of dopachrome produced during the reaction was determined spectrophotometrically by measuring the absorbance at λ 475 nm (Spectroquant® Pharo 100 Merck). Tyrosinase activity in the absence of an inhibitor was defined as 100%. The degree of tyrosinase inhibition was calculated using the following equation:

$$\text{Infibition rate } (\%) = [1-(OD_2-OD_0)/(OD_1-OD_0)]x100$$

where OD_1 was the absorbance value without inhibitor, OD_2 was the absorbance value with inhibitor, OD_0 was the absorbance value without inhibitor or tyrosinase substrate. The kinetic parameters of tyrosinase inhibition were determined using the Lineweaver-Burk double reciprocal plot method [6].

RESULTS:

The degree of inhibition of tyrosinase activity rate was determined using L- tyrosine and L-DOPA as substrates in the presence of various concentrations of the investigated compounds. The degree of inhibition of the oxidation of the used substrates to dopachrome after 10 minutes at 25 °C is presented in Fig. 2.

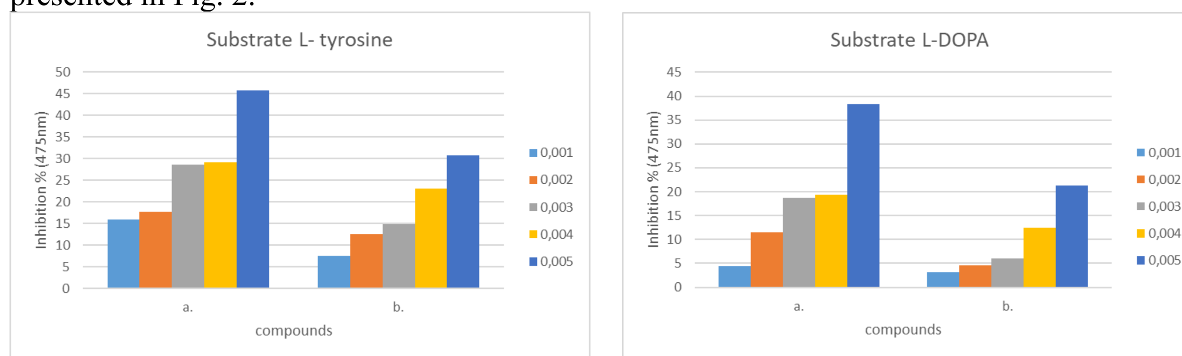


Fig. 2. Inhibition of tyrosinase activity with L-tyrosine and L-DOPA as substrate in the presence of different concentrations of the studied compounds (1, 2, 3, 4 and 5 mM, 25 °C)

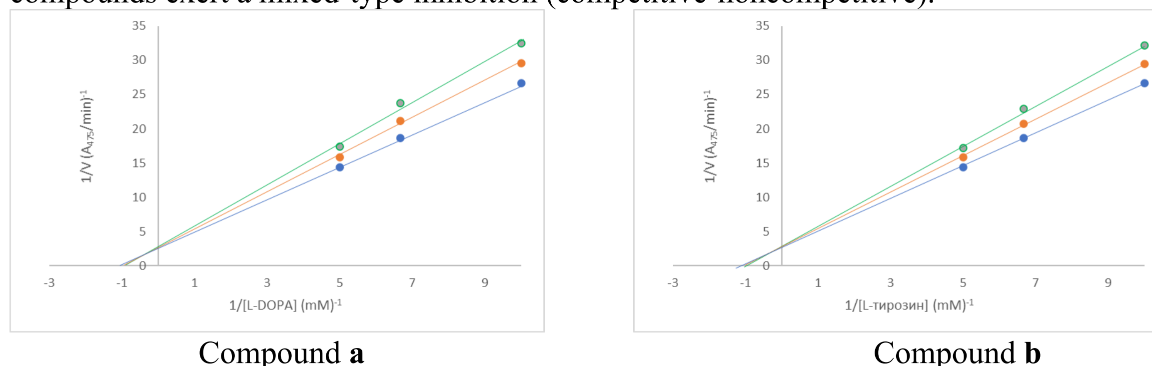
The inhibitory effects of the tested compounds on tyrosinase increased with increasing concentrations of the phosphonates, both when L- tyrosine was used as the substrate and when L-DOPA was used as the reaction substrate. The results demonstrating the inhibition potency of

tyrosinase activity were utilized to calculate the IC_{50} values of the compounds against the used substrates. The calculated values are presented in Table 1.

Table 1. Determination of the IC_{50} values for the different types of substrates (mM).

substrates	compounds	
	a.	b.
L-tyrosine	6,27	8,60
L-DOPA	7,19	13,63

To determine the mechanism of inhibition, an analysis of the kinetic parameters of the L-DOPA oxidation reaction was performed using the double reciprocal Lineweaver-Burk method. The plots for tyrosinase activity in the presence of increasing substrate concentrations and various inhibitor concentrations yielded a family of straight lines with different slopes, intersecting one another in the second quadrant (Fig. 3.). As the concentration of the tested compounds increases, the, V_{max} decreases and the Michaelis-Menten constant (K_m) increases. These results indicate that the investigated compounds exert a mixed-type inhibition (competitive-noncompetitive).



Compound **a** Compound **b**

Fig. 3. Lineweaver-Burk plot for the inhibition of the mushroom tyrosinase with DOPA as substrate in the presence compounds **a** and **b**.

DISCUSSION:

Regardless of the substrate used, the relative enzyme activity decreased with increasing inhibitor concentration for both substrates, indicating that the investigated compounds exhibit inhibitory activity in dose-dependent manner. These results are consistent with a number of publications reporting the identification of phosphorus-containing compounds as potent tyrosinase inhibitors [7]. Various factors significantly influence the inhibitory potency of tyrosinase inhibitors, including the affinity for copper ions and the lipophilicity of the molecule. The stronger inhibitory effect observed when using compound **a** is likely due to the presence of an additional heterocyclic ring, which increases both the compound's hydrophobicity and its potential to interact with groups in the active site [2, 8].

CONCLUSIONS:

Despite the large number of tyrosinase inhibitors of natural and synthetic origin that have been identified, there is a growing interest in identifying new, more effective, and safer compounds. In the present study, the investigated α-hydroxyallenyl phosphonates were found to exhibit significant inhibitory activity against tyrosinase and have the potential to be used as tyrosinase inhibitors in medicine, cosmetics, and agriculture.

Abbreviations:

L-DOPA - L-3,4-dihydroxyphenylalanine
Compound **a** - Dimethyl 3-methyl-1-[1-methyl-1-(tetrahydro-2H-pyran-2-yloxy)-ethyl]-penta-1,2-dienephosphonate
Compound **b** - Dimethyl 1-(1-hydroxy-1-methylethyl)-3-methylpenta-1,2-dienephosphonate

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IMPACTS OF COMPLETE EDENTULISM ON EATING HABITS, SPEECH, AND SOCIAL ADAPTATION

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Abstract

Background: Complete edentulism remains a major oral health problem worldwide, particularly among the elderly population, and has profound effects on mastication, speech, aesthetics, and overall quality of life.

Objective: To investigate the effects of complete edentulism on dietary habits, speech function, and social adaptation, and their impact on quality of life.

Materials and Methods: A cross-sectional study was conducted among 64 patients diagnosed with *Adentia totalis maxillaris et mandibularis* at the Department of Prosthetic Dentistry. Quality of life was assessed using a validated questionnaire consisting of 23 items, addressing socio-demographic characteristics, motivation for dental care, and the influence of edentulism on daily life. Data were analyzed using descriptive statistics and Pearson's chi-square test ($p \leq 0.05$).

Results: The prevalence of complete edentulism was higher among women (57.8%) compared to men (41.2%) ($p < 0.001$). The largest proportion of patients belonged to the 70–79 age group (37.5%). Education, place of residence, and marital status were significantly associated with edentulism. Functional limitations were most evident in food choice (40.6% reported strong and 23.4% extremely strong impact) and chewing (34.4% strong and 25% extremely strong impact). Problems with swallowing were less frequent, with 65.6% reporting no difficulties. Aesthetic concerns were more pronounced among women, while men tended to underestimate the impact. Overall, about 40% of respondents rated the influence of edentulism on their lives as strong or extremely strong.

Conclusions: Complete edentulism significantly impairs oral function, psychosocial well-being, and quality of life. The findings emphasize the need for timely prosthetic rehabilitation, targeted preventive programs, and increased awareness of oral health in aging populations.

Keywords: complete edentulism, quality of life, prosthetic rehabilitation, elderly patients, oral health

Introduction: Edentulism, defined as the complete loss of natural teeth, remains a problem of high social and medical significance worldwide. The population aged 60 years and older is increasing faster than any younger group, and the number of elderly individuals is expected to more than double globally by 2050. This demographic shift will have a profound impact on society's ability to meet the needs of aging populations, including oral health care [1].

A new field within dental medicine—**geriatric dentistry**—focuses on providing dental treatment for older adults, including diagnosis, prevention, and management of oral diseases. These patients often present with specific dental and systemic conditions that require a multidisciplinary approach [2].

Following complete tooth loss, dental treatment aims to provide prosthodontic rehabilitation of the masticatory system while preventing further structural and functional deterioration in the edentulous areas, the maxillofacial region, and the body as a whole [3]. Numerous studies have demonstrated the strong link between oral and general health—individuals with good oral health are more likely to maintain good overall health and vice versa [4]. Poor oral health has been shown to adversely affect quality of life (QoL) and general well-being [5]. Teeth are essential for chewing, maintaining facial height, and supporting facial appearance. After complete tooth loss, structural and functional changes occur in the facial region, leading to negative effects on daily life and quality of life [6,7]. The main causes of tooth loss are dental caries and periodontal diseases, with the latter being the leading cause of edentulism worldwide [8]. Complete edentulism is recognized as a chronic condition because it involves all components of disability—functional, structural, and psychological [9]. The psychological trauma of total tooth loss is comparable to the loss of any other vital organ. Therefore, classifying completely edentulous individuals as patients with a medical condition is fully justified on biological and clinical grounds.

Material and Methods: The objective of this study was to investigate the effects of complete edentulism on dietary habits, speech ability, and social adaptation, and to evaluate their relationship with quality of life.

Study Design: The quality of life of completely edentulous patients was assessed using a validated questionnaire previously adapted for evaluating the QoL of patients with chronic periodontitis [10]. Permission for use was obtained from the original author. The questionnaire consisted of 23 items—five related to sociodemographic data, questions on motivation for seeking dental care, and a specific section addressing the impact of complete edentulism on daily life.

The survey was distributed in paper form to 64 patients at the Department of Prosthetic Dental Medicine. All participants were diagnosed with *Adentia totalis maxillaris et mandibularis* and provided informed consent prior to inclusion. Questionnaires were administered before the beginning of prosthetic treatment.

Statistical Analysis: Data were coded and analyzed using IBM SPSS Statistics v19.0. Descriptive statistics (means, standard deviations, confidence intervals) and Pearson's Chi-square test (χ^2) were used to verify hypotheses, with statistical significance set at $p \leq 0.05$. Graphical representations were created using Microsoft Excel 2010.

Results: The age and gender distribution of the sample revealed a predominance of females (57.81±6.17%) compared to males (41.19±6.17%), a statistically significant difference ($\chi^2 = 19.101$; p = 0.000), indicating that complete edentulism was more common among women. The largest proportion of respondents were between 70–79 years (37.5±6.05%), followed by 60–69 years (25±5.41%).

Educational background showed that the majority had secondary education (54.68±6.22%), while only 10.93±3.9% held a master's degree. Most participants resided in urban areas (75±5.41%), with 25±5.41% living in rural settings ($\chi^2 = 10.40$; p = 0.001).

Regarding family status, 48.87±6.23% were married, 34.37±5.93% widowed, and 9.37±3.64% divorced or single. Female respondents were more likely to report strong or extremely strong negative effects of tooth loss on facial appearance, whereas men more frequently rated the effect as "strong" rather than "extremely strong."

Analysis of responses related to food choice, chewing, and swallowing (Tab. 1) revealed that 40.63% reported that tooth loss strongly limited their dietary choices, while 23.44% described it as "extremely strong." Only 9.38% reported no influence. Regarding chewing ability, 34.38% rated the effect as strong and 25% as extremely strong. Although most respondents (65.63%) did not report swallowing difficulties, 14.06% described a mild effect and 6.25% an extremely strong one.

Table 1. Impact of complete toothlessness on nutrition

	Influence on food choices			Effect of chewing food			Swallowing problems		
	n	**%**	**Sp**	**n**	**%**	**Sp**	**n**	**%**	**Sp**
No	6	9.38	3.64	11	17.19	4.72	42	65.63	5.94
Yes, slightly	6	9.38	3.64	4	6.25	3.03	1	1.56	1.55
Yes, a little	5	23.44	5.30	3	4.69	2.64	9	14.06	4.35
Yes, moderately	6	9.38	3.64	8	12.5	4.13	5	7.81	3.35
Yes, strongly	26	40.63	6.14	22	34.38	5.94	3	4.69	2.64
Yes, extremely strong	15	23.44	5.30	16	25.00	5.41	4	6.25	3.03

Discussion: The present study confirmed that the proportion of completely edentulous women was higher than that of men, consistent with prior reports [1,2]. Women are generally more health-conscious and tend to seek dental treatment more frequently [3]. The predominance of edentulism among older adults (≥60 years) reflects demographic trends observed globally [4,5].

Educational level strongly correlates with oral health. Individuals with limited education and lower socioeconomic status tend to exhibit poorer oral hygiene, limited awareness, and reduced dental attendance [6]. Similar findings were observed in studies linking edentulism with rural residence and limited access to dental care [7].

Family status also affects the psychosocial impact of tooth loss. Complete edentulism changes facial aesthetics and speech, leading to reduced self-esteem and social participation [8,9]. However, in this study, no significant relationship was found between marital status and edentulism, likely due to the advanced age of the respondents. Women reported greater concern about aesthetics, consistent with prior evidence of heightened self-perception of oral appearance among female patients [10,11]. Tooth loss can cause depression and social withdrawal, emphasizing the psychological burden of edentulism [12,13]. Physical appearance and speech fluency are recognized determinants of self-esteem and social success [14].

Speech articulation was also affected, especially in producing fricative and sibilant sounds [15,16]. These findings are in line with studies demonstrating that oral structures directly influence phonation quality.

Masticatory efficiency in completely edentulous patients remains low, even after prosthetic rehabilitation, reaching only 25–30% of the function of natural teeth [17]. Consequently, many patients adopt softer diets, which may lead to nutritional deficiencies and weight loss [18,19]. Restoration with complete dentures has been shown to significantly improve oral health–related quality of life, particularly in comfort, speech, chewing, and aesthetics [20].

Conclusion: Complete edentulism is not only a dental condition but also a public health and social issue. The loss of all teeth leads to significant changes in mastication, speech, nutrition, facial aesthetics, and psychosocial adaptation, all of which collectively reduce quality of life.

Our results confirm that sociodemographic factors—such as gender, age, education, and residence—are associated with the prevalence and consequences of edentulism. These findings highlight the need for national oral health programs targeting at-risk groups and improving access to prosthetic rehabilitation for the elderly population.

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THE ROLE OF HEAT STRESS IN THE DEVELOPMENT OF MUSCULOSKELETAL DISORDERS

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ABSTRACT

Introduction: Heat stress in the workplace can modify the impact of ergonomic and biomechanical loads on the musculoskeletal system. Leading Musculoskeletal disorders (MSDs) are a leading cause of temporary disability in industries with high physical and thermal loads. **Objective:** To analyze the role of heat stress as a modifying factor for the development and severity of musculoskeletal disorders by examining temporary disability rates over a one-year period. **Materials and methods:** Documentary and statistical methods were used to assess temporary disability indicators by comparison with indicative-normative groups according to the Batiks-Lekarev statistical system. An analysis of data on temporary disability for a class of diseases of the musculoskeletal system and connective tissue was performed. The number of cases and days of temporary incapacity for work by diagnosis were analyzed. The results were interpreted in the context of current scientific evidence on the impact of heat stress on muscle fatigue and work capacity. **Results:** A total of 182 cases of temporary incapacity for work were registered, with a total of 3,835 days of temporary incapacity for work and an average duration of 21.1 days per case. The largest share of lost working days (48.4%) was due to intervertebral disc damage with radiculopathy. There was a predominance of chronic and degenerative diseases with high severity and a long recovery period. **Conclusion:** The results support the hypothesis that heat stress acts as a modifying factor that aggravates the clinical course of musculoskeletal disorders and increases the duration of temporary incapacity for work. An integrated approach to occupational risk assessment and management is needed, combining heat stress control and ergonomic prevention measures.

Keywords: heat stress; musculoskeletal disorders; temporary incapacity for work; occupational risk; working environment.

INTRODUCTION.

Workers in the glass industry are exposed to an overheated microclimate (furnaces with temperatures above 1000–1500°C), infrared radiation, limited convection, and often inadequate local ventilation. The work processes require considerable physical effort, a standing static working posture with repetitive movements, and manual handling of heavy loads. The complex and cumulative effects of ergonomic risks and heat stress are a prerequisite for the development of musculoskeletal disorders. The specificity of chronic heat stress in the glass industry is determined by the continuous production process, limited opportunities for frequent physiological breaks, and the use of special work clothing and personal protective equipment. Under conditions of intense radiant heat stress, physiological and cognitive stress is established, measured by high WBGT (Wet-Bulb Globe Temperature) values and manifested by changes in thermoregulation, dehydration, fatigue, and the development of musculoskeletal disorders (MSDs). Scientific evidence in industries with high physical exertion, such as glassmaking, shows that heat stress acts as a modifying factor for the development of

musculoskeletal disorders (MSDs). Biophysiological mechanisms linking heat stress and MSDs**.** Exposure to an overheated microclimate reduces muscle performance, increases the risk of microtrauma, and accelerates physiological fatigue. In industries with significant physical exertion, such as glassmaking, where processes are carried out near furnaces, there is an increased risk of overload injuries to the spine and upper limbs (low back pain, shoulder syndromes, tendinopathies).Prolonged work in high heat is accompanied by significant loss of fluids and electrolytes, increased frequency of muscle cramps and stiffness, and reduced elasticity of muscle and connective tissue structures, which is a prerequisite for microtrauma and chronic degenerative changes. Heat stress affects cognitive and motor functions, leading to imprecise movements, compensatory postures, and increased biomechanical stress on the musculoskeletal system. The combination of shift work and continuous work in conditions of heat stress, typical of the glass industry, causes impaired blood supply and delays recovery processes.

PURPOSE: The aim of this study is to analyze the role of heat stress as a modifying factor for the development of musculoskeletal disorders in workers exposed to high heat loads.

MATERIALS AND METHODS: Documentary and statistical methods were used. The assessment of temporary incapacity indicators was carried out by comparison with indicative-normative groups according to the Batiks-Lekarev statistical system, which refer to a one-year period. The sources of information are 1,103 primary sick leave certificates for the period 01.01.-31.12.2023, issued to 657 workers from a glass products factory in the Republic of Bulgaria, containing a comprehensive description of each illness: type of sick leave certificate, duration in calendar days, year and reason for issuance, diagnoses according to ICD 10.

RESULTS: An analysis of indicators for temporary incapacity for work due to diseases of the musculoskeletal system and connective tissue shows that in 2023 a total of 182 cases were registered, resulting in 3,835 days of temporary incapacity for work. The average duration of a sick leave certificate is 21.1 days, which reflects the significant severity and tendency toward chronicity of these diseases. The largest share of the total number of days of incapacity for work is accounted for by intervertebral disc disorders in the lumbar and other parts of the spine with radiculopathy – 73 cases, with 1,856 days of lost work or 48.4% of all days of temporary incapacity for work. This makes musculoskeletal disorders the leading cause of sick leave. Other degenerative diseases of the spine and peripheral joints also contribute significantly, including other types of disc herniation (6 cases with 241 days), radiculopathy (10 cases with 147 days), and various forms of dorsalgia and cervicalgia. Together, these diagnoses account for more than half of the registered temporary incapacity for work. Degenerative joint diseases (gonarthrosis, coxarthrosis, and polyarthrosis) occur less frequently but are characterized by prolonged periods of sick leave, which increases their relative weight in the overall structure of morbidity. Damage to soft tissues, ligaments, and bursae associated with overload and pressure accounts for a significant proportion of cases, with a moderate to high average duration of sick leave [tabl.1]

Table 1. Diseases of the musculoskeletal system and connective tissue

No	Professional group sick leave	Cases	Days
	Diseases of the musculoskeletal system and connective tissue	**182**	**3835**
1	Other seropositive rheumatoid arthritis	1	8
2	Seronegative rheumatoid arthritis	2	17
3	Idiopathic gout	1	12

4	Arthritis, unspecified	2	19
5	Other polyarthrosis	1	14
6	Primary coxarthrosis, bilatera	1	7
7	Other primary coxarthrosis	0	60
8	Primary gonarthrosis, bilateral	2	23
9	Other primary gonarthrosis	3	52
10	Gonarthrosis, unspecified	1	14
11	Primary arthrosis of other joints	1	38
12	Arthrosis, unspecified	1	7
13	Other meniscus disorders	1	14
14	Chronic instability of knee joint	2	67
15	Intra-articular disorder of knee joint, unspecified	2	28
16	Other disorders of articular cartilage	1	3
17	Joint effusion	4	56
18	Enthesopathy of the spine	1	22
19	Sacroiliitis, not classified elsewhere	1	13
20	Other spondyloses with radiculopathy	5	74
21	Други спондилози Other spondyloses	1	7
22	Damage to the intervertebral discs in the cervical spine	1	6
23	Damage to the intervertebral discs in the cervical spine with radiculopathy	4	60
24	Damage to the intervertebral discs in the cervical spine, unspecified	2	15
25	Damage to intervertebral discs in other segments	1	10
26	Damage to intervertebral discs in the lumbar and other segments of the spine with radiculopathy	73	1856
27	Other specified herniation of intervertebral disc	6	241
28	Other specified intervertebral disc damage	1	8
29	Intervertebral disc damage, unspecified	8	79
30	Radiculopathy	10	147
31	Cervicalgia	1	37
32	Sciatica	1	7
33	Lumbago with sciatica	1	7
34	Low back pain	4	38
35	Pain in the thoracic spine	2	16
36	Dorsalgia, unspecified	4	20
37	Stenosing chronic tenosynovitis of the thumb [de Quervain]	1	24
38	Other synovitis and tenosynovitis	4	34
39	Ganglion	1	79
40	Damage to the synovium and tendons, unspecified	2	20
41	Bursitis of the greater trochanter	1	54
42	Other soft tissue damage related to strain, overload, and pressure	4	66
43	Soft tissue damage related to overload, strain, and pressure, unspecified	2	19
44	Bursopathy, unspecified	1	7
45	Fasciitis, not classified elsewhere	1	7
46	Fibroblastic injury, unspecified	1	10

47	Bursitis of the shoulder	1	14
48	Other injuries of the shoulder	2	25
49	Injury of the shoulder, unspecified	3	16
50	Other enthesopathies of the foot	1	10
51	Other enthesopathies, not elsewhere classified	1	7
52	Aseptic idiopathic osteonecrosis	2	161
53	Other specified cartilage disorders	1	180

DISCUSSION: A comparison between the results obtained and published scientific data shows a high degree of consistency regarding the role of heat stress as a modifying factor for the development and severity of musculoskeletal disorders (MSDs). The study by Sharif et al. (2024) found that when working in conditions of increased heat stress, the incidence of low back pain, radicular syndromes, and chronic muscle fatigue is significantly higher. In the context of the physiological mechanisms described by Cheung and Sleivert (2016), the results demonstrate a real manifestation of the theoretically substantiated effects of thermal stress – reduced muscle strength, faster onset of fatigue, and impaired stabilization of the spine. The systematic review and meta-analysis by Greggi et al. (2024) shows that work-related MSDs are the result of cumulative exposure to risks, with physical overload significantly increasing both the frequency and severity of the disorders. The marked imbalance between frequency and severity — a relatively limited number of cases for some diagnoses but with extremely long periods of incapacity — confirms Greggi et al.'s thesis that the severity of MSDs is often underestimated when the analysis is based solely on frequency, without taking into account the duration of absences. According to the observations of Spector et al. (2019), heat exposure not only increases the risk of injuries and illnesses, but is also associated with more severe clinical forms and longer recovery times. The observed pattern of temporary morbidity for heat stress management in the workplace shows that in the absence of effective control over thermal risk, classic ergonomic factors manifest themselves with greater severity and lead to chronic MSDs (WHO, 2025).

CONCLUSION: Heat stress in the context of the glass industry should be considered synergistically with ergonomic risks, a prerequisite for the development and chronicity of musculoskeletal disorders, reduced work capacity, and increased morbidity. A multidisciplinary approach is needed, including ergonomic interventions, control of physical factors (microclimate), and administrative measures.

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NUTRITION AND HYGIENE IN EARLY AND PRESCHOOL CHILDREN

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Abstract

Background: Early and preschool childhood is a critical period for the establishment of dietary habits that influence growth, development, and long-term health outcomes. Recent decades have seen significant transformations in children's nutrition, characterized by increased consumption of fats, salt, and sugars, and decreased intake of fruits, vegetables, and fiber. These patterns contribute to both micronutrient deficiencies and early-onset overweight and obesity.

Objective: This article aims to review nutritional deficiencies, malabsorption syndromes, and their impact on growth and development in early childhood, as well as the role of dietary hygiene in preventing obesity and promoting overall health.

Methods: A literature review was conducted..

Results: Common nutritional deficiencies include iron, calcium, zinc, folic acid, and vitamins D and E. Malabsorption syndromes, including carbohydrate and fat malabsorption, contribute to undernutrition and impaired growth. Behavioral and food hygiene practices, such as regular meal schedules, mindful eating, and proper food safety, are critical in shaping healthy dietary habits. Simultaneously, excessive caloric intake and irregular eating patterns are associated with early-onset obesity.

Conclusions: Children face a double burden of malnutrition: micronutrient deficiencies and overnutrition. Early identification of nutritional deficiencies, implementation of proper dietary hygiene, and monitoring of growth are essential to prevent long-term health consequences. A comprehensive, evidence-based approach to nutrition and hygiene in early childhood is vital for promoting optimal physical and cognitive development.

Keywords: early childhood nutrition, preschool children, malabsorption, micronutrient deficiency, dietary hygiene, obesity prevention, growth, development

Introduction

Children's dietary habits in early and preschool age have undergone significant transformations in recent decades, posing new challenges to pediatrics and public health. In contemporary society, there is a tendency for increased consumption of fats, salt, and sugar, along with reduced intake of fruits, vegetables, and fiber [1]. Only one-fifth of children meet the recommended daily intake of plant-based foods [1]. This imbalance is most pronounced among children from families with low socioeconomic status [2].

The aim of this article is to present nutritional deficiencies, malabsorption syndromes, and their consequences on growth and development, as well as the increasing problem of childhood obesity and dietary hygiene.

Methods: A literature review was conducted, focusing on global and regional studies on childhood nutrition, micronutrient deficiencies, malabsorption syndromes, dietary hygiene, and obesity prevalence. Key sources included publications from UNICEF, WHO and peer-reviewed journals.

Nutritional Deficiencies in the Modern World. Paradoxically, in the era of caloric excess, children often suffer from "hidden hunger"—deficiencies in key micronutrients [2, 5]. The most common deficiencies include calcium, folic acid, vitamins D and E, iron, and zinc. Iron deficiency anemia is a global health problem recognized by the WHO and affects both developing and developed countries [1, 5]. Vitamin D deficiency is prevalent even in sunny countries such as Australia and Israel [6].

Undernutrition in early childhood is associated with long-term neurocognitive deficits and behavioral changes [9, 14].

Malabsorption Syndromes Malabsorption represents a disruption in the absorption of nutrients, leading to undernutrition and growth retardation [7].

1. Carbohydrate Malabsorption

Most often caused by deficiencies in disaccharidases such as lactase, sucrase, and maltase [7, 8]. Symptoms include acidic stool pH, diarrhea, and dehydration.

2. Impaired Fat Digestion and Absorption

Conditions such as cystic fibrosis, cholestasis, and short bowel syndrome result in steatorrhea and deficiencies of fat-soluble vitamins [7].

Vitamin and Mineral Absorption Disorders
Minerals

- Zinc deficiency leads to skin lesions and immune deficiency.
- Copper deficiency results in anemia and neurological disorders.
- Iodine deficiency causes goiter and cognitive impairment [10].

Vitamins

- Vitamin B12: megaloblastic anemia and neurological damage.
- Vitamin D: rickets and skeletal deformities [6, 13].
- Vitamin A: night blindness and immunosuppression.
- Vitamin K: coagulopathies.

Growth Disorders

Growth retardation may result from:

- Genetic/familial factors: Turner syndrome, achondroplasia [10];
- Constitutional factors: growth delay that normalizes over time;
- Systemic/endocrine disorders: chronic diseases, hormonal disorders, malnutrition [3];
- Intrauterine growth restriction (IUGR): associated with maternal smoking and hypoxia [10].

Iron Deficiency Anemia Iron deficiency anemia is the most common form of anemia in childhood [5]. It often results from low dietary iron intake, early introduction of cow's milk, or occult blood loss. Symptoms include pallor, fatigue, and pica.

Dietary Hygiene in Early and Preschool Age

1. Food Safety and Hygiene. Dietary hygiene is key to infection prevention and habit formation. Core elements include proper food storage, handwashing, and avoiding cross-contamination [12].

2. Behavioral Hygiene of Eating

- Regular meal times;
- Avoiding eating in front of screens;
- Slow and mindful eating;

- Limiting high-calorie snacks [4].

3. Dietary Hygiene and Obesity Prevention. Unhealthy eating habits, irregular meals, and high consumption of sugary drinks are leading contributors to early overweight [3, 11]. Early implementation of structured dietary routines and promotion of physical activity are critical.

Conclusion. Modern children face a double burden: undernutrition (deficiencies, malabsorption) and overnutrition (obesity). Early diagnosis, nutritional assessment, and proper dietary hygiene are crucial for preventing long-term health risks [1, 3, 5, 6, 12, 14, 15]. Early identification of nutritional deficiencies and malabsorption syndromes enables timely intervention, prevents growth delays, and supports normal neurocognitive development in children [5, 7, 14]. Implementing systematic dietary hygiene—including food safety, regular meal schedules, and limiting high-calorie snacks—is a key factor in establishing healthy eating habits and preventing childhood obesity [3, 4, 12]. A comprehensive approach to nutrition, combining dietary balance, growth monitoring, and behavioral hygiene, is necessary to minimize the long-term health consequences of the double burden of undernutrition and overnutrition [1, 6, 11, 15].

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DIETARY IMPROVEMENT OF IMMUNE HEALTH

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Abstract
Nutrition plays an important role on human`s health overall but also has a significant role on modulation of immunological response. Over the last decades, there has been rising scientific interest about the delicate relationship between dietary intake and immune function. The reason for that interest is that the systematic inflammatory response during surgery procedures, trauma or infections leads to high metabolic demands and exhaustion of essential nutrient stores. The state of malnutrition prevalent among patients with such issues is characterized by both macro- and micro nutrient deficiencies which is related with higher risk for prolonged hospital stay and higher mortality rate. Therefore there are controversial states related with applying standard enriched formulas and immunonutrition formulas which requires more detailed studies to establish the sole nutrient effect from one side and the proper combination of immunonutrients from the other side with aim to achieve the optimal outcome.
Key words: nutrient deficiency, inflamation, immunonutrition, immune function

Introduction:
Malnutrition is an acute or chronic state related with adverse effect on every organ and system in the human body, in particular the immune function and susceptibility to infection. [1] The prevalence of malnutrition in hospitals is between 35-90% depending on underlying disease. [2] Properly conducted nutritional support seeks to enhance the compromised nutritional status of malnourished patients. Over the last decades, there has been rising scientific interest about the delicate relationship between nutrition and immune function. The reason for that interest is that the systematic inflammatory response during surgery procedures, trauma or infections leads to high metabolic demands and exhaustion of essential nutrient stores. The normal immune response is compromised by pro-inflammatory cytokines and hormones, such as cortisol, glucagon and epinephrin, which have an immunosuppressive effect, increase catabolic changes and energy expenditure by 50%. [3] Therefore growing evidence suggests that certain nutrients that have immunomodulating effect may help optimize immune functions including improving gut microbiome composition that might benefit homoeostasis and regulate the dysbiotic state, which trigger inflammatory responses. [4] Nutrition therapy is proposed as a tool to provide sufficient energy, protein, and other vital nutrients for preserving the body tissue and to support the inflammatory response. [5] Those nutrients are omega-3 polyunsaturated fatty acids (PUFA), nucleotides, probiotics, prebiotics, polyphenols and other bioactive food ingredients which increase immune control in human body. [6]
In a relation of that, the termin immunonutrition is introduced as modulation of the activity of the immune system by nutrients or specific food components ingested in amounts above those normally taken in the diet [7] and have beneficial effect on host protection in different levels - gut health, allergic diseases, respiratory infections, wound healing, cancer. Additionally, some trace elements take part as antioxidant defence in the human body in the content of antioxidant enzymes: caeruloplasmin (copper), superoxide dismutases (copper, zinc, manganese), and glutathione peroxidase (selenium). The positive effects of supplementation are multiple. Many studies report a reduction in hospital length of stay and infection rates. [8] However, mortality is not reduced. Immune therapy may not be efficacious among all patient groups probably due to several factors including the methodology of dietary administration,

the amounts of food and supplements intake, the timing of feeding, underlying diseases and individual genetic factors.
Nutritional support with arginine, glutamine, nucleotides and PUFA have beneficial effect on the trophic processes of the gastro-intestinal tract (GIT) in hospitalized patients and outpatients. Glutamine plays an important role in kidney, liver and gut function. Meta-analysis show that glutamine supplementation reduces the incidence of infections, hospital stay and costs. [9] but it`s not confirmed from other trials. Arginine is conditionally essential aminoacid because during growth, illness and injury its synthesis is inadequate. Supplementation with arginine improves nitrogen balance, enhance T cell function and increase collagen synthesis and deposition during wound healing. [10] Nucleotides are precursors of DNA and RNA, so that they improve cellular immune function along better integrity of intestinal tissue. Omega -3 PUFA, mainly eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), are most intensively studied about their immune function. Apart from inhibition of eicosanoids (PGE2, leukotrienes), pro-inflammatory cytokines (IL-1β, TNF-α, IL-6) and chemokines (IL-8), they also increase the production of anti-inflammatory cytokine IL-10. [11] (Tabl.1)
Vitamin D (Calcitriol) is a fat-soluble vitamin with pleiotropic effect. It regulates the antimicrobial proteins - cathelicidin and defensin which are responsible for intestinal microbiota modulation. It also has protective role in lung infection, gut integrity, renal and corneal epithelial function. [12]
Vitamin A is responsible for the normal differentiation of epithelial tissue. It is important for intestinal immune response that supports the gut barrier. Its immunoregulatory function includes reducing the toxic effects of ROS and regulating membrane fluidity and gap-junctional communication.
There is a clear correlation between vitamin E deficiency and immune function impairment. It enhances T cell-mediated function which is responsible for delayed hypersensitivity response, lymphocyte proliferation and decreased prostaglandine E2 production. [13]
Zn is essential micronutrient that plays a crucial role in the normal growth, development, also maintenance cellular integrity and functionality. It is responsible for IL-2 production, natural killers (NK) cell activity, macrophage phagocytic activity and neutrophils function. Adequate supplementation can reverse the impaired immune system. [14]
Probiotics include a huge variety of species which have beneficial effect by different mechanisms on human`s immune health. Interestingly, a study of Mane at al found that participants with probiotic group have higher amount of B cells, NK cells, CD4+ and CD8+ in their peripheral blood which correlates with less frequency of pneumonia and mortality caused by latter. [15] The combination of probiotics with prebiotics in many randomized trials has promising but variable results. Findings show that probiotics modulate immune regulation in respiratory and dietary allergies. Prebiotics like GOSs (galacto-oligosaccharides) and FOS (fructo-oligosaccharides) reduce allergic outcomes in high risk infants, as those oligosaccharides lead to beneficial bacterial growth. [16] This profound impact of gut microbiota in immune regulation and allergic disorders gives the chance to organize therapeutic nutritional approach for prevention and treatment of allergic and many other infectious and metabolic diseases.

Tabl. 1. Immunonutrients which improve immune status and mechanism

Immuno nutrient	**Influence on immune fun ction**	**Possible mechanism**	**Food**

Omega-3 PUFA	Inhibits pro-inflammatory mediators, enhances T cell function	Changes the structure of cellular membrane phospholipids and their function	Fish, nuts,seeds
Arginine	Stimulates proliferation of NK cells Stimulates T cell function	Stimulates production of growth hormone, prolactin Stimulates GI barrier function	Meat, poultry, eggs, diary products
Glutamine	Stimulates T cell function	Renal handling of amonia, substrate for hepatic gluconeogenesis, fuel source for enterocytes	Meat, poultry, eggs, diary products, nuts
Probiotics	Modulate immune and inflammatory response in gut, upper respiratory tract and the systemic immune system	Enhance host resistance against infection, allergy	Diary products
Vitamin A	Contribute integrity of skin and mucosa	Taking part in inflammatory response	Carrot, spinach, kale, beef
Vitamin D	Impact function on immune cells through VDR, activation of T- and B- cells	Promotes the chemotactic and phagocytic capacity of macrophages	Fatty fish, egg yolks, liver
Vitamin E	Protects the immune cells from oxidative damage, improve integrity of skin and mucosis	Enhance T cell mediation function,delayed type hypersensitivity response, lymphocyte proliferation	Avokado, artichoke, nuts, seeds
Nucleotides	Synthesis DNA, RNA Metabolic regulators Coenzymes (NAD+, FAD)	Restores damaged tissue with rapid cellular turnover Protects structural and functional integrity of intestinal mucosa	Meat , fish, seafood, eggs, legumes

Conclusion: Nutrient status has the potential to modulate cytokine biology and immune function in humans. The adequate macro- and micronutrient intake is crucial for optimal immune function and infection resistance. Studies related with immunonutrition have some limitations - the solutions from the different producers are varied with different quantity of omega-3 PUFA, arginin, glutamine etc, the needs of different patients also are diverse related with the underlying disease - surgery patients, critically ill patients, burn and trauma patients etc. Consequently, there are controversial states related with applying standard enriched formulas and immunonutrition formulas which requires more detailed studies to establish the sole nutrient effect from one side and the proper combination of immunonutrients from the other side with aim to achieve the optimal outcome.

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WHEN INFECTION MEETS COMPLEXITY: PNEUMONIA-RELATED HOSPITALIZATIONS IN CHILDREN WITH CEREBRAL PALSY AND AUTISM SPECTRUM DISORDER

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ABSTRACT

Introduction: Children with cerebral palsy (CP) and autism spectrum disorder (ASD) are at increased risk of acute respiratory illnesses, particularly pneumonia, yet data on hospitalization patterns remain limited, especially in middle-income countries.

Methods: A cross-sectional study included 91 children aged 2–12 years from Varna and Ruse, northeastern Bulgaria: 16 with CP, 48 with ASD, and 27 neurotypical controls. Caregivers completed standardized questionnaires regarding acute illnesses, pneumonia episodes, physician visits, and hospitalizations in the past year. Data were analyzed using ANOVA and chi-square tests. Statistical significance was defined as $p < 0.05$.

Results: Children with ASD and CP reported significantly higher rates of acute respiratory illnesses compared to controls (40.0%, $p<0.001$). Hospitalization in the past year occurred in 60.0% of children with CP, 47.3% with ASD, and only 20.0% of controls ($p=0.001$). Pneumonia affected over half of the neurodevelopmental groups: 52.9% of CP and 62.3% of ASD children had ≥1 episode annually. Recurrent pneumonia (≥4 episodes/year) was reported in 11.8% of CP and 17.5% of ASD cases, vs. 0% in controls ($p=0.92$). Pneumonia-related hospitalizations (≥1/year) were reported in 41.2% of CP and 41.9% of ASD children. Physician visits were significantly more frequent among CP (80.0%) and ASD (74.3%) groups compared to controls (30.0%, $p<0.001$).

Conclusion: Children with CP and ASD experience a substantially higher burden of acute respiratory illnesses, pneumonia, and hospitalizations compared to their peers. Improved screening, early referral to specialists, and targeted preventive strategies are urgently needed.

Keywords: cerebral palsy (CP), autism spectrum disorder (ASD), acute respiratory illnesses, pneumonia, hospitalization, middle-income countries

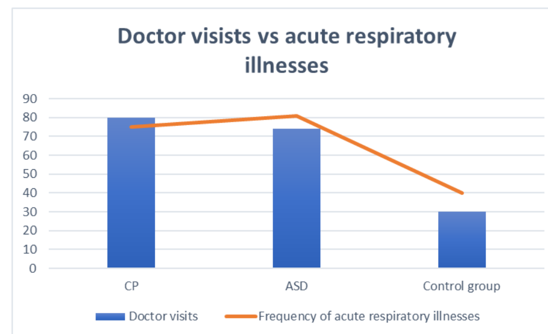
Introduction Cerebral palsy (CP) and autism spectrum disorder (ASD) are among the most common neurodevelopmental conditions of childhood. CP, defined as a group of permanent movement and posture disorders caused by non-progressive disturbances in the developing brain, affects about 2–3 per 1000 live births [1, 2]. ASD is characterized by deficits in social communication and restricted or repetitive behaviors, affects roughly 1–2% of children globally, with prevalence rising over the last two decades [3]. These conditions frequently co-occur: estimates suggest that 7–30% of children with CP also have ASD, and over half may show autistic traits or other neuropsychiatric impairments [4, 5]. Pneumonia remains one of the leading causes of morbidity, hospitalization, and mortality among children with CP and ASD worldwide, and they are at increased risk of severe respiratory disease, prolonged hospitalization, and associated complications [6, 7, 8]. Population-based studies show that children with severe motor impairments (Gross Motor Function Classification System [GMFCS] levels

IV–V) have up to a 15–20 times higher risk of hospitalization for pneumonia, compared with their peers [9]. Risk is driven by impaired swallowing, gastroesophageal reflux, weak respiratory muscles, and immobility, all of which predispose to aspiration and reduced airway clearance [9, 10]. In contrast, pneumonia in ASD is less directly linked to neuromuscular impairment but is influenced by higher rates of comorbid asthma, atypical immune responses, feeding difficulties, and barriers to timely care due to communication challenges [11, 12]. Despite the burden, systematic data on pneumonia-related hospitalizations in children with CP and ASD remain limited, especially for low- and middle-income countries. The aim of our study is to assess the frequency of acute illnesses, including pneumonia, physician visits over the past year, total hospitalizations, and pneumonia-related hospitalizations in children with CP and ASD.

Materials and Methods A cross-sectional study was conducted between August 2023 and March 2025 in the cities of Varna and Ruse, located in northeastern Bulgaria. The study population comprised 91 children: 16 diagnosed with CP, 48 with ASD, and 27 neurologically healthy controls. Recruitment was carried out through the Karin Dom Foundation (Varna), the Equilibrium Association (Ruse), and the Varna Home for Medico-Social Care for Children. Parents underwent screening through semi-structured interviews, and subsequently provided written informed consent prior to participation. Children were eligible if they were aged 2–12 years and had a confirmed diagnosis of CP or ASD established by a pediatric neurologist or pediatrician. Exclusion criteria included acute or life-threatening illness, the presence of genetic syndromes, lack of adequate parental comprehension of study procedures, or unavailability during the study period. The study protocol received approval from the Ethics Committee on Scientific Research at the Medical University "Prof. Dr. P. Stoyanov"—Varna. All procedures adhered to the ethical principles outlined in the Declaration of Helsinki. Collected demographic variables included age, sex, gestational age, and parental age and educational attainment. Parents completed a structured questionnaire addressing frequency of acute infections, health-care utilization (physician consultations, timeliness of medical response), and specialist referrals. Data analysis was performed using Jamovi software (version 2.6). Continuous variables were expressed as mean ± standard deviation (SD) and compared using one-way analysis of variance (ANOVA) with Tukey's post-hoc testing. Categorical variables were summarized as absolute frequencies and percentages, and intergroup comparisons were conducted using the chi-square test or Fisher's exact test where appropriate. Statistical significance was defined as $p < 0.05$.

Results A total of 91 children aged between 2 and 12 years were analyzed. Of these, 16 children had CP, 48 had ASD, and with 27 controls. The mean age for the three groups was 8.33±3.07, 9.04±6.92, and 6.48±3.07 years, respectively. The time to diagnosis for CP was 1.10±0.54 and 1.07±1.62, respectively, for ASD. No statistically significant difference in age at diagnosis was found ($F=2.04$, $p=0.136$). The most frequently reported acute illnesses included upper respiratory infections (URIs), lower respiratory tract infections (LRTIs), bronchitis, laryngitis, and tonsillitis, with otitis and gastrointestinal problems reported less frequently. The highest frequency of acute respiratory illnesses was observed in children with ASD (81.1%), followed by CP (75.0%), and the control group (40.0%) ($\chi^2(2)=23.28$, $p<0.001$). In the past year, 47.1% of children with CP and 38.7% of children with ASD had no pneumonia. Conversely, 41.2% of children with CP and 43.5% of children with ASD were treated 1–3 times for pneumonia, compared with 41.1% in the control group. Only11.8% of CP and 17.5% of ASD had four or more episodes of pneumonia ($p=0.92$). Children with CP had the highest proportion of physician visits (80.0%), followed by children with ASD (74.3%), whereas the control group had a significantly lower rate (30.0%) ($\chi^2(2)=28.34$, $p<0.001$) (Fig. 1).

Fig. 1. Frequency of doctor visits in CP, ASD, and control group



The highest overall hospitalization rate in the past year was observed in CP children (60.0%), followed by the ASD (47.3%), while the control group had a substantially lower frequency of hospitalizations (20.0%) ($\chi^2(2)=13.35$, $p=0.001$). Approximately 35.3% of children with CP were hospitalized for pneumonia 1–3 times in the past year, while 5.9% were hospitalized 4–5 times or more, and 41.9% and 12.9% ($p=0.71$) for ASD children, respectively. At the same time, 47.4% (9) of CP, 34.0% (17) of children with ASD and 47.6% (10) of controls have never been consulted by a pulmonologist. We find no difference in the approach to respiratory problems in at-risk children compared to healthy controls.

Discussion Respiratory issues are a significant concern for children with CP and ASD, often leading to increased morbidity and mortality. Neurodevelopmental disability (CP and ASD) as a group is linked to higher hospital and ED visits—about 1.8 times that of the general pediatric population. Understanding these problems is crucial for effective management and care [10, 13]. Our data show statistically significant differences between three study groups – ASD, CP, and controls – in terms of frequency of acute illnesses, number of hospitalizations, and need for doctor visits over the past year. Worldwide, children with CP have higher number of hospitalizations due to pneumonia, epilepsy, gastrointestinal problems, UTI, and bacteremia. Remarkably, the top three admissions (pneumonia, epilepsy, and various respiratory conditions) accounted for a substantial portion of admissions (62%). Most admission reasons appeared to prolong length of hospital stay (LOS), and the LOS exhibited an increasing trend as age increased [10,14,15]. Pneumonia admissions are not only prolonged and recurrent, but also with high mortality rate [10,16,17, 18]. About 90% of children with CP have swallowing difficulties leading to aspiration pneumonia [17,19], recurrent lower respiratory tract infections due to GER [6]. Seizures may trigger aspiration episodes, compounding pneumonia risk [7], while immobility and weak respiratory muscles may limit airway clearance, increasing susceptibility to infection [9, 20]. Unlike CP, the link between ASD and pneumonia admissions is less direct. Nevertheless, children with ASD are at increased risk for several reasons. First, studies show higher asthma prevalence among children with ASD compared with controls, contributing to greater vulnerability to pneumonia [11]. Second, children with ASD exhibit food selectivity, oral motor dysfunction, or dysphagia, raising aspiration risk [21]. Third, emerging evidence suggests altered immune responses in ASD, which may predispose to respiratory infections [22]. Finally, communication difficulties and sensory sensitivities may delay presentation or complicate inpatient treatment, resulting in more severe illness at admission [12]. U.S. discharge data show that children with ASD are overrepresented among pneumonia admissions, though the absolute burden remains lower than in CP [13]. Our findings, however, indicate a higher prevalence of pneumonia in ASD than in CP, with affected children displaying broader symptomatology. This aligns with Hall et al., who reported early ear and respiratory symptoms associated with later ASD diagnoses or elevated autistic traits [23]. As such symptoms may be misinterpreted as infection, early recognition is essential to prevent misdiagnosis, unwarranted antibiotic use, and avoidable hospitalizations.

Conclusion Pneumonia is a serious condition that can be fatal, particularly in high-risk groups such as children with ASD and CP. Greater awareness of their specific clinical characteristics, regular medical monitoring, and recognition of associated risk factors may facilitate the prevention of complications, support the implementation of a holistic and individualized approach, and improve the quality of life of affected children as well as their parents and caregivers. Future research should prioritize integrated, population-based studies employing standardized pneumonia definitions, evaluate preventive interventions, and incorporate caregiver perspectives. Addressing these gaps will be essential to reduce hospital burden, improve clinical outcomes, and guide evidence-based practice.

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BEYOND BEHAVIOR: THE OVERLOOKED RESPIRATORY BURDEN IN CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

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Abstract

Background: Children with neurodevelopmental disorders, particularly cerebral palsy (CP) and autism spectrum disorder (ASD), frequently experience respiratory complications that significantly impact their health outcomes and quality of life. This study aimed to analyze the prevalence, characteristics, and management of respiratory symptoms in children with CP and ASD compared to neurotypical controls.

Methods: A cross-sectional study was conducted from August 2023 to March 2025 in northeastern Bulgaria, involving 91 children aged 2-12 years: 16 with CP, 48 with ASD, and 27 controls. Data were collected through parental questionnaires addressing respiratory symptoms over the past year, including cough, wheeze, retained secretions, fever, and choking episodes. Diagnostic approaches, antibiotic use, and healthcare utilization patterns were analyzed.

Results: Children with ASD demonstrated significantly higher rates of cough and rhinorrhea occurring more than twice yearly, with chest wheezing showing statistically significant differences among groups (p=0.012). Cough was the most frequent symptom during respiratory illnesses in the ASD group (62.3%) compared to CP (23.2%) and controls (14.5%) (p=0.014). Vomiting was also more prevalent in ASD children (60.7%) (p=0.045). Acute illnesses affected 81.1% of ASD and 75.0% of CP children versus 40.0% of controls (p<0.001). Antibiotic use was notably high, with 56.9% of ASD and 35.5% of CP children requiring ≥4-5 courses annually.

Conclusion: Children with neurodevelopmental disorders, particularly ASD, show increased respiratory symptom burden and higher healthcare utilization. These findings highlight the need for specialized respiratory care protocols and multidisciplinary management approaches for this vulnerable population.

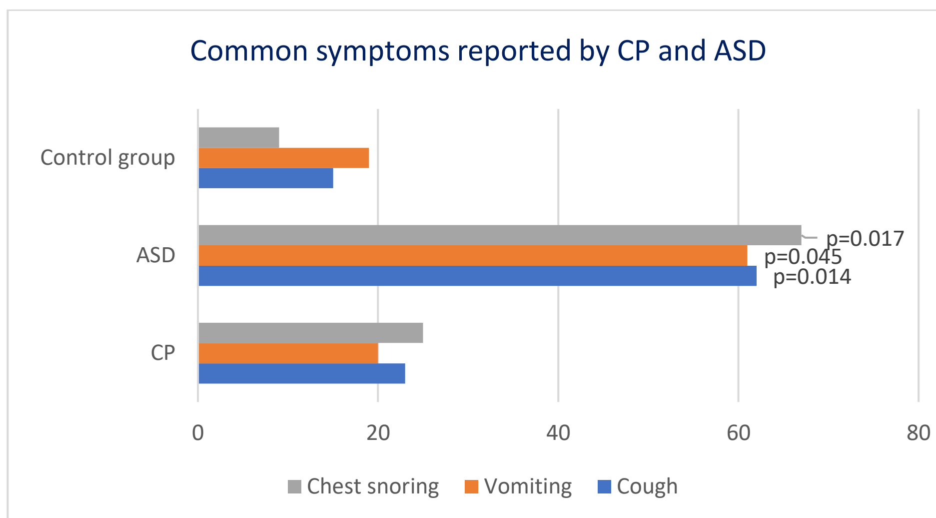
Keywords: cerebral palsy, autism spectrum disorder, respiratory symptoms, neurodevelopmental disorders, pediatric respiratory health, antibiotic use, healthcare utilization, Bulgaria

Introduction Children with neurocognitive impairments such as CP or ASD frequently present with chronic or recurrent respiratory problems. CP affects 2–3 per 1,000 live births and is characterized by non-progressive motor impairments due to early brain injury [1, 2], while ASD, diagnosed in about 1 in 36 children, involves challenges in social communication, behavior, and sensory processing [3, 4]. Both conditions are associated with significant comorbidities, and respiratory issues are a leading cause of morbidity, hospital admissions, and reduced quality of life. In CP, wheezing, cough, aspiration pneumonia, recurrent infections, and sleep-disordered breathing are common, often linked to oropharyngeal dysphagia (up to 86%) and gastroesophageal reflux (70–90%) [5, 6], contributing to a 14-fold higher mortality risk from respiratory disease [7, 8]; other factors include uncontrolled epilepsy and scoliosis [9]. In ASD, asthma (20.4% prevalence, OR 1.69) and allergic rhinitis (OR 1.66) are more frequent than in peers [10], with sleep-disordered breathing affecting ~8% of cases [11, 12].

Given the scarcity of systematic studies in these populations, this study aimed to analyze common respiratory symptoms, their prevalence, risk factors, and diagnostic approaches in children with CP and ASD.

Methods This cross-sectional study was conducted from August 2023 to March 2025 in Varna and Ruse, northeastern Bulgaria. Ninety-one children participated: 16 with CP, 48 with ASD, and 27 controls without neurological conditions. Recruitment was facilitated through the Karin Dom Foundation (Varna), the Equilibrium Association (Ruse), and the Varna Home for Medico-Social Care for Children. Parents were invited by phone or email, screened through semi-structured interviews, and provided written informed consent. Inclusion criteria were age 2–12 years and confirmed CP or ASD diagnosis by a pediatric neurologist or pediatrician. Exclusion criteria included acute or life-threatening illness, genetic syndromes, insufficient parental understanding of study procedures, or unavailability during the study period. Ethical approval was obtained from the Ethics Committee on Scientific Research of the Medical University "Prof. Dr. P. Stoyanov"—Varna (protocol no. 134/20 July 2023), and all procedures followed the Declaration of Helsinki.
Demographic information included child's age, sex, gestational age, and parental age and education. Parents completed a questionnaire on respiratory symptoms over the past year (fever, cough, chest wheeze, retained secretions), frequency of acute infections, physician consultations and response time, antibiotic use, diagnostic tests (blood/urine analysis, chest X-ray, chest CT, microbiology of nasal/throat swabs or sputum), and referrals to specialists. Analyses were performed using *Jamovi* (version 2.6). Continuous variables were summarized as mean ± SD and compared with one-way ANOVA and Tukey's post-hoc test. Categorical variables were presented as counts and percentages, compared with chi-square tests, and Fisher's exact test when expected counts were <5. Statistical significance was set at $p < 0.05$.

Results A total of 91 children between the ages of 2 and 12 years were analyzed. Among them, 16 children had CP, 48 were diagnosed with ASD, and 27 served as controls. The mean age across the three groups was 8.33±3.07, 9.04±6.92, and 6.48±3.07 years, respectively. The mean age at diagnosis was 1.10±0.54 years for CP and 1.07±1.62 years for ASD. No statistically significant differences were observed in the age at diagnosis between groups ($F=2.04$, $p=0.13$). With regard to respiratory symptoms within the past year—cough, sputum production, retained bronchial secretions, wheezing, fever accompanied by respiratory difficulties, and choking during coughing or feeding, they were reported with varying frequency. Cough and rhinorrhea, as primary manifestations of respiratory infections, occurred in more than two episodes during the past year and were more frequently reported in children with ASD. Wheezing demonstrated statistically significant difference among groups ($p=0.012$), again with higher prevalence in the ASD cohort. Other symptoms—namely, fever associated with respiratory complaints and choking during coughing or feeding did not differ significantly between groups ($p>0.05$). In addition to being reported as general complaints, cough was identified as the most frequent symptom during respiratory illnesses ($p=0.014$). Comparing individual groups, its prevalence was highest among children with ASD (62.3%, n=43), lower in those with CP (23.2%, n=16), and least common in controls (14.5%, n=10). Vomiting ($p=0.045$) was also reported most frequently in children with ASD (60.7%, n=51), followed by CP (20.2%, n=17) and controls (19.0%, n=16). Similarly, wheezing ($p=0.01$) was described as "frequent" in the ASD group (66.7%, n=38), less commonly in CP (24.6%, n=14), and least in controls (8.8%, n=5) (Fig. 1).
Fig. 1. Common symptoms reported by parents/caregivers of children with CP and ASD



Various diagnostic investigations commonly performed to support the evaluation of respiratory and pulmonary diseases were analyzed. All groups were compared with respect to standard blood or urine tests, chest radiography (CXR), microbiological analysis of sputum, nasal and throat swabs, and chest computed tomography (CT). No statistically significant differences were observed between groups for any of the prescribed investigations ($p>0.05$). Blood tests were most frequently performed, reported in 68.5% (n=37) of children with ASD, 16.7% (n=9) of those with CP, and considerably less often in controls (13.0%, n=7). Chest CT and sputum culture were performed rarely across all groups. No statistically significant differences were found between groups regarding the timeliness of consultation with a general practitioner ($p=0.99$). Response options included: same day, next day, within 2–3 days, or telephone advice. Across all groups — CP, ASD, and controls — the majority of children were examined on the same day, specifically 16.7% (n=8), 66.7% (n=32), and 18.8% (n 9), respectively. The remaining children received medical check-up within 24–72 hours or were provided with advice by telephone. Children aged 2–12 years frequently suffered from acute illnesses. Based on medical records from the previous year, the highest frequency was observed in ASD (81.1%), followed by CP (75.0%), whereas the control group demonstrated nearly half this rate (40%), a statistically significant difference ($\chi^2(2)=23.28$, $p<0.001$). Respiratory illnesses were a common indication for antibiotic treatment. During the past year alone, 82.4% of children with CP and 94.8% of children with ASD had received at least one antibiotic course. Moreover, 35.5% of the CP group and 56.9% of the ASD group required ≥4–5 antibiotic courses annually.

Discussion Children with CP and ASD are predisposed to infections early in life compared to the general population and to children with other developmental conditions. Respiratory complaints are complicated conditions that involve multiple factors and are not yet fully understood. Oropharyngeal dysphagia, gastroesophageal reflux, and sleep-disordered breathing lead to difficulties in swallowing, breathing, or communicating. On the other hand, an uncontrolled epilepsy increases salivation and contributes to more severe respiratory issues which are a leading cause of morbidity and mortality in this population, particularly in children with severe motor impairments (e.g., GMFCS Levels IV and V). For children with ASD, sensory sensitivities or behavioral challenges might make it harder to diagnose and manage these problems, though specific research on this combination is limited [13]. While respiratory issues are not as widely studied as other aspects of autism, evidence suggests that children may experience certain conditions more frequently than their neurotypical peers. Some common respiratory symptoms are wheezing, shortness of breath, and coughing [14]. Other common

complaints are rhinitis, marked by sneezing, nasal congestion, and itchy eyes [10]. Children with autism may face more frequent respiratory infections. This could stem from immune dysregulation, sensory challenges affecting hygiene (e.g., handwashing), or co-occurring health conditions [15, 16]. Often, these complaints can be mistaken for symptoms of other diseases, including respiratory problems. Respiratory complaints in children with ASD may often not indicate an underlying disease, but rather reflect characteristics inherent to the condition itself. Our study found that cough and rhinorrhea were reported as complaints in more than two episodes over the past year and were more frequent in children with ASD compared to those with CP. Similarly, wheezing (p=0.012), cough (p=0.014), and vomiting (p=0.0459) were predominant complaints in the ASD group compared to the CP group. To support the diagnosis of respiratory diseases and determine the extent to which complaints are associated with infection, we analyzed the use of various diagnostic tests. Our study revealed that blood tests were more frequently ordered for children with ASD (68.5%), followed by children with CP (16.7%) and controls (13%). Urine tests and chest X-rays were less commonly performed. CT of the lungs and microbiological tests were extremely rare across all groups. Children with ASD and CP frequently experienced acute illnesses (81.1% and 75%, respectively), while the control group had a nearly 2-fold lower rate (40%) (p<0.001). Respiratory complaints are a common reason for antibiotic use. Specifically, 35.5% of children with CP and 56.9% of children with ASD underwent at least 4-5 antibiotic courses annually, in contrast to the limited use of laboratory and imaging studies for diagnosis. This raises significant concerns regarding the frequency of respiratory complaints in this population, their association with viral or bacterial infections, diagnostic approach and management.

Conclusion Respiratory issues are a significant concern for children with CP and ASD, often leading to increased morbidity and mortality. Understanding these symptoms is crucial for effective management and care. These symptoms are often interconnected and can significantly impact the health and quality of their life. Early detection and management requires a multidisciplinary, holistic approach, as outlined in recent guidelines.

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STUDY OF LEARNING STYLES AMONG REHABILITATION AND DENTAL TECHNOLOGY STUDENTS USING THE VARK QUESTIONNAIRE

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2 - VDerm Sofia

ABSTRACT

Increasing student motivation and academic achievement is a challenge that many educators face. This study aims to formulate recommendations for a contemporary teaching model in the Rehabilitation Specialist and Dental Technician program based on an analysis of students' preferred learning styles. The research is motivated by the need to align the educational process with modern standards and individual learner needs. A quantitative study was conducted. Among rehabilitation students (n = 104), the most preferred learning style was auditory (68.3%), followed by visual (13.5%), kinesthetic (9.6%), and reading/writing (8.7%). A notable proportion of students exhibited multimodal preferences, most commonly A+V(25%), A+K(21.9%), and A+R(18.8%). Among dental technology students (n = 100), 71% showed unimodal preferences, with auditory (56.3%) being the most dominant, followed by visual (22.5%), reading/writing (12.7%), and kinesthetic (8.5%). Multimodal preferences were observed in 29% of participants, with bimodal combinations accounting for 72.4% of these. A comparative analysis revealed no statistically significant difference between the two specialties ($\chi^2 = 0.82$, $p = 0.37$), but indicated a clear trend toward diversity in preferred learning styles. The findings underscore the importance of implementing flexible, multimodal educational strategies that integrate visual, auditory, and kinesthetic elements to improve learning outcomes and enhance student engagement.

Keywords: *VARK, learning styles, multimodal teaching, auditory, kinesthetic, educational strategies*

INTRODUCTION

Enhancing student motivation and academic achievement in medical education is a challenge for educators that requires a multifaceted and adaptive approach. To improve education and bridge the achievement gap between highly motivated and less engaged students, barriers must be addressed: improving motivation to learn, including low intrinsic motivation, limited access to learning resources, socioeconomic inequalities, and systemic barriers (1,2). An important component in the educational process is the concept of learning styles, which represent individual preferences in perceiving, processing, and assimilating new information. The VARK model, developed by Fleming and Mills (1992), categorizes learners into four basic styles: visual (V), auditory (A), reading/writing (R), and kinesthetic (K). This model distinguishes between unimodal learners, who favor a single style, and multimodal learners, who prefer a combination of styles (3,4,5,6,7). Recognizing students' learning style preferences allows educators to adapt their teaching strategies, improving their engagement, motivation, and academic achievement. The application of the VARK model is particularly valuable in healthcare education, where the ability to effectively communicate and understand complex

information is vital. Adapting educational content to different learning styles not only deepens students' comprehension but also strengthens their ability to convey information to future patients (2,3,4,5)

AIM: This study aims to explore the preferred learning styles of students enrolled in the *Rehabilitation Specialist* and *Dental Technician* programs at the Medical College and, based on the findings, to propose recommendations for an innovative teaching model that aligns with current requirements in healthcare education.

MATERIALS AND METHODS

We conducted the study in January 2025 with rehabilitation and dental technology students at the Medical College of the Medical University of Varna, Bulgaria. Participation was voluntary and anonymous. The standardized VARK questionnaire by Neil Fleming was used, which was distributed via Google Forms. It contains 16 questions with four answer options for each learning style: V(visual), A(auditory), R(reading/writing), and K(kinesthetic). Respondents could select one or more answers per question, identifying their preferences for unimodal and multimodal learning (8). The students who met our criteria were 236 participants (rehabilitation: n=136; dental technology: n=100), achieving a high response rate (94.4%) and required statistical power.
Data were processed with SPSS 26. Analysis included descriptive statistics (absolute and relative frequencies,%) for VARK learning styles and multimodal combinations, as well as cross-tabulation and Chi-square (χ^2) tests to examine the correlation between learning style preferences and student specialities. Statistical significance was set at $p < 0.05$.
To ensure sample representativeness, random sampling was used. A minimum of 92 valid replies per speciality was needed with a 95% confidence level and 5% margin of error. Participants were categorised by main learning mode (unimodal or multimodal). Multimodal learners were further classified to determine the most common style combinations.

RESULTS

Out of 250 invited students, 236 participated in the study (response rate: 94.4%). Specialty distribution: *Rehabilitation* – n=136 (57.6%), *Dental Technology* – n=100 (42.4%). Gender: 128 males (54.2%), 108 females (45.8%), with no significant gender difference between specialties (χ^2=0.23, df=1, $p \approx$ 0.63).Among *Rehabilitation* students (n=136), 104(76.5%) showed unimodal preferences: Auditory (A) – 71 (68.3%), Visual (V) – 14 (13.5%), Kinesthetic (K) – 10 (9.6%), Read/Write (R) – 9 (8.7%). Multimodal learners (n=32,23.5%) were distributed as follows: bimodal – 24 (75%), trimodal – 6 (18.8%), and quadrimodal – 2 (6.2%). The most frequent combinations were A+V (25.0%), A+K (21.9%), and A+R (18.8%).In the *Dental Technology* group (n=100), 71 students (71.0%) had unimodal preferences: A – 40 (56.3%), V – 16 (22.5%), R – 9 (12.7%), K – 6 (8.5%). Multimodal learners (n = 29, 29.0%) were classified as bimodal – 21 (72.4%), trimodal – 6 (20.7%), and quadrimodal – 2 (6.9%). The most frequent bimodal combination was A+V (31.0%), followed by V+K (~21%). *(Table 3).* Unimodal styles were more common in *Rehabilitation* (76.5%) than in *Dental Technology* (71.0%), though not statistically significant (χ^2 = 0.82, p=0.37). Auditory preference (A) was significantly stronger in *Rehabilitation* (68.3%) vs. *Dental Technology* (56.3%) (p<0.001). *Dental*

Technology students showed slightly more multimodal tendencies (29.0% vs. 23.5%), including more trimodal learners (24.1% vs. 9.4%). Female students in *Dental Technology* demonstrated higher multimodal preference (34%) than their *Rehabilitation* peers (22%), though the difference was not significant (χ^2=1.85, p=0.17).

DISCUSSION

Our findings offer practical insights for tailoring instructional methods. The data revealed a strong overall preference for auditory learning (A) across both programs, with students demonstrating better comprehension through lectures, discussions, and verbal explanations. These results align with existing research in healthcare education (9,10). Similarly, Mirza (2019) reported that 40% of third-year medical students at Foundation University, Islamabad preferred auditory learning, while Ramulu et al. (2025) identified it as the second most favored unimodal style after kinesthetic learning (11,12). Based on the present findings, targeted instructional strategies are recommended. For Rehabilitation students, who are predominantly unimodal auditory learners, teaching should emphasize verbal instruction, group discussions, audio materials, and peer teaching, while also integrating visual and multimodal methods for students with varied preferences. For Dental Technology students, who showed more multimodal tendencies, a blended approach combining auditory and visual tools—such as diagrams, 3D visualizations, and models—should be paired with kinesthetic activities like practical exercises and simulations. Multimedia formats (e.g., PowerPoint, Prezi), narrated instructional videos, and interactive content can enhance understanding and engagement across modalities.

Despite the dominance of auditory preferences, a significant portion of students demonstrated multimodal learning styles, particularly combinations such as A+V, A+R, and V+K. These findings support the adoption of integrated teaching strategies that combine multiple sensory inputs. Previous studies (7,13,14) have similarly emphasized the benefits of multimodal learning in medical education. Instructional design should consider: Visual learners: diagrams, infographics, animations; Kinesthetic learners: demonstrations, simulations, hands-on labs; Read/Write learners: written materials, structured note-taking tasks; Auditory learners: podcasts, lectures, and verbal explanations via tools like LectureKeepr. Creating flexible and inclusive teaching environments that incorporate lectures, reading materials, visual aids, and experiential components can enhance knowledge retention and skill acquisition. The results support a multimodal instructional framework that can be universally applied across medical specialties, regardless of statistically insignificant differences between groups. Such a model may improve both academic performance and clinical preparedness, reflecting the complex, interdisciplinary nature of modern medical education. However, this study has several limitations. The sample included students from only two specialties within a single institution, which limits generalizability. Additionally, the cross-sectional design does not allow evaluation of long-term effects on academic achievement or clinical skill development. Future research should aim to include a broader range of medical specialties across multiple institutions, adopt a longitudinal design to assess the impact of multimodal education on academic and clinical outcomes, and explore correlations between learning styles and performance across different training stages.

CONCLUSION

The study highlights the importance of personalized and multimodal teaching strategies in healthcare education. Learning style distributions were largely similar, supporting the implementation of a unified, flexible educational approach. Integrating auditory, visual, and kinesthetic methods while remaining responsive to individual needs can enhance both theoretical and practical training. These findings improve health profession education through evidence-based instructional design that serves diverse learners and maintains high academic standards.

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WORK ABILITY AND PERFORMANCE IN OBSTRUCTIVE SLEEP APNEA: CURRENT EVIDENCE AND IMPLICATIONS FOR PUBLIC HEALTH

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Abstract

Obstructive sleep apnea (OSA) is a common sleep-related breathing disorder characterized by intermittent hypoxia and sleep fragmentation, leading to excessive daytime sleepiness and neurocognitive deficits that impair vigilance, attention, and executive functioning—abilities essential for safe and effective work performance. This review synthesizes recent evidence on the impact of OSA on occupational outcomes, including productivity, absenteeism, presenteeism, and job stability. Studies consistently show that untreated OSA is associated with slower cognitive processing, reduced task efficiency, increased workplace errors, and diminished performance on neurobehavioral tests. International data indicate that individuals with moderate-to-severe OSA experience higher rates of sick leave and substantial presenteeism, contributing to significant indirect economic costs. OSA severity is also linked to unstable employment histories, including repeated involuntary job loss. Although global research demonstrates clear occupational consequences, population-level data remain limited in several countries, including Bulgaria, where existing studies document high symptom burden but do not quantify productivity loss. Evidence further shows that continuous positive airway pressure (CPAP) therapy improves daytime alertness, processing speed, and cognitive performance, suggesting that much of the work-related impairment associated with OSA is preventable. Overall, OSA represents an important but under-recognized determinant of work ability and economic sustainability. Strengthening early detection, improving access to diagnostic services, and promoting effective treatment could reduce productivity losses and enhance workforce functioning, underscoring the need for targeted national research and workplace health policies.

Keywords: Obstructive sleep apnea; Work productivity; Cognitive impairment; Absenteeism and presenteeism; Employment outcomes.

Background

Obstructive sleep apnea (OSA) is a chronic sleep-related breathing disorder characterized by recurrent episodes of upper airway collapse during sleep, resulting in intermittent hypoxia, sleep fragmentation, and excessive daytime sleepiness [1–3]. These physiological disturbances disrupt normal sleep architecture and impair restorative sleep processes, contributing to a wide range of daytime symptoms. OSA affects key neurocognitive functions—including vigilance, sustained attention, working memory, and executive control—that are essential for maintaining consistent work performance and ensuring safety in tasks requiring rapid decision-making and mental alertness [2,4,5]. Beyond cognitive impairment, research demonstrates that untreated OSA reduces overall quality of life, increases the risk of accidents, and contributes to the development or worsening of cardiovascular and metabolic comorbidities such as hypertension, diabetes, and dyslipidemia [6–8].
Work ability and performance are influenced by a combination of physical health, cognitive functioning, and sleep quality, making OSA a significant factor in occupational outcomes. Numerous

studies have shown that individuals with OSA experience reduced work productivity, increased absenteeism, and a higher likelihood of negative employment events, including job instability [9–12]. In particular, Silva et al. reported that moderate-to-severe OSA was associated with significantly higher odds of multiple involuntary job losses among recently unemployed adults, even after adjusting for demographic and employment-related variables [9]. These findings highlight the broader socioeconomic implications of untreated OSA.

Daytime sleepiness and fatigue—two hallmark symptoms of OSA—are strongly linked to slower cognitive processing, impaired attention, and memory deficits [2,3,5,13]. Such impairments correlate with higher rates of workplace errors, reduced task completion efficiency, and diminished performance in both routine and complex occupational tasks. Systematic assessments consistently show that individuals with OSA perform worse on neurobehavioral tests compared with matched controls, underscoring the disorder's pervasive impact on cognitive functioning [4,5,14].

Absenteeism and presenteeism represent additional dimensions of the occupational burden associated with OSA. Individuals with moderate-to-severe OSA tend to accumulate more sick leave days and exhibit reduced effective working hours, even when physically present at work [10–12,15]. International estimates indicate that untreated OSA leads to measurable reductions in productive work time and contributes to increased organizational costs through decreased efficiency, higher error rates, and greater healthcare utilization [11,12,15,16]. These indirect costs often exceed the direct medical expenses associated with diagnosis and treatment.

Despite the growing body of international evidence, large population-level studies directly evaluating the impact of OSA on work outcomes remain limited in many countries, including Bulgaria. Local clinical research confirms a high prevalence of sleep-disordered breathing among referred populations and documents associated symptoms such as fatigue and excessive sleepiness, as well as frequent comorbidities, but these studies do not quantify productivity loss or employment-related consequences [17]. This gap in national data underscores the need for targeted research to better understand the occupational implications of OSA within the Bulgarian context.

Understanding the relationship between OSA and occupational performance has important implications for workplace health policies, employee screening programs, and the implementation of effective interventions. Continuous positive airway pressure (CPAP) therapy, the standard treatment for OSA, has been shown to improve daytime alertness, cognitive functioning, and overall quality of life, suggesting that timely diagnosis and treatment can mitigate many of the disorder's negative effects on work performance [14,18,19]. Integrating OSA management into occupational health strategies may therefore offer substantial benefits for both individual workers and employers.

Review Results

Multiple studies document that untreated OSA is associated with reduced work productivity and impaired cognitive performance relevant to workplace tasks [9–12,14]. Objective assessments consistently show that individuals with OSA exhibit slower reaction times, decreased vigilance, and attention deficits compared with matched controls [2,4,5], and these neurobehavioral impairments translate into poorer performance in simulated work tasks and everyday functions requiring sustained focus. Such deficits highlight the extent to which untreated OSA can compromise the cognitive resources necessary for maintaining efficiency and accuracy in occupational settings. Evidence from a large systematic evaluation of CPAP therapy further demonstrates that treatment leads to consistent improvements in cognitive performance and subjective daytime alertness [18,19]. Patients using CPAP show better processing speed and attention compared with baseline assessments, suggesting that untreated OSA imposes a substantial burden on performance capacity and that effective therapy can mitigate workplace inefficiency.OSA contributes to both absenteeism and presenteeism, reducing overall effectiveness while at work. Although national workforce data on sick leave specific to OSA

remain limited, international estimates indicate that individuals with moderate-to-severe OSA accrue more sick days than unaffected peers [10–12,15]. Presenteeism represents an even larger component of productivity loss, as individuals with OSA often spend significant portions of their working hours functioning below optimal capacity due to excessive daytime sleepiness and fatigue [3,5,13,15]. In economic terms, the combination of absenteeism and presenteeism results in substantial losses in effective working hours, contributing to measurable productivity deficits at both organizational and societal levels. Recent health economic reviews emphasize that untreated sleep apnea generates considerable direct and indirect costs, with productivity losses forming a major share of the overall burden [11,12,16,20].The relationship between OSA and job stability has also been examined. The ADAPT study found that adults with moderate-to-severe OSA had significantly increased odds of reporting multiple involuntary job losses compared with those without OSA, even after adjusting for demographic and occupational factors (9). Broader occupational health reviews similarly indicate that OSA negatively affects workplace safety, job retention, and overall occupational functioning [2], reinforcing the notion that untreated OSA can undermine long-term employment trajectories.Comorbidity further amplifies the functional burden associated with OSA. The condition frequently co-exists with cardiovascular and metabolic disorders, which themselves contribute to reduced work capacity and increased risk of functional impairment [6–8]. Additionally, comorbid depression and persistent fatigue are common among individuals with OSA and further erode the ability to sustain effective work performance, underscoring the multifactorial nature of occupational impairment in this population [3,13].Despite strong international evidence, significant gaps remain in population-level data. Estimates of OSA prevalence vary by age and diagnostic criteria, and few large national studies quantify associated productivity loss. In Bulgaria, available data on work outcomes are largely indirect, derived from clinical samples that document fatigue, sleepiness, and related quality-of-life impairments without providing objective workplace performance metrics [17]. This lack of comprehensive national data highlights the need for targeted research to better understand the occupational consequences of OSA and to inform effective workplace and public health strategies.

Conclusion

Current evidence shows that obstructive sleep apnea has a clear and measurable negative effect on work ability and performance [9–12,14]. Untreated OSA impairs attention, vigilance and cognitive processing—core cognitive domains required for maintaining accuracy, situational awareness and sustained task engagement in most occupational environments [2,4,5]. These impairments manifest as slower reaction times, reduced concentration, and diminished executive functioning, ultimately translating into reduced productivity, increased presenteeism, more frequent sick leave, and a heightened risk of unstable employment, including repeated involuntary job loss [9–12]. Such findings underscore that OSA is not only a clinical concern but also a significant determinant of functional capacity in the workplace.

The severity of OSA further influences the magnitude of occupational impairment. Moderate-to-severe disease is consistently associated with worse work-related outcomes than mild or absent OSA, reflecting the cumulative burden of more pronounced sleep fragmentation and hypoxic stress [9,12]. Importantly, evidence shows that treatment with continuous positive airway pressure (CPAP) improves daytime alertness, processing speed and overall cognitive performance, indicating that a substantial portion of the work-related burden associated with OSA is preventable [18,19]. These improvements highlight the potential for targeted interventions to restore functional capacity and reduce the risk of work-related errors and productivity loss.

Despite strong international evidence, national data on work productivity and employment outcomes in many countries, including Bulgaria, remain limited [17]. Existing local studies document high prevalence of symptoms such as fatigue and excessive sleepiness, as well as frequent comorbidities,

but they do not quantify the direct impact on workplace performance or economic loss. This gap in evidence limits the ability of policymakers and employers to fully appreciate the societal burden of untreated OSA and underscores the need for systematic, population-level research.
From a public health perspective, OSA should be considered not only a medical condition but also a factor with substantial implications for workforce performance and economic sustainability. Early detection, improved access to diagnostic services, and effective treatment strategies have the potential to reduce productivity losses, enhance occupational safety, and improve both individual and societal outcomes [16,18,19]. Integrating OSA screening and management into workplace health programs and national health policies could therefore yield meaningful benefits for public health and economic resilience.

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