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Original article

CHARACTERIZATION OF HYPERTENSION AND MIGRAINE IN RELATION TO SEX, AGE AND AB0 BLOOD GROUP AFFILIATION

Gergana Panayotova, Stanislav Ivanov, Evgeniya N. Ivanova,
Department of Developmental Biology, Faculty of Biology, University of Plovdiv "Paisii Hilendarski", Plovdiv, Bulgaria.

ABSTRACT:

Among the group of multifactorial pathologies that are increasingly common and with high social importance in human populations are hypertension and migraine. Currently, about 27% of the world's adult population suffers from hypertension and about 11.4% – from migraine.

Purpose: The aim of the present study is to investigate hypertension and migraine frequency among representatives of the reproductive population in Bulgaria and to characterize the potential relationships between these diseases and the factors of sex, age and AB0 blood groups.

Material and methods: A total of 817 individuals aged between 18 and 59 years are included in the study. They voluntarily have filled out a questionnaire, giving disease information (hypertension and migraine) after they have been diagnosed by a physician. AB0-blood group affiliation has been determined in laboratory conditions by a routine technique. The statistical analysis has been performed using the IBM SPSS Statistics software package, version 22.0

Results: Differences in the frequency of hypertension and migraine have been found depending on sex, age and blood group of the individuals. It has been established that in the majority of the analyzed individuals, both diseases are simultaneously expressed.

Conclusions: The risk of hypertension is higher for men and increases for both sexes over 44 years. The disease is more common among people in AB blood group. The risk of migraine is greater for women and increases for both sexes in the age group above 44 years. The disease is more common among people with blood types A and AB. Simultaneously appearance of both diseases is reported with the highest frequency in the representatives with blood group A, followed by those with blood group 0.

Keywords: hypertension, migraine, sex, age, AB0 blood group,

INTRODUCTION:

The complex phenotypic characteristics are of particular interest to researchers due to the interactions between genotype and environmental factors. These complex traits also include multifactorial diseases, which, due to the genes involved in their control and the variety of associated factors, are characterized by a substantial polymorphism. Among the multifactorial pathologies, groups that are increasingly more common in human populations are high blood pressure [1] and migraine [2]. These diseases are characterized by high social significance, and besides genotype, they also depend on other factors, such as gender, age, ethnicity, environmental pollution, harmful noises, educational stress, working and home environments, body weight, physical activity, eating and dietary habits, behavior, harmful foods and drinks usage, smoking, hormones, other medical conditions [3, 4, 5, 6].

The global importance of hypertension is increasing due to the aging of the population and the increasing prevalence of obesity, which is expected to affect one third of the world's population by 2025. Hypertension is known to have a significant impact on cardiovascular outcomes, resulting in heart failure, and is also a high risk factor for myocardial infarction, ischemic stroke, and other serious medical conditions. As with many diseases, its prevalence increases with age, rising from 27% in patients younger than 60 years up to 74% in those older than 80 years. Approximately 65% of men and 75% of women will develop hypertension by the age of 70 years. Minding the rapid aging of the population, the prevalence of hypertension can only be expected to increase [7]. Globally, high blood pressure is estimated to cause 7.5 million deaths, which is about 12.8% of all deaths, according to the WHO.

Migraine is a neurovascular disorder that affects over 1 billion people worldwide or one in ten people. Its prevalence is also increasing worldwide, and the related disabilities have a number of negative and significant effects not only on those affected but also on their families, colleagues, employers and society as a whole [8].

There have been identified seven genes located at different locations in the genome (1q31, 4q24, 6p12.2-21.1, 11q24, 14q21.2-q22.3, 15q11-q13 and Xq24-28) that underlie the genetic predisposition to the disease [11]. Currently, the multiple variants of migraine expression are associated with variations in the genetic components and certain envi-

ronmental factors, including stress, specific foods, specific odors, hormones, medications, metabolic features, etc. [6]. According to some authors, one of the genetic markers related to the possibilities of the early detection of groups vulnerable to multifactorial diseases such as hypertension and migraine is the AB0 blood group pattern [12]. In this aspect, there is some evidence of increased cardiovascular risk levels among representatives of different AB0 blood groups, who are bounded by geographical location and ethnicity, but there is insufficient data on the relationship between these markers and migraine. According to Wang and Wang, 2021 [13], hypertension and migraine often occur together.

This study focuses on analyzing the incidence of hypertension and migraine among representatives of a reproductive population in Bulgaria and aims to characterize potential dependencies between these diseases and the factors of sex, age and AB0 blood group affiliation.

MATERIAL AND METHODS:

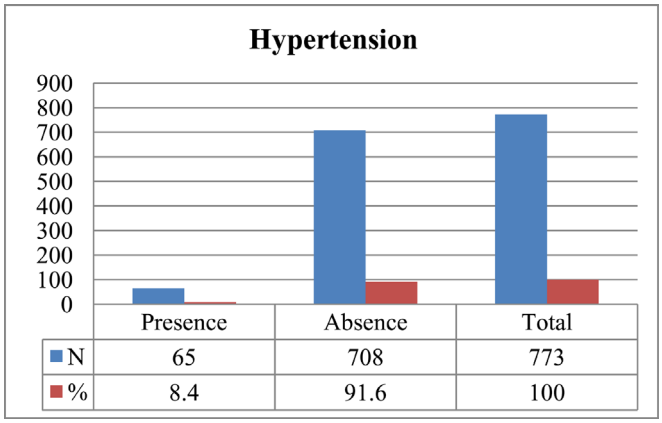
The present study was conducted in the period between 2017 and 2021 among a total of 817 subjects (30.2% male and 69.8% women) aged between 18 and 59, divided into two age categories – up to and over 44 years. The individuals included in the study, all of Bulgarian ethnic origin, living on the territory of the Plovdiv region, Southern Bulgaria, have voluntarily filled out a questionnaire prepared in accordance with the objectives of the study, in which they designated the presence of diseases from the selected groups (multifactorial, with genetic predisposition), after their diagnosis by a specialist physician.

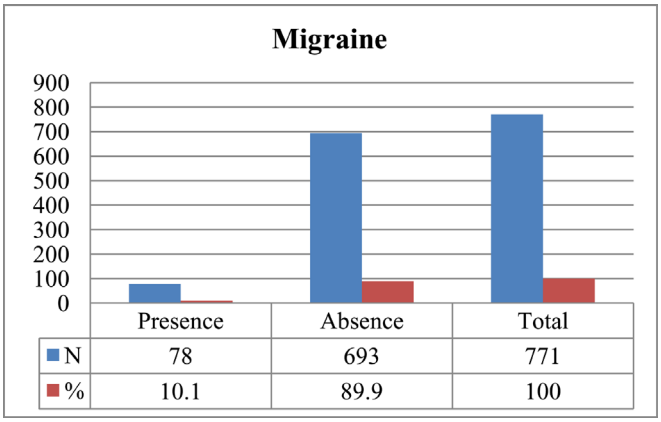
AB0-blood group affiliation has been determined in laboratory conditions by a routine technique and the use of test serums on the principle of isohemagglutination – Moss method or has been accepted directly by an official document provided by a clinical laboratory. The statistical analysis has performed by using of IBM SPSS Statistics software package, version 22.0.

RESULTS:

The data on the established incidence of diseases among the group studied are presented in Fig. 1.

Fig. 1. Incidence of hypertension (**a**) and migraine (**b**) in the Plovdiv Region sample; N – number of individuals; % – percentage





From the results presented, it is clear that among the persons studied, 8.4% provided information on the presence of high blood pressure and 10.1% – on the presence of migraine. Study data indicates that 11.8% of men and 7.8% of women enrolled in the study suffer from hypertension ($p = 0.026$) and that migraine is manifested in 11.4% of women and in 7.1% of men (Table 1). Additionally, it can be found that joint manifestation of the two diseases is more common in representatives of the female sex (71.5%) – $p > 0.05$.

Hypertension and migraine manifestation has also been analyzed based on the age characteristics of the individuals. The age characterization of both diseases has been considered in two categories – up to 44 and over 44 years, in accordance with WHO [14]. The results demonstrate that 7.3% of men and 4.1% of women in the group up to 44 years have evidence of elevated blood pressure and that among the group over 44 years, hypertension has been reported in 21.8% of women and 37.1% of men. In both age groups, in terms of both sexes, the difference found is statistically significant at 90% confidence ($p = 0.099$ and $p = 0.082$, respectively) – Table 2.

Table 3 presents data on the age distribution found among the representatives of both sexes in relation to migraine expression. The results obtained indicate that 10.7% of women and 6.8% of men up to the age of 44 ($p = 0.124$), and 14.9% of women and 8.6% of men over the age of 44 ($p = 0.226$) suffer from migraine.

Table 4 provides data on the occurrence of the diseases studied and their percentage distribution according to the AB0 blood group affiliation of the individuals enrolled in the study. The established differences are without distinct statistical significance ($p > 0.1$), but nevertheless, it is possible to characterize some trends.

Table 1. Hypertension and migraine – sex distribution: N – number of individuals; % – percentage; (+) presence of disease; (-) absence of disease

Sex	N	Hypertension			Migraine		
	%	+	-	Total	+	-	Total
Male	N	27	201	228	16	210	226
	%	11.8	88.2	100.0	7.1	92.9	100.0
Female	N	38	507	545	62	483	545
	%	7.0	93.0	100.0	11.4	88.6	100.0
Total	N	65	708	773	78	693	771
	%	8.4	91.6	100.0	10.1	89.9	100.0

Table 2. Hypertension – age distribution among the representatives of both sexes: N – number of individuals; % – percentage; (+) presence of disease; (-) absence of disease

Age groups	Sex	N	Hypertension		Total
		%	+	-	
Up to 44 years	Male	N	14	179	193
		%	7.3	92.7	100.0
	Female	N	19	439	458
		%	4.1	95.9	100.0
	Total	N	33	618	651
		%	5.1	94.9	100.0
Over 44 years	Male	N	13	22	35
		%	37.1	62.9	100.0
	Female	N	19	68	87
		%	21.8	78.2	100.0
	Total	N	32	90	122
		%	26.2	73.8	100.0

Table 3. Migraine – age distribution among the representatives of both sexes: N – number of individuals; % – percentage; (+) presence of disease; (-) absence of disease

Age groups	Sex	N%	Migraine		Total
		+	-		
Up to 44 years	Male	N	13	178	191
		%	6.8	93.2	100.0
	Female	N	49	409	458
		%	10.7	89.3	100.0
	Total	N	62	587	649
		%	9.6	90.4	100.0
Over 44 years	Male	N	3	32	35
		%	8.6	91.4	100.0
	Female	N	13	74	87
		%	14.9	85.1	100.0
	Total	N	16	106	122
		%	13.1	86.9	100.0

Table 4. Hypertension and migraine – distribution, depending on AB0 blood group affiliation: N – number of individuals; % – percentage; (+) presence of disease; (-) absence of disease

Blood group type	N %	Hypertension			Migraine		
		+	-	Total	+	-	Total
0	N	25	190	215	25	190	215
	%	11.6	88.4	100.0	11.6	88.4	100.0
A	N	27	233	260	32	228	260
	%	10.4	89.6	100.0	12.3	87.7	100.0
B	N	11	118	129	7	121	128
	%	8.5	91.5	100.0	5.5	94.5	100.0
AB	N	13	86	99	12	87	99
	%	13.1	86.9	100.0	12.1	87.9	100.0
Total	N	76	627	703	76	626	702
	%	10.8	89.2	100.0	10.8	89.2	100.0

As could be seen from the data presented in Table 4, the highest proportion of people suffering from hypertension is reported among persons with blood group AB (13.1%), and the lowest – among those with blood group B (8.5%). Among migraine sufferers, the largest share is for those with blood groups A (12.3%) and AB (12.1%) and the smallest – for individuals with blood group B (5.5%).

Among the studied individuals, a large proportion reports simultaneously a manifestation of both diseases – Table 5. When monitoring this circumstance depending on the blood group affiliation, it could be noted that co-manifestation is most common in people with blood group A (36.6%) and rarest – in those with AB blood group ($p > 0.1$).

Table 5. Co-expression of hypertension and migraine, depending on AB0 blood group affiliation

Hypertension and migraine		AB0 blood group				
		0	A	B	AB	Total
Absence	N	45	55	18	24	142
	%	31.7	38.7	12.7	16.9	100.0
Presence	N	170	205	110	75	560
	%	30.4	36.6	19.6	13.4	100.0
Total	N	215	260	128	99	702
	%	30.7	37.0	18.2	14.1	100.0

DISCUSSION:

Hypertension

Studies show that high blood pressure results from the complex action of genetic, environmental and behavioral components, and a healthy lifestyle can significantly reduce the risk of its occurrence [1,5]. Genetic factors, sex, age and ethnicity have been identified as non-modifiable risk factors for monogenic and polygenic hypertension [15]. The results obtained in the present study showed a lower percentage of people suffering from hypertension within the study sample (8.4%) compared to the average values of 27% for the general population in subjects under 60 [7]. Oliveros et al. (2020) [7] and Kauko et al. (2021) [16] analyze how sex differences can affect the risk of developing hypertension. Based on the obtained results, they discuss that the sex factor is more significant in women than in men in the process of disease development. However, the results of our research do not support the quoted data. In the studied Bulgarian sample, it is reported that hypertension has a higher incidence among the male representatives compared to the female (11.8% and 7.8%, respectively), where the difference found is statistically significant ($p = 0.026$) – Table 1.

Regarding age as a factor affecting hypertension expression, our results are consistent with the findings of other authors that demonstrate the disease is most common in people over 40 years and its incidence increases with advancing age [7]. Our results also confirm the opinion of Kauko et al. (2021) [16] that men tend to develop hypertension at a younger age. When examining the relationship between the disease and blood groups, as already noted, the largest proportion of suffering from hypertension is recorded among persons with blood group AB (13.1%) and the smallest - among those with blood group B (8.5%).

Comparisons of these results with those available in the literature demonstrate quite a few differences. For example: Nishi et al. (2012), Chandra and Gupta (2012)

[12,17] report that blood groups A, B and 0 predispose to a higher risk of developing hypertension, which does not correspond to our findings; Ketch et al. (2008) [18] report that AB0 blood types other than 0 are associated with greater cardiovascular risk and/or increased incidence of cardiovascular disease, which partially coincide with our results; Chandra and Gupta (2012) [17] indicate that the risk of developing hypertension is highest in blood group B and lowest in blood group AB, in contrast to our study's data, which are opposite for both specified groups; Kaur (2012) [19] report the highest incidence of hypertension in individuals with blood group 0 and the lowest incidence in those with blood group AB – also different from that reported in the present our study; Kaur et al. (2016) [20] in another subsequent study report that among hypertensives, the most common blood group is B and the least common – AB.

Possible inaccuracies of a subjective nature related to filling out the questionnaire may contribute to some discrepancies. But, in our opinion, the inconsistencies in the results are most likely due to differences in the combinations of genetic variations in the gene pool of the studied populations, as well as to the peculiarities of the studied ethnic groups. Our opinion is in agreement with other published scientific results. For example: Rajasthan, Sachdev (2011) [21] report that individuals with blood group B are more prone to develop hypertension compared to those with blood groups A and 0, and the most resistant to the disease are people with blood group AB.

Migraine

As with hypertension and migraine, the heterogeneity of the disease is due to the various components involved in its etiology – genetic, environmental, social. Migraine is a complex disease affecting approximately 11.6% of human populations worldwide – 10.4% in Africa, 10.1% in Asia, 11.4% in Europe, 9.7% in North America, 16.4% in Central and South America [9]. The results of our study indicate a slightly lower percentage of individuals suffering from migraine in the studied Bulgarian sample (10.1%) compared to the above cited data, which could be due to both population-genetic causes and differences in the age range surveyed.

Regarding the differences found between both sexes, the results of our study show that the migraine frequency is 7.1% among men and 11.4% – among women. This trend is similar to that found by Woldeamanuel and Cowan (2017) [9], who report that globally, up to 13.8% of among women and 6.9% of among men in the general population are affected by migraine. The results obtained regarding age as a factor influencing migraine are in agreement with the findings of Ashina et al. (2021) [2] for a higher prevalence of the disease among women up to 50 years of age. Obviously, the female gender is a risk factor for migraine appearance and development. When looking for a linkage between the disease and the blood group affiliation of the individuals, controversial information is again found in the studied literature. According to Nishi et al. (2012) [12], the prevalence of migraine is most common in individuals with blood type 0. According to Korucu and Oktay (2019) [22], blood type A is the most common and blood type AB is the least common in migraine patients. The data of our study differs from those of Nishi et al. (2012) [12] but show some similarity with the findings of Korucu and Oktay (2019) [22] about the highest percentage of persons with diagnosed migraine among representatives of blood type A.

In the course of the present study, cases of co-expression of both diseases are also examined, and the results obtained give reason to assume that the female gender and A blood group are risk factors for their simultaneous manifestation.

CONCLUSIONS:

The risk of hypertension is greater in men and increases for both sexes over 44 years. The disease is more common among people in AB blood group.

The risk of migraine is greater in women and increases for both sexes in the age group above 44 years. The disease is more common among people in blood types A and AB.

Simultaneous manifestation of both diseases was reported with the highest frequency in the representatives of blood group A, followed by those in blood group 0.

REFERENCES:

1. Pazoki R, Dehghan A, Evangelou E, Warren H, Gao H, Caulfield M, et al. Genetic Predisposition to High Blood Pressure and Lifestyle Factors: Associations With Midlife Blood Pressure Levels and Cardiovascular Events. *Circulation.* 2018 Feb 13;137(7):653-661. [PubMed]

2. Ashina M, Katsarava Z, Do TP, Buse DC, Pozo-Rosich P, Özge A, et al. Migraine: epidemiology and systems of care. *Lancet*. 2021 Apr 17; 397(10283):1485-1495. [PubMed]

3. Nikolova M. Genetic and environmental influences on morphological characteristics. *Mankind Quarterly*. 1994 Jan 14;35(1):27-38. [Crossref]

4. Nikolova M, Boyadjiev D. Relation between body composition and some social factors and habits in children and adolescents. *Acta Morphologica et Anthropologica.* 2011; 17:156-162. [Internet]

5. Ahn SY, Gupta C. Genetic Programming of Hypertension. *Front Pediatr.* 2018 Jan 22;5:285. [PubMed]

6. Charles A. The pathophysiology of migraine: implications for clinical management. *Lancet Neurol.* 2018 Feb;17(2):174-182. [PubMed]

7. Oliveros E, Patel H, Kyung S, Fugar S, Goldberg A, Madan N, et al. Hypertension in older adults: Assessment, management, and challenges. *Clin Cardiol.* 2020 Feb;43(2):99-107. [PubMed]

8. Goadsby PJ, Lantéri-Minet M,

Michel MC, Peres M, Shibata M, Straube A, et al. 21st century headache: mapping new territory. *J Headache Pain.* 2021 Apr 1;22(1):19. [PubMed]

9. Woldeamanuel YW, Cowan RP. Migraine affects 1 in 10 people worldwide featuring recent rise: A systematic review and meta-analysis of community-based studies involving 6 million participants. *J Neurol Sci.* 2017 Jan 15;372:307-315. [PubMed]

10. Lipton RB, Seng EK, Chu MK, Reed ML, Fanning KM, Adams AM, et al. The Effect of Psychiatric Comorbidities on Headache-Related Disability in Migraine: Results From the Chronic Migraine Epidemiology and Outcomes (CaMEO) Study. *Headache.* 2020 Sep;60(8):1683-1696. [PubMed]

11. Gormley P, Anttila V, Winsvold BS, Palta P, Esko T, Pers TH, et al. Meta-analysis of 375,000 individuals identifies 38 susceptibility loci for migraine. *Nat Genet.* 2016 Aug;48(8):856-66. [PubMed]

12. Nishi K, Gupta NK, Sharma SC. Study on the incidence of hypertension and migraine in ABO blood groups. *ISCA J Biol Sci.* 2012 Jun; 1(2):12-6. [Internet]

13. Wang YF, Wang SJ. Hypertension and Migraine: Time to Revisit the Evidence. *Curr Pain Headache Rep.* 2021 Jul 16;25(9):58. [PubMed]

14. Ahmad OB, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age Standardization of Rates: A New WHO Standard. GPE Discussion Paper Series, No 31. WHO. 2001. [Internet]

15. Precone V, Krasi G, Guerri G, Stuppia L, Romeo F, Perrone M, et al. Monogenic hypertension. *Acta Biomed.* 2019 Sep 30;90(10-S):50-52. [PubMed]

16. Kauko A, Aittokallio J, Vaura F, Ji H, Ebinger JE, Niiranen T, et al. Sex Differences in Genetic Risk for Hypertension. *Hypertension.* 2021 Sep; 78(4):1153-1155. [PubMed]

17. Chandra T, Gupta A. Association and Distribution of Hypertension, Obesity and ABO Blood groups in Blood Donors. *Iran J Ped Hematol Oncol.* 2012; 2(4):140-5. [PubMed]

18. Ketch TR, Turner SJ, Sacrinty MT, Lingle KC, Applegate RJ, Kutcher MA, et al. ABO blood types: influence on infarct size, procedural characteristics and prognosis. *Thromb Res.* 2008; 123(2):200-5. [PubMed]

19. Kaur M. Blood pressure trends and hypertension among rural and urban Jat women of Haryana, India. *Coll Antropol.* 2012 Mar;36(1):139-44. [PubMed]

20. Kaur M, Gill K, Bassi R, Kaur D. Association of ABO and Rh blood groups with hypertension. *Pak J Physiol.* 2006; *12*(2):11-14. [Internet]

21. Sachdev B. Prevalence of hypertension and associated risk factors among Nomad Tribe groups Screening of Hypertension, Adiposities and ABO Blood Group among Select Nomad Tribes of Rajasthan, India. *Antrocom: Online J Anthropology.* 2011; 7(2): 125-131. [Internet]

22. Korucu O, Oktay B. Relationship between ABO blood group and Migraine. *Ankara Medical Journal.* 2019 Sep 30;19(3):524-528. [Crossref]

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Address for correspondence:
Evgeniya N. Ivanova,
Department of Developmental Biology, Faculty of Biology, University of Plovdiv "Paisii Hilendarski"
24, Tzar Asen str., Plovdiv 4000, Bulgaria
E-mail: geneiv@uni-plovdiv.bg