

A look at the population variability in the appearance of some human descriptive and personality traits in Bulgaria

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Abstract. The phenotypic diversity relating to some descriptive human features in a complex with the basic personality traits, as well as the possible interactions between them were studied in a sample of 945 individuals. Using a self-reported questionnaire, data were collected about the following descriptive traits: hand dominance (left or right); hair on hand back; hairiness of the middle phalanges, bent little finger and thumb flexibility. The basic characteristics of personality – extraversion, agreeableness, conscientiousness, emotional stability and intellect/imagination – were studied through the Goldberg's "Big-Five factor markers, International Personality Item Pool – IPIP" questionnaire, adapted to the Bulgarian population. The frequencies of the investigated phenotypic groups and statistic relations were calculated by usage of descriptive statistics and SPSS software. Statistically significant variations in the mean values of the personality factors were observed in relation to the descriptive traits studied, as follows: higher levels of conscientiousness and agreeableness in people with right hand dominance ($p = 0.025$ and 0.05 , respectively) and higher levels of emotional stability in people with left hand dominance ($p = 0.05$); higher levels of emotional stability and lower levels of extraversion in people with hair on hand back ($p = 0.012$ and 0.06 , respectively); higher levels of intellect/imagination in people with hairiness of the middle phalanges ($p = 0.00$); higher levels of conscientiousness and emotional stability in persons with a straight little finger ($p = 0.004$ and 0.05). The results of the investigation provide information on phenotypic variability regarding the studied descriptive and behavior characteristics, as well as on the established correlations between them. Future researches in this field would enrich the information concerning the polymorphism in the human populations and the characteristics of their phenotypic profile.

Key words: human population variability, descriptive traits, personality characteristics.

Introduction

The heredity and variability characteristic of *Homo sapiens* are the subject of study in the human genetics. The manifestation of human phenotypic characteristics is the result of the expression of individual genes, their interactions or the complex relationships in the continuum "genotype - environment" (Nikolova, 1994; 2000; Nikolova and Boyadjiev, 2011; Ivanova et al., 2021). In most

of the studies for the heritability and variability in humans, the attention of researchers has been directed mainly to the reasons for expression of various pathological processes. The frequency and the way of manifestation of the non-pathological descriptive monogenic and polygenic characteristics in human populations are less studied (Aleksandrov, 2010; Ivanova et al., 2001; 2011). This is so because of the growing role of medical

genetics, but at the same time, the peculiarities of psycho-emotionality and the personality characteristics of the individual, which could be described and studied by methods of behavioral genetics, are also important for the human health and well-being. The investigation of the human phenotypic diversity in the breadth of its manifestations in different human populations is increasingly at the center of interdisciplinary approaches (Andreenko et al., 2003a,b; Mladenova et al., 2003; Baker, 2004; Malih et al., 2008; Alexandrov, 2010, etc.). Not only the researchers in the field of psychology are interested in the complex personality characteristics (McCrae and John, 1992; Goldberg, 2001; Goldberg et al., 2006; Costa and McCrae, 2008; Aleksandrova - Karamanova, 2016; Magyar et al., 2017), but also those studying features of the human genome and its role in the appearance of complex behavioral phenotypes related to the temperament and personality of individuals (Thibaut et al., 2005; Medland et al., 2009; Adhikari et al., 2016; Zaidi et al., 2018). In Bulgaria in recent decades, the attention of anthropologists has been mainly directed to interdependence between some anthropophysiological indications and social factors, relationship between somatotype and some functional parameters of psychological efficiency, genetic and environmental influences on morphological characteristics, relation between body composition and some social factors and habits in children and adolescents (Nikolova and Petrov, 1982; 1986; Petrov et al., 1987; Nikolova, 1993; 1996; 1997; Nikolova and Susanne, 1996; Andreenko et al., 2003a,b; Mladenova et al., 2003; Nikolova and Boyadjiev, 2011). Studies in the context of population behavioral genetics are few and insufficient (Ivanova et al., 2018a,b; Ivanova et al., 2021). This fact motivates the aim of the present study, which is pointed to: 1) characterizing the phenotypic diversity in terms of selected descriptive and behavioral traits in a human population from Bulgaria and 2) examination of the possible interactions in the manifestation of the studied descriptive morphological and personality characteristics.

Materials and Methods

Totally 945 individuals (70.9% women and 29.1% men), aged between 16 and 90 years were included in the study.

In order to characterize the phenotypic diversity, some descriptive features, the five basic characteristics of personality and the possible interactions between them were investigated. Using a self-reported questionnaire, data were collected about the following descriptive features of the human hand: hand dominance (left or right); hair on back of hand; hairiness of the middle phalanges, bent little finger and thumb flexibility.

The basic characteristics of personality – extraversion, agreeableness, conscientiousness, emotional stability and intellect/imagination (openness to the experience) – were studied through the Goldberg's "Big-Five factor markers, International Personality Item Pool - IPIP" questionnaire (Goldberg, 2001, <http://ipip.ori.org/>), adapted for the Bulgarian population (Alexandrova-Karamanova, 2016).

Data were analyzed through the IBM SPSS Statistics software package, version 22.0. Descriptive statistics analyses (frequencies, crosstabs), group statistics (mean levels, standard deviation, standard error mean) and the independent samples t-test were used.

Results

The frequency of occurrence of the studied descriptive traits is presented in Table 1. As could be seen, right hand dominance, absence of the hair on the hand back, absence of the hairiness of the middle phalanges, straight little finger and thumb flexibility up to 30° were characteristics with higher frequencies.

The mean levels of expression of extraversion, agreeableness, conscientiousness, emotional stability and intellect/imagination (openness to the experience) are presented in the Figure 1. Data from the study showed that the mean values of the Big-five personality traits ranged between 29.15 (for emotional stability) to 40.25 (for agreeableness).

Statistical relationships found between the both groups of traits are presented in Table 2. Statistically significant variations in the mean values of the personality factors studied were

observed in relation to four of the studied traits, as follows: hand dominance – agreeableness, consciousness and emotional stability; hair on the hand back – extraversion and emotional stability; hairiness of the middle phalange – intellect/imagination; little finger shape – consciousness and emotional stability (Table 2).

Discussion

Among the studied descriptive traits under dominant genetic control were right hand dominance in activity, presence of the hair on the hand back and hairiness of the middle phalanges, bent little finger and thumb flexibility not more than 30°. The relevant dominant alleles for these traits could be found in the studied population in both homo and heterozygous phenotypes.

The obtained data showed that in the studied Bulgarian population there was a high frequency of homozygous recessive allele genotypes, determining the manifestation of recessive signs such as: lack of hair on the hand back; lack of hairiness of the middle phalanges and presence of a straight little finger. This demonstrated a high frequency of occurrence of the indicated recessive alleles in both homozygous and heterozygous combinations. In contrast, the dominant alleles for presence of hair on the hand back, hairiness of the middle

phalanges and a bent little finger occurred at a lower frequency in the studied population in both homo and heterozygous phenotypes.

Data received for the studied Bulgarian population concerning the investigated basic personality traits showed higher levels of agreeableness, conscientiousness and intellect/imagination and lower levels of extraversion and emotional stability. Although the socially desirable characteristics lead to giving socially desirable answers (Alexandrova-Karamanova, 2016), given the obvious results obtained for individual behavior traits in the present study, it could be assumed that they reflect the characteristic of the personality within the Bulgarian population.

Statistically significant relations were found between the mean values of four of studied descriptive features and the five studied personality factors. They demonstrated significance in dependences between: 1) higher mean levels of agreeableness and consciousness and right hand dominance; 2) lower mean levels of emotional stability and right hand dominance, lack of the hair on the hand back and bent little finger; 3) higher mean levels of consciousness and straight little finger; 4) lower mean levels of extraversion and lack of the hair on the hand back; 5) higher mean levels of intellect/imagination and hairiness of the middle phalanges.

Table 1. Distribution (in number and %) of the studied descriptive characteristics

Descriptive trait	Type of manifestation	N	Valid %
Hand dominance	Right hand dominance	812	88.2
	Left hand dominance	109	11.8
Hair on the hand back	Presence of the hair on the hand back	225	24.3
	Absence of the hair on the hand back	700	75.7
Hairiness of the middle phalanges	Presence of the hairiness	290	31.7
	Absence of the hairiness	624	68.3
Little finger shape	Straight little finger	673	72.7
	Bent little finger	253	27.3
Thumb flexibility	The thumb does not bend more than 30°	613	66.6
	The thumb bends more than 30°	307	33.4

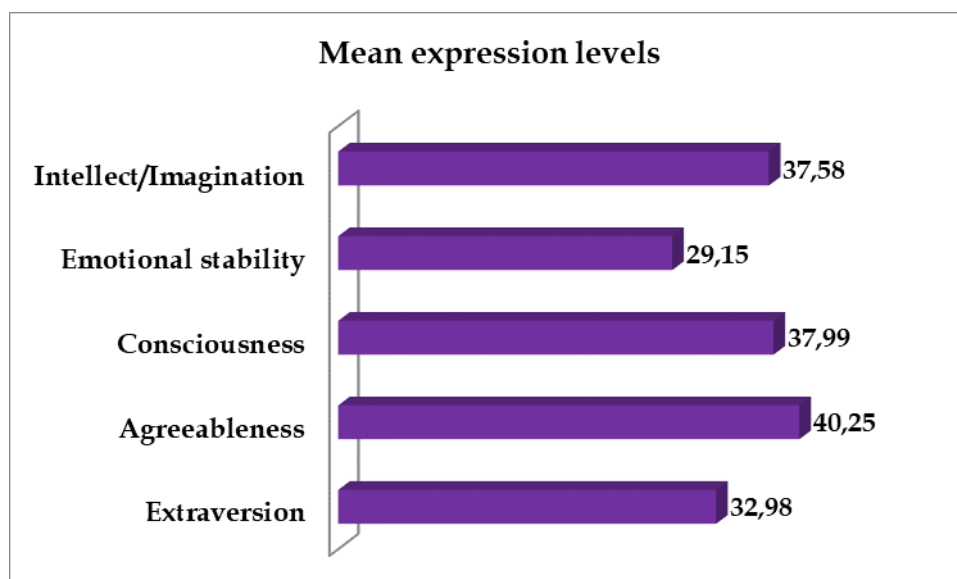


Fig. 1. Mean expression levels of the studied personality characteristics

Table 2. Statistical association between the studied descriptive characteristics and the Big-five personality traits

Descriptive trait	Personality trait	Type of manifestation	Mean	t (P)
Hand dominance	Agreeableness	Right hand dominance	40.30	1.936 (0.05)
		Left hand dominance	39.04	
	Consciousness	Right hand dominance	38.14	2.244 (0.025)
		Left hand dominance	36.49	
	Emotional stability	Right hand dominance	28.87	-1.946 (0.05)
		Left hand dominance	30.71	
Hair on the hand back	Extraversion	Presence of the hair on the hand back	32.16	-1.852 (0.06)
		Absence of the hair on the hand back	33.29	
	Emotional stability	Presence of the hair on the hand back	30.42	2.525 (0.012)
		Absence of the hair on the hand back	28.62	
Hairiness of the middle phalanges	Intellect/Imagination	Presence of the hairiness	38.75	3.657 (0.00)
		Absence of the hairiness	37.08	
Little finger shape	Consciousness	Straight little finger	38.40	-2.875 (0.004)
		Bent little finger	36.87	
	Emotional stability	Straight little finger	29.49	-1.965 (0.05)
		Bent little finger	28.15	

Conclusion

The complexity of the net of factors, important for a particular human phenotype expression, is under the control of different genes and depends on interaction among them and their specific activity environment. Investigations on the nature

and the basis mechanisms for the complex manifestation of different descriptive and behavior characteristics would contribute to more detailed investigations of the phenotypic diversity in human populations and to the more complete description of their anthropo-genetic profile.

References

- Adhikari, K., Fontanil, T., Cal, S. et al. (2016). A genome-wide association scan in admixed Latin Americans identifies loci influencing facial and scalp hair features. *Nature Communications*, 7, 10815. doi: [10.1038/ncomms10815](https://doi.org/10.1038/ncomms10815)
- Alexandrov, A. A. (2010). *Psychogenetics*. SPb: Peter, 192 p.
- Alexandrova-Karamanova, A. (2016). Guide to Using the Bulgarian Version of the Big-Five Factors Markers - International Personality Item Pool, L. Goldberg. Sofia: Department of Psychology, 18 p.
- Andreenko, E., Nikolova, M., & Vasilev, V. (2003a). Psychometric reactivity and personal profile of men with different physical activity. *Journal of Anthropology*, 4, 103-108.
- Andreenko, E., & Nikolova, M. (2003b). Factors defining antropo-physiological status of men of three professional groups. *Journal of Anthropology*, 4, 109-113.
- Baker, C. (2004). *Behavioral Genetics*. American Association for the Advancement of Science: AAAS Publisher, 131 p.
- Costa, P. T. Jr., & McCrae, R. R. (2008). The Revised NEO Personality Inventory (NEO-PI-R), in: Boyle, G.A., Matthews, G., & Saklofske, D.H. *The Sage Handbook of Personality Theory and Assessment*, 2: Personality Measurement and Testing (pp. 179-198). London: SAGE Publications.
- Goldberg, L. R. (2001). International Personality Item Pool - IPIP. Retrieved from: <http://ipip.ori.org/>
- Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. G. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality*, 40, 84-96.
- Ivanova, E. N., Alexandrova-Karamanova, A., Ivanov, S., Lazarova, D., Bozhinova, B., & Karadzova, E. (2018a). Age and sex as factors that influence the human health. *Ecologia Balkanica*, 10(2), 205-211.
- Ivanova, E. N., Alexandrova-Karamanova, A., Ivanov, S., Grozeva, S., Georgieva, M., Dimitrova T., & Hayverova T. (2018b). Characteristics of personality in people with different talents. *Ecologia Balkanica*, 10(2), 199-204.
- Ivanova, E. N., Dzhoglov, S. N., Mitkovska, V., & Boyadzhiev, D. T. (2021). Complex view on the relationship "Heredity - Environment - Male Reproductive Health". *Plovdiv: Recursi*, 210.
- Ivanova, E. N., Staykova, T., & Andreenko, E. (2011). *Genetics with biological bases of behavior and psychogenetics*. Plovdiv: Paisii Hilendarski University Publishing House, 380 p.
- Ivanova, E. N., Staykova, T. A., & Irikova, T. P. (2001). *Human genetics with elements of general genetics*. Plovdiv: Plovdiv University Publishing House, 206 p.
- Magyar, M., Gonda, X., Pap, D., Edes, A., Galambos, A., Baksa, D., Kocsel, N., Szabo, E., Bagdy, G., Elliott, R., Kokonyei, G., & Juhasz, G. (2017). Decreased openness to experience is associated with migraine-type headaches in subjects with lifetime depression. *Frontiers in Neurology*, 8, 270. doi: [10.3389/fneur.2017.00270](https://doi.org/10.3389/fneur.2017.00270)
- Malykh, S. B., Egorova, M. S., & Meshkova, T. A. (2008). *Psychogenetics. Textbook for universities*. SPb: Peter, 408 p.
- McCrae, R. R., & John, O. P. (1992). An Introduction to the Five-Factor Model and It's Applications. *Journal of Personality*, 60, 175-215. doi: [10.1111/j.1467-6494.1992.tb00970.x](https://doi.org/10.1111/j.1467-6494.1992.tb00970.x)
- Medland, S. E., Nyholt, D. R., Painter, J. N., McEvoy, B. P., McRae, A. F., Zhu, G., Gordon, S. D., Ferreira, M. A., Wright, M. J., Henders, A. K., Campbell, M. J., Duffy, D. L., Hansell, N. K., Macgregor, S., Slutske, W. S., Heath, A. C., Montgomery, G. W., & Martin, N. G. (2009). Common variants in the trichohyalin gene are associated with straight hair in Europeans. *American journal of human genetics*, 85(5), 750-755. doi: [10.1016/j.ajhg.2009.10.009](https://doi.org/10.1016/j.ajhg.2009.10.009)
- Mladenova, S., Nikolova, M., & Godina, E. (2003). Socioeconomic factors and their role in the processes of intragroup differentiation of certain morphological characteristics in children and adolescents from the Smolyan region (Bulgaria). *Anthropology on the threshold of the III millennium*. ed. T.I. Alekseeva, Moscow, 2003, 2, 686-697.
- Nikolova, M. (1993). Hereditary estimates of the somatotype components based of family analysis. *GlasniuADJ*, 29, 61-63.

- Nikolova, M. (1994). Genetic and environmental influences on morphological characteristics. *Mankind Quarterly*, 35(1), 27-38. doi: [10.46469/mq.1994.35.1.3](https://doi.org/10.46469/mq.1994.35.1.3)
- Nikolova, M. (1997). Morphological configurations in women and their relation to certain factors. *Mankind Quarterly*, 37(4), 373-401.
- Nikolova, M., & Boyadjiev, D. (2011). Relation between body composition and some social factors and habits in children and adolescents. *Acta morphologica et Anthropologica*, 17, 156-162.
- Nikolova, M., & Susanne, Ch. (1996). Familiar resemblance for anthropometrical traits in a Bulgarian population. *International Journal of Anthropology*, 11, 27-33.
- Nikolova, M., & Petrov, I. (1982). Einfluss der exogenen und endogenen faktoren auf die phenotypische Ausbildung der plovdiver Madchen in Alter von 7 bis 22 Jahren. *Human Biology, Budapest*, 12, 35-40.
- Nikolova, M., & Petrov, I. (1986). Interdependence between some anthroprphysiological and nervous psychological indications and social factors among some categories working men. *Glasnik ADJ*, 23,21-25.
- Nikolova, M. (1996). Similarities in anthropometrical traits of children and their parents in a Bulgarian population. *Annals of Human Genetics*, 60(6), 517-525.
- Nikolova, M. (2000). Genetic and environmental bases of morphological variability. *Monographs, Plovdiv: Amarant Media OOD*, 210 p.
- Petrov, I., Nikolova, M., & Popova, L. (1987). Relationship between somatotype and some functional parameters of psychological efficiency of the students attending Plovdiv's higher institutes. *Biology, University of Plovdiv "P. Hilendarski"* 25(6) 205-213.
- Thibaut, S., Gaillard, O., Bouhanna, P., Cannell, D. W., & Bernard, B. A. (2005). Human hair shape is programmed from the bulb. *Cutaneous Biology*, 152(4), 632-638. doi: [10.1111/j.1365-2133.2005.06521.x](https://doi.org/10.1111/j.1365-2133.2005.06521.x)
- Zaidi, A. A., Mattern, B. C., Claes, P., McEvoy, B., Hughes, C., & Shriver, M. D. (2017). Investigating the case of human nose shape and climate adaptation. *PLoS Genet* 13(3), e1006616. doi: [10.1371/journal.pgen.1006616](https://doi.org/10.1371/journal.pgen.1006616)

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