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# Correlation of resting-state EEG indicators with personal and genetic characteristics of subjects living in different socio-climatic conditions

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*Motivation and Aim*: EEG is a universal method for the study of functional activity of the human brain. EEG rhythms reflect the individual, genetic and behavioral characteristics of individuals, as well as the influence of climatic conditions [1]. As you know, mental disorders have a biopsychosocial model [2]. To date, depression and anxiety disorders are the leading disorders of affective disorders according to WHO. The issue of the relationship of depression-prone EEG markers to genetic and environmental factors is still relevant.

*Methods and Algorithms*: The questionnaires "Big Five Factor Markers", Goldberg Big Five IPIP Markers [3] and Eysenck Personality Questionnaire were used to measure personality within the five-factor model. We also used well-known questionnaires to measure personal anxiety (State Trait Anxiety Inventory). Emotional intelligence was measured using Barchard's questionnaire [4]. Two questionnaires were used to assess the manifestations of individualistic and collectivist tendencies: the Singelis questionnaire on the collective and independent self-concept (Self Construal scale) [5] and the second, which selectively measures affiliative tendencies to next of kin or close relatives (RISC, The Relational-Independent Self-construal). Beck's questionnaire was used to assess the severity of depressive symptoms [6]. EEG electrodes were placed on the head according to the international scheme 10–10 %. In adult participants in Novosibirsk, resting state EEG was recorded through 128 channels, in children through 64 channels. For participants from Tuva and Yakutia, EEG was recorded through 64 channels. The Cz channel was always used as a reference electrode, and the AFpz channel was used as a ground electrode. The resistance under the electrode was measured before the start of EEG recording and was less than 5 kΩ. Genomic DNA was isolated using a kit to extract DNA from samples of buccal epithelium («Biosilica», Russia). The frequencies of the short (S-) and long (L-) alleles of the serotonin transporter gene were determined using allele-specific PCR using 5 -ggcgttgctctgagc-3 or 5 -gaggtgcacat3 primers (Lesch et 1996) and the genomic DNA of the subjects as a matrix. The allele L-was also subdivided into La- and Lg-. In further analysis, the allele Lg-was treated as S-. PCR products were separated by electrophoresis in 3 % agarose gel.

*Results*: There was a different relationship of anxiety with the spectral power in the alpha-2 rhythm range in the frontal cortex at open eyes in a dormant state for men and women The difference between men and women was observed in the group of high anxiety subjects and was not observed for the group with low and medium anxiety: the

high anxiety women have an increased spectral power of alpha-2 rhythm, for highly anxious men - reduced spectral power alpha-2-rhythm. We also found differences in the relative spectral power of alpha 2 in the parietal cortex in the conditions of functional penis with open eyes between urban residents and those living in the village, which may indirectly indicate that in Siberian regions, urban residents are more at risk of developing depressive symptoms than villagers. We also noted the reliable effect of the local influence on the relative spectral power of delta rhythm under opened eyes in the frontal cortex: it was more pronounced in the city residents than in the village, which may indirectly indicate that that citizens have a greater ability to suppress behavior. This effect was also positively correlated with gender (women had a higher effect than men) and consciousness, which may indicate that women are more likely to suppress impulsive behavior than men. The Goldberg neurotism effect was different in alpha-2 in open eyes and delta in closed eyes for the entire sample of subjects. In the case of alpha-2: the higher the neuroticism, the lower the alpha-2 ($F(1.431) = 4,15$, $p = 0.042$, $\eta^2 = 0,010$. In the case of delta: the higher the neurotism, the lower the delta. When considering the polymorphism 5-5-HTTLPR (SS> LL+ LS - more so in the Mongoloid group) effect on brain activity in resting-state conditions with closed eyes, the brain activity in the delta range was clearly expressed in the superior frontal gyrus and the frontal cortex, the right gyrus and parietal cortex were involved in the theta range. In Caucasians (LL+LS > SS), the polymorphism 5-HTTLPR effect was strongly expressed in alpha 1 rhythm in the superior frontal gyrus and frontal lobe, and in alpha 2 rhythm in the postcentral gyrus and parietal cortex.

*Conclusion*: It can be proposed that the S- allele of the serotonin transporter is associated with better adaptability to life conditions in high-risk environments, which is indirectly confirmed by the frequency of this allele in various ethno-regional groups. The question of spectral-power interaction and the psychological characteristics of different ethnic groups, as well as the polymorphism of the serotonin transporter and psychological characteristics, is still open and requires further detailed study.

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