

# Associations Between Neuropsychophysiological and Dermatoglyphic Indicators in the Assessment of Human Health

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## Abstract

**The purpose** of this study was to explore the relationship between psycho-physiological markers of human health and dermatoglyphic indicators in young people.

**Materials and Methods:** The study included 920 healthy volunteers aged between 18 and 21 years. All volunteers underwent the following examinations: EEG, an assessment of the anxiety level according to the BAI, and dermatoglyphic scanning.

**Results:** According to the data obtained, there was a statistically significant strong negative correlation between the stress load indicator and dermatoglyphic data, such as the summary delta index (DI) and summary ridge count. A strong positive correlation was found between the percentage of whorls and stress ( $r=0.88$ ). The predominant increase in anxiety is characteristic of persons with total ridge count (TRC) on the thumb of the right hand in the range from 19 to 23.

**Conclusion:** Results demonstrate the interrelationships (association) between psycho-physiological (anxiety level, stress load indicator) and dermatoglyphic markers (DI, TRC and whorl pattern type) in young healthy people. (**International Journal of Biomedicine. 2019;9(1):48-51.**)

**Key Words:** anxiety • electroencephalography • young people • dermatoglyphic markers

## Abbreviations

**BAI**, the Beck Anxiety Inventory; **DI**, delta index; **EEG**, electroencephalography; **SLI**, stress load indicator; **SRC**, summary ridge count; **TRC**, total ridge count.

## Introduction

Dermatoglyphic features begin developing during early stages of fetal life and are fully formed by the end of the fourth month of intrauterine life, and very importantly, they do not change throughout postnatal life.<sup>(1,2)</sup> Finger ridge counts and patterns are a model human polygenic trait in quantitative genetic analyses because they are some of

the few age-independent human traits.<sup>(3)</sup> Dermatoglyphic studies are widely used in predicting the diversity of human individuality.<sup>(4-7)</sup> The prerequisites for such predictions are determined by the manifestation of not only the physical and physiological, but also the mental properties of the individual.<sup>(8-11)</sup> Dermatoglyphics as a diagnostic aid and supportive evidence in the diagnosis of several diseases, such as diabetes, mongolism, Tel Hashomer camptodactyly syndrome, and schizophrenia, has been reported in recent literature.<sup>(12-15)</sup>

**The purpose** of this study was to explore the relationship between psycho-physiological markers of human health and dermatoglyphic indicators in young people.

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## Materials and Methods

The study was conducted on the basis of the Scientific and Educational Center “Morphology and Physiology of a Healthy Person” at the Krasnoyarsk State Medical University named after Professor V.F. Voino-Yasenetsky. The present study was approved by the local Ethics Committee. The subject of the research was the population of the Krasnoyarsk city and Krasnoyarsk Krai.

A total of 4,919 people aged over 18 years were surveyed. For this study, we identified a group of healthy volunteers (409 young men and 511 young women) aged between 18 and 21 years. Volunteers did not receive any remuneration for participating in the study. All volunteers underwent the following examinations: EEG, an assessment of the anxiety level according to the BAI, and dermatoglyphic scanning.

The EEG was performed using the computer system Neurokartograf (MBN, Russia), including spectral, power, and coherent analysis methods. We evaluated the characteristics of the neurophysiological maturation, the bioelectrical activity of the brain, and the state of the hemispheric and inter-hemispheric connections.<sup>(16-19)</sup>

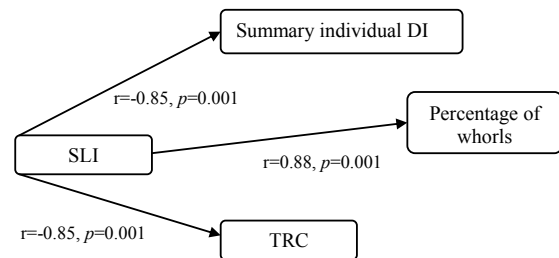
The BAI was used to assess the level of clinical anxiety of the participants. The BAI is a 21-item self-report inventory, with high reliability for measuring clinical anxiety. The total score is calculated by finding the sum of the 21 items. Score of 0-21 = low anxiety, Score of 22-35 = moderate anxiety, Score of 36 and above = potentially concerning levels of anxiety.<sup>(20)</sup>

The fingerprint patterns were assessed for both hands, starting from the thumb to little finger. We analyzed the patterns of fingers according to Henry's system of classification (1900), which classifies fingertip patterns into three main types, namely, whorls (W), ulnar and radial loops (UL, RL), and arches (A). The percent distribution of these patterns was calculated for both hands, and the prevalence of dermatoglyphic phenotypes was assessed. To assess the asymmetry of different types of fingerprint patterns, DI was calculated separately on each finger of the right and left hands. We also calculated the local ridge count on each finger, TRC for the right and left hands, and the sum of the ridges on the 10 fingers of both hands (SRC).<sup>(21-23)</sup>

Statistical analysis was performed using IBM SPSS Statistics V22.0 (SPSS Inc., Chicago, IL, USA), StatPlus 2009 Professional 5.8.0, and Microsoft Excel (2013). The normality of distribution of continuous variables was tested by one-sample Kolmogorov-Smirnov test. Continuous variables with normal distribution were presented as mean and standard deviation (SD). Categorical variables were analyzed using the Chi-square test with the Yates' correction. Spearman's rank correlation coefficient was calculated to measure the strength and direction of the relationship between two variables. We used two-stage cluster analysis and data visualization with regression variable charts. Data mining analysis based on decision trees was used to evaluate the associations between various dermatoglyphic and neurophysiological parameters.<sup>(24)</sup> The logistic regression method was also applied. A probability value of  $P < 0.05$  was considered statistically significant.

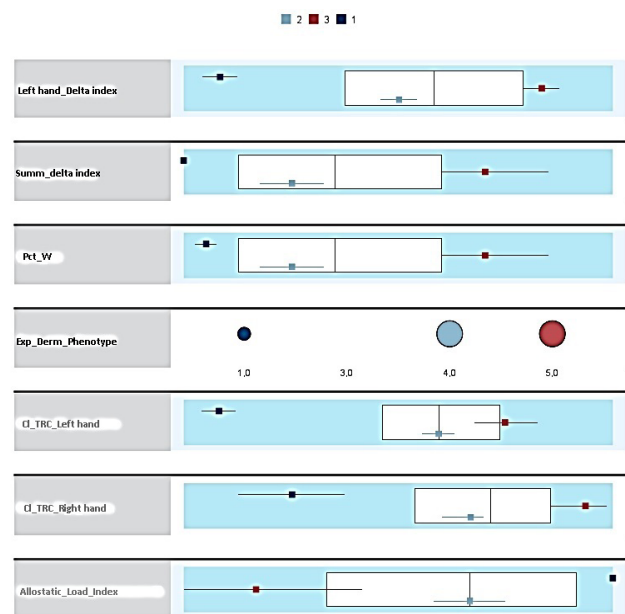
## Results and Discussion

According to the data presented in Figure 1, there was a statistically significant strong negative correlation between the stress load indicator and dermatoglyphic data, such as the summary DI and SRC. A strong positive correlation was found between the percentage of whorls and stress ( $r=0.88$ ).



**Fig. 1.** Correlations between psycho-physiological and dermatoglyphic markers.

Two-stage cluster analysis was used to identify group similarities among the studied accounting features (Fig.2). A model with the quality of clusters on silhouette measure of connectivity and separation of clusters over 0.5 was obtained. Analysis of Figure 2 allows allocating three clusters. Cluster 2 has the average values of stress load index, delta indices, the percentage of whorls, TRC, and the fourth dermatoglyphic phenotype. Cluster 1 combined the lower values of dermatoglyphic indices, the first dermatoglyphic phenotype and the lower values of the stress load indicator. Cluster 3 is its opposite and includes the fifth dermatoglyphic phenotype.



**Fig. 2.** Comparison of clusters in psychophysiological and dermatoglyphic markers.

The scatter plot (Fig.3) suggests the possibility of a non-linear relationship between the BAI score and the ridge

count on the thumb of right hand, which is confirmed by the decision tree data (Fig.4). The predominant increase in anxiety is characteristic of persons with TRC on the thumb of the right hand in the range from 19 to 23.

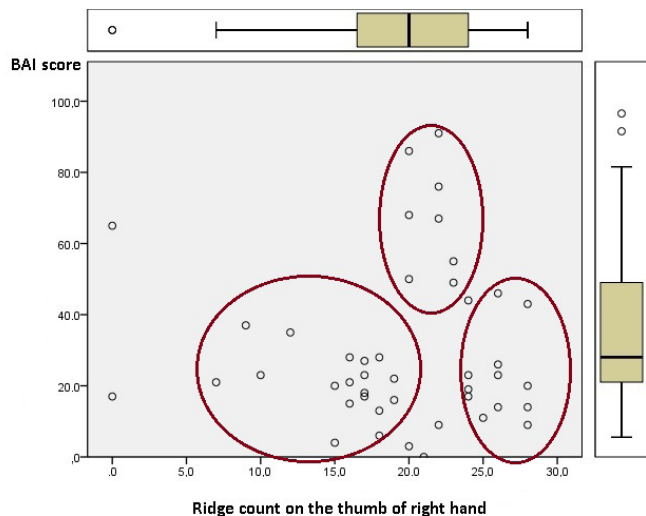


Fig. 3. BAI score depending on the ridge count on the thumb of right hand.

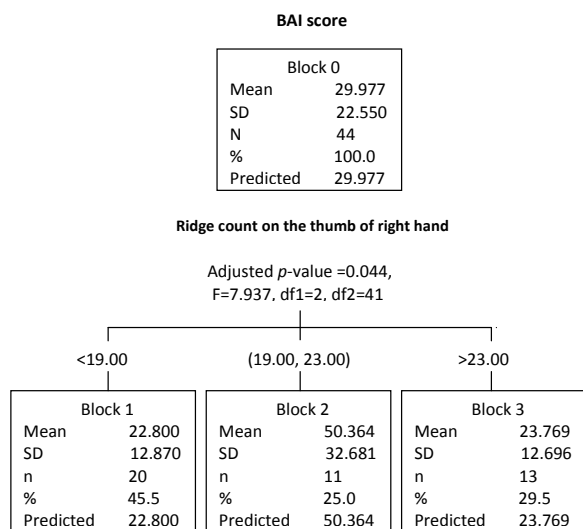


Fig.4. The decision tree data.

Table 1 presents the results of the construction of logistic regression, where the binary value of the stress factor up to 300 and below acts as a variable; dermatoglyphic indices (W,% ) were chosen as influencing factors.

Table 1. Linear regression model

	Regression coefficient (b)	Standard Error	Wald test $\chi^2$	DF	Sig. (p)	Exp (b)	95% CI for Exp(b)	
							Lower Bound	Upper Bound
Percentage of whorls	-.091	.046	3.981	1	.046	.913	.834	.998
Constant	1.952	1.060	3.391	1	.066	7.039		

After 6 iterations, a regression model was obtained with the Nagelkerke  $R^2$  of 0.59 and a fraction of the predicted values of 77.8%.

## Conclusion

This study demonstrated the *interrelationships* (association) between psycho-physiological (anxiety level, stress load indicator) and dermatoglyphic markers in young healthy people. Dermatoglyphic markers (DI, TRC and whorl pattern type) can be used as additional markers to assess the state of psycho-physiological health of the population.

## Conflict of interest

The authors declare that they have no competing interests.

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