Wiadomości Lekarskie
Medical Advances

VOLUME LXXVI, ISSUE 12, DECEMBER 2023
Official journal of Polish Medical Association has been published since 1928

ISSN 0043-5147
E-ISSN 2719-342X

INDEXED IN PUBMED/MEDLINE, SCOPUS, EMBASE, EBSCO, INDEX COPERNICUS,
POLISH MINISTRY OF EDUCATION AND SCIENCE, POLISH MEDICAL BIBLIOGRAPHY

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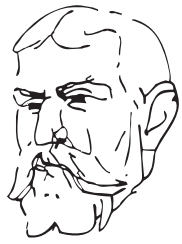

Memory of
dr Władysław
Biegański

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The journal Wiadomości Lekarskie is cofinanced under Contract No.RCN/SN/0714/2021/1 by the funds of the Minister of Education and Science

Wiadomości Lekarskie
Medical Advances

Distribution and Subscriptions:
Bartosz Guterman prenumerata@wydawnictwo-aluna.pl

Graphic design / production:
Grzegorz Sztank fajne.work

Publisher:
ALUNA Publishing
ul. Przesmyckiego 29,
05-510 Konstancin – Jeziorna
www.wydawnictwo-aluna.pl
www.wiadomoscilekarskie.pl
www.wiadlek.pl

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DOI: 10.36740/WLek202312101

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ORIGINAL ARTICLE

RELATIONSHIP OF DERMATOGLYPHICS WITH SPEED OF REACTION AND TYPE OF TEMPERAMENT OF ATHLETICS

DOI: 10.36740/WLek202312103

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ABSTRACT

The aim: To establish and practically substantiate the relationship between dermatoglyphic markers and the speed of reaction and type of temperament of track and field athletes.

Materials and methods: Analysis of scientific and methodological literature, survey, dermatoglyphics, methods of mathematical and statistical processing of the received data.

Results: Track and field athletes among the population of the Sumy region of Ukraine have a tendency to decrease the number of whorls ($p<0.05$). Athletes of the sanguine type of temperament are most common (67,6%), and in the control group (among students of a medical university) the phlegmatic type of temperament is most common (68,4%). Also, among the subjects of the main group there is no such temperament as melancholic. We also determined the ATD angle for the palm. It was 37±4.88 in the main group, and 47±3.11 in the control group. This indicates a hereditary predisposition of this trait. The delta index in the control group has lower values (DI=9.5) than in the main group (DI=13.3).

Conclusions: We established and practically substantiated the relationship between dermatoglyphic markers and reaction speed and temperament type of track and field athletes. Determined the relationship between the anatomical features of the fingers and the speed of mastering movements. For track and field athletes of the population of Ukraine, there were characteristic features of the dermatoglyphic structure: higher values of the deltoid index and genetic markers of the distance between the triradii a and d of the fingers.

KEY WORDS: genetic marker, dermatoglyphics, athlete, temperament, finger patterns

Wiad Lek. 2023;76(12):2564-2571

INTRODUCTION

Dermatoglyphics is a branch of human morphology that studies the skin relief of palmar and plantar surfaces, where the skin is covered with numerous combs (papillary lines) that form certain patterns [1]. Combs are linear thickenings in depth and on the surface of the epidermis. Papillary lines and patterns do not change with age, are not influenced by environmental conditions and are characterized by great individual variability. Many of their features are passed on to descendants [2].

Dermatoglyphics are patterns on the pads of the fingers and toes. They, like the patterns on the palms and feet, are one of the most important individual characteristics of a person. Dermatoglyphic indicators are one of the most accessible genetic markers for study and use. Finger patterns are an invariable genetically determined hereditary feature during life, formed in 3-5 months of pregnancy, have structural diversity and high individual group variability [3, 4].

The secret of dermatoglyphics is extremely deep. The study of finger patterns will make it possible to determine whether there is a connection between heredity and types of temperament. Today it is known that every person has hidden resources and potential for the development of individual abilities and physical qualities [5-9]. An urgent issue today is the determination of the most optimal ways of developing individual abilities and their forecasting.

It is also worth noting that benign forms with finger patterns are extremely important and valuable material, because they can be used for other research in the future. Therefore, the study of finger patterns in individuals with different types of temperament will make it possible to reach a certain consensus on the issue of the influence of heredity on the manifestation of physical qualities of track and field athletes, which causes a large number of discussions in scientific circles.

In the world, there is a growing need for quick and effective prediction of future athletes, which can be provided by studying genetic markers (finger patterns,

ATD angle for the palm, delta index (DI), the distances between the triradii a and d, c). Sports performance is a complex phenomenon that includes will, discipline, training, psychological state, ability to work in a team and many other aspects. Literature suggests, that the study of genetic markers can provide additional information about physiological aspects that can influence sports potential [5-9], can also reliably predict the future sports potential or achievements of athletes. So, genetics is one of the factors for predicting future sports success by genetic markers.

In the future, genetic research can provide valuable data to improve the effectiveness of training, personalization of the approach to sports and health. But in order to fully predict sports potential, it is important to combine genetic data with other important factors, such as physical training, psychological state, support and others. Indeed, genetic factors can influence some aspects related to physical abilities, such as muscle mass, reaction speed, visibility, height, etc. However, the determination of athletic potential using genetic markers can be a challenging task due to the large number of genetic interactions and the influence of external factors that can alter the detection of these markers. This question needs further research.

During our study, we established and practically substantiated the relationship between dermatoglyphic markers and speed of reaction and type of temperament of track and field athletes. According we determine the most common dermatoglyphic markers of the control and main group of subjects; to find out the relationship between dermatoglyphic markers and the type of temperament of track and field athletes; to determine the values of the ATD angle and the delta index for the palm of athletes-athletes among the population of Ukraine; to determine the relationship between dermatoglyphic markers and the prediction of performance in athletics.

The object of the study is the dermatoglyphic markers of students and track and field athletes with different types of temperament. The subject of the research is the study of dermatoglyphic markers in people with different types of temperament.

THE AIM

The purpose of our study was to establish and practically substantiate the relationship between dermatoglyphic markers and the speed of reaction and type of temperament of track and field athletes.

MATERIALS AND METHODS

The research sample comprised of 76 medical students aged 17–20 (control group) and 68 track and field athletes aged 18-25 (main group). Both the main and control groups had only men in their composition. The control group included ordinary first-year students of the medical institute without concomitant diseases. The main group included track and field athletes with the rank of candidate for master of sports (50%) and master of sports of Ukraine (50%).

Before the start of the research, students and track and field athletes were familiarized with the goals and hypothesis of the research, and consent to the research was obtained. The hypothesis of our research is the detection of finger patterns in athletes with different types of temperament, which will make it possible to reach a certain consensus on the issue of the influence of heredity on the manifestation of physical qualities of track and field athletes, which provides a large number of discussions in scientific circles. Temperament determines the strength and speed of reactions to life events, its degree of manifestation in sports activities. In this way, by establishing a connection between temperament and such a genetic marker as dermatoglyphics, we will predict the effectiveness of forecasting in the selection of future track and field athletes. This is realized in increasing sports results, reducing financial costs for training athletes.

This study consisted of a one-time data collection (fingerprinting) and a temperament survey of respondents. The study was conducted at two universities of Ukraine: Sumy State University and Makarenko Sumy State Pedagogical University. The questionnaires were distributed in paper form and respondents were instructed on how to complete it and informed of survey questions related questions about the definition of temperament. The work was performed in accordance with the principles Declaration of Helsinki of the World Health Organization association «Ethical principles of medical investigations involving a person as an object research» and approved by the Bioethics Commission Sumy State Medical Institute. All participants provided informed consent to participate in this study and all of the procedures were approved by the ethics committee of the Sumy State University.

To diagnose a person's temperamental features, a questionnaire developed by V. M. Rusalov, based on his own concept of temperament, was used [10]. Students are asked to answer 105 questions, which are aimed at finding out the usual way of behavior. You need to answer quickly and accurately. Keys are used to calculate points on one or another scale. The conclusion about the dominant type of a person's temperament is made on the basis of a comparison of indicators obtained from different temperament properties with the typical combinations of these properties corresponding to different types of temperament given below. San-

Table I. Number of finger patterns in both groups, %

groups	Loop (%)				Arch (%)		Whorl (%)	
	Ulnar (U)		Radial (R)					
	Right	Left	Right	Left	Right	Left	Right	Left
main	6,5±0,02	19,5±0,07	30±0,23	23±0,3	4±0,06	6±0,04	6±0,05	5±0,06
	26		53		10		11	
control	13±0,25	25±0,13	22±0,03	3±0,22	3±0,06	6±0,03	13±0,15	15±0,13
	38		25		9		28	

Table II. Relationship between finger patterns and temperament

Temperament	Arch				Whorl				Loop			
	min	max	μ	σ	min	max	μ	σ	min	max	μ	σ
control group												
Choleric (n=9)	3	10	5,7	2,22	2	5	3,44	1,28	9	13	10,6	1,24
Melancholic (n=3)	7	7	7	0	1	2	1,5	1,18	10	11	10,5	0,22
Sanguine (n=12)	6	10	7,7	1,87	0	2	0,87	0,61	9	13	10,8	1,35
Phlegmatic (n=52)	1	2	1,5	1,18	8	14	11	2,28	9	13	10,6	1,24
main group												
Choleric (n=16)	6	10	7,7	1,87	8	14	11	2,28	9	13	10,6	1,24
Sanguine(n=46)	5	8	6,4	1,6	5	6	5,5	1,61	9	17	12.5	2,29
Phlegmatic (n=6)	1	2	1,5	1,25	4	4	4	1,1	3	10	7,1	1,87

guine is a moderately developed indicator in terms of all temperament properties. Choleric - high indicators of energy, pace and emotionality with average or high indicators of plasticity. Phlegmatic - low indicators in all properties of temperament. Melancholic - low indicators of energy, plasticity, pace with average or high indicators of emotionality.

Technique for the study of sports dermatoglyphics is very basic, consisting of taking fingerprints on pre-established paper formats or direct observation with a magnifying glass. For dermatoglyphic studies, the method of removing impressions of the surfaces of the phalanges of the fingers, using gouache, was used. A sponge and white sheets of A4 format were used to remove prints. Paints or gouache are diluted to the consistency of thick sour cream. The paint is diluted on glass, then rolled onto a sponge, with which the dye is evenly applied to the fingers. Press each finger separately, rolling it on paper from the radial side to the ulnar side. An important practical place here is the clamping force. According to the method, the paint should be applied only to the tops of the crests of the finger patterns, for clarity and recognition of future drawings. A 4 x 7 cm sponge was used to apply paint to the palm.

The next step was to transfer the paint from the fingers to specially prepared questionnaires. This type of form contains in its structure places for actual fingerprints, as well as individual data of each subject. Moreover, the drawings from the right and left hands are located separately. This makes it possible to more easily navigate the subsequent statistical analysis by comparing the results. We would also like to draw your attention to the fact that when transferring the paint to the form, it is advisable to place a resilient surface under it to obtain clearer results. The obtained data were analyzed statistically.

The following methods were used during the research: analysis of scientific and methodological literature, survey, dermatoglyphics, methods of mathematical and statistical processing of the received data. Statistical data processing was carried out on a personal computer using standard Statgraphics and STATISTICA programs. The Excel package was used for the initial preparation of tables and intermediate calculations. All clinical data were entered in an Excel database for statistical analysis. Results are expressed as median (range), mean ± standard deviation for continuous variables, and number and corresponding percentage for qualitative variables. We compared fingerprints, dermatoglyphic indicators with temperament in the studied and control groups, and determined the hereditary predisposition of the traits. All statistical analyses were two-sided and significance was set at $P < 0.05$.

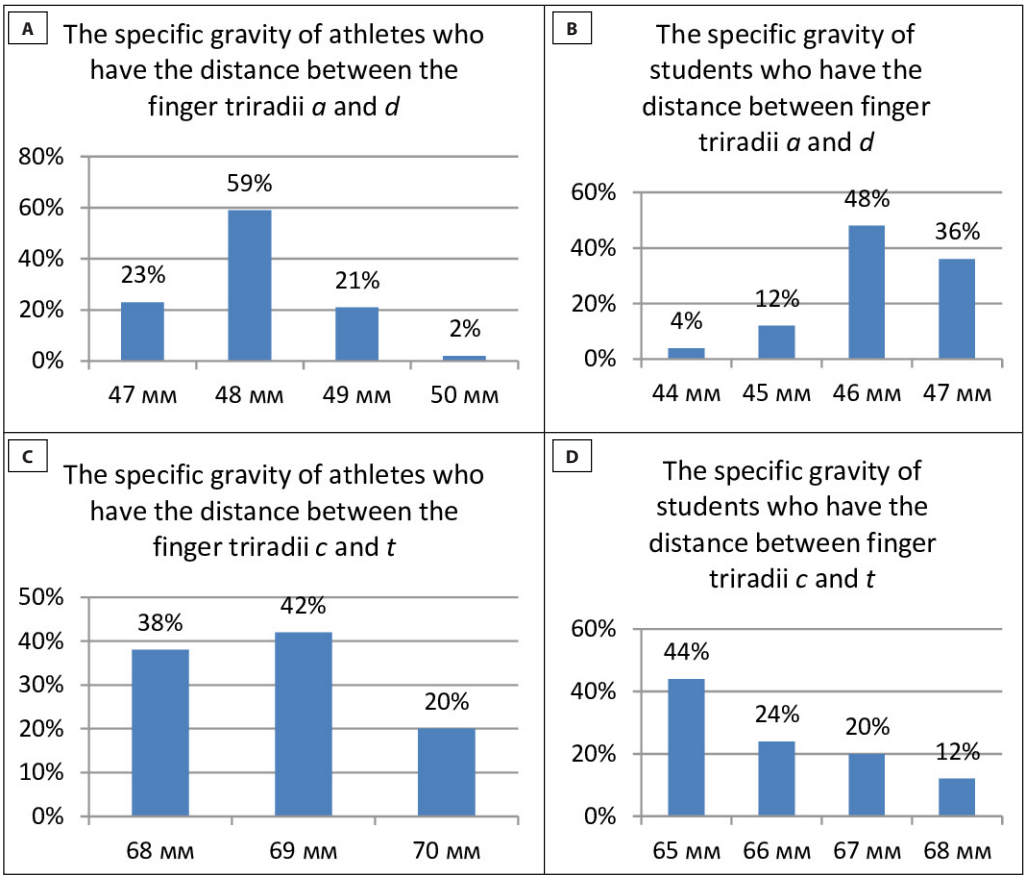

Fig. 1. The specific gravity of persons who have the distance between the triradii of the fingers: A) The specific gravity of athletes who have the distance between the finger triradii a and d; B) The specific gravity of students who have the distance between the finger triradii a and d; C) The specific gravity of athletes who have the distance between the finger triradii c and t; D) The specific gravity of students who have the distance between the finger triradii c and t;

RESULTS

When analyzing the data, after recognizing the types of fingerprints, we found that the most common fingerprint is a loop in both groups. It occurs with a frequency of approximately 79 % in the main group and 63% in the control group; whorl a frequency of 11 % in the main group and 28 % in the control group; arches – 10 % in the main group and 9 % in the control group (Table I). Our research confirms that the radial loop is also related to a high sports performance. We can also say that the physical quality of speedis determined by one delta of loops. This is confirmed by research D. Chapa-Guadiana [11].

According to the results of the study, we determined that the main group of athletes has 17% less whorls than the control group. Thus, we can conclude that the genetic markers of athletes have a higher percentage of such finger patterns as radial loops, fewer whorls and very little archs, unlike the control group. Normally for the Ukrainian population, the number of whorls is 30 - 40%. That is, track and field athletes among the population of the Sumy region of Ukraine have a tendency to decrease the number of whorls ($p<0.05$).

According to the Eysenck method, the type of temperament was determined in the control and main groups [12]. Sanguine has a strong, lively, balanced type of nervous system (mobile); phlegmatic – strong, calm, balanced type of nervous system (inert); choleric – mobile, unrestrained, strong type of nervous system (unbalanced); melancholic – an unbalanced, inactive type of nervous system (weak).

We determined that among the subjects of the main group, athletes of the sanguine type of temperament are most common (67,6%), and in the control group (among students of a medical university) the phlegmatic type of temperament is most common (68,4%). Also, among the subjects of the main group there is no such temperament as melancholic, in the control group there are also very few of them – 3,9%.

According to the obtained data, it was determined which finger patterns are characteristic for each type of temperament (Table II). The most extended patterns are loops (L), which occur with almost equal frequency in all temperament types, as well as in the main such and control groups. Such a pattern as a whorls (W) occurs in cholerics, in melancholics it occurs very weakly and only on one hand, and in phlegmatics it is absent in the control group. In phlegmatic patients, only such a finger pattern as loops is found, there are very few archs ($p<0,001$).

No melancholic temperament type was found among those studied in the main group. The remaining types of finger patterns were observed in the ratio that we see in Table II. Loops are also the most common patterns among people of the main group.

We also determined the ATD angle for the palm, which exists between the triradii A, D and T. This angle should not exceed 57°. It was 37±4.88 in the main group, and 47±3.11 in the control group. This indicates a hereditary predisposition of this trait.

We also determined the delta index (DI). The delta index in the control group has lower values (DI=9.5) than in the main group (DI=13.3). Thus, the delta index of track and field athletes among the population of Ukraine is 19% higher than that of students. This also indicates a tendency to increase the delta index in athletes.

The relationship between dermatoglyphic markers and the prediction of performance in athletics was determined. By measuring the distances between the triradii a and d, c and t, we confirmed L.P. Sergienko's [13] conclusions that the speed of mastering movements depends on them.

In the studied athletes, the distances between the finger triradii a and d were more than 47 mm, compared to the control group, where the distance ranged from 44 to 47 mm. And the distance between the finger triradius c and the main triradius t in track and field athletes exceeded 68 mm, while in the control group it was less than 68 mm. Thus, it can be concluded that the prediction of future athletes can be made by genetic markers of the distance between the finger triradii a and d, which should exceed 47 mm and the distance between the triradii c and t, which should exceed 68 mm (Fig 1).

The results indicate a possible connection between the anatomical characteristics of the fingers and the speed of mastering movements. Thus, in most athletes (59%), the distance between the triradii a and d of the fingers was 48 mm, and in students it was 46 mm. The distance between the triradius c of the finger and the main triradius t in most of the athletes (42%) exceeded 68 mm, while in the majority of the control group (44%) it was 65 mm. The results indicate a possible connection between the anatomical characteristics of the fingers and the speed of mastering movements.

So, the track and field athletes in the population of Ukraine were characterized by the features of the dermatoglyphic constitution: higher values of the deltoid index and the genetic markers of the distance between the finger triradii a and d.

DISCUSSION

Such researchers present fingerprints as a genetic marker due to their association with basic physical qualities and muscle fiber type [14]. Some researchers believe that physical qualities are determined both by genetics and the environment, that is, by a combination of genetics and the environment [15]. For the detection of sports talent, dermatoglyphics has scientific evidence and importance, application and use in various contexts such as sports. Exercise is a powerful tool that affects a wide range of body parameters, and genetic factors will help guide the effects of exercise on the body [13, 16-18].We agree with the authors (Fernandez et al., 2020) that dermatoglyphics is an effective method characterize physical capabilities in the studied sports [19]. The aim of the study was to compare to compare the dermatoglyphic markers of students and athletes, and to establish and practically substantiate the relationship between dermatoglyphic markers and the speed of reaction and type of temperament of track and field athletes.

It was determined that the most common dermatoglyphic markers of the control and main group of subjects is the loop. Genetic markers of track and field athletes will have a higher percentage of such finger patterns as radial loops and very little - archs. Athletes among the population of Ukraine tend to increase the number of radial loops ($p<0.05$). Thus, our study confirms the research of other researchers [20-22].

Scientist M. Bogdanov proved the connection between dermatoglyphic signs and psycho-emotional components of a person's character. So, for example, people in whom arcs predominate among finger patterns are usually characterized by purposefulness, directness, frankness, but not very high intelligence [16]. The complete opposite of them are people with a predominant curly pattern. Such persons are characterized by a very high intellectual potential, but they usually cannot implement their ideas, which is associated with indecision and self-doubt. The golden mean between these two types is people with an average delta index, that is, those people whose dermatoglyphic pattern is represented mostly by loops.

Based on the analysis of our results, we can say that such a type of pattern as loops (L) prevails in all types of temperament in the main group. Using the results of dactyloscopy, it was established that the control group with a strong and balanced nervous system has more loops on the finger pattern, whorls in people with a strong and mobile nervous system, and archs in people with a weak nervous system. If we correlate the type of temperament and the finger pattern on ten fingers in percentage terms, the following turns out to be the case: choleric has more than 50% whorls; sanguine has more than 50% loops; phlegmatic usually has all loops; a melancholic has at least one arch, and the more there are, the weaker the nervous system, i.e. low efficiency.

According to the classification of character, tempera-

ment and behavior of a person according to skin patterns, it can be said that athletes of all types of temperament are dominated by such a finger pattern as a loops (L).

The value of the ATD angle and delta index for the palm was determined: we observe a tendency to decrease the ATD angle for the palm by 10% in track and field athletes among the population of Ukraine. The delta index in the control group has lower values (DI=9.5) than in the main group (DI=13.3). Thus, the delta index of track and field athletes among the population of Ukraine is 19% higher than that of students. This also indicates a tendency to increase the delta index in track and field athletes. The delta index provides an important basis for identifying athletics talent in children, because speed is essential for most sporting events. Many scientists recognize dermatoglyphics as key element in sports selection [16-21].

The relationship between dermatoglyphic markers and the prediction of performance in athletics was determined. Future track and field athletes can be predicted by genetic markers of the distance between the finger triradii a and d, which should exceed 47 mm and the distance between the triradii c and t, which should exceed 68 mm.

CONCLUSIONS

The research-descriptive nature made it possible to reveal the relationship between dermatoglyphic markers and the type of temperament of track and field athletes and students. It had a research character, since, at least in Ukraine, in the studied literature, there is no work that studies the relationship between dermatoglyphic markers and the type of temperament.

We established and practically substantiated the relationship between dermatoglyphic markers and reaction speed and temperament type of track and field athletes. By measuring the distances between the triradii a and d, c and t, we determined the relationship between the anatomical features of the fingers and the speed of mastering movements. Thus, for track and field athletes of the population of Ukraine, there were characteristic features of the dermatoglyphic structure: higher values of the deltoid index and genetic markers of the distance between the triradii a and d of the fingers. The type of temperament is associated with such genetic markers as finger patterns, ATD angle for the palm, delta index (DI).

The predominant type of temperament in track and field athletes is sanguine. They refer specifically to the strong type of nervous system and its varieties, psychological properties, caused primarily by the strength, balance and mobility of nervous processes, are a necessary condition for achieving great success in sports. Among athletes, there is no such temperament as melancholic, it is a weak type of nervous system. Therefore, temperament affects the achievement of high results in athletics. Studying which temperament prevails in this type of sport will help athletes and coaches adjust the training process, better understand each other and, accordingly, achieve high results.

The track and field athletes in the population of Ukraine were characterized by the features of the dermatoglyphic constitution: higher values of the deltoid index and the genetic markers of the distance between the finger triradii a and d. Hereditary predisposition of the ATD angle was determined to be 37±4.88. Delta index of track and field athletes among the population of Ukraine is 19% higher than that of students. This also indicates a tendency to increase the delta index in athletes.

The study, provides a reference for future studies or for the detection and selection of talent for athletics. All the data that we reviewed confirm the opinion that the physical activity of a person can be influenced by the genetic markers presented in the article in speed sports. On the material of fingerprints and palm prints, and with the help of various statistical methods, the connections between dermatoglyphic signs and human temperament were studied. It should be noted that these are only general principles of determining a person's character using dermatoglyphics, because for a more accurate assessment of a person's character, it is necessary to take into account many other dermatoglyphic factors.

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The submitted work was carried out within the framework of the topic of scientific research with state budget funding «Investigation of the connection of polymorphism of single nucleotides in individual genes with the development of physical qualities of athletes», No. Registration 0119U103044.

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Conflict of interest:
The Authors declare no conflict of interest.

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Received: 30.01.2023
Accepted: 05.10.2023

A - Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article