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DERMATOGLYPHIC CHARACTERISTICS OF HIGH-PERFORMANCE FUTSAL PLAYERS

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ABSTRACT

The aim was to compare the distribution of dermatoglyphic indicators in high-performance male futsal players. For this, 340 men divided into two groups: Group A (Futsal) consisted of 170 professional elite futsal players, and Group B (Control) comprised 170 randomly selected controls. The protocol selected for analyzing the fingerprints was dermatoglyphics, proposed by Cummins and Midlo through the Dermatoglyphic Reader®. The number of Radial Loops (RL) in A predictive formula for coaching futsal players is suggested because the numbers of RL on MDT3 and MDT5 and of Whorls in MDT1 and MET2 are higher in the Futsal group than in the Control group. The number of lines was also higher in the Futsal group compared to the Control group in MESQL1, MESQL3, MESQL5, and MDSQL1, SQTLE and SQTL. These findings suggest a predictive formula to train and guide futsal players.

Key words: Dermatoglyphic. Fingerprints. Futsal. Athletes.

RESUMO

Características dermatoglíficas de jogadores de futsal de alto desempenho

O objetivo foi comparar a distribuição dos indicadores dermatoglíficos em jogadores de futsal masculino de alto rendimento. Para isso, 340 homens divididos em dois grupos: Grupo A (Futsal), composto por 170 jogadores profissionais de elite do futsal, e Grupo B (Controle), composto por 170 controles selecionados aleatoriamente. O protocolo selecionado para análise das impressões digitais foi a dermatoglifia, proposta por Cummins e Midlo por meio do Dermatoglyphic Reader®. O número de presilhas radiais (RL) em uma fórmula preditiva para treinar jogadores de futsal é sugerido porque os números de RL em MDT3 e MDT5 e de espirais em MDT1 e MET2 são maiores no grupo de futsal do que no grupo de controle. O número de linhas também foi maior no grupo Futsal em comparação ao grupo Controle em MESQL1, MESQL3, MESQL5 e MDSQL1, SQTLE e SQTL. Esses achados sugerem uma fórmula preditiva para treinar e orientar jogadores de futsal.

Palavras-chave: Dermatoglífico. Impressões digitais. Futsal. Atletas.

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INTRODUCTION

The search for tools aimed at improving human performance has intensified in the field of sports. Sports training consists of a set of complex activities organized to maximize performance, even for only a specific time period.

This improved performance depends on periodized training and enhanced techniques and tactics as well as the psychological control of the athlete (Dantas, 2014).

Historically, sports medicine and exercise physiologists have focused on the morphological and functional aspects of athletes, believing that high performance levels were the result of the athlete's phenotype and that training and specific nutritional monitoring were decisive factors in athletic performance. However, over time, genetic factors were also considered determinants of individual athletic performance (Dias et al., 2007).

Subsequently, the combination of genotype and phenotype began to be investigated as a factor involved in the development of high-performance athletes (Abramova, Nikitina, Kochetkova, 2013).

Despite scientific advances in methods and assessments of body components, sports science still faces difficulties in finding suitable methodologies for detecting the genetic potential of an individual (Borin et al., 2012).

One possible method for analyzing genetic potential is dermatoglyphics (Cummins, Midlo, 1961) because fingerprints are dermal representations of genetic traits and therefore are biological markers (Butova, Lisova, 2001).

Studies based on dermatoglyphics have shown that the complexity of fingerprints can determine genotypic traits of physical aptitude (Guba, Tchernova, 1995; Nikitjuk, 1988).

Thus, dermatoglyphic traits could be used to assess athletes in terms of both their physical ability and morphofunctional understanding.

An increase in the number of studies focusing on genetic factors in relation to sport predisposition (Borin et al., 2012; Cabral et al., 2005; Cunha Junior et al., 2005) and investigations of the possibilities of using dermatoglyphics in association with basic physical qualities suggests that this method should be thoroughly and reliably examined to allow its correct application in sports training.

The assessment of elite athletes has established parameters related to the physical and anthropometric traits as well as the genetic profile of individuals who exhibit specific characteristics in each sport.

Tools and methods that help to assess and train elite athletes are essential in the search for maximum sport performance (Volkov, Filin, 1983).

Considering the increase in the number of futsal practitioners in Europe and Latin America, it is necessary to observe the existence of dermatoglyphic marks that characterize this sport.

This information constitutes one more tool to qualify the orientation of sports talents to this modality and the practice of the physical preparation of athletes in this sport. Studies bringing together the 12 best futsal teams in the world have never been realized; thus, the results presented here portray the elite of the futsal world.

In this sense, the present study aimed to compare the distribution of dermatoglyphic indicators in high-performance futsal players and a control group of non-athletes.

MATERIALS AND METHODS

The sample consisted of 340 men who were divided into two groups: Group A, consisting of 170 professional elite futsal players, and Group B, comprising 170 randomly selected Brazilians non-athletes of the same sex and age group (control group).

The futsal players belonged to the top three teams in the Italian, Spanish, Portuguese and Brazilian leagues in 2010.

The data were collected from the players at their team headquarters in Brazil, Italy and Portugal, as well as during the King's Cup in Spain.

The protocol selected to analyze genetic potential via fingerprint collection consisted of dermatoglyphics, as proposed by Cummins and Midlo (1961).

A computerized dermatoglyphic reading process was used to capture, process and analyze fingerprints.

Specifically, a reader consisting of an optical scanner equipped with a roller collected and interpreted the image and created a binary code drawing.

The drawing was then captured by specific software that analyzed and reconstructed real and binarized black and white images using the Dermatoglyphic Reader® (Nodari Júnior et al., 2008).

After all the images were collected, the Dermatoglyphic Reader® was used to select single images to define the points (nuclei and deltas) and automatically draw Galton's Line, and the software, via specific algorithms, intersected the drawn line with the fingerprint lines, thereby providing the number of lines on each finger, as well as the type of fingerprint pattern.

The software allowed the qualitative and quantitative identification of the image and lines, respectively, and produced a computerized spreadsheet from the processed data (Volkov, Filin, 1983).

Statistical analyses were processed using Statistical Package for the Social Science (SPSS) 20 for Windows.

The Kolmogorov-Smirnov test was used to compare the two groups and their quantitative variables to determine if they were normally distributed. In the event of non-normal distribution, the Mann-Whitney nonparametric test was applied to compare the following numerical variables: left hand, sum of the number of lines on finger 1 – thumb (MESQL1); left hand, sum of the number of lines on finger 2 – index (MESQL2); left hand, sum of the number of lines on finger 3 – middle finger (MESQL3); left hand, sum of the number of lines on finger 4 – ring (MESQL4); left hand, sum of the number of lines on finger 5 – little (MESQL5); sum of the total number of lines on the left hand (SQTLE); right hand, sum of the number of lines on finger 1 – thumb (MDSQL1), right hand, sum of the number of lines on finger 2 – index, (MDSQL2); right hand, sum of the number of lines on finger 3 – middle (MDSQL3); right hand, sum of the number of lines on finger 4 – ring (MDSQL4); right hand, sum of the number of lines on finger 5 – little (MDSQL5); sum of the total number of lines on the right hand (SQTLD); and sum of the total number of lines – both hands (SQTL). In addition, the size effect (d) was calculated to analyze the magnitude of the results obtained in the present study.

The chi-square test was used to compare the following categorical variables: arch (A), radial loop (RL), ulnar loop (UL), whorl (W); left hand fingerprint patterns, finger 1 (MET1), finger 2 (MET2), finger 3 (MET3), finger 4 (MET4) and finger 5 (MET5); and right hand fingerprint patterns, finger 1 (MDT1), finger 2 (MDT2), finger 3 (MDT3), finger 4 (MDT4) and finger 5 (MDT5). Adjusted residual analysis was applied when significant differences were observed. The study adopted $p \leq 0.05$ as the significance level.

Ethics

The study was approved by the Human Being Research Ethics Committee of the University of Western Santa Catarina/Santa Teresa University Hospital (UNOESC/HUST), under protocol number 292.868. It was conducted in accordance with the ethical standards of the regulatory guidelines and research directives involving human beings and in compliance with Resolution 466/12 of the National Health Council and Declaration of Helsinki.

RESULTS

The numbers of lines on six possible fingerprint pattern variations were significantly higher in Group A (futsal players) than in Group B (control). The effect size (d) was moderate ($d \geq 0.3$) in MESQTL1, MESQTL3, MESQTL5, MDSQTL1, SQTLE and SQLT (Table 1), which indicates the magnitude of the results between groups.

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Table 1 - Comparison of fingerprint lines on the left, right and both hands (SQTLE, SQTLD and SQTL). Significant 133iferences were found between Group A (Futsal) and Group B (Control).

	Mean ± SD (Futsal)	Mean ± (Control)	Δ %	p	d
MESQL1	14.8 ± 5.01	12.1 ± 5.33	21.6	<0.001*	0.5
MESQL2	9.3 ± 5.73	9.2 ± 5.22	1.0	0.907	0.0
MESQL3	11.6 ± 5.59	10.0 ± 5.58	16.2	0.008*	0.3
MESQL4	13.4 ± 5.19	12.4 ± 5.28	8.2	0.105	0.2
MESQL5	13.0 ± 5.85	11.2 ± 6.16	15.7	0.016*	0.3
MDSQL1	16.5 ± 5.07	14.3 ± 5.45	15.1	<0.001*	0.4
MDSQL2	9.2 ± 5.46	9.3 ± 5.54	-0.4	0.924	0.0
MDSQL3	11.0 ± 4.98	10.1 ± 5.22	9.1	0.094	0.2
MDSQL4	13.5 ± 5.14	12.7 ± 5.18	5.7	0.263	0.2
MDSQL5	12.4 ± 4.61	11.6 ± 4.88	7.6	0.096	0.2
SQTLE	62.0 ± 21.48	54.9 ± 21.58	13.0	0.006*	0.3
SQTLD	62.6 ± 19.94	58.0 ± 21.41	8.0	0.075	0.2
SQTL	124.6 ± 40.80	112.8 ± 41.71	10.4	0.020*	0.3

Legenda: *p ≤ 0.05, Mann-Whitney test; Δ %: percentage variation; d: effect size.

A greater number of lines was observed in Group A than in Group B. This finding may be related to the higher number of complex patterns because greater distances of the nucleus from the delta will result in greater spacing as indicated by Galton’s line.

The categorical variables showed a significant intergroup difference in four fingerprint variables (MET1, MDT1, MDT3 and MDT5) with a higher frequency in Group A (futsal players) compared with Group B (control) (Table 2).

Table 2 - Significant differences in the fingerprint patterns on the right and left hands between Group A and Group B

MET1	MET2	MET3	MET4	MET5	MDT1	MDT2	MDT3	MDT4	MDT5
0.022*	0.180	0.352	0.162	0.130	0.007*	0.120	0.024*	0.053	0.040*

*p ≤ 0.05.

If a significant difference was identified between the categorical variables of Group A and Group B, adjusted residual analysis was conducted to determine which patterns exhibited a significant value in the groups.

This enabled the determination of the predominant and different fingerprint patterns in Group A compared to Group B. When a significant intergroup difference in patterns was observed, adjusted residual analysis was Applied.

In this case, the data were compared with the standard value of 1.96, i.e., all findings higher than the standard value demonstrated a significant intergroup difference.

The most frequent fingerprint patterns in Group A are shown in Table 3.

Table 3 - Adjusted residual analysis results (with a standard value of 1.96) of the categorical variables that showed a significant difference between Group A and Group B by the chi-square test.

		Fingerprint patterns			
		A	LR	LU	W
MET1	Group A (Futsal)	-1.5	1.6	-2.1	2.1
	Group B (Control)	1.5	-1.6	2.1	-2.1
MDT1	Group A (Futsal)	-1.4	1.3	-2.8	2.8
	Group B (Control)	1.4	-1.3	2.8	-2.8
MDT3	Group A (Futsal)	-1.7	2.1	-1.6	1.5
	Group B (Control)	1.7	-2.1	1.6	-1.5
MDT5	Group A (Futsal)	-1.4	2.5	-1.1	0.2
	Group B (Control)	1.4	-2.5	1.1	-0.2

For the fingerprints in which significant differences were found, Group A exhibited a predominant fingerprint pattern compared to Group B. This is shown in Table 3, in which the fingerprint pattern for Group A exhibits a larger value for W on MET1 and MDT1 and a larger value for RL on MDT3 and MDT5.

DISCUSSION

This study showed that when comparing high-performance futsal players to a control group of non-athletes, significant differences were observed in terms of quantitative (number of lines) and qualitative dermatoglyphic traits (types of patterns), with athletes exhibiting a larger number of lines and a predominance of the W and RL patterns.

The results obtained in this study corroborate the findings of Abramova, Nikitina, Kochetkova (2013) suggesting that speed-based sports are characterized by a lack of A patterns, an increase in W patterns and an increase in the SQTL.

The results obtained in this study corroborate the findings of Alberti et al., (2018), showing that the RL patterns are characteristic marks of the high-performance futsal.

The analysis of fingerprints by the dermatoglyphic method may contribute to the coaching process and promote sports talent, as it suggests that athletes displaying strength and coordination exhibit a larger number of lines, lack of A patterns and a high number of W patterns.

Moreover, athletes involved in speed and power-based sports with short periods of maximum effort exhibit a high frequency of A patterns and lines and a low number of W patterns and total number of lines (Vecchio, Gonçalves, 2001).

Futsal is a high-intensity sport that requires athletes to move at high speeds (Pedro e al., 2013; Rodrigues et al., 2011.

The contradictions in dermatoglyphic findings may be associated with the different methods used for fingerprint analysis. The results of the present study, which used the computerized technique in place of the traditional ink and paper fingerprinting method (Nodari Júnior et al., 2008), showed a dermatoglyphic difference in futsal players.

In addition to computerized collection, the comparison of high-performance futsal players with a control group of non-athletes resulted in data analysis with higher reliability.

The significant difference in the fingerprints of futsal players compared to the control group, in both quantitative and qualitative variables, suggests that dermatoglyphics can be considered a valuable tool in sports training.

In addition to sample selection, computerized fingerprinting was more accurate for dermatoglyphic analysis, and the collection process was approximately ten times faster, demonstrating that it is an important tool for optimizing analysis and providing more reliability in the counting and marking of lines and patterns (Nodari Júnior et al., 2008).

In Brazil, information on dermatoglyphics, as applied to sports science, has only focused on the distribution of pattern frequency, which limits many possible contributions. This study identifies the differences in dermatoglyphic research studies by comparing our findings with those of a control group (Borin et al., 2012).

CONCLUSION

A predictive formula for coaching futsal players is suggested because we found that the number of RL patterns MDT3 and MDT5 and W patterns on MDT1 and MET1 were significantly higher in the futsal group than in the control group. In the present study, the number of lines was also significantly different, with the futsal group consistently exhibiting a higher number of lines on MESQL1, MESQL3, MESQL5, and MDSQL1, as well as larger SQTLE and SQTL values than the control group.

These findings suggest that the different genetic markers and fetal development observed in athletes may be associated with the location of this marker on the fingers, and not only on the type of patterns and number of lines on the fingers.

It is important to underscore that genetic markers and fetal development, as presented by dermatoglyphics, may help guide talented athletes and that a number of studies have corroborated these methods as powerful tools.

Channeling athletic potential using dermatoglyphics is an innovative process that allows differentiation in the referrals process, thus increasing the confidence of professionals that use this technique. Investigations with different ethnic groups and performance levels and larger sample populations involving intersex comparisons are needed to more clearly determine distinguishable traits in different groups of futsal players.

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