Early detection of increased blood pressure and its relation to the study of fingerprints among young football players in the city of Bogotá

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Summary

Blood pressure as a hemodynamic variable is a useful and key diagnostic element for the detection of arterial hypertension (HTA), since through this variable it is possible to recognize optimal cardiovascular functioning in addition to quickly identifying the risk of suffering from this disease, which unfortunately is identified late, since in most cases the patients do not show symptoms. Determining predisposing factors to develop the disease is of great importance for public health and in this sense dermatoglyphics becomes an alternative that allows, through the recognition of genetic markers, the early identification of this pathology. Therefore, the objective of this work is to identify the relationship between fingerprint dermatoglyphics and increased blood pressure in athletes. Male university athletes between 18 and 26 years old were included for the study. Those who were divided into two groups, controls and cases, according to their blood pressure figure, the case definition corresponds to high blood pressure figures (120-129 and <80 mmHg). While the definition of control linked those participants who presented normal blood pressure values (<120 and <80 mmHg). A questionnaire was carried out in which the data of blood pressure, weight, height, family and personal history were recorded, additionally, the fingerprinting of the Cummins and Midlo (1942) protocol was carried out. As a result, it was found that In the group of football players with high blood pressure (TAA), a greater count of whorls in the left hand was identified 1.54 ± 1.50 in relation to the normotensive group 1.49 ± 1.47. The appearance of whorls was found in the TAA group when they had a family history of cardiovascular disease with an OR 3.9 (*P* <0.000). Therefore, it is concluded that there are fingerprint dermatoglyphic patterns associated with the predisposition to increased blood pressure.

Key words:
Dermatoglyphics. Arterial Pressure. Football.

Detección temprana de aumento de presión arterial y su relación con la dermatoglifia dactilar en futbolistas jóvenes de la ciudad de Bogotá

Resumen

La presión arterial como variable hemodinámica, se constituye en un elemento diagnóstico útil y clave para la detección de la hipertensión arterial (HTA), ya que mediante esta variable se logra reconocer el funcionamiento cardiovascular óptimo. Determinar factores predisponentes a desarrollar la enfermedad es de gran importancia para la salud pública y en ese sentido la dermatoglifia se convierte en una alternativa que permite mediante el reconocimiento de marcadores genéticos la identificación precoz de esta patología. Por ello el objetivo de este trabajo es identificar la relación entre la dermatoglifia dactilar y el aumento de tensión arterial en futbolistas de Bogotá. Para el estudio se incluyeron deportistas hombres entre 18 a 26 años, quienes se dividieron en dos grupos, controles y casos, según su cifra de tensión arterial, la definición de caso corresponde a cifras tensionales altas (120-129 y <80 mmHg). Mientras que la definición de control vinculó aquellos participantes que presentaron cifras tensionales normales (<120 y <80 mmHg). Se realizó un cuestionario en el cual se registraron los datos de presión arterial, peso, talla, antecedentes familiares y personales, adicionalmente, se realizó la toma de huellas del protocolo de Cummins y Midlo (1942). Como resultados se encontró que el grupo de futbolistas con tensión arterial alta (TAA) se identificó un mayor recuento de verticilos en mano izquierda 1,54 ±1,50 con relación al grupo normotensos 1,49 ±1,47. Se encontró en el grupo de TAA la aparición de verticilos cuando se tienen antecedentes familiares cardiovasculares con un OR 3,9 (p<0,000). Por lo tanto, se concluye que existen patrones dermatoglíficos dactilares asociados a la predisposición del aumento de la tensión arterial.

Palabras clave:
Dermatoglifia. Presión arterial. Fútbol.

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Introduction

Dermatoglyphics has been considered a useful tool based on the use and identification of fingerprint patterns. These uses initially focussed on analysis and detection of aspects related to the subjects' physical condition and provided an understanding of processes associated with embryonic development and genetic implications that might affect health conditions in the future. It is important to note that the configuration of these patterns is unique and it lasts throughout each human being's lifetime, explaining why each dermatoglyphic pattern provides information related to the subject's embryonic development, health and development conditions, demonstrating a high capacity to identify chronic illnesses such as diabetes, cancer and hypertension[1-3].

Regarding hypertension, this pathological entity is clearly a multifactorial disease which is largely silent. Having said that, referencing the systematic review by Wijerathne *et al.*[4], hypertension is a pathology that has contributed to overloading public health resources due to the concomitant development of cardiovascular and cerebrovascular events, among others. In Colombia, the prevalence of arterial hypertension varies by the region of the country being analysed. Nevertheless, it is concerning that, according to García *et al.*[5], 59.6% of the population has not had an assertive and early diagnosis.

In this respect, early recognition of the underlying factors is imperative for public health actions that seek to prevent the on-going risk[6]. Genetic inheritance through fingerprints appears in the mother's intrauterine environment during the third and sixth month of pregnancy[6,7]. These genetic markers contain information on the predisposition of individuals both at a physical (somatotype) and physiological level. The study of fingerprints is currently considered a valid, reliable test because they are unique and unchanging in each human being[8-10].

Although this is true, studies such as Kulkarni *et al.*[11], which involved 200 subjects randomly divided into case groups and control groups, managed to identify differences in the presentation of dermatoglyphic patterns where there are clear changes in the size of the whorls and the ulnar loops; these changes were also clear in the study by Tafazoli *et al.*[12], which not only identified changes in the whorl size but also demonstrated an increase in their frequency among the hypertensive group.

Likewise, various studies that compared the dermatoglyphic patterns between the hypertensive and normotensive population found that subjects who suffered from AHT commonly present radial loops while normotensive persons mainly present ulnar loops. In turn, the ATD angle in hypertensive individuals tends to be greater than among normotensive subjects and whorls are the most frequent dermatoglyphic pattern among persons who suffer from arterial hypertension[12-14].

Simultaneously, a great difference is seen in the number of lines and the ulnar loops between subjects with hypertension and the healthy group. In addition, there is a statistically significant difference in the ulnar loop pattern in the fifth finger of the left hand, and the fourth and fifth on the right hand; this pattern frequently appeared in the hypertensive group[9].

Other findings have managed to demonstrate the possible relationship between certain fingerprint patterns and the presence of arterial hypertension (AHT), by means of quantitative analysis of the frequency and the type of designs on an individual, to discriminate persons who might have inherited AHT. Various studies focus on the analysis of dermal ridges on the palms and soles. However, this study will be based on the distal phalanges of the hands which are closely related to potential biophysical capacities, and a predisposition to develop certain illnesses[13-15].

Some physiological approaches that help to explain the relationship between these dermatoglyphic changes and the presence of arterial hypertension would be associated with biological processes derived from embryonic instability during pregnancy, plus impacts on nutrition and maternal stress. On the other hand, it is relevant that some studies have involved the genetic component in determining fingerprints and vascular endothelium although it is true that the genes responsible for developing the different layers of skin and blood vessels can be key to shaping dermatoglyphic patterns. Part of the research has identified the SMARCAD1 gene as one of the genes responsible for forming dermatoglyphics, although its role is not clear in the whole vascular endothelial context and so research is continuing in this respect. It certainly cannot be ignored that the shape of these fingerprint patterns and the genetic basis of a subject would be directly influenced by other factors during foetal development such as infections, consumption of psychoactive substances, among other elements alter the mother's uterine environment[16,17].

According to the above, the aim of this research is to work from dermatoglyphics to identify the presence of digital traits which concur with previous research, making it possible to recognise the presence of arterial hypertension in young football players.

Material and method

Study design

Analytical study of cases and controls.

Participants

The study included 86 football players aged between 18 and 26 years old who trained more than three times a week; the players must have belonged to the group for at least six months, and played in competitions for their category (second division professional football). The case definition was football players who had high blood pressure readings (120-129 and <80 mmHg), according to definitions from the *American Heart Association* regarding high blood pressure[18]. The control definition was any subjects with normal blood pressure readings

(<120 and <80 mmHg) according to definitions by the *American Heart Association* regarding normotensive subjects[18]. As exclusion criteria, the study did not consider participants presenting diagnoses of hypothyroidism, AHT, burns on their hands, congenital deformations on their hands, partial or total hand amputation.

Data collection instruments

A questionnaire was produced for continuous variables which recorded data for arterial pressure, weight, height and family and personal history (morbid, orthopaedic trauma, surgical, pharmacological, neonatal) in an open format for this purpose. It is important to clarify that family history was recorded to acknowledge any history of hypertension in their family. The oscillometric blood pressure was taken using a Ri-champion N digital blood pressure monitor (Riester, Jungingen, Germany), with the participant seated and relaxed for around 5 minutes, their feet resting on the floor and their back against the backrest, their arm supported on a fixed surface. It was taken twice and the average of the two readings was used to record blood pressure for the individuals (desktop-table); the user was not allowed to tighten their muscles as this affects the real values. The measurements were taken on one day between 7:00 and 8:00 am. The height was measured using the Holtain® height rod (0-209 cm; accurate to 0.1 cm) and the Tanita® scales were used to measure the weight. Finally, fingerprints were taken using the Cummins and Midlo protocol[19]. They were taken from all 10 fingers of each subject on a biometric Futronic FS-50 fingerprint scanner reader, which considered the following variables: a) patterns from the fingers on each hand (arches, loops, whorls); b) total ridge count on the fingers (SQTL); c) design of the fingerprint types. Subsequently, they were reclassified taking into account the average of the Arch, Loop and Whorl figures, and the sum of the ridges. Using the data collected in dermatoglyphics, they were re-categorized into nominal Yes and No variables, and so all values above the average were re-classified into the Yes category and any below the average were put into the No category. This provided the corresponding odds ratios (OR).

The information was recorded in an Excel document, alongside the data from each user, which were coded due to information confidentiality. Subsequently, the data were divided into cases and controls, finding 35 cases and 51 controls.

Results analysis

Version 25 of the IBM SPSS statistics programme was used. The averages and the standard deviation were described for the quantitative dermatoglyphic data from cases and controls. Subsequently, a Chi Squared test was applied to determine if there were statistically significant differences for the dermatoglyphic variable. The exposure prevalence (population, cases and controls) and odds ratio (OR) were determined.

Ethics Committee

The research took place according to the Declaration of Helsinki[20], Resolution No. 008430 of 1993 from the Colombian Ministry of Health. Additionally, the research project was approved by the Committee of Ethics, Bioethics and Scientific Integrity for research from the Santo Tomás University on 27 June 2019 in document no. 10.

Results

A total of 86 people took part in the research, with an average age of 19 ± 2.82 years old. The average height for the sample was 1.74 ± 0.07 metres and the average weight was 66.5 ± 9.97 kg. All the participants did sport at least 3 times a week. After dividing the group according to their blood pressure readings, the high blood pressure (HBP) group comprised 35 persons and the normotensive group comprised 51 persons (Table 1).

It was found that radial loops and arches are the variables least presented by both study groups (Table 1). The average number of arches in both hands is slightly higher in the HBP group, although there is no significant difference. Regarding the ulnar loops on the right hand, they have a lower average in the group of football players with high blood pressure compared to the normotensive group.

On the other hand, no significant difference was found in the radial loops on both hands and ulnar loops on the left hand. A slightly greater whorl average was found on the right hand in the HBP group and a lower average in the SQTL of the right hand in football players with HBP. Finally, no significant difference was found in the LH and D10 SQTL variables.

Among the data collected in the population, family history was determined as a parameter to recognise genetic predisposition to high blood pressure finding that there was no significant statistical

Table 1. Descriptive statistics for the dermatoglyphic characterisation of the sample by group.

Variables	Players with HBP		Normotensive players	
	Average	S.D.	Average	S.D.
RH arches	0.17	±0.45	0.10	±0.36
LH arches	0.29	±0.83	0.18	±0.48
RH radial loops	0.20	±0.41	0.20	±0.45
LH radial loops	0.14	±0.36	0.27	±0.49
RH ulnar loops	2.60	±1.46	2.94	±1.36
LH ulnar loops	2.97	±1.40	3.10	±1.27
RH whorls	2.07	±1.63	1.75	±1.43
LH whorls	1.54	±1.50	1.49	±1.47
RH SQTL	94.34	±40.02	94.98	±42.27
LH SQTL	90.86	±41.89	90.82	±43.89
Sum of SQTL	185.20	± 79.96	185.80	± 84.88
D10	13.11	±3.55	12.98	±3.13

HBP: high blood pressure; RH: right hand; LH: left hand; SQTL: sum of quantity of total lines; D10: delta index in the designs.

relationship between the normotensive and high blood pressure groups. However, by relating the background history with what was found in the fingerprints, Table 2 shows a relationship between history of hypertension and the presence of whorls on the left hand. Additionally, a relationship was found between the sum of total ridges and the sum of ridges on the left hand with family history of hypertension.

Discussion

The aim of this study was to find patterns that made it possible to use the study of fingerprints to identify the increase in blood pressure among young football players in the city of Bogotá. The findings initially highlight a larger whorl count on the left hand and the right hand for the group which presents high blood pressure. These results concur with the study by Kulkarni *et al.*[11] which stated that hypertensive patients tend to present a higher frequency of whorl patterns which appear alongside a higher average ridge count than the controls[15].

Likewise, in a study performed with 200 people who suffered from arterial hypertension and a group of 200 people with normal blood pressure, Ganesh *et al.*[21,22] stated that the sample of hypertensive persons showed a significant frequency in the number of whorls in all ten fingers, plus a decrease in ulnar loops and the ATD angle.

Table 2. Odds ratio according to dermatoglyphic patterns, groups and family history of hypertension.

Whorls on left hand (WLH)				
		No	**Yes**	**P value**
No		3.0	-3.0	
Yes	OR	-3.0	3.0	0.002
Whorls on left hand with history of hypertension (WLHAHT)				
		No	**Yes**	**P value**
No		3.9	-3.9	
Yes	OR	-3.9	3.9	0.000
Designs on little finger with history of hypertension (DLHAHT)				
		No	**Yes**	**P value**
No		2.6	-2.6	
Yes	OR	-2.6	2.6	0.008
Sum of total ridges with history of hypertension (STLHAHT)				
		No	**Yes**	**P value**
No		2.1	-2.1	
Yes	OR	-2.1	2.1	0.032
Sum of ridges on left hand with history of hypertension (SLHAHT)				
		No	**Yes**	**P value**
No		2.1	-2.1	
Yes	OR	-2.1	2.1	0.032

Own work.

It was also possible to identify a larger arch count on the left hand in the group with high blood pressure, similar to the result in a study carried out by Igbigbi *et al.*[23], which assessed 99 persons aged between 25 and 66 years old. The study sample was divided into three groups (27 patients with type 2 diabetes, 21 patients with hypertension and 51 patients with diabetes and hypertension). This study looked for variability in the fingerprint and footprint patterns. The differences in the fingerprint patterns showed that the male diabetic patients did not have arches on their thumb, although hypertensive women did display arches.

In SQTL, the result was slightly higher in the high blood pressure group, as in the study by Tafazoli *et al.*[12], which analysed the dermatoglyphics of the individuals who suffer from arterial hypertension and reported that in comparison with a normotensive group, the number of ridges is greater in the hypertensive population. It should be highlighted that the frequency of whorls and arches in all ten fingers is greater in comparison with a group of normotensive persons. In addition, the research performed by Arista *et al.*[24] concluded that the total ridge count is higher in the hypertensive population compared to normotensive subjects.

In the study by Nodari *et al.*[9], including 268 adults, 134 individuals were diagnosed with hypertension finding a significant difference in all ten fingers. Additionally, it identified that fingerprint patterns such as ulnar loops on the fifth finger of the left hand and the fourth and fifth finger of the right hand are more frequent in individuals who suffer arterial hypertension.

In the same way, it was demonstrated that the fifth finger of the left hand, the fifth finger on the right hand and the fourth finger on the same hand contain an ulnar loop pattern that is more frequent in subjects in the hypertensive group, as opposed to results from this study, where despite having found a lower average of ulnar loops on the right hand and on the left hand, no statistically significant difference was found that would provide an indicator.

The article by Rudragouda *et al.*[25] which collected data from the fingerprints of a control group and a group with hypertension, identified that both the right hand and left hand of the hypertensive group presented more arches than the control group. In addition, the study group demonstrated a greater number of radial loops in both hands than in the control groups. However, more ulnar loops appeared in the control group, both in the left hand and the right hand. These results concur with figures obtained in this research, given that the group of football players with high blood pressure showed a higher arch and ulnar loop count in both hands than the group of normotensive football players.

Finally, the odds ratio was used to identify that there was a relationship with the presence of whorls on the left hand among the individuals with family history of high blood pressure. Likewise, there is a relationship between the total sum of the ridges and the sum of ridges on the left hand with family history of hypertension. These

results are not currently found in research because family history has not been used as an indicator. The odds ratios can be used as a variable of interest for future studies.

Limiting factors, which should be emphasised when developing this research, include a lack of information and research focused on the study of fingerprints, particularly in Colombia. As suggestions for future research, data should be taken from a larger number of participants than in this research project to improve the reliability and validity of results.

Conclusions

It is thereby concluded that dermatoglyphics are a promising way of screening by recognising the risk factor related to the presence of high blood pressure in association with the subjects' family history, given the multifactorial nature of this disease. Dermatoglyphics could thereby be used as an early detection tool due to the characteristic profile presented by persons and athletes around the increase in arterial pressure and the possible development of arterial hypertension.

Conflicts of interest

The authors declare that there is no conflict of interest.

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