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The interest of principal component analysis for anthropological research of digital dermatoglyphs: Case of some Algerian and Mediterranean populations

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Abstract

Principal component analysis (PCA) is a powerful tool for compressing and synthesizing information in the processing of quantitative data from multivariate analysis. It is used in this study to help explore variations in digital dermatoglyphic patterns within some Algerian and Mediterranean populations as part of anthropological research. The PCA carried out in the male sex shows that the first axis, separates the North African populations on the side of the positive abscissa to which are added Andalusia with more whirlpools, and the other populations of the North of the Mediterranean on the side of the negative abscissa with more arcs (and ulnar loops for the female sex). The second axis clearly contrasts the populations of the South of the Mediterranean on the side of the positive ordinates with more vortices, and the populations of the North of the Mediterranean on the side of the negative ordinates with more radial and ulnar loops. The Algerian populations are close to each other and close to Tunisia and Andalusia (and Libya for the female sex). The affinity recorded between these populations can be explained by the cultural, anthropological, geographical mixing that has affected these regions over time.

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دور التحليل بالمكونات الرئيسة في البحث الأنثروبولوجي لبصمات الأصابع: حالة بعض المجتمعات الجزائرية والمتوسطية

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الكلمات المفتاحية

التحليل بالمكونات الرئيسة، مجتمع، بصمات الأصابع، أنثروبولوجيا، الجزائر، البحر المتوسط.

الملخص

يعد تحليل المكونات الرئيسة أداة قوية لضغط وتجميع المعلومات في معالجة البيانات الكمية في التحليل متعدد المتغيرات. يتم استخدامه في هذه الدراسة للمساعدة على استكشاف الاختلافات في أنماط بصمات الأصابع لدى بعض السكان الجزائريين والمتوسطين كجزء من البحوث الأنثروبولوجية. ويظهر من إجراء هذا التحليل في جنس الذكور أن المحور الأول، يفصل بين سكان شمال أفريقيا من جهة الإحداثيات الموجبة الذي تضاف إليه الأندلس ذات الدوامات الأكثر، وسكان شمال البحر الأبيض المتوسط الأخرى من جهة الإحداثيات السالبة المزيد من الأقواس (والحلقات الزندية للجنس الأنثوي). ويفصل المحور الثاني بشكل واضح بين سكان جنوب البحر الأبيض المتوسط من جهة الإحداثيات الموجبة مع عدد أكبر من الدوامات، وسكان شمال البحر الأبيض المتوسط من جهة الإحداثيات السالبة مع المزيد من الحلقات الشعاعية والزندية. سكان الجزائر قريبون من بعضهم البعض وقريبون من تونس والأندلس (وليبيا بالنسبة للجنس الأنثوي). ويمكن تفسير التقارب المسجل بين هؤلاء السكان من خلال الاختلاط الثقافي والأنثروبولوجي والجغرافي الذي أثر على هذه المناطق مع مرور الوقت.

المؤلف المرسل: نجلاء مرتاض

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1- Introduction:

Principal component analysis (PCA) is an extremely powerful tool for collecting and synthesizing information, very useful when there is a large amount of quantitative data to process and interpret.

It is used to reduce the dimensionality of a data set while preserving as much of the information contained in that data as possible. PCA is generally used to process quantitative data, but it can also be applied to qualitative data under certain conditions.

This communication aims to study a principal component analysis (PCA) of the characteristics of digital dermatoglyphs recorded in some Algerian and Mediterranean populations.

The objective of this work is to provide information on the similarities and differences between these populations with regard to the patterns of the cutaneous finger ridges in the cited populations.

2- Digital dermatoglyphics

The hand, as a complex tool and communication tool, has attracted the interest of many researchers and writers throughout the ages and in various disciplines including anthropology, medicine, psychology and even literature (Figure 1).

The term "Dermatoglyph" was coined in 1926 by Harold Cummins, a famous American anatomist and embryologist. It comes from the Greek "derma", which means "skin" and "glyph", which means "engraving" or "imprint"(Cummins & Midlo, 1926). Thus, the term dermatoglyph refers to the particular patterns present on the surface of the skin, such as fingerprints, palm prints and foot prints.

Dermatoglyphs or papillary ridges are longitudinal projections located on the inner surface of the hand at the level of the pulp of the last phalanx (digital ridges), on the palm at the base of the fingers (palmar ridges), and on the plantar surface of the foot. They represent a particularly valuable characteristic for anthropologists: they do not undergo modifications during life and are constant from birth to death.(Chamla, 1971).

The fingerprint is the pattern formed by the ridges of the skin of the fingers. These crests form unique patterns for each individual, making them a widely used biometric tool for identification and authentication. Similar lines are also present on the palms of the hands, toes or soles of the feet. Indeed, the probability that two people have the same fingerprint is very low, even on the scale of the human population. The probability that two individuals have the same fingerprints is estimated at 1/64 billion.

Dermatoglyphs have three characteristics that make them excellent genetic markers. These characteristics are their high heritability, their high degree of individual variation and their unchanging morphology throughout postnatal life.(Adda Neggaz, *2017-1018).The last characteristic is valuable since it demonstrates that they are not subject to the variety of extrinsic factors that can contribute to the expression of numerous morphological traits(King, Mancini-Marie, A, Walker, Meney, & MJ, 2009).*

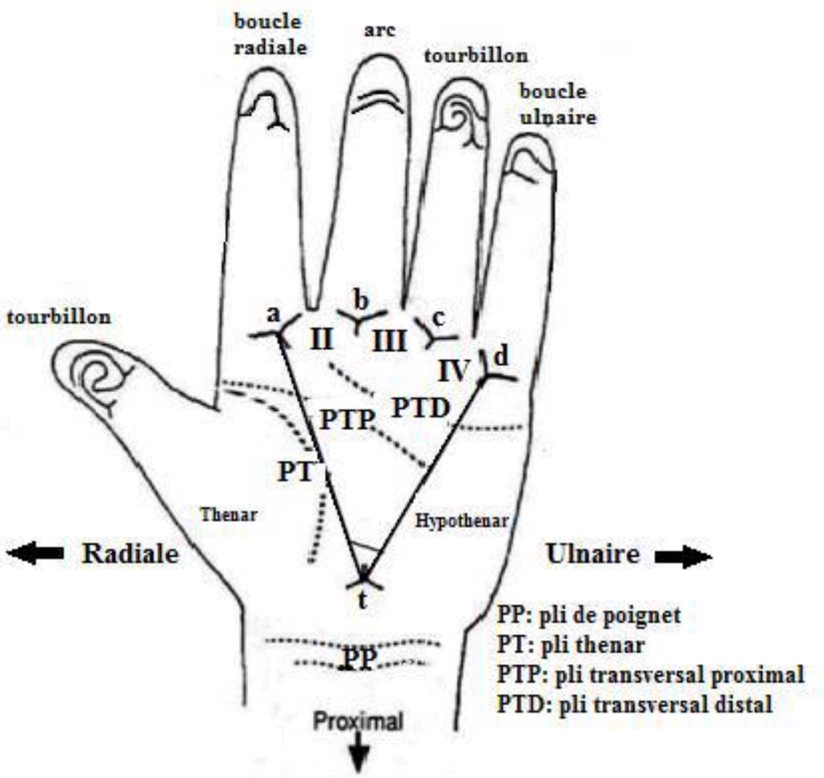


***Figure 1**: Most common patterns in dermatoglyphics of the palm and fingers.*
(Reed & Meier, 1990)

2-1- History of dermatoglyphs

If the handprints left by our Paleolithic ancestors on the walls of caves have not revealed their meaning to us, the thumbprint left in a clay tablet probably served as a signature during commercial transactions in Babylon ago. 5000 years and later in ancient China(Salmo, 2007).

The first attempt to classify fingerprint patterns is found in the work of Joannes Evangelista Purkinje, a Czech physiologist and biologist in 1823. He used a classification of nine patterns(Purkinje, 1823).

In Europe, Marcello Malpighi, an Italian doctor, studied drawings as early as the seventeenth century. However, it was only from 1870 that fingerprints were used to identify people. The classification of the prints was undertaken by an English colonial *doctor, Henry Faulds, stationed in Asia. He published a letter in Nature magazine in 1880 which did much to draw attention to his method.(Faulds, 1880).*

He wrote to Charles Darwin to explain, but the famous naturalist, old and ill, did not want to deal with it and forwarded his mail to his cousin Francis Galton who published a work in 1892; Finger prints, in which he established the uniqueness and permanence of skin figures and proposed a classification system(Cummin & Midlo, 1943)

The second quarter of the twentieth century, the field was dominated by Harold Cummins, professor of Microscopic Anatomy at Tulane University. One day, in 1926, he coined the word "Dermatoglyphs" and used it at the annual meeting of the American Association of Anatomists.(Durham & Plato, 1990).

In 1891, the first fingerprint file was established in Argentina by Juan Vucetich, a police officer who was also the first to identify a criminal by his fingerprints in 1892.

Today, the prints are photographed, digitized and processed by computer. Specific programs compare them, identify similarities and differences in a very short time.

With the development of anthropology, dermatoglyphs soon became of interest to researchers whose major concern was the research and determination of the biological variability of human populations.

2-2- Classification of dermatoglyphs

Dermatoglyphs are classified into three categories: The vault (the arc), the loop and the swirl (the spiral) (SALMO. T., 2007) (Figure 2).

Figure 1: Three characteristic patterns in fingerprints: Arc (vault), loop and swirl (spiral)(Salmo, 2007)

According to(Pichard, Hebrard, & Chillard, 2004), the most classic form is the family of arcs, and the most complex is that of loops (Figure 3).

La forme la plus classique est la famille des arcs.

Une forme plus complexe constitue la famille des boucles qui peuvent partir sur la droite ou sur la gauche.

Figure 3: The main families of dermatoglyphs (Pichard, Hebrard, & Chillard, 2004)

In anthropology, dermatoglyphic traces are generally classified according to the rules proposed by(Galton, 1892)And(Cummin & Midlo, 1943)and by(Penrose, 1968). These are all based on the presence of the triradius, point or three systems of ridges converging in three different directions with angles of approximately 120°.

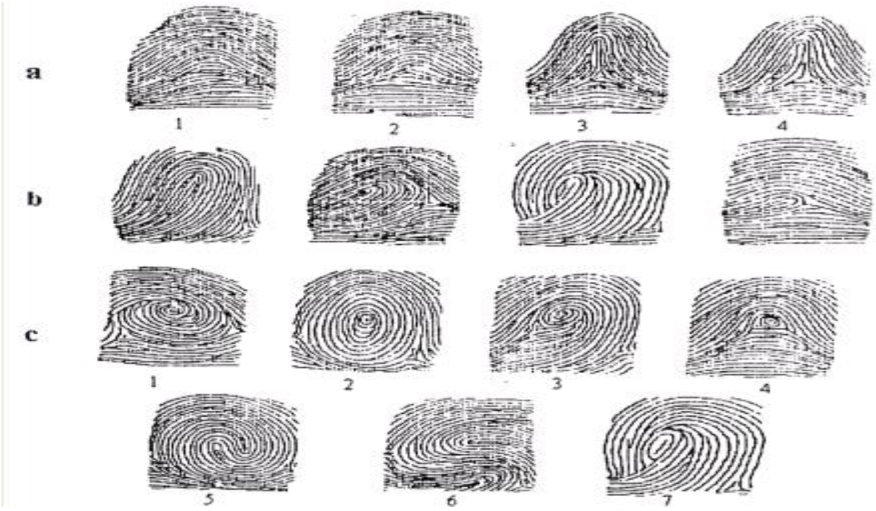
Each individual has its own digital formula composed of the types of ridges of the five fingers. We recognize three basic types (Figure 4).

Arcs, loops and swirls which represent approximately 27 possible variations classified according to the orientation of the figures (symmetrical, radial and ulnar or ulnar) or their complexity (single and two-centered swirl).

The arcs: this is the simplest type of figure, where the dermopapillary ridges are slightly curved or arched, without a triradius. The different models are: Tent arch (At), Arc with a central axis and Flat arc (Ap).

The loops: formed by the ridges whose departure and arrival are on the same side of the phalanx and with a triradius on the side opposite the opening of the loop. If this opening is oriented towards the thumb, the loop is called radial (Br), if on the contrary it is oriented towards the little finger the loop is called ulnar (Bu).

The swirls: these are the most complex figures and are typically associated with two triradii. The ridges in this type of figures curl to give concentric circles or ellipses or spirals. They are symmetrical or asymmetrical and sometimes they have the shape of two intertwined loops (double loops).



a: (1,2) Flat arches and (3, 4) Tent arches. b: Loops.

c: (1,2,3,4) Swirls, (5,6) Double loops.

Figure 4: The main digital figures (Penrose, 1968)

3- Principal component analysis

Factor analysis is an excellent example to illustrate the multivariate study of data. It is an approach which aims to reduce a large amount of information on a given subject to a small number of more easily interpretable elements.(Stafford & Bodson, 2006).

Principal component analysis is usually an exploratory factor analysis; the results of the analysis will be new hypotheses allowing to expand and better understand the problem studied.

Demographic inferences such as migration, geographic isolation and admixture in genetic structure can be made from the study of the PCA figure. Principal component analysis uses as an input file the frequency matrix of digital figures in all populations analyzed(Duby & Robin, 2006).

The appearance in recent years of increasingly efficient and easy-to-use software now makes this type of data analysis accessible to all social science researchers.(Guerrien, 2003).

3-1-The objectives of principal component analysis

Principal components factor analysis has three purposes (Stafford & Bodson, 2006):

1- Study the interrelationships between a fairly large number of variables
2- From this study, group these variables into limited groups called factors or components;
3. Establish a hierarchy between these groups of variables based essentially on the explanatory value of each of them (it should be noted that the method also makes it possible to establish a hierarchy of variables in each of the components).

In short, factor analysis considers four types of relationships:
1- The relationships of the variables to each other;
2- The relationships of variables to factors;
3-The relationships between the variables of the same factor;
4- The relationships between the different factors.

4- Anthropological study of digital dermatoglyphics of some Algerian and Mediterranean populations

Several studies have been carried out on Algerian populations within the anthropological framework; cite the work of(Chamla M., 1961),(Chamla, 1971),(Mortad, 2007-2008)…, and on Mediterranean populations(Falco, 1917),(Naffah, 1974),(FusterM.J, 1985),(Portabales, 1983)…..and several other studies.

4-1- Inter-population comparisons by sex

Comparisons were made by sex with populations from North Africa, the Middle East and the northern Mediterranean (Table 1). In men from Algerian populations, the frequencies of arcs, radial loops and ulnar loops fit into the variation intervals of North Africans and North Mediterraneans, however they are higher than the maximum values of the near orientals for the three types of figures. The frequency of vortices falls within the two variation intervals of North Africa and Europe; however, it is lower than the minimum value recorded in the Middle East.

Among Algerian women, the frequencies of the four types of figures fit into the variation intervals of North Africans and Europeans.

On the other hand, they are higher than the value recorded in the Middle East for ulnar loops, and lower than that found for arches, radial loops and swirls.

Table 1: Variations in the frequencies of digital figures in Algerian and Mediterranean populations

	Algerian populations	North Africa	Middle East	Northern Mediterranean
Men				
Bows	3.2-5.6	2.3 – 8.8	2.9 – 3.8	1.8 – 7.0
Radial oops	2.9-3.5	1.6 – 4.3	2.6 – 3.4	3.5 – 5.9
Ulnar loops	55-56.6	51.8 – 58.0	52.3 – 54.5	52.1 – 65.2
Swirls	34.3-38	31.7 – 42.7	39.1 – 41.4	26.9 – 37.8
Women				
Bows	5.3	2.5 – 7.2	5.9	2.1 – 8.7
Radial oops	2.1	1.2 – 3.4	3.3	2.6 – 4.6
Ulnar loops	58.1	56.3 – 64.8	54.4	55.1 – 65.9
Swirls	34.3	27.7 – 36.0	36.4	21.1 – 38.0

4-2- Interpopulation comparisons of the overall frequencies of digital figures in men from some Algerian and Mediterranean populations

The basic populations cited in this study as well as the frequencies of the four types of digital figures (Arcs: A; Ulnar loops (Bu); Radial loops (Br); Swirls (T) are recorded in (Table 2).

(Table 2) presents the interpopulation comparisons of the four types of digital figures in men from Algerian populations with those recorded in other populations.

The comparison of the distributions of digital figures between the Algerian and Mediterranean populations carried out by the X2 test using the SPSS V22 software (Statistical Package for Social Sciences).

On the scale of North Africa, the Algerian populations represent non-significant differences (%DNS) with all populations (%DNS) = 87.5%. The %DNS is 100% compared to the Algerian populations.

Concerning the Middle East and the northern shore of the Mediterranean, the Algerian populations do not represent insignificant differences with all populations.

Table 2: Interpopulation comparisons of the overall frequencies of digital figures in men from some Algerian and Mediterranean populations

Population	NOT	%HAS	%B. r	% Drank	%T	X2	References
				North Africa			
Algeria							
Far West Algeria (Msirda)	149	5.6	3.5	56.6	34.3	……	(Mortad, 2007-2008)
Kabyles	1408	4.2	3.0	56.1	36.7	1.56 (NS)	(Chamla M., 1961)
Total Algeria	2336	3.9	3.0	56.3	36.8	2.41 (NS)	(Chamla M., 1961)
Algeria nomads	114	4.3	3.0	56.6	36.1	0.47 (NS)	(Chamla M., 1961)
Algeria Orientals	310	3.6	2.9	55.5	38.0	2.39 (NS)	(Chamla M., 1961)
Algeria hundred. West	340	3.2	3.5	55.0	38.0	3.29((NS)	(Chamla M., 1961)
LibyaBerbers	250	3.3	4.3	52.5	39.9	3.98((NS)	(Falco, 1917)
Libyaarabs	250	3.8	3.3	54.4	38.5	1.69((NS)	(Falco, 1917)
Tunisia (Tunis)	1852	4.6	2.7	54.6	38.1	1.39((NS)	Chamla, 1973 1
Middle East							
Syria (Bedwouin Rwala)	231	3.8	2.6	54.5	39.1	1.80(NS)	Shanklin et al., 1937 1
Lebanon	240	2.9	3.4	52.3	41.4	4.25(NS)	(Naffah, 1974)
Northern Mediterranean							
Spain							
Galicia	100	3.3	5.2	75.5	34.0	2.02(NS)	Oyhenart, 1983 1
Delta Ebre	141	4.1	5.4	60.4	30.1	2.22(NS)	Esteban and Moral, 1992 1
Sierra de Gredos	108	4.2	3.5	58.7	33.6	0.72(NS)	(Fuster & Cabello, 1985)
La Alcarria	339	5.1	4.8	60.6	29.5	1.72(NS)	(Portabales, 1983)
Murcia	163	5.2	4.6	60.5	29.7	1.03(NS)	Esteban and Moral, 1993 1
Valencia	200	5.3	4.5	60.1	30.1	0.93(NS)	Sala, 19911
Asturias	262	5.4	4.7	59.3	30.6	1.16(NS)	Egocheaga, 1973 1
Pays Basque	841	7.0	4.5	58.5	30.0	1.62(NS)	Arrieta, 19851
Catalonia	100	4.9	5.9	61.1	28.1	2.38(NS)	(Pons, 1952)
Andalusia	911	4.8	3.8	56.2	35.2	0.59(NS)	(Oyhenart, 1985)
Balearic Islands	102	5.5	3.8	56.8	33.9	0.13(NS)	(Moreno & Pons, 1985)
Portugal	100	3.6	4.3	65.2	26.9	2.98(NS)	Cunha and Abreu, 1954 1
France	184	3.9	5.3	57.0	33.8	2.86(NS)	Gassain and Gessain, 1956 1
Italy Bologna	211	3.9	4.5	59.6	32.0	2.23(NS)	Gualdi-Russo et al., 1982 1
Italy Sardinia	195	3.2	3.8	61.0	32.0	3.41(NS)	(Bozicevic, Milicic, N'dhlowu, Pavicic, Rudan, & Vassalo, 1993)
Malta	164	3.4	4.1	59.1	33.4	2.24(NS)	(Bozicevic, Milicic, N'dhlowu, Pavicic, Rudan, & Vassalo, 1993)
Greece	177	6.1	4.1	52.1	37.7	1.06(NS)	(Bozicevic, Milicic, N'dhlowu, Pavicic, Rudan, & Vassalo, 1993)
Cyprus	79	1.8	4.2	52.2	37.8	4.16(NS)	Plato, 1970 1

NS : $p \geq 0.05$; *: $0.01 \leq p \leq 0.05$; **: $0.001 \leq p \leq 0.01$; ***: $p \leq 0.001$

[1]: cited by(Harich, Esteban, Chafik, Lopez-Alomar, Vona, & Moral, 2002)

4-3- Interpopulation comparisons of the overall frequencies of digital figures among women from some Algerian and Mediterranean populations

The basic populations cited in this study as well as the frequencies of the four types of digital figures (Arcs: A; Ulnar loops (Bu); Radial loops (Br); Swirls (T) are recorded in (Table 3).

Table 3 presents the results of the comparison of the distributions of digital figures between the Algerian and Mediterranean populations carried out by the X2 test using the SPSS V22 software (Statistical Package for Social Sciences).

Among Algerian women (population of Msirda) (Table 3) comparisons of the frequencies of digital figures revealed no non-significant difference with all populations from the three continents. These figures may be due to the high frequencies of arches, ulnar loops and swirls in Algerian populations.

Table 3: Interpopulation comparisons of overall frequencies of digital figures among women from some Algerian and Mediterranean populations

Population	*NO T*	*%HA S*	*%B. r*	*% Drank*	*%T*	*X2*	*References*
North Africa							
Far West Algeria (Msirda)	101	5.3	2.1	58.1	34.3	….	(Mortad, 2007-2008)
Tunisia (Tunis)	241	5.1	2.6	56.3	36.0	0.57(NS)	Chamla, 19731
Libya (Berbers)	107	5.8	2.4	58.2	33.6	2.95(NS)	(Pons, 1952)
Middle East							
Lebanon	240	5.9	3.3	54.4	36.4	1.24(NS)	(Naffah, 1974)
Northern Mediterranean							
Spain							
Balearic Islands (Menorca)	80	5.6	4.6	59.4	30.4	1.72(NS)	(Moreno & Pons, 1985)
Andalusia	887	6.8	3.1	59.9	30.2	1.39(NS)	(Oyhenart, 1985)
Sierra de Gredos	107	6.7	3.7	55.3	34.3	1.46(NS)	(Fuster & Cabello, 1985)
La Alcarria (center)	314	8.3	3.5	64.1	24.1	3.70(NS)	(Portabales, 1983)
Catalonia	100	7.7	4.6	61.1	26.6	2.78(NS)	(Pons, 1952)
Pays Basque	911	7.9	3.8	59.4	28.9	3.14(NS)	Arrieta, 1985 1
Asturias	250	7.8	3.2	61.8	27.2	2.22(NS)	Egocheaga, 1973 1
Galicia	100	8.0	4.4	65.1	22.5	3.76(NS)	Oyhenart, 1983 1
Seville	100	6.1	3.7	61.9	28.3	1.18(NS)	(Oyhenart, 1985)
Valencia	200	7.0	4.5	61.9	26.6	3.20(NS)	Sala, 19911
Murcia	184	8.7	4.3	65.9	21.1	5.26(NS)	Esteban and Moral, 1993 1
Portugal	500	8.6	3.8	63.2	24.4	4.41(NS)	Cunha and Abreu, 1954 1
France	163	6.9	3.8	61.6	27.7	1.81(NS)	Gassain and Gessain, 1956 1
Italy Bologna	91	6.5	2.6	60.1	30.8	0.51(NS)	Floris and Sanna, 1986 1
Italy Sardinia	209	7.0	2.7	59.8	30.5	0.79(NS)	Gualdi-Russo et al., 1982 1
Malta	115	5.2	2.9	62.5	29.4	0.87(NS)	(Bozicevic, Milicic, N'dhlowu, Pavicic, Rudan, & Vassalo, 1993)
Greece	155	5.6	2.9	55.1	36.4	0.57(NS)	Roberts et al., 19651
Cyprus	41	2.1	2.9	57.0	38.0	1.21(NS)	Plato, 19701

NS: $p \geq 0.05$; *: $0.01 \leq p \leq 0.05$; **: $0.001 \leq p \leq 0.01$; ***: $p \leq 0.001$

[1] Quoted by(Harich, Esteban, Chafik, Lopez-Alomar, Vona, & Moral, 2002).

4-4-Principal component analysis

In order to situate the Algerian populations in relation to the Mediterranean populations, the frequencies of the different recorded digital figures were processed by the ACP using the SPSS software. V22(Statistical Package for Social Sciences).

4-4-1- ACP in men

Principal component analysis was carried out to situate the Algerian populations in the North African and Mediterranean region based on the frequencies of the digital dermatoglyphs studied.

The PCA representation (Figure 5) shows that the first two axes contribute 85.2% to the total variation.

The first principal component has a variance (eigenvalue) of 2.3069 and represents 57.7% of the total variance. According to this first axis

The second principal component has a variance of 1.0987 and represents 27.5% of the data variability.

The first axis separates the North African populations on the side of the positive abscissa to which are added Andalusia with more Whirlwinds, and the other populations of the North of the Mediterranean on the side of the negative abscissa with more Arcs.

The second axis clearly contrasts the populations of the South of the Mediterranean on the side of the positive ordinates with Cyprus with more Swirls, and the populations of the North of the Mediterranean on the side of the negative ordinates with more Radial and Ulnar Loops.

The Algerian populations (the Msirda (located on the x-axis), the Nomads and the Algerian Kabyles) are close to each other, and close to Tunisia and Andalusia.

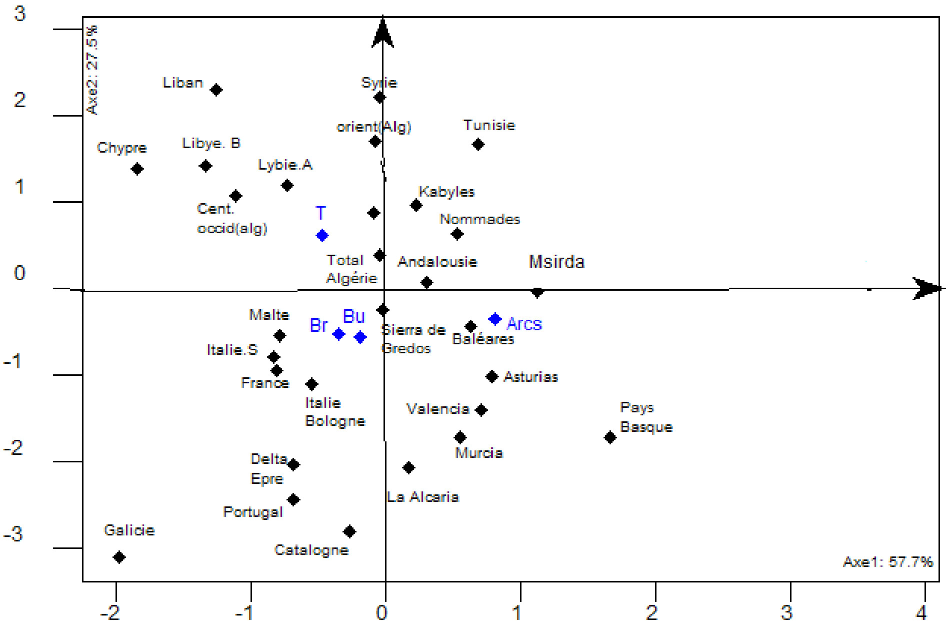


Figure 5: Principal Component Analysis carried out from the frequencies of digital figures across the Mediterranean among men

4-4-2-ACP in women

(Figure 6) represents the factorial plan generated by the first two axes of the principal component analysis calculated from the frequencies of digital dermatoglyphs of the populations differentiating women from Algerian populations (Msirda) from other female populations. The first two axes have a contribution of 88.6% to the total variability.

The first principal component has a variance (eigenvalue) of 2.8570 and represents 71.4% of the total variance. The second principal component has a variance of 0.6860 and represents 17.2% of the data variability.

The first axis shows a separation between the North African populations on the side of the positive abscissa with more vortices, and the majority of the populations on the North shore with more ulnar loops. The second axis reveals a difference between the majority of the populations of North Africa on the positive ordinate side and the three populations: Greece, Cyprus and Sierra De Gredos to which are added the populations of Tunisia and Libya on the side of the negative ordinate axes. The Algerian population is close to Libya on the positive abscissa and ordinate side.

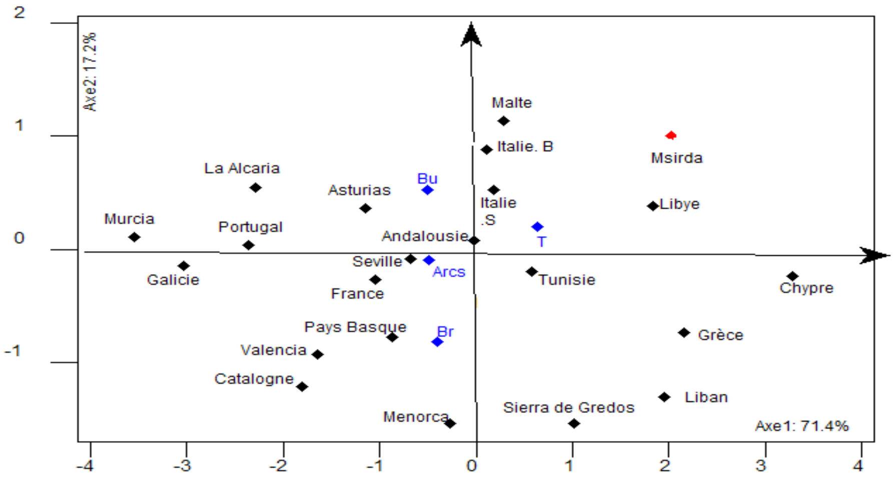


Figure 6: Principal Component Analysis carried out from the frequencies of digital figures across the Mediterranean among women

5- Discussion

The frequency distribution of digital figures of Algerian populations falls within the range of variation of Mediterranean populations.

The review of Algerian and Mediterranean populations shows the dominance of ulnar loops, followed by swirls, arcs and radial loops.

Comparison of the frequency distribution of the four types of digital figures shows that the Algerian populations are similar to the North African populations in the reduced frequency of the radial loops.

The high frequencies of ulnar loops and low frequencies of eddies also bring them closer to populations in the northern Mediterranean.

Interpopulation comparisons of the frequency distribution of digital figures indicate non-significant differences in men with all the Algerian populations cited.

Among women, the recorded frequencies of the digital figures obtained show great homogeneity following the % DNS carried out on a Mediterranean scale.

The extension of data from the literature shows that a population considered white can present the same frequencies of configurations of digital figures as a yellow or black population and vice versa.(Pereira da Silva, 1971).

(Chamla M., 1961)also reports that European populations show a similar phenomenon: the frequencies of the configurations are distributed from one region to another neighboring one as by waves of growth or decay, that is to say that the eddies increase their frequencies in going from North to South and from West to East, while in Asia and Africa we observe an opposite phenomenon.

The principal component analysis carried out in both sexes shows, according to the first axis, strong genetic affinities between the Algerian populations and the North African populations in general.

According to the second axis, the Algerian populations are close to the North African populations and certain populations of the North shore.

These exceptions shown by the principal component analysis may be due to the large North-South and East-West migratory flows that have existed throughout history.(Arnai-Villena, Martinez-Laso, & Alonso-Garcia, 1999)report that Berber peoples were forced to emigrate around 6,000 BC, when the hyper-arid conditions of the Sahara became established. They headed towards the Canary Islands, towards the Middle East, towards the Iberian Peninsula and towards the Mediterranean islands.

Populations from North Africa may also have populated certain regions of Southern Europe and crossed the Strait of Gibraltar at a time when it was not yet underwater.(Chaabani & Cox, 1988). Indeed, since protohistory, the Mediterranean rim has experienced an uninterrupted movement of men and ideas mixing its peoples and cultures.(Sabir, Cherkaoui, Baali, Hachri, Lemaire, & Dugougon, 2004).

The Algerian populations are mainly linked to the Berber and Arab ethnic groups, despite the multiple invasions experienced in the past in North Africa: by the Phoenicians, the Romans, the Vandals, the Arabs, the Turks and the French.(Aireche & Benabadji, 1994).

6- Conclusion

The principal component analysis for anthropological research of the digital dermatoglyphs of the Algerian and Mediterranean populations cited in this study reveals a certain affinity between these populations. But the latter only reflects a small part of the diversity or similarity between human populations. This can also be explained by the conjunction of several other factors such as geographic, genetic, orographic, historical constraints or even cultural heterogeneity.

The use of this multivariate statistical method in this study reveals the originality of the Algerian populations which, despite their apparent geographical unity, are linked to other Mediterranean populations carrying historical and cultural or other factors anchored in the region.

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