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## Qualitative Dermatoglyphics and Population Relationships in Spanish Pyrenees

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**Resumo.** Analisam-se as relações existentes em termos de dermatoglifos digitais, entre várias populações actuais do sul dos Pirinéus através da análise da distância. Este estudo foi feito separadamente para cada sexo. As classificações populacionais obtidas para ambos os sexos são bastante diferentes. O padrão de 'cluster' da amostra masculina não se ajusta a qualquer padrão geográfico.

**Palavras chave:** População dos Pirinéus; Dermatoglifos; Tipos de padrões digitais; Distâncias genéticas.

**Abstract.** Digital dermatoglyphic (pattern types) relationships among several populations living on the southern side of Pyrenees have been investigated by means of distance analysis. The study has been carried out separately for each sex. The population classifications obtained are strikingly different between the two sexes. The clustering of male samples does not fit any geographical pattern.

**Key Words:** Pyrenean populations; Dermatoglyphics; Digital pattern types; Genetic distances.

### Introduction

Dermatoglyphics has been applied in physical anthropology to understanding the biological structure of human populations. The distribution of these characteristics has been analyzed in large groups of world populations and this information can be important in population studies, even though dermatoglyphics often fails to shed much light on the nature of interpopulation relationships. Numerous examples in the

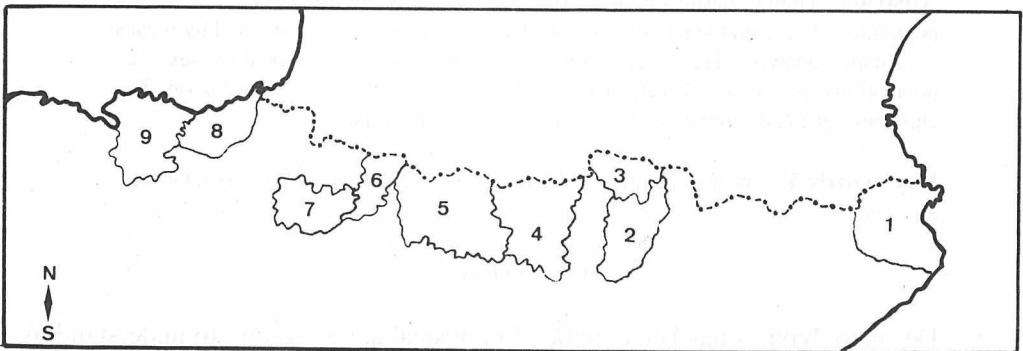
literature show a considerable methodological variation among studies (Jantz and Chopra, 1983; Meier, 1980).

In the Iberian peninsula, several investigations have been carried out on the whole of the Spanish population using multivariate methodologies (Martin, 1982; Martin and Portabales, 1983; Arrieta, 1985). However, until recently, no more detailed studies have been possible because of the scanty information available on particular regions with interesting geographical and biosocial features, as the populations living on the southern side of the Pyrenees. The investigations undertaken lately in various Pyrenean zones (Pons, *et al.*, 1986; Arrieta, *et al.*, 1986; Pons; Moreno, 1988; Fañanás; Palau, 1991) have added to our knowledge of dermatoglyphic characteristics in these populations.

In this context, the aim of the present paper is to analyze the dermatoglyphic differentiation inside the Pyrenees and to the population relationships among several communities in the southern watershed of the Pyrenees mountain. For this purpose we examine the genetic distances through a dendrogram starting from the frequencies of dermatoglyphic digital patterns. Since these traits show sexual variation, the analysis is performed for the two sexes separately.

#### Material and Methods

Data on digital patterns classified in four categories (arches, radial loops, ulnar loops and whorls) according to Cummins and Midlo (1961), were collected from nine autochthonous population samples scattered all along the southern side of Pyrenees (Fig. 1). The populations are well defined cultural (differences of language e.g. Basque, Catalan, Spanish) or geographical (location in the mountain range along the Spanish Pyrenees).



**Fig. 1.** Location of population samples: 1. Gérons; 2. Pallars Sobirà; 3. Aran Valley; 4. Sobrarbe; 5. Jactania; 6. Roncal Valley; 7. Navarra; 8. Basques Guipuzcoa; 9. Basques Biscay.

From East to West the populations chosen are:

Three samples in the Catalan-speaking zone: Gerona, the easternmost sample, which includes individuals originating in the area round the city of Gerona, and the natural regions of Pallars Sobirà and Aran Valleys.

From the central Pyrenees four samples are available, two Spanish-speaking in the Aragonese Pyrenees (Sobrarbe and Jacetania) and two others at the center-west (Navarra, sampled in Pamplona city, and the natural region of Roncal Valley) culturally related to Basque populations.

Finally, two Basque samples from the provinces of Guipuzcoa and Biscaya.

The sample sizes and bibliographic sources of the data are specified in table

1.

Table 1. Population samples used in the analysis.

Populations	N(males)	N(Females)	References
1. Gerona	152	—	Cornellà; Bertranpetit, 1985
2. Pallars Sobirà	78	92	Pons et al., 1986
3. Aran Valley	103	—	Pons, 1962
4. Sobrarbe	73	86	Pons; Moreno, 1988
5. Jacetania	138	122	Fañanás; Palau, 1988
6. Roncal Valley	57	61	Arrieta, et al., 1986
7. Navarra	469	472	Argemi, et al., 1973
8. Basques Guipuzcoa	582	315	Arriandiaga; Lostao, 1980
9. Basques Biscay	841	911	Arrieta, 1985

In order to study the differentiation of populations, genetic distances between groups were calculated using the squared Euclidean and the cosine coefficients (SPSS program), the results are highly correlated. In view of this general concordance, only the Euclidean distances are considered further in this analysis. This simple distance measure is defined as the sum of the squared differences over all of the variables. As these distances depend on the units of measurement and on different scales for the variables, we have calculated those differences based on the standardized variables. The information of the distance matrix were displayed in a dendrogram produced by the average linkage method of hierarchical cluster analysis.

### Results and Discussion

The distance values from finger qualitative dermatoglyphic frequencies by males and females are reported in tables 2 and 3, respectively. The corresponding dendrograms are represented in fig. 2 and 3. The heterogeneity observed between sexes suggests separate considerations.

*Differentiation Among the Male Samples*

The inspection of table 1 shows a remarkable heterogeneity, the distance values ranging from 0.150 between Gerona and Basques of Guipuzcoa to 28.624 between Roncal and Pallars Sobirà valleys.

Table 2. Distances among the male Pyrenean samples.

	1	2	3	4	5	6	7	8	9
1. Gerona	—								
2. Pallars	6.406	—							
3. V. Arán	10.562	22.539	—						
4. Sobrarbe	0.534	9.666	10.848	—					
5. Jacetania	9.249	16.044	14.368	12.697	—				
6. V. Roncal	9.335	28.624	11.974	8.787	7.933	—			
7. Navarra	1.698	9.504	5.733	3.006	4.410	6.163	—		
8. V. Goyerrí	0.150	7.937	11.572	0.428	9.063	7.880	1.960	—	
9. Vascos	2.373	6.396	6.549	4.559	4.799	10.469	0.619	3.162	—

It is noteworthy that the lowest distances appear in the comparisons among three samples located at the two extremes (Gerona and Basques of Guipuzcoa) and at the central region (Sobrarbe) of Pyrenees, showing a dermatoglyphic differentiation pattern not correlated with geographic distances, unlike other genetic markers (Moral, 1988; Bertranpetit; Moral, 1990). In relation to groups living at the two ends of the mountain chain, the resemblance is higher among the three western populations than among the eastern samples.

The distance relations are represented on the dendrogram of figure 2. This representation exhibits the striking concordance among the three western samples (Basques and Navarra), grouping together the Gerona and Sobrarbe populations. The remaining samples cluster successively, the group of the Aran Valley the last population to merge, and so the most differentiated among the ensemble.

*Differentiation Among the Female Populations*

Although distances are not as heterogenous as among the male groups, the values obtained also show a considerable range of variation from 1.051 between Navarra and the Roncal valley to 18.397 between Basques of Guipuzcoa and Pallars Sobirà. Between both Basque female populations the distance is twice as big as between males samples (6.026 vs 3.162).

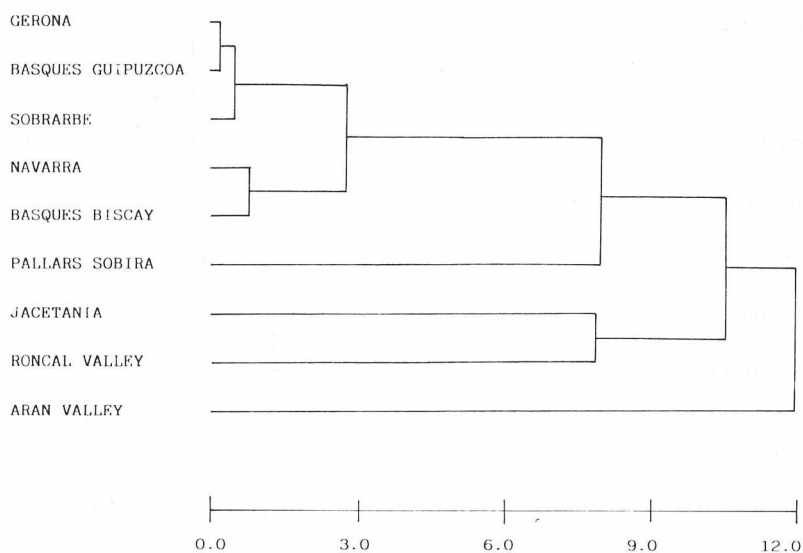


Fig. 2. Dendrogram showing the relations among the male Pyrenean samples.

Table 3. Distances among females Pyrenean samples.

	1	2	3	4	5	6	7
1. Pallars	—						
2. Sobrarbe	11.379	—					
3. Jacetania	8.317	2.282	—				
4. V. Roncal	3.132	2.913	3.504	—			
5. Navarra	6.732	2.231	5.682	1.051	—		
6. V. Goyeri	18.397	4.593	6.403	9.879	7.835	—	
7. Vascos	16.032	13.207	16.059	12.599	9.746	6.026	—

The dendrogram of figure 3 shows three main groups separated in the geographical sense. The greatest resemblance appears among the four central populations clustering in an highly homogenous group. Clearly differentiated, the oriental sample of the Pallars Sobirà valley seems to group with those populations. Finally, there is great similarity between the two Basque samples, which constitute the last group to merge, and so the most differentiated in the whole of the populations considered.

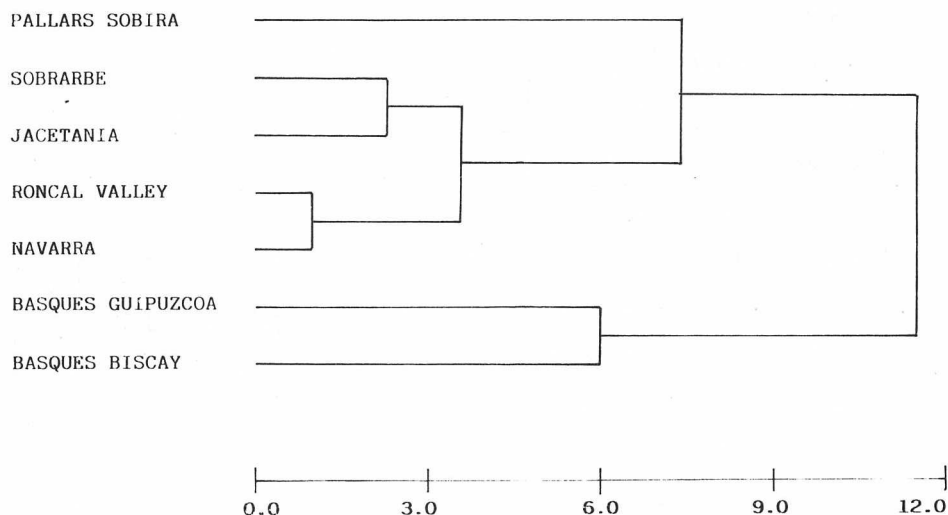


Fig. 3. Dendrogram showing the relations among the female Pyrenean samples.

Although our analyses have only a provisional value because they only consider four dermatoglyphic variables, stress should be laid on the differences in the population relationships between both sexes. So while female sample classification agrees with a differentiation in the Pyrenean populations mostly dependent on geographical distance and supported on other genetic markers (Vergnes, *et al.*, 1980; Moral, 1988; Bertranpetit; Moral, 1990), the clustering of male populations does not fit any recognizable geographical pattern.

The same findings have reported by other authors (Martin; Portabales, 1983) and could reflect either the typical sexual differentiation of the dermatoglyphic traits or the fact that the pattern and extent of sexual variation are different for each population.

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