ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/225359123

A study of sutural bones in Anatolian-Ottoman skulls

Article *in* International Journal of Anthropology · April 1997

DOI: 10.1007/BF02447895

CITATIONS
29

READS
239

5 authors, including:



Ayla SEVİM EROL
Ankara University Faculty of Humanities
120 PUBLICATIONS **468** CITATIONS
SEE PROFILE



Esat Adiguzel
Pamukkale University
53 PUBLICATIONS **616** CITATIONS
SEE PROFILE



Erksin SAVAS Güleç
University of Arizona
46 PUBLICATIONS **1,564** CITATIONS
SEE PROFILE

All content following this page was uploaded by Ayla SEVİM EROL on 16 June 2015.

The user has requested enhancement of the downloaded file.

INTERNATIONAL JOURNAL
OF ANTHROPOLOGY

Vol. 12 - N. 2 - 1997

M.Rubini, M. Licitra, M.Baleani — A study of cremated human remains from an urn field dating to the final phase of the Bronze Age, found at "Le Caprine" (Guidonia, Rome, Italy 10th-9th century B.C.) 1 - 9

E. Gualdi Russo, P. Brasili Gualandi, M.G. Belcastro — Body composition assessment of young tennis players by multi-frequency impedance measurement 11 - 20

H. Kaarma, U. Salundi, S. Koskel —Body build structure of neonates 21 - 28

M. Tommaseo Ponzetta, G. Hauser, A. Vienna — Auditory hyperostosis and the environment: an update 29 - 42

E. Gümüsburun, A. Sevim, U. Katkici, E. Adigüzel, E. Güleç A study of sutural bones in Anatolian-Ottoman Skulls 43 - 48

L. Fañanás, J. Sala, S. Vives, P. Moral — Pairwise associations between classical polymorphism in a human population from the Central Pyrenees 49 - 54

J. Pinto-Cisternas, H. Arvelo, R. Martínez, D. Castro de Guerra Coeficient of relationship (RI) within and between four black venezuelan populations 55 - 62

K. Bose, C.G.N. Mascie-Taylor — Ethnic differences in regional adiposity between adult caucasian and migrant pakistani males which are unexplained by some common indicators of lifestyles 63 - 72

INTERNATIONAL JOURNAL OF ANTHROPOLOGY - Vol. 12 - N. 2 - 1997

INTERNATIONAL JOURNAL OF ANTHROPOLOGY

VOLUME 12 APRIL - JUNE 1997 - N. 2



ANGELO PONTECORBOLI EDITORE
FIRENZE

Pöch R., 1905b. *Zweiter Bericht von meiner Reise nach Neu-Guinea über die Zeit vom 26. März 1905 bis zum 21. Juni (Bismarck-Archipel, 20 März bis 14 Juni 1905)*. Sitzungsber. d. kaiserl.Akad.d. Wiss. in Wien. Mathem.-naturw. Klasse, Bd. CXIV, Abt.I, Oktober 1905: 1-10.
Pöch R., 1906a. *Dritter Bericht über meine Reise nach Neu-Guinea*. Sitzungsber. d. kaiserl.Akad.d. Wiss. in Wien. Mathem.-naturw. Klasse, Bd. CXV, Abt.I, Mai 1906: 1-15.
Pöch R., 1906b. *Vierter Bericht über meine Reise nach Neu-Guinea (Niederländisch-Neuguinea), über die Zeit vom 10. Februar bis zum 31. März 1906*. Sitzungsber. d.kaiserl.Akad.d. Wiss. in Wien. Mathem.-naturw. Klasse, Bd. CXV, Abt.I, Juni 1906: 1-9.
Pöch R., 1907a. *Reisen in Neu-Guinea in den Jahren 1904-1906*. Zeitschr. für Ethnol., XXXIX : 382-400.
Pöch R., 1907b. *Einige bemerkenswerte Ethnologika aus Neu-Guinea*. Mitt. d. Anthrop.Ges.in Wien, XXXVII: 5-71.
Pöch R., 1908. *Berichte über meine Reisen nach Südafrika 1907-1909*. Akad.Anz.d.kaiserl.Akad.d.Wiss.in Wien. VI: 1-7; IX: 1-3; XIV: 1-3; XVI: 1-7; XX: 1-4; XXVI: 1-6.
Pöch R., 1909. *Berichte über meine Reisen nach Südafrika 1907-1909*. Akad.Anz.d.kaiserl.Akad.d.Wiss.in Wien. IV: 1-4; V und VI: 1-9; VIII: 1-2; XI: 1-8; XV: 1-5; XX: 1-3; XXI: 1-5; XXVI: 1; XXVII: 1-2.
Politzer A., 1893. *Lehrbuch der Ohrenkrankheiten*. 3rd ed., Stuttgart.
Rightmire G.P., 1972. *Cranial measurements and discrete traits compared in distance studies of African Negroes skulls*. Hum.Biol., 44: 263-276.
Risdon D.L., 1939. *A study of the cranial and other human remains from Palestine excavated at Tell Duweir (Lachish) by the Wellcome-Marston archeological research expedition*. Biometrika, 31: 99-166.
Roche A.F., 1964. *Aural exostoses in Australian aboriginal skulls*. Ann.Otol.Rhinol.Laryng., 73: 1-10; 82-91.
Seligmann F., 1864 . *Über Exostosen an Peruanerschädeln*. Arch.Anthrop.Wiss. Med.1864: 147-148.
Sheehy J.L., 1958. *Osteoma of the external auditory canal*. Laryngoscope, 68: 1667-1673.
Snow C.E., 1948. *Indian Knoll skeletons of Site Oh 2, Ohio County, Kentucky*. Lexington: University of Kentucky Press.
Snow C.E., 1972. *Early Hawaiians. An initial study of skeletal remains from Mokapu, Oahu*. Lexington: University of Kentucky Press.
Ten Kate H., 1896. *Sur quelques points d'osteologie ethnique imparfaitement connus*. Rev.Mus La Plata, 7: 264-265.
Tommaseo M. & Barion U., 1993. *Esostosi del canale acustico esterno negli Asmat della Nuova Guinea*. Quaderni di Anatomia Pratica, XLIX, 1-4: 61-71.
Tommaseo M., Hauser G., Vienna A., Konrad G. & U., 1995. *Fattori biologici e culturali nello studio di crani Asmat (Nuova Guinea indonesiana)*. Museologia scientifica. Supplemento anno 1995 (in pubblicazione).
Ubelaker D.H., 1981. *The Ayalan cemetery: A late integration period burial site on the south coast of Ecuador*. Smithson.Contr.Anthropol. No. 29.
Van Arsdale P., 1978 (First Publ. 1975). *Perspectives on development in Asmat*. An Asmat Sketch Book n. 5, 2 vols.. Agats, Irian Jaya: Asmat Museum.
Van den Broek A.J.P.,1943-1945. *Untersuchungen an Schädeln aus Niederländisch Sud/West Neu Guinea*. Leiden.
Vecchi F., 1968. *Sesso e variazioni di caratteri discontinui del cranio*. Riv. Antrop., 55: 283-290.
Wood-Jones F., 1933. *The non-metrical morphological characters of the skull as criteria for racial diagnosis. IV. The non-metrical morphological characters of the North Chinese Skull*. J.Anat., 68: 96-108.
Wunderly J. & Wood Jones F., 1935. *Non metric morphological characters of the Tasmanian skull*. J.Anat., 68: 96-108.
Wyman J., 1874. *Report on a Collection of Peruvian Crania*. 7th Annual Report Peabody Museum, pp. 1-37.
Zivanovic S., 1979. *Anthropological finds from the Serbian necropolis at Trujane*. Sbornik IX-X Narodnog Muzeja: 163-175.

Received November 10, 1995 *Accepted April 20, 1996*

E. Gümüsburun[1]
A. Sevim[2]
U. Katkici[3]
E. Adigüzel[1]
E. Güleç[2]

[1] *Department of Anatomy, Faculty of Medicine, Cumhuriyet University , 58140 Sivas, Türkiye*
[2] *Department of Paleoantropology, Faculty of Language-History-Geography, Ankara University, Ankara, Türkiye*
[3] *Department of Forensic Medicine, Faculty of Medicine, Adnan Menderes University, Aydin, Türkiye*

A study of sutural bones in Anatolian-Ottoman Skulls*

In this study, a total of 302 adult Anatolian-Ottoman skulls were classified into three morphological forms (dolichocephalic, mesocephalic, brachycephalic), and were examined in order to find the incidence of sutural bones in each forms. In addition, the cranial capacity was measured in the skulls with and without sutural bones. Comparison of the incidence of sutural bones in each form of the skulls, and cranial capacity in skulls with and without sutural bones showed no significant difference. In most populations, the average measure of difference between Anatolian-Ottoman and the others was statistically significant. In conclusion, the incidence of sutural bones is well suited for comperative studies as an anthropological marker or an indicator of population distance.

Introduction

Sutural (Wormian) bones are small, irregularly shaped ossicles, which are found in the cranial sutures and at the fonticulus. Generally when there are sutural bones present there are only two or three, but they may also be present in greater number in skulls of hydrocephalics (Warwick & William, 1989). The mechanism of formation of sutural bones is not been entirely known. Some authors claim that the bones are developed from external influences (Hess,1946; Bennett,1965; Finkel,1971), and the others believed that sutural bones derive from normal developmental processes and are genetically determined (Murphy,1956; El-Najjar & Dawson 1977; Pal & Routal 1986; Pal et al. 1986).

In this study, the incidence of sutural bones in three different morphologic forms (dolichocephalic, mesocephalic, brachycephalic) were determined, and compared to other populations. Additionally, cranial capacity of skulls was measured with and without sutural bones, in order to estimate the role of external factors.

Material and Method

302 adult skulls (192 male, 110 female) belonging to the period of Anatolian-Ottoman period (A.D. 18th century) were examined in the Department of Paleoanhtropology, Faculty of Language-History-Geography, Ankara University, Ankara. The cephalic index of each

*This study was presented in the 3rd National Anatomy Congress (6-9 Sept 1995) Izmir, Türkiye.

skulls was calculated using this formula; k=Breadth * 100 / Length. According to the k value, the cephalic index were classified as follows: 1) Brachycephalic; k>80. 2)Mesocephalic; 75 < k > 80. 3) Dolichocephalic; k < 75. Cranial capacity was measured using the following formulas (Olivier, 1969).

$524.6cm^3+266*10^{-6}$(length*breadth*basio-bregmatic height) for male

$812.0cm^3+156*10^{-6}$(length*breadth*basio-bregmatic height) for female

Comparison of the incidence of sutural bones in Anatolian-Ottoman crania with other populations was calculated using the multivariate distance statistic method developed by C.A.B. Smith and used by Berry & Berry (1967).

A measure of difference, X, between two population, 1 and 2, with incidences for a single variant of p_1 and p_2 respectively, is given by: $X= (\theta_1 - \theta_2)^2 - (1/ N_1 + 1/N_2)$ where q_1 and θ_2 are the angular values corresponding to p_1 and p_2 measured in radians, N_1 and N_2 are the sample size of the two populations. The value of θ is obtained from $\theta= Sin^{-1}(1-2p)$. In case where several characters, n, are classified, a mean measure of difference between two populations is used, $(\Sigma x/n)$. The variance of a mean measure of difference is given by the formula: $(1/N_1 + 1/N_2)\ \Sigma(\theta_1-\theta_2) - (1/N_1 + 1/N_2)/n$. Using this variance (V), 4the significance of divergence can be calculated. X is significant at p=0.05 when greater than 3V, at p=0.01 when greater than 6V.

Chi-square (x^2) and Fisher exact tests were applied to know sex and side differences, and the difference in distribution of a sutural bone in three morphological forms of skulls. The calculations were made by Epi Info database program (Dean AG, Burton A and Dicker R. MSC 08 Centers for Diseases Control, Atlanta, GA 30333, USA).

Results

Table 1 shows the distribution of sutural bones in two sexes. Table 2 presents the distribution of unilateral sutural bones in three morphological forms of skulls. Bilateral sutural bones and their side difference in three morphological forms of skulls were given Table 3-4 respectively. While the incidence of bregmatic bone was the least (0.66%), the incidence of lambdoid bone was the highest (61.89%) among the others (Table 1). There were no significant difference between the two sexes. No statistically significant difference was observed in the distribution of unilateral and bilateral sutural bones and their side differences in three types of skulls (Table 1-3). Additionally, comparison of cranial capacity in skulls with and without sutural bones showed no significant difference (Table 5). Table 6 gives the mean measure of divergence between Anatolian-Ottoman and other population's skulls.

Discussion

The incidenc of sutural bones in present and other studies were given Table 7 (Berry & Berry 1967; Kellock & Parsons 1970; Corruccini,1974; Pal et al. 1986) . North America shows the highest frequency for three sutural bones (lambda, coronal, asterion), American Blacks represent the lowest for three sutural bones (asterion, lambdoid, epipteric) (Corruccini, 1974). Bregmatic bone is least (0.66%), while lambdoid bone is too much (61.89%) than the others in our study. The incidence of bregmatic bone was reported as 0.6% by Cireli (1985), 0.2% by Magden & Müftüoglu (1990), 1.09% by Aycan (1993).

Some authors claimed that the bones were developed from external influences (Hess,1946; Bennett,1965; Finkel,1971). According to Hess (1946), sutural bones are found in cases of congenital or early acute hydrocephals. On the other hand, there are some authors believe that sutural bones develop from normal processes and are genetically determined (Murphy,1956; El-Najjar & Dawson 1977; Pal & Routal 1986; Pal et al. 1986). El-Najjar and Dawson (1977) showed the presence of sutural bones in foetal skulls. Pal & Routal (1986), Pal et al. (1986) noted that there were not any correction between cranial capacity and the three types of skulls with sutural bones. These findings supports genetic determination of sutural bones. Similarly, there are the non-significant differences between cranial capacity and the three types of skulls with sutural bones in our study.

Corruccini (1974) found side dimorphism for a few sutural bones. Contrary to this, Pal et al. (1986) stated that there was no side difference for any of the sutural bones. Similar findings were also found in this study.

According to the comparason made among the many different populations, the nearest (less difference), and the farhest (more difference) average measure of difference to Anatolian-Ottoman skulls belongs to the Egyptians and Palestinians (Modern) respectively. The mean measure of difference of Anatolian-Ottoman is significant for the other populations except Palestine (Modern), North America (Brit.Col) and Black (USA).

The incidence of sutural bones are well suited for comparative studies as an anthropological marker or an indicator of population distance, because of lack of age influence, and independence of sex and side (Pal et al. 1986). In conclusion, the findings from the present study support Pal's opinion.

TABLE 1. Distribution of sutural bones in two sexes.

Sex		B	S	L	C	Lam	E	A	PN	OM
Male	**n**	2	1	26	4	117	22	32	14	3
(192)	**%**	1.04	0.52	13.5	2.08	60.93	11.5	16.66	7.29	1.56
Female	**n**	-	4	7	5	70	8	14	10	-
(110)	**%**	-	3.63	6.36	4.54	63.63	7.27	12.72	9.09	-
Total	**n**	2	5	33	9	187	30	46	24	3
(302)	**%**	0.66	1.65	10.9	2.97	61.89	9.92	15.20	7.92	0.99

p>0.05 for all bones
B:Bregmatic bone, S:Sagittal bone, L:Ossicle at lambda, C:Coronal ossicles, Lam: Lamdboid bone, E:Epipteric bone, A:Asterion ossicles, PN:Parietal notch bone, OM:Occipito-mastoid bones.

TABLE 2. Distribution of unilateral sutural bones in three morphological forms of skulls.

		UNILATERAL BONES		
		B	**S**	**L**
Dolichocephalic	n	-	-	6
(47) 15.6	%	-	-	12.76
Mesocephalic	n	1	2	12
(113) 37.4	%	0.88	1.76	10.61
Brachycephalic	n	1	3	15
(142) 47.0	%	0.70	2.11	10.56

p>0.05 for all bones
B:Bregmatic bone, S:Sagittal bone, L:Ossicle at lambda

TABLE 3. Distribution of bilateral sutural bones in three morphological forms of skulls.

		C	Lam	E	A	PN	OM
Dolichocephalic	**n**	3	19	4	3	1	-
47	**%**	6.38	40.42	8.51	6.38	2.12	-
Meso6cephalic	**n**	4	37	10	9	8	2
113	**%**	3.53	32.74	8.84	7.96	7.07	1.76
Brachycephalic	**n**	2	60	12	19	8	1
142	**%**	1.40	42.25	8.45	13.38	5.63	0.70

P>0.05 for all bones

C:Coronal ossicles, Lam:Lamdboid bone, E:Epipteric bone, A:Asterion ossicles, PN:Parietal notch bone, OM:Occipito-mastoid bones.

TABLE 4. Comparison and distribution of bilateral sutural bones in left-right sided.

		C		Lam		E		A		PN		OM	
		n	%	n	%	n	%	n	%	n	%	n	%
Dolichocephalic	R	-	-	17	36.8	2	4.25	1	0.33	1	2.12	-	-
(47)	L	3	6.38	12	25.5	3	0.99	2	6.38	1	4.25	-	-
	x^2	1.38		0.80		0.01		0.01		0.51		-	-
Mesocephalic	R	1	0.88	28	24.8	5	4.42	8	7.07	4	3.53	1	0.88
(113)	L	3	2.65	28	24.8	7	6.19	4	3.53	6	5.30	1	0.88
	x^2	0.25		0.02		0.09		0.79		0.10		0.47	
Brachycephalic	R	2	1.40	51	35.9	8	5.63	15	10.6	6	4.22	1	0.70
(142)	L	-	-	51	35.9	5	3.52	16	11.3	6	4.22	-	-
	x^2	0.50		0.02		0.32		0.01		0.09		0.01	

p>0.05 for all bones

R:Right, L:Left

C:Coronal ossicles, Lam:Lamdboid bone, E:Epipteric bone, A:Asterion ossicles, PN:Parietal notch bone, OM:Occipito-mastoid bones.

TABLE 5: Comparison of cranial capacity in skulls with and without sutural bones.

	Range of endocranial vol.	Mean	S.D
Skulls with sutural bones	1192-1580	1349.3 ± 2.714	47.181
Skulls without sutural bones	1124-1547	1346.1 ± 2.486	43.209

p>0.05

CONTROLLARE BENE LE TABELLE

TABLE 6: Mean measure of divergence (x) between Anatolian-Ottoman and other population's skulls.

Population	**n**	**Anatolian-Ottoman (302)**	**S.D.**
India (Punjab)	53	0.012 (p=0.05)	0.009
India (Burma)	51	0.015 (p=0.01)	0.005
Egypt	250	0.004 (p=0.01)	0.003
Palestine (Lachish)	54	0.011 (p=0.05)	0.012
Palestine (Modern)	18	0.040 (unsignificant)	0.018
South Amerika (Peru)	53	0.017 (p=0.01)	0.004
North Amerika (Brit.Col)	50	0.035 (unsignificant)	0.109
Australia (Aborigins)	1184	0.007 (p=0.01)	0.012
Caucasian	139	0.006 (p=0.01)	0.003
Black (USA)	182	0.013 (unsignificant)	0.018
India (Gujarat)	284	0.008 (p=0.05)	0.019

TABLE 7:Percentage incidence of sutural bones in this and other studies.

s. no	Population	B	S	L	C	Lam	E	A	PN	OM	
1	India (Punjab)	53	0	-	20.07	1.9	32.1	16.9	9.8	7.5	-
2	India (Burma)	51	0	-	13.7	1	29.5	14.7	9.8	7.8	-
3	Egypt	250	0.8	-	14.8	2.6	32.3	14.4	12.9	7.4	-
4	Palestine (Lachish)	54	0	-	11.1	3.7	29.8	9.4	6.5	2.8	-
5	Palestine (Modern)	18	0	-	22.2	0	33.3	6.4	8.3	11.1	-
6	South America (Peru)	53	0	-	15.9	1.9	45.2	7.5	14.2	11.3	-
7	North America (British Columbia)	50	0	-	28.0	32.0	54.0	12.0	19.0	10.0	-
8	Australia (Aborigins)	1184	0.3	-	12.9	5.4	47.0	19.8	17.9	15.4	-
9	Caucasian	139	0	2.87	10.07	1.43	37.0	12.94	10.76	11.05	-
10	Black	182	0	1.09	12.63	0.27	22.5	2.19	7.96	7.14	
11	India (Gujarat)	284	0	1.05	20.07	0	37.4	7.74	13.95	11.26	6.68
12	Present study	302	0.66	1.65	10.92	2.97	61.89	9.92	15.20	7.92	0.99

B:Bregmatic bone, S:Sagittal bone, L:Ossicle at lambda, C:Coronal ossicles, Lam:Lamdboid bone, E:Epipteric bone, A:Asterion ossicles, PN:Parietal notch bone, OM:Occipito-mastoid bones.

Note:Data for S.No. 1 to 7 were taken from Berry & Berry (1967), S.No. 8 from Kellock & Parsons (1970), S.No. 9 and 10 from Corruccini (1974), and S.No. 11 from Pal et al (1986).

References

Aycan K., (1993). Os bregmaticum. EÜ Sag. Bil. Der. 2:181-182.

Berry AC., Berry RJ (1967). Epigenetic variation in the human cranium. J. Anat 101:361-379.

Cireli E., Tetik S., (1985). Sutura varyasyonlary. EÜ Typ. Fak. Der. 24:3-18.

Corruccini R.S., (1974) An examination of the measuring of cranial discrete traits for human skeletal biological studies. Am J. Phys Anthrop. 40:425-447.

El-Najjar M.Y., Dawson G.L. (1977). The effect of artificial cranial deformation on the incidence of wormian bones in the lambdoidal suture. Am J. Phys Anthrop 46:155-160.

Finkel D.J., (1971). Wormian bones. A study of environmental stress. Am J. Phys. Anthrop 35:278.

Hess L., (1946). Ossicula wormiana. Hum. Biol. 18:61-80.

Kellock W.L., Parsons PA (1970) A comparison of the incidenceof minor nonmetrical cranial variants in Australian Aborigines with those of Melanesia and Polynesia. Am J. Phys Anthrop 33:235-239.

Leri A., Treliakoff A. (1923). Cited by Pal G.P., Routal R.V. (1986) A study of sutural bones in different morphological forms of skulls. Anthrop. Anz. 44:169-173.
Maðden O., Müftüoðlu A. (1990) Ynsan desmocranium'unda sutural ve epectal kemiklerin varyasyonlary. Cerrahpa_a Typ Fak Der 21:319-323.
Murphy M. (1956) The pterion in the Australian Aborigines. Am J. Phys Anthrop 14:255.
Olivier G. (1969). Practical Anthropology. Charles C Thomas, Illinois, pp 131-32,135.
Pal G.P., Routal R.V. (1986) A study of sutural bones in different morphological forms of skulls. Anthrop Anz 44:169-173.
Pal G.P., Bhagwat S.S., Routal R.V. (1986) A study of sutural bones in Gujarati (Indian) crania. Anthrop. Anz 44:67-75.
Williams P.L., Warwick R. (1989). Gray's Anatomy, 37th Ed. Churchill Livingstone, Edinburgh, p. 386.

Received October 20, 1995 *Accepted May 20, 1996*

L. Fañanás[1]
J. Sala[1]
S. Vives[2]
P. Moral[1]

[1]Laboratori de Antropologia, Departament de Biologia Animal.
[2]Departament de Bioestadistica. Facultat de Biologia, Universitat de Barcelona. Diagonal 645. 08028 Barcelona. Spain

Pairwise associations between classical polymorphism in a human population from the Central Pyrenees

Analysis of pairwise associations between 17 genetic systems was performed on a sample of 160 unrelated and autochthonous individuals from the Spanish central Pyrenees. In contrast to other studies, association between ABO-Hp, ACP1-ADA or EsD-C3 systems was not detected. Significant differences between observed and expected frequencies of the joint phenotypes of Gc-P polymorphisms are described (χ^2_4=14.02, p=0.007). The significance of this association is discussed.

Key Words. Pairwise polymorphism associations. Pyrenees. Spain

Introduction

Factors such as migration, selection and inbreeding can produce significant deviations from Hardy-Weinberg equilibrium in a population. Furthermore, alleles at different loci may also affects fitnes. Workman (1969) proposed that interaction between single-locus systems may be worth examining in the search for evidence of selection acting on Man. Studies by Sinnock and Sing (1972) on gametic associations indicated significant disequilibria in several two-locus analyses, which suggested selection maintain, these genetic disequilibria. In addition, linkage disequilibrium between two loci and population stratification lead to genetic association. Finally, certain modes of testing association can also result in a statistically signicat value that is due to chance alone.

Brackenridge et al. (1975) reported a number of associations between phenotypes of blood systems in Melbourne but,following appropriate statistical adjustments, none was found to be significant. An overview of the most recent association studies with special reference to Caucasian populations (Table 1) has revealed some apparent interaction, for example, between ABO and Haptoglobin (Fröhlander, 1985; Mitchell and Eslick, 1988), Esd and C3 (Mohan Raj et al. 1990), ACP1 and ADA (Engracia et al. 1991), and Glyoxalase 1 and Haptoglobin (Payne and Huntsman, 1982). However, these associations have not always been confirmed. For example, some authors do not find a GLO1-HP association (Paustch et al., 1985; Franco et al., 1986; Pancorbo and Garcia-Orad, 1987) and the matter remains controversial.

The present study reports a pairwise association study of 17 hematic polymorphisms from 160 individuals from Pallars Sobirà, an autochthonous population in the Spanish Pyrenees, extensively studied for many classical markers.