CONSANGUINITY STRUCTURE IN A ZONE OF GUADALAJARA (SPAIN)

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Abstract: *In a fairly large past of the province Guadalajara (Molina, Spain), made up of eightytwo parishes, pedigrees concerning consanguineous marriages up to the fourth generation were taken from ecclesiastical dispensations.*

Based on consanguineous matings celebrated in that mentioned area, over a period of fifty years (1875-1924), the following anthropogenetical items are evaluated: (i) levels of consanguinity. (ii) genealogical structures with regard to types of relationship - sex and number of intermediate ancestors - in relation to the mobility of the mates.

The average frequency of consanguineous marriages was 24.9%, the mean inbreeding coefficient (α) being 5.5 10^{-3}.

The type of relationship found in marriages "with migration" was significantly different from that in marriages "without migration".

Key words: *Consanguinity; Types of relationship; Migration; La Molina, Guadalajara, Spain.*

Introduction

Numerous studies have been carried out to explain the factors that determine the frequencies of different types of consanguineous marriages found in human population. The correlation between the age of both mates seems to have a fundamental bearing on the consanguinity structure (Barrai, Cavalli-Sforza and Moroni 1962, Hajnal 1963, Cazes and Jacquard 1981, Leslie 1983). At the same time other factors such as the altitude of the location and size of the population (Cavalli-Sforza, Moroni, Zalaffi and Zei 1960, Relethford 1985), geographical mobility (Barrai et al. 1962, Imaizumi 1977, 1978, Pettener 1985) and social stratification (Abelson 1978, Malhotra 1979, Leslie 1981, Imaizuimi 1986) may play an important part.

In a previous analysis of the Archbishopric of Toledo one of the authors (Calderón 1987) points out a number of close consanguineous marriages, that is higher than expected, if at least one of the mates does not stem from where the wedding took place. In the study presented here this aspect is being expanded upon. Furthermore we are trying to evaluate the effect that common surnames might have had on the frequency of certain types of relationship.

Characteristics of the Population Being Studied

The population studied here comes from Molina, a region in the East of the province of Guadalajara in the center of Spain (Fig. 1). This region with a surface of 3350 km² includes 82 parishes which are situated at heights ranging from 900 m. to 1500 m. above sea level, on average 1200 m. They are isolated from the main roads. About 39.000 people lived in that area in 1900 (density approx. 12 inhabitants / Km²), with an average number of inhabitants per parish of about 470. Only five of the parishes had more than 1000 inhabitants. The basis of their economy was agriculture.

Fig. 1: Geographical situation of Molina

Materials and Methods

Data on 4239 consanguineous marriages from 1875 to 1924, in the 82 parishes of the region, were collected from Roman Catholic Dispensations filed in the Archive of the Archbishop. These documents include the pedigree of the mates, that allowed us to trace back the genealogical tree of consanguineous mates up to four generations until 1917. From that date onwards, the requirements for getting married where lowered to second cousin marriages. Records of the total number of marriages per year and parish were gathered from the parish books in order to estimate the average consanguinity coefficient α. When studying this coefficient we only selected those parishes (53) which could provide a full data basis for the time span analysed here.

Temporal evolution of mean inbreeding coefficient and the different degrees of relationship were researched on. In order to investigate into the consanguinity structure, multiple consanguinities were separated into their constituent single consanguinities.

In the second part of our study the consanguineous marriages have been split up into two groups according to the premarital migration of the couple. Marriages "without migration" are defined as those where the place of marriage coincides with that of birth and residence of both bride and groom. Marriages "with migration" are those in which one of both of the spouses does not meet this condition.

Following Cavalli-Sforza, Kimura and Barrai (1966), the classes of relatives (II-II, II-III, III-III ...) will here be called "degrees of relationship"; while the relationship specified by a type of pedigree as determined by the arrangement of males and females among intermediate ancestors will be called "type of relationship".

Results and Discussion

Table 1 shows the frequencies of the different degrees of relationship (in periods of five years) as well as the relative frequency rate of consanguineous marriages and the corresponding consanguinity coefficient α. Marriages with various degrees of relationship have been broken down into their corresponding single relationships.

Table 1. **Temporal changes in inbreeding (α) in the population of Molina. T. M.: total marriages, C. M.: consanguineous marriages.**

Period	T.M.	C.M.	%	$\alpha.10^{-3}$	I–II	II–II	II–III	III–III	III–IV	IV–IV
									Degrees of Relationship	
1875–79	1156	267	23.10	4.38		41	205	64	64	164
1880–84	1182	307	25.97	5.16	1	46	16	96	75	189
1885–89	1117	295	26.41	5.73	1	50	26	92	63	177
1890–94	1122	308	27.45	5.31	2	36	24	91	85	178
1895–99	1089	296	27.18	6.14		54	27	100	59	163
1900–04	1194	323	27.05	6.08	1	60	26	94	70	200
1905–09	1064	281	26.41	5.74		52	12	96	54	178
1910–14	1066	300	28.14	6.27		55	20	106	59	200
1915–19	935	196	20.96	5.52		42	20	102	31	82
1920–24	1051	154	14.65	4.63	1	40	18	118		
Total	10976	2727	24.85	5.49	6	476	205	959	560	1531

The frequency of consanguineous marriages (24.85%) discovered in relation to the total of marriages deserves special mentioning. Due to the great extension of the region studied here this percentage can be regarded as high.

According to these figures the consanguinity rate also shows relatively high levels, $\alpha = 5.49 \ 10^{-3}$.

It is a well-known fact that temporal variation of α in European populations displays two main visible trends: an increase during the second half of the 19th century, followed by a decrease which began at a time during the two World Wars.

In order to find out the typical trends of the Molina region, first we calculated (by means of two linear regressions) the expected values for the degrees of relationship III–IV and IV–IV in the last two periods. In this way it was possible to compensate the lack of registers from 1917 onwards. Then we carried out a new regression of the corrected consanguinity coefficient on time. The graph ($y = 4.015 + 0.583 \ x - 0.04 \ x^2$, $p < 0.01$) shows a rising tendency until the beginning of this century, followed by a slightly falling tendency during the last two periods (Fig. 2).

Fig. 3 visualizes the temporal variation of the frequency of each of the degrees of relationship with respect to the total of the consanguineous marriages. In the course of time the interrelations between different degrees of relationship do not manifest any significant changes, which means that time does not appear to affect their distribution.
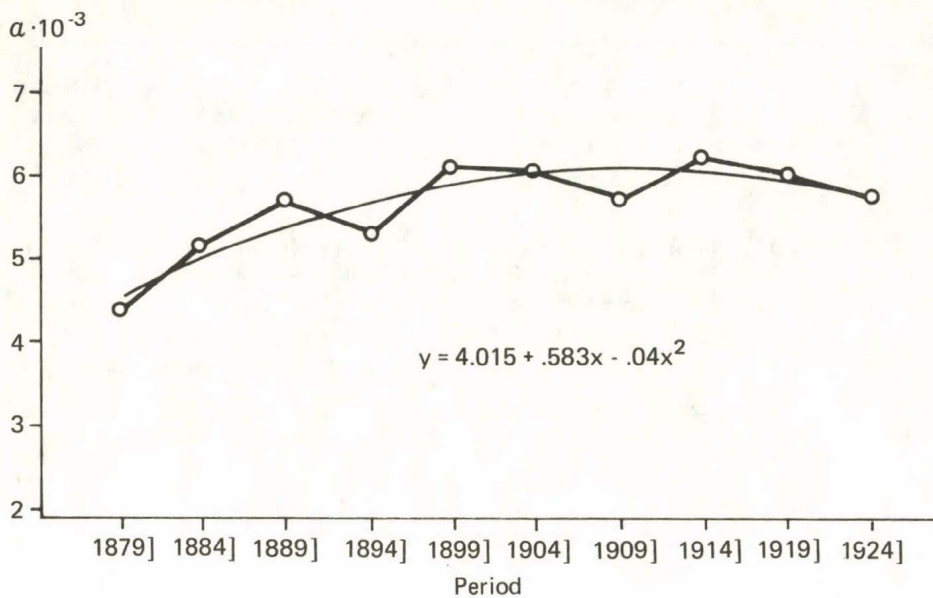
$$y = 4.015 + .583x - .04x^2$$

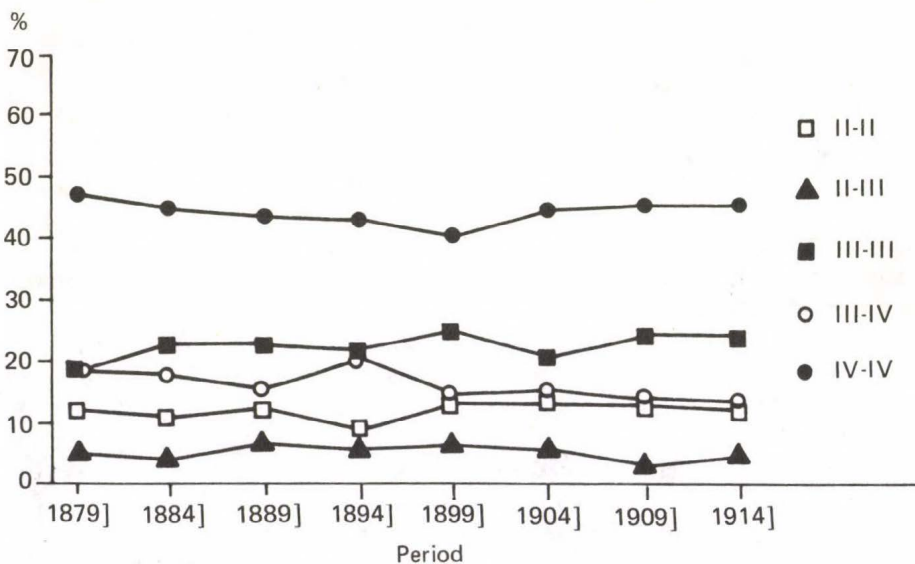*Fig. 2:* Temporal trends of mean inbreeding coefficient in Molina

Fig. 3: Temporal trends of relative frequencies of different degrees of relationship

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In the second place, the frequency distribution of the different degrees of relationship has been analysed in function of the spouses' places of origin. Consanguineous couples with at least one of the mates being non-autochthonous are characterized by a higher number of close relationships than couples in which both partners are autochthonous. As can be seen from table 2, in marriages "with migration" the relative frequency of the degrees of close relationship, mainly I–II and II–II, is higher than in marriages "without migration". The opposite is true with reference to the degrees III–IV and IV–IV.

Table 2. **Frequency distribution of different degrees of relationship: consanguineous marriages "with" versus "without migration"**

Degree of relationship	Without migration		With migration		Total
	N	%	N	%	
I–II	6	0.1	2	0.4	8
II–II	649	12.2	91	17.3	740
II–III	290	5.4	41	7.8	331
III–III	1314	24.7	149	28.4	1463
III–IV	804	15.1	63	12.0	867
IV–IV	2264	42.5	179	34.1	2443
Total	5327		525		5852

This fact has already been pointed out by Calderon (1987): The quotient between the number of first cousins and the number of second cousins, of the population in the Archbishopric of Toledo, was 0.41 as to marriages "without migration". On the other hand, marriages "with migration" showed a quotient of 0.77. In Molina, the corresponding figures are 0.49 and 0.61, respectively. With respect to the quotient II–II : IV–IV this difference increases, the figures being 0.29 in the case of marriages "without migration" and 0.51 in the case of those "with migration".

Fig. 4 shows the accumulated contributions of different degrees of relationship to the total consanguinity, which is statistically recorded as the number of consanguineous marriages as well as mean inbreeding coefficient; marriages "with migration" were differenciated from marriages "without migration". With regard to other previous findings, we can see that the main differences bvetween both marriage groups can be observed in the cases of close relationship. For a detailed analysis of the causes determining the differences between marriages "with migration" and marriages "without migration" we researched into a series of variables which characterize the different types of pedigrees in each degree of relationship. These variables include the number of females among intermediate ancestors, the difference between the numbers of females in the ancestry of the groom and in the ancestry of the bride, and the existence of marital isonymy.

We clustered together the different types of pedigree in function of each of these variables.

The comparison of the frequencies encountered according to the number of females intermediate ancestors between marriages "with" and "without migration" showed considerable differences (Table 3).

Table 3. **Frequency distribution of the different types of relationship, according to the number of female intermediare ancestors**

Degree of relationship	Females	Without migration		With migration		Ratio
		N	%	N	%	
II–II	2	133	20.49	38	41.76	2.04
	1	336	51.77	42	46.15	0.89
	0	180	27.73	11	12.09	0.44
Total		649		91		
III–III	4	80	6.09	13	8.72	1.43
	3	282	21.46	44	29.53	1.38
	2	525	39.95	48	32.21	0.81
	1	345	26.26	37	24.83	0.94
	0	82	6.24	7	4.70	0.75
Total		1314		149		
IV–IV	6	41	1.81	3	1.68	0.93
	5	184	8.13	16	8.94	1.10
	4	528	23.32	47	26.26	1.13
	3	683	30.17	57	31.84	1.05
	2	533	23.54	30	16.76	0.71
	1	246	10.87	22	12.29	1.13
	0	49	2.16	4	2.23	1.03
Total		2264		179		

With reference to the degrees of close relationship, and concentrating on those classes with a high number of females, the marriages "with migration" reach relative frequency levels which are higher than those in marriages "without migration". This tendency is reversed as the number of females in the ancestry diminishes. As to the degrees of remote relationship this pattern disappears, though.

Since not all the classes have got the same number of pedigrees, the expected frequencies vary from class to class. In order to eliminate this disproportion the quotient between marriages "with migration" and marriages "without migration" was calculated for the percentages of each class (Table 3).

It the quotient assumes a value of 1, it indicates a frequency which is identical in both kinds of marriages.

Fig. 5. shows this quotient for each of the degrees of relationship. With respect to the types of degree II–II, the diagram indicates a falling tendency of the quotient in proportion to the decrease of the number of females. The same tendency can be observed for degree III–III, even if it is less pronounced. As in the previous case, however, the ratio assumes values superior to 1 always if there are more females than males. It should finally be pointed out that practically all the values for third cousins are situated around the 1 mark.
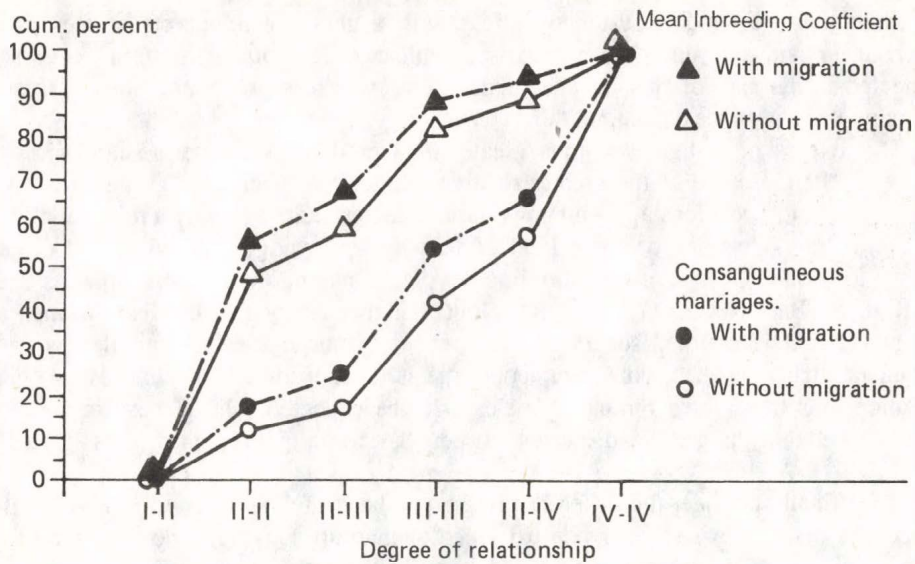
Fig. 4: Accumulated relative frequencies for the consanguinity coefficient and the number of consanguineous marriages between marriages "with migration" and those "without migration"
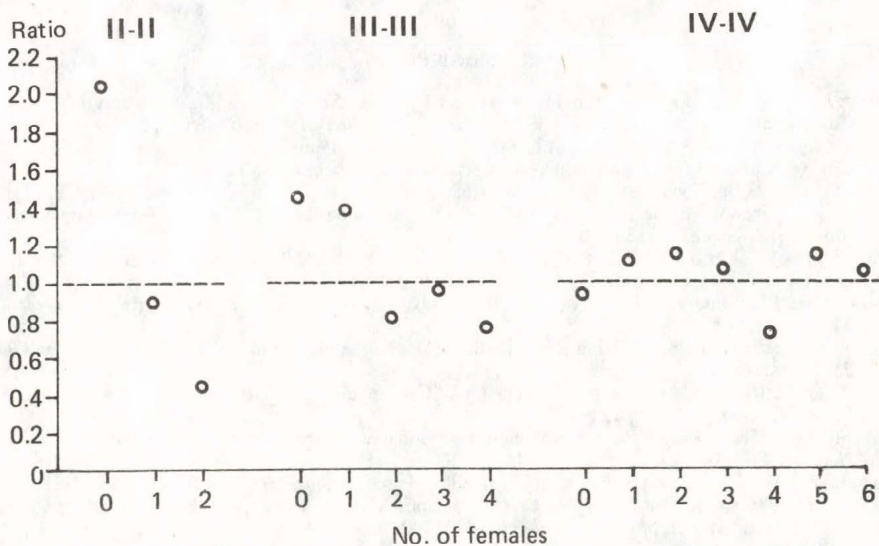

Fig. 5: Quotient of the frequencies observed in marriages "with migration" and in marriages "without migration" in function of the number of female intermediate ancestors

So higher frequencies of the pedigrees with a greater number of females in the marriages "with migration" in comparison with those "without migration" have been detected in the case of first cousins. This tendency is less pronounced among second cousins and does not exist among third cousins.

This excess of pedigrees with a greater number of female intermediate ancestors seems to be the cause of the greater relative frequencies of close relationships – with regard to remote relationships – among consanguineous marriages "with migration".

Here we might think of some kind of "kinship knowledge", which would make it easier to include close relatives, born in other places, among the potential spouses of the individual. Barrai et al. (1962) pointed out that the family ties between women are stronger, and, therefore, social contact between consanguineous females is more frequent than between consanguineous males. Accordingly, an excess of close relationships transmitted through females is to be expected. This excess is the more pronounced, the bigger the distance between the consanguineous partners' places of birth.

If we finally consider the difference in the number of females between both spouses' ancestors and the existence or non-existence of marital isonymy, a comparison of the frequencies which were observed for marriages "with" and "without migration" does not show any significant differences.

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