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GENETIC STRUCTURE THROUGH SURNAMES IN CAMPOBASSO PROVINCE, ITALY

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Summary. The population of Campobasso Province shows a level of inbreeding that is distinct from most Italian rural populations, regardless of their geographic location (F_r=0·0040; F_n=0·0102; F_t=0·0142). The genetic structure of the Italian–Greek communities of Lecce and Reggio Calabria Provinces does not appear to be affected by ethnicity. The level of inbreeding in Italian–Greeks of Reggio Calabria Province is similar to other Italians of Campobasso Province (F_r=0·0041; F_n=0·0127; F_t=0·0168). The Italian–Greeks of Lecce Province show random mating, and their inbreeding is in fact very low (F_r=0·0038; F_n=0·0024; F_t=0·0062).

Introduction

In 1965 a classic paper by Crow and Mange provided biological anthropologists and human geneticists with a new 'tool' for investigating the genetic structure of human populations. The authors evolved the concept first developed by G. Darwin in his study on the biological effects of marriages between first cousins published in 1875 and almost forgotten for ninety years, for estimating human inbreeding by surnames. Under the assumption that people with the same surname are descendants of a common ancestor, Crow and Mange used marital isonymy – marriages in which spouses have the same surname – to estimate the frequency of consanguineous marriages as a measure of inbreeding. They defined the total inbreeding by isonymy (F_t) and its random (F_r) and non-random (F_n) components, following Wright's hierarchical model, to describe the effects of subdivision of a population into discrete entities in causing deviations from random mating. In that model Wright (1943, 1951) defined the total value of inbreeding as F_{IT} (among all individuals within the sample), and its components as F_{ST} (among subdivisions within the total sample) and F_{IS} (among subdivisions of the total sample).

The method is useful in evaluating the genetic structure of populations in which the social use of surnames goes back a long time, as in Western societies, where surnames first came into use in the Middle Ages. In most of these populations the surname is inherited patrilineally, thus it behaves like a Y-linked gene with thousands of alleles.

Table 1. The population of the examined villages in Campobasso Province and sample sizes

Villages	Population of the villages*	No. of children in sample
Bojano	8640	265
Campolieto	1140	31
Casacalenda	2620	114
Cercemaggiore	4635	169
Guardialfiera	1159	28
Guardiaregia	835	37
Macchia Valfortore	903	20
Mafalda	1567	28
Monacilioni	743	18
Montagano	1281	31
Montefalcone nel Sannio	1974	100
Morrone del Sannio	885	22
Palata	2164	42
Petacciato	3364	137
Riccia	6000	184
Ripabottoni	739	18
Ripalimosani	2483	67
Roccavivara	1024	39
Rotello	1356	40
S. Elia a Pianisi	2402	75
Spinete	1491	59
Trivento	5416	243

*Resident population (Istituto Nazionale di Statistica, 1998).

Here the purpose was to study marriage patterns by surnames in Campobasso Province (Crow & Mange, 1965; Crow, 1980, 1983), and to re-evaluate inbreeding in the Greek–Italians of Lecce and Reggio Calabria Provinces, previously examined only through one relationship (fathers–mothers of the schoolchildren; see Biondi *et al.*, 1990).

Materials and methods

The commune is the smallest Italian administrative unit and in this study corresponds to a village. During the 1980s, schools in each of the 22 communes in Campobasso Province, the nine communes of the Greek language in Lecce Province, and the four communes of the Greek language in Reggio Calabria Provinces (Table 1; see Biondi *et al.*, 1990, for the list of Greek–Italian communes) were visited and one child in each family was asked to record the surnames and birthplaces of themselves, their parents and grandparents. The study of inbreeding by isonymy was carried out by the analysis

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of the surnames of the four grandparents: father's father (FF), father's mother (FM), mother's father (MF) and mother's mother (MM). These yield six relationships of two surnames in the ancestry of each pupil (Biondi *et al.*, 1993). Thus the method offsets in part the disadvantage that surnames represent only the male line, and increases the amount of information substantially.

The B method of Crow (1980) was used, where isonymy (I) is the frequency of pairs in which both of the two individuals in a relationship have the same surname. Random inbreeding (F_r) is calculated as:

$$F_r = \frac{\Sigma S_{i1} S_{i2}}{4 N_1 N_2}$$

in which S_{i1} is the number of individuals of the i^{th} surname in one ancestry and S_{i2} is the number of individuals of the same surname in the other ancestry of each pair of names, and N_1 and N_2 are ΣS_{i1} and ΣS_{i2} respectively. Non-random inbreeding (F_n) is calculated as:

$$F_n = \frac{I - \dfrac{\Sigma S_{i1} S_{i2}}{N_1 N_2}}{4\left(1 - \dfrac{\Sigma S_{i1} S_{i2}}{N_1 N_2}\right)}$$

Total inbreeding (F_t) is calculated as:

$$F_t = F_r(1 - F_n) + F_n$$

The random component of inbreeding within the communes has been examined in two ways: that of the weighted mean of the communes, and that of the communes treated as a single population. The difference between these two calculations represents the level of inbreeding caused by the subdivision of the population into discrete entities, i.e. the communes (the Wahlund effect). Since cousins are included in the sample, surnames of the same individual grandparents may occur repeatedly and thus isonymy and inbreeding are weighted by these multiple grandchildren.

The six pairs of names were analysed in two groups, because FF–FM and MF–MM pairs indicate grandparental migration and the remaining four pairs indicate migration in the parental generation.

Results and discussion

The proportions of isonymous relationships – and hence the total inbreeding coefficients – reported in Table 2 are significantly heterogeneous in parental and grandparental comparisons among the three provinces ($\chi^2_{2\text{df}} = 65{\cdot}981$, $p << 0{\cdot}001$, and $\chi^2_{2\text{df}} = 53{\cdot}513$, $p << 0{\cdot}001$, respectively), and between Greek–Italians of Lecce and Reggio Calabria Provinces ($\chi^2_{1\text{df}} = 54{\cdot}000$, $p << 0{\cdot}001$, and $\chi^2_{1\text{df}} = 23{\cdot}095$, $p << 0{\cdot}001$, respectively). On the other hand, the population of Campobasso Province and the Greek–Italians of Reggio Calabria Province show more similar isonymy rates and

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Table 2. Number and frequency of isonymous pairs by generation in the population of Campobasso Province and in the Greek–Italians

Populations	Sample size	Paired comparisons*	No. of isonymies*	Parental*	Paired comparisons†	No. of isonymies†	Grand-parental†	Total
Campobasso Province	1767	6747	302	0·0448	3380	268	0·0793	0·0563
Greek–Italians (Lecce)	1420	5335	111	0·0208	2671	88	0·0329	0·0249
Greek–Italians (Reggio Calabria)	337	1252	76	0·0607	630	49	0·0778	0·0664

*FF–MF, FF–MM, FM–MF and FM–MM.
†FF–FM and MF–MM.

Table 3. Inbreeding coefficients in the population of Campobasso Province and in the Greek–Italians

Populations	F_r		F_n		F_t	
	Parental	Grand-parental	Parental	Grand-parental	Parental	Grand-parental
Campobasso Province	0·0040	0·0040	0·0073	0·0161	0·0113	0·0200
Weighted mean*	0·0040		0·0102		0·0142	
Population as a whole†	0·0005		0·0136		0·0141	
Greek–Italians (Lecce)	0·0038	0·0039	0·0014	0·0044	0·0052	0·0083
Weighted mean*	0·0038		0·0024		0·0062	
Population as a whole†	0·0011		0·0051		0·0062	
Greek–Italians (Reggio Calabria)	0·0041	0·0043	0·0113	0·0154	0·0153	0·0196
Weighted mean*	0·0041		0·0127		0·0168	
Population as a whole†	0·0036		0·0132		0·0168	

*Weighted mean of parental and grandparental inbreeding coefficients of separate villages.
†All villages are treated as a single population.

hence total inbreeding. The differences are statistically just significant in parents ($\chi^2_{1df}=5{\cdot}367$, $p<0{\cdot}05$), while I and hence F_t in grandparents are virtually identical ($\chi^2_{1df}=0{\cdot}014$, $p>0{\cdot}90$). Furthermore, isonymy and hence total inbreeding are significantly higher in grandparents than in parents in the population of Campobasso Province and the Greek–Italians of Lecce Province ($\chi^2_{1df}=44{\cdot}684$, $p<<0{\cdot}001$, and $\chi^2_{1df}=10{\cdot}258$, $p<0{\cdot}01$, respectively). However, no statistically significant difference has been found between the two generations in the Greek–Italians of Reggio Calabria Province ($\chi^2_{1df}=1{\cdot}716$, $p>0{\cdot}10$).

Average random inbreeding is identical in the two generations of the three populations and it is thus the non-random fraction that has significantly decreased in the parental generation (Table 3). The random component of inbreeding accounts for 28% and 24% of the total inbreeding in Campobasso Province and the Greek–Italians of Reggio Calabria Province. A considerably higher value is shown by the Greek–Italians of Lecce Province (61%). When the communes are treated as a single population, the random component is smaller, and the non-random component, which includes the effect of subdivision of the population in discrete entities (the Wahlund effect), is correspondingly larger. However, the subdivision of the population into communes plays a minor role in the Greek–Italians of Reggio Calabria Province.

As for the ethnic element, isonymy and hence total inbreeding in the Greek–Italians of Lecce Province are substantially the same as was found in Albanian–Italians of southern Italy ($I=0{\cdot}0251$ and $F_t=0{\cdot}0063$; Biondi *et al.*, 1993). However, the Greek–Italians of Reggio Calabria Province and the population of Campobasso Province show figures similar to those found in Croat–Italians of southern Italy ($I=0{\cdot}0418$ and $F_t=0{\cdot}0105$; Biondi, 1994).

Conclusions

Ethnicity does not appear to produce relevant effects on the population structure of the ethnic minorities of Greek language living in southern Italy, because the level of inbreeding found in Greek–Italians and in the population of Campobasso Province is comparable to that of other Italian rural communities. On the other hand, the difference in the rates of inbreeding between Greek–Italians of Lecce and Reggio Calabria Provinces could suggest that social, economic and geographic factors are playing a major role.

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