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VALONGO, AN ISOLATED BRAZILIAN BLACK COMMUNITY. I. STRUCTURE OF THE POPULATION

Ilíada Rainha de Souza and Lodércio Culpi

ABSTRACT

A Southern Brazilian isolated community of predominantly Black origin, with a total population of 81 individuals and a high degree of inbreeding was studied. Its inbreeding coefficient was equal to 0.048, a value that was still 3.5 times lower than that theoretically expected (0.1727) if consanguineous marriages had occurred at random. The inbreeding coefficient of the offspring of consanguineous couples was also very high: 0.069. The frequency of prenatal mortality was 11.2%; that of infant mortality, 9.0%; and that of twin births, 2.0%. The small sizes of the breeding (28), and of the effective (15) population, and the very small migration rate of the breeding population (7.1%) suggest a high chance for the occurrence of genetic drift in this population, provided these conditions prevail for several generations.

INTRODUCTION

Human populations are undergoing intense structural modifications due to different factors such as improved communication, urbanization, improved living conditions etc. Small isolated populations are excellent sources of data for the understanding of how genetic drift can change gene frequencies. It is difficult to find genetically isolated populations for which a significant amount of demographic information is available and whose history is well known, such as the population described here. The population of this isolate, of predominantly Black origin, lives in a region of difficult access in the State of Santa Catarina, Southern Brazil, where a high rate of consanguineous marriages was found.

Departamento de Genética, Setor de Ciências Biológicas, Universidade Federal do Paraná, Caixa Postal 19071, 81531 Curitiba, PR, Brasil. Send correspondence to L.C.

MATERIAL AND METHODS

Population

The Black community of "Sertão de Valongo" occupies a small valley located about 20 km from the coast in the municipality of Porto Belo, State of Santa Catarina, 27°12'12" latitude south and 48°44'30" longitude west (Figure 1).

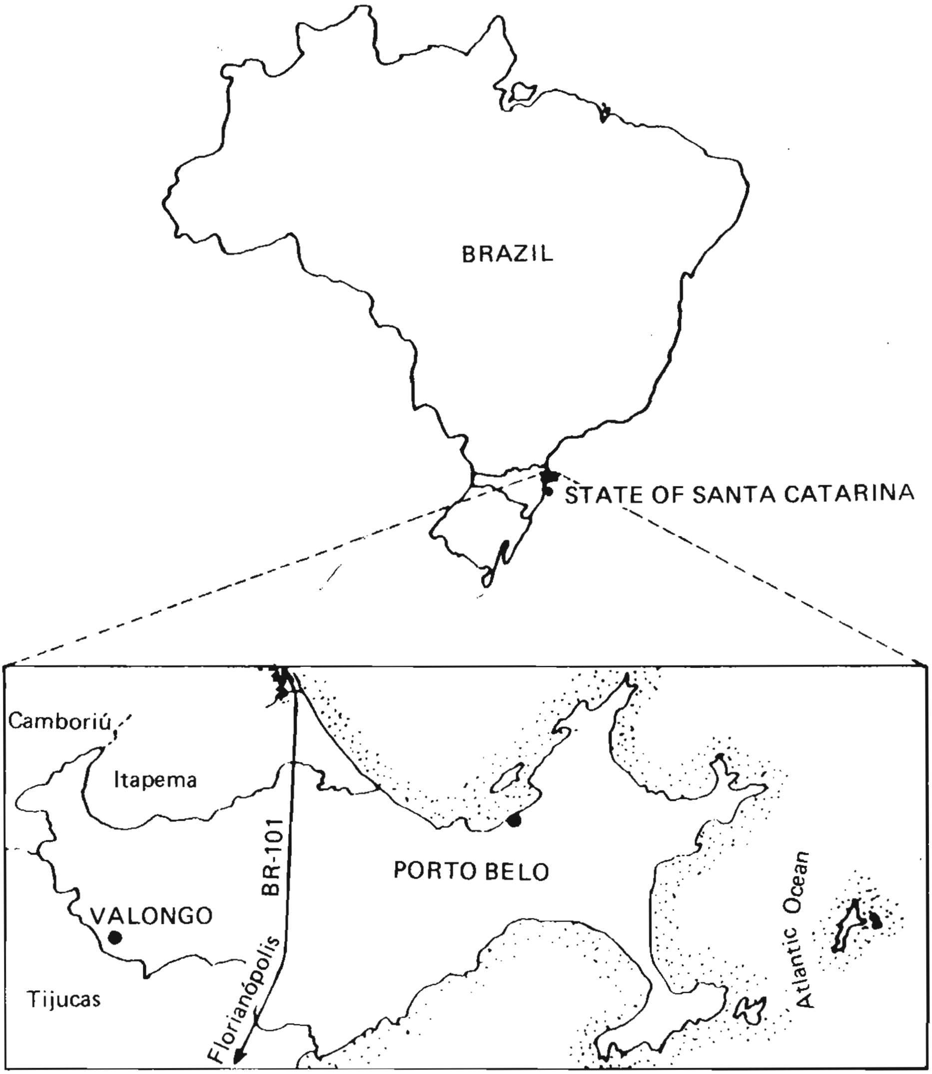

Figure 1 - Map of Brazil showing the State of Santa Catarina, and the localization of Valongo and Porto Belo.

Data were collected from September 1984 to March 1985 on the occasion of several home visits to the 17 houses existing in the community. The community consisted at the time of 81 persons (36 males) between children and adults. All presented some negroid traits, such as kinky hair, nose shape ranging from wide and short to narrow and long, and usually light brown eyes, although some had green eyes. Skin color was dark, ranging from Mulatto to Negro, except for one White individual who had recently joined the isolate.

Most of the individuals belonging to the isolate were illiterate and followed the Adventist religion. The region where they live is warm and humid and has been a focal point of malaria for approximately two decades. Practically all of the inhabitants aged more than 20 years had already had the disease which, at the time of our study, appeared to have been eradicated. The general health conditions were reasonable, despite a high incidence of verminoses. The population subsisted on agriculture.

Origin of the isolate

In 1817, D. João VI, King of Portugal, decreed the installation of a fisherman colony at Porto Belo. The first fishermen started to come from Portugal in 1818. After a few years, the settlers were forced to engage in agricultural activities in order to survive. The growth of this activity required large numbers of manual labor, leading to slave trading through Porto Belo. Slave trade was practiced intensely until August 1852, when the English warship "Locust" arrived with the specific purpose of repressing it (IBGE, 1959). Some of the sailors from the "Locust" decided to settle in the region and joined the local communities. Around 1880, a few runaway slaves and others that had been freed plus a white individual of English descent, making up a total of four couples, settled in the region today called "Sertão de Valongo", giving origin to the isolated community. Today's population descends directly from the four founding couples and practically all individuals have kinship ties, as shown in the pedigree in Figure 2.

Methodology

The coefficient of inbreeding (F) was calculated by a genealogical survey carried out using Wright's formula (1951):

$$F = \Sigma\,(1/2)^{n} \,.\, (1 + Fa),$$

where n is the number of steps that tie the consanguineous couple through each common ancestor and Fa is the coefficient of inbreeding of the common ancestor. The mean coefficient of inbreeding was obtained by weighting the different F values with the total

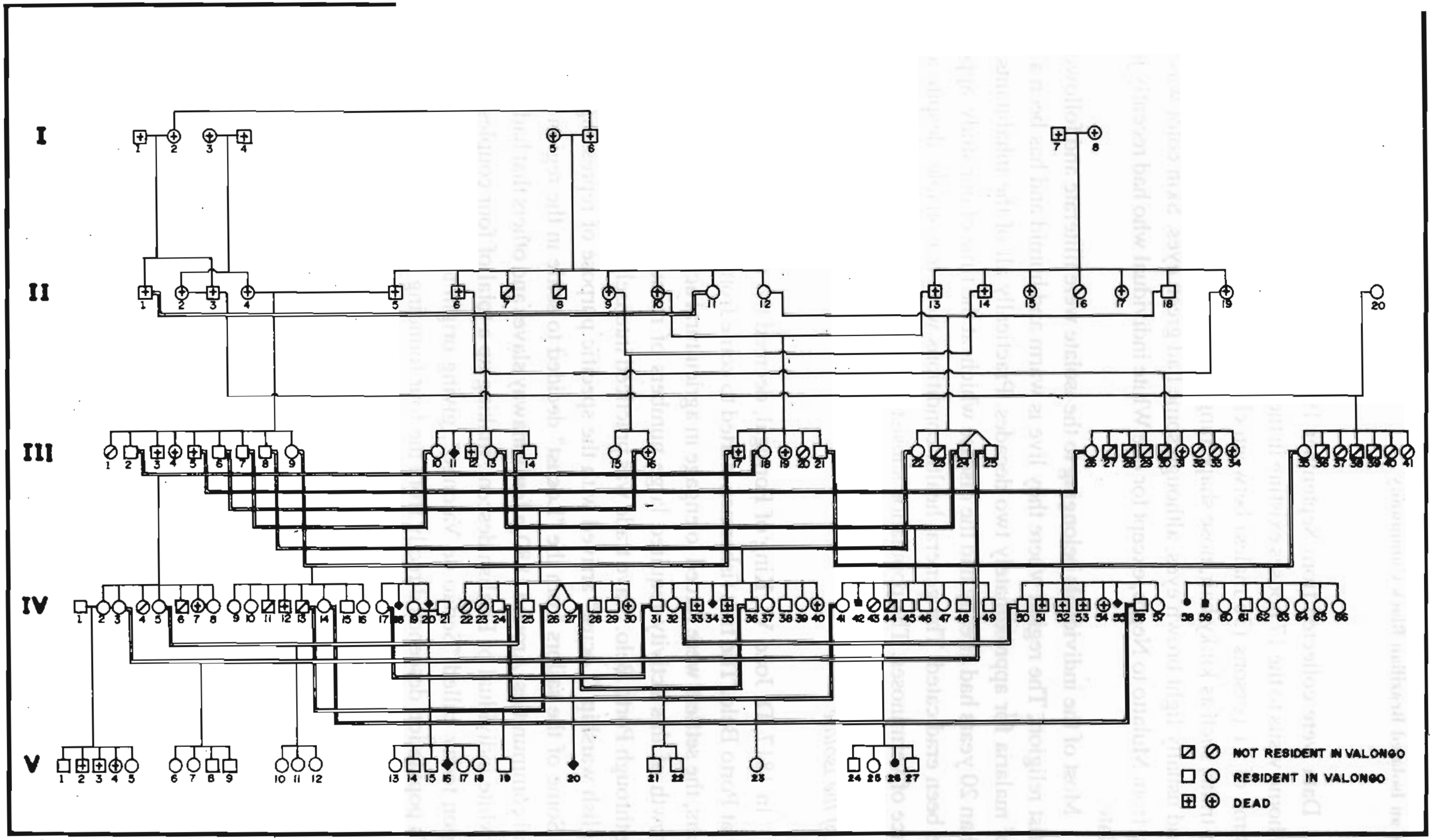

Figure 2 - Pedigree of the Valongo community.

number of individuals. The effective population (*Ne*) or effective population size was calculated by the formula of Crow and Kimura (1970):

$$Ne = \frac{2\,Nr - 2}{k - 1 + \sigma^2\, k/k}$$

where *Nr* is the breeding population size and *k* is the mean number of children of the individuals in the breeding population. We considered to be part of the breeding population living individuals who have living children aged 0 to 30 years (Freire-Maia, 1974).

The expected mean coefficient of inbreeding in a population in which consanguineous marriages occur at random was calculated by the formula of Wright (1931, 1969):

$$F = \frac{2\,Nr - 2}{2\,Ne - (2\,Ne - 1)\,(1 - me)^2}$$

where *me* is the effective migration.

RESULTS AND DISCUSSION

Inbreeding

The pedigree in Figure 2 shows 151 individuals. Of these, 43 were dead and of the 108 persons alive at the time of the survey, 81 (75%) were still living in the isolate. Of the 20 marriages surveyed, 17 (85%) were consanguineous and distributed as follows: seven between first cousins and second cousins; six between first cousins; one between a first cousin once removed and a second cousin once removed; one between first cousins once removed, and two between second cousins. The mean coefficient of inbreeding (*F*) among the inbred individuals was 0.06906, and for the isolate as a whole, 0.04774. This value is much higher than that calculated by De Bassi (1983) for the State of Santa Catarina (*F* = 0.00032) and approximately 54 times higher than that estimated for Brazil (*F* = 0.00088) by Freire-Maia (1990). The mean coefficient of inbreeding for Valongo is also many times higher than that estimated in other studies of isolated populations in Brazil (Table I).

Table I - Some demographic and genetic parameters evaluated for Valongo and for other Brazilian isolates.

	Jewish isolate (1)	Lençois Island (2)	D. Pedro (3)	Guaraqueçaba (4)	Valongo (5)
1. Total population (n)	2,000	307	554	922	81
2. Pregnancies	361	-	662	1,122	98
3. Abortions (%)	8.0	5.1	6.0	5.8	11.2
4. Stillbirths (%)	3.3	3.2	1.4	2.0	0.0
5. Infant mortality (%)	4.5	10.1	9.8	8.9	9.0
6. Twin births (%)	1.1	1.1	1.1	1.5	2.0
7. Inbreeding coefficient (mean)	0.00135	0.00150	0.00041	0.00239	0.04774
8. Breeding population (*Nr*)	680	104	179	316	28
9. Effective population size (*Ne*)	626	94	163	122	15

(1) Freire-Maia and Krieger (1963); (2) Freire-Maia and Cavalli (1978); (3) Muniz (1978); (4) Magalhães and Arce-Gomez (1987a,b); (5) Present study.

In general, the rates of consanguineous marriages are low in most countries. Freire-Maia (1968), in an extensive survey of the mean coefficient of inbreeding in dioceses of several countries in Latin America and in Canada and the United States, obtained values ranging from 0.00008 in the U.S. to 0.00274 in Peru. An exception among large populations was the study carried out in Andhra Pradesh, India, in which the mean calculated coefficient of inbreeding was 0.02280 (Dronamraju and Meera Khan, 1960). Higher *F* values are expected to be found in isolated populations rather than in panmictic populations, as is the case for three isolated localities on the East Coast of Canada, where mean *F* values were 0.00320, 0.00171 and 0.00070 (Bear *et al.*, 1988).

When we calculated the mean coefficients of inbreeding for the five generations in the isolate under study, we obtained $F = 0$ for generations I and II, with an increase to 0.01172 for generation III, 0.05450 for generation IV, and, 0.06882, for generation V. Even when two immigrants entered generation IV (individuals IV-1 and IV-21), the mean *F* value for this generation was not decreased.

When mean *F* values were calculated only for inbred individuals, proportionally large increases were observed in the last generations. This is due to the occurrence of multiple consanguinity, with mean *F* reaching the extremely high value of 0.1 in generation V, similar to the values detected for children of uncle(aunt)-niece(nephew) or double first cousins (0.12500). In large populations or in isolates receiving individuals from outside, the frequency of consanguineous marriages decreases with time (Moroni, 1964; De Bassi, 1983), contrary to what was observed in the present study.

If consanguineous marriages had occurred at random, the mean coefficient of inbreeding for the Valongo population would be 0.17269, considering an effective population size of 15 and an effective migration of 7.1%. As can be seen, the expected value is higher than the observed value (0.04774). An explanation for this fact is that, despite the elevated number of consanguineous marriages, these marriages occur only starting from a certain kinship degree, while closer kinship degrees such as uncle(aunt)-niece(nephew) or incest are avoided.

Sex and age distribution, fecundity, mortality and twinning

Table II shows the sex and age distribution of the individuals residing in Valongo. Most of the population (53%) is less than 20 years old. Mean age was 25.9 ± 20.5 years for men and 24.3 ± 21.3 years for women. The mean number of liveborn children per couple was 4.9 ± 2.9. The frequency of abortions was 11.2% ± 3.2%. No stillborns were reported; infant mortality was 9.0% ± 3.0% and the frequency of twin pairs 2.0% ± 1.4%. These data are compatible with those reported for other Brazilian isolates (Table I).

Table II - Distribution by age of males and females living in Valongo in 1985.

Age (years)	Males (n)	Females (n)
≤ 10	12	15
11 - 20	7	9
21 - 30	4	6
31 - 40	3 (1)	6
41 - 50	4 (1)	0
≥ 51	6	9
Total	36	45

Number in parentheses correspond to immigrants.

Only one case of a congenital malformation of genetic interest was found. A 19 year-old young woman, 6th in a sibship of eight, was born prematurely (seven months) with a cleft palate. The mother reported that her husband had died at 58 years of age of diabetes and that he was her first cousin.

Effective size (Ne) and breeding population size (Nr)

The effective size of the isolate (*Ne* = 15) corresponds to 18.5% of the total population (N = 81), a frequency similar to that found in most large populations, which ranges from 20% to 34%.

The breeding population size (*Nr*) was estimated as 28 individuals, 34.6% of the total population. This value is identical to that found in large populations, i.e., 35% of the total population (Freire-Maia, 1974).

Migration and effective migration (me)

Only two men, a White individual (IV-1) and a Negro individual (IV-21) migrated to Valongo (2.5% of the total population). Both contributed to the next generation, representing 7.1% of the breeding population.

Isolation, genetic drift and conclusions

The effective population size for Valongo, *Ne* = 15, is approximately half the value for the breeding population size, *Nr* = 28. The effective migration rate, 7.1%, is low. These data confirm the fact that the Valongo population is indeed a genetic isolate. Thus, this population has the conditions necessary for the action of genetic drift, one of the factors that may promote evolutionary changes. A way of measuring genetic drift suggested by Wright (1931, 1969) is to use the effective migration rate (*me*) and the effective number (*Ne*) of the population. According to this author, values of *Neme* lower than five indicate a high probability of gene fixation or loss. The *Neme* calculated for the Valongo population was 1.07.

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RESUMO

Estudamos uma comunidade brasileira isolada no Sul do Brasil de origem predominantemente negra, com uma população total de 81 indivíduos. O coeficiente médio de endocruzamento é igual a 0,04774, um valor que é ainda 3,5 vezes menor do que o teoricamente esperado (0,17269) se os casamentos consangüíneos ocorressem ao acaso. O coeficiente médio de endocruzamento entre os descendentes de casais consangüíneos

é também muito alto, 0,06906. A freqüência de abortos é de 11,2% ± 3,2%; a mortalidade infantil de 9,0% ± 3,0% e os nascimentos gemelares de 2,0% ± 1,4%. Os pequenos tamanhos das populações reprodutora (28) e efetiva (15), assim como a pequena taxa de migração da população reprodutora (7,1%) sugerem uma alta probabilidade para a ocorrência da deriva genética nesta população.

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