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S. YASEEN SAHEB

DEMOGRAPHIC STRUCTURE OF A SMALL GENETIC ISOLATE IN KARNATAKA — SOUTH INDIA

Kodagu, the smallest district in Karnataka State is the abode of many tribal and non-tribal populations. Amma Kodavas, an endogamous group is one among the many castes of Kodagu, with a total population of 2.000. Their primary occupation is cultivation and coffee plantation. Amma Kodavas are strict vegetarians and tee-totallers. They belong to one of the martial communities of India. According to Risley's [1915] classification, Amma Kodavas are classified under Indo--Scythians. They speak *kodagi* dialect which belongs to Dravidian languages [Srinivas 1952]. The results of the study on demography and its genetic implications are presented in this paper.

MATERIAL AND METHOD

Demographic information has been collected from 35 households of Amma Kodavas through schedules and large pedigrees. Each schedule consists of the information on household census, couple information covering name, age, sex, relationship, birthplace, and residence of the siblings, parents and grandparents. A detailed pedigree from each household with full information on reproductive history, morbidity and mortality of the offspring including abortions, miscarriages, and stillbirths have been callected. The sample is drawn from the Virajpet and Mercara *taluks* of Kodagu. Ages were recorded from the elder persons of the family and also from birth certificates, wherever possible. In some cases ages were estimated by recalling the important events and happenings in the area through the village headman. The information on age is reliable since in Amma Kodavas the literacy rate is quite high.

The data are divided arbitrarily into three age groups — 50 years and above, 31 to 49 years and 30 years and below, to study the fertility and mortality differentials, marital distance, consanguinity and admixture rate in each age group and in between the age groups, to find out the temporal trends.

The analysis of the demographic data was carried out according to the demographic techniques of Polard et al. [1974]; Roberts [1956]; Basu [1969]; and Salzano [1967, 1972]. The fertility and mortality components and selection intensity were calculated following Crow [1958]. Admixture rate, breeding size, effective population size, random genetic drift and coefficients of breeding isolation were calculated according to Lasker [1952, 1960], Lasker and Kaplan [1964]; Li [1955], Wright [1922, 1938]; Cavalli-Sforza and Bodmer [1971], and Basu [1969]. The consanguinity and its effects on fertility and mortality were examined in terms of rates. The possible socio-economic factors were also examined. Biometrical and other statistical constants were calculated using standard formulae. The data were compared with other available data on Indian and world populations.

RESULTS AND DISCUSSION

Age and sex structure of Amma Kodavas shows a higher frequency in 15 - 39 age group than in the other age groups, both among males and females. The sex ratio in 0 - 14 age group is 117.6 males per 100 females. In 15 - 39 years age group the sex ratio shows a considerably declining trend. The average marriageable age for males is 27.34 and for

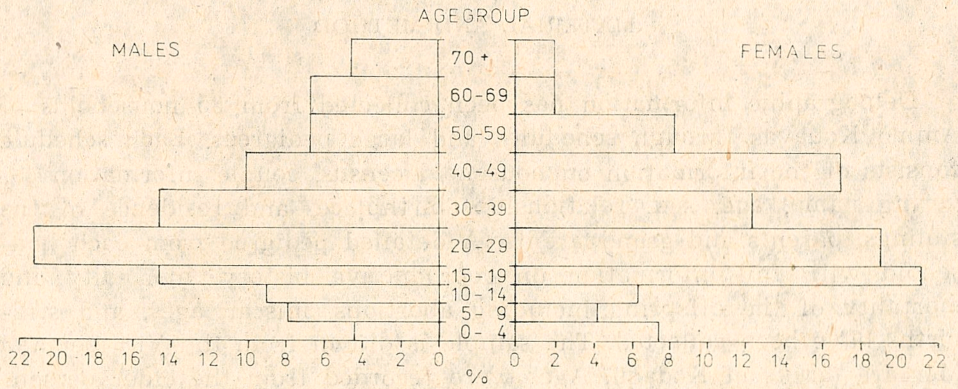

Fig. 1. Amma Kodava population pyramid. Sex ratio is 93.68 males per 100 females

females 20.73. The mean age of paternity is 29.62 years and the mean age at maternity is 22.66 years. More unmarried individuals are observed in 20 - 29 age group. Nearly 60 per cent of males and females are found to be unmarried in procreative age group, affecting the fertility ratio. The child/woman ratio is 16.67 in Amma Kodavas for te number of women between 15 to 49 years of age. The fertility rate, when

Table 1. Age and sex structure

Age group	Males	Females	Total	Sex ratio
0 - 14	21.35	17.89	19.57	111.764
15 - 39	50.56	52.64	51.63	90.000
40 - 70+	28.09	29.47	28.80	89.286

compared to other Indian and world populations shows an extremely low value [S a h e b 1979].

The population pyramid (fig. 1) shows a narrow base, with abrupt broadening in the middle, reflecting a transition in population dynamics of growth or a decreasing trend in the population expansion in Amma Kodavas [S a h e b 1979]. The net reproduction rate is 2.05. About 2.46% of Amma Kodava possible mothers are found to be never pregnant. The mean number of live births in completed families is 4.20. The sex ratio in the liveborn children is 108.13, with a mean sex ratio for all children 100.679. The mean number of surviving children per mother is 3.94 and with 108.23 sex ratio in surviving children. The child mortality is very low, lower than in the most of the other Indian populations [S a h e b 1979].

A high frequency (36.96%) of surviving sibship size of 2 has been observed for mothers of 50 years and above age group. The mean number of surviving children in the above age group is 2.93. The mean number of surviving offspring in 31 - 49 years age group shows significantly higher value. However, in 30 years and below age group the mean number is comparatively lower than in the other age groups, but signifi-

Table 2. Mean number of surviving children per woman ever married

Age group	No. of mothers	M ± S. E.	S. D. ± S. E.	C. V. ± S.E.
50 years and above	46	2.93 ± 0.31	2.10 ± 0.22	71.67 ± 7.47
31 - 49 years	130	3.97 ± 0.17	1.90 ± 0.12	47.86 ± 2.97
30 years and below	121	1.81 ± 0.10	1.08 ± 0.07	59.67 ± 3.83
Pooled	297	2.94 ± 0.11	1.97 ± 0.08	67.01 ± 2.75

Table 2.A. *t* values for means of surviving children of women ever married

Age group	31 - 49 years group	30 years and below	Pooled
50 years and above	2.9416++	3.4384+++	0.0304
31 - 49 years		10.9516+++	5.0868+++
30 years and below			7.6012+++

++ Significant at 1% level of probability
+++ Highly significant value

Table 3. Average number of surviving and liveborn children per mother
Average number of dead children per mother aged 40 and above

No. of women	No. of surviving children		total	Av. No. of surviving children per mother	No. of live born children		total	Av. No. of liveborn children per mother
	M	F			M	F		
122	231	250	481	3.94	246	266	512	4.20

No. of women	No. of children dead		total	Av. No. of dead children per mother
	M	F		
122	15	16	31	0.25

Table 4. Estimates of the negative binomial parameters for distribution of progeny size

n	p	$n \cdot p$	$np(1+p)$	$1+P$
88.24	0.0476	4.20	4.40	1.0476
d. f=8	$\chi^2=7.888$		$P=.50>P>.30$	

Estimates of the Poisson distribution for progeny size
d.f=9 $m=4.20$ $\chi^2=8.256$ $P=0.70>P>0.50$

Table 5. Selection intensity

$\bar{x}$	V_f	P_d	P_s	I_m (P_d/P_s)	I_f	I_f/P_s	I
4.20	4.40	0.06	0.94	0.06	0.25	0.27	0.33

cant difference can be observed (tab. 2.A). When the data of all the three age groups are pooled, the mean number of surviving children per woman ever married is 2.94 (tab. 2). The frequency of never pregnant women in 30 years and below age group is higher than in the other two age groups and is due to the inclusion of ever married women, who have not completed even one year of conjugal life, at the time of investigation. The sterile women constitute about 2.46% in postreproductive families.

The mean number of liveborn children per mother aged 40 and above is 4.20 with a variance of 4.40. The observed and expected values in progeny size do not show a good fit to either negative binomial or to Poisson distributions (tab. 4). The frequency of mortality prior to reproductive age is 6.00% (tab. 3). The fertility component of the Crow's index is 0.25, whereas the mortality component is 0.06. The population

Table 6. Admixture rate

Age group	Total No. of marriages	Both parents from the same group	One parent from another group/sub-population	Both parents from other population	Admixture rate
30 and below	121	120	1	–	0.413
31 - 49 years	130	126	4	–	1.538
50 and above	46	46	–	–	0.000
Pooled	297	292	5	–	0.856

Table 7. Breeding size and effective population size

Breeding size			Effective population size		
			I	II	III
N_m	N_f	N	$N_e=\frac{4N_f N_m}{N_f+N_m}$	$N_e=\frac{N}{1+F}$	$N_e=\frac{4N-2}{\sigma K^2+2}$
296	311	607	606.63	605.36	412.59

Table 8. Coefficient of breeding isolation and random genetic drift

Coefficient of breeding Isolation ($N_e \cdot m$)			Random genetic drift		
I	II	III	I	II	III
5.19	5.18	3.53	0.00041	0.00041	0.00061

shows higher fertility component rather than the mortality component, indicating the selection is operating due to fertility rather than the mortality (tab. 5). Hence differential fertility is more obvious than the differential mortality. The same trend has been observed in 30 world populations, including 8 Indian populations out of 42 populations [Saheb 1979]. The selection potential or the index of opportunity for selection is 0.33 in the present study and is low, indicating that selection is not operating with much vigour. The value of selection intensity (I) ranges from 0.23 to 3.69 in 64 populations from all over the world [Spuhler 1973].

The admixture rate is 0.856, with a higher rate in 31 - 49 years age group (tab. 6). The breeding size is 607 while the effective population size varies from 412.59 to 606.63, when calculated according to the formulae of Lasker [1952]; and in Li [1955] (tab. 7). The coefficient of breeding isolation varies from a value of 3.53% to 5.19%. Lasker and Kaplan [1964] postulated that genetic drift might be expected to have a considerable effect on the genetic microdifferentiation of a population with a coefficient of 5 or less. If their view is upheld then in Amma Kodavas, genetic drift is having considerable effect on the genetic microdifferentiation of the population. The variance due to random genetic drift varies from 0.00041 to 0.00061, which is quite low when compared to other Indian populations [S a h e b 1979].

The distance between the birthplaces of spouses (marital distance) was collected from 165 married couples. The frequency of village en-

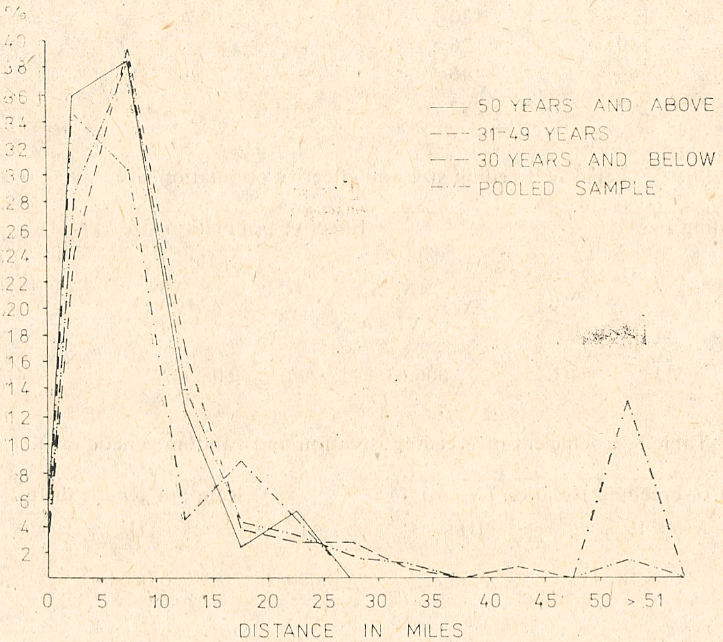

Fig. 2. Matrimonial distance in Amma Kodavas

dogamy in all the three age groups is comparatively low and a decreasing trend (5.13% to 3.88%) has been observed from older to younger age groups in the population. The frequency distribution of matrimonial distance in the population is positively skewed (fig. 2) and leptokurtic [S a h e b 1979]. The bimodal distribution observed in 31 - 49 years and 30-years-below age groups can be explained by the socio-cultural norms regulating the choice of mates and the geographical dispersal of the population.

The mean marital distance in 50 years and above age group is 7.04 miles, whereas in 31 - 49 years age group the mean is 10.72 miles. In 30

Table 9. Statistical constants of matrimonial distance

Age group	N	Mean ± S. E.	S. D. ± S. E.	C. V. ± S. E.
50 and above	39	7.04 ± 0.85	5.31 ± 0.60	75.43 ± 8.54
31 - 49 years	103	10.72 ± 1.28	13.01 ± 0.91	121.36 ± 8.46
30 and below	23	15.97 ± 4.90	23.52 ± 3.47	147.28 ± 21.72
Pooled	165	10.45 ± 1.10	14.12 ± 0.78	135.12 ± 7.44

Table 9.A. *t* values for mean marital distance in Amma Kodavas

Age groups	31 - 49 years	30 years and below	Pooled
50 years and above	2.3950⁺	1.7956	2.4530⁺
31 - 49 years		1.0366	0.1600
30 years and below			1.0992

⁺ Significant at 1% level of probability

years and below age group it is observed to be 15.97 miles. The mean marital distance for each age group shows that in older age group marital distance is less than in the younger age group (tab. 9). Only a few marriages were contracted over 50 miles range in the population, in each age group. The mean marital distance indicates that people selected their mates within 20 miles range. The mean marital distance in Amma Kodava population agrees with three of the earlier findings in South Indian populations except a few tribal and non-tribal populations of Andhra Pradesh [S a h e b et al. 1978].

The coefficient of inbreeding for autosomal loci observed in the present population is very low, lower than in most of South Indian populations studied earlier [S a h e b 1979]. The frequency of consanguinity is found to be significantly lower than in the other South Indian populations [R a o and S a h e b 1981]. Even the neighbouring Karnataka populations like the Vokkaligas (0.08193), Lingayat (0.02742), Kurubas (0.02311), Adi-Karnataka (0.02210), Bangalore populations (0.02308) and the Canarese Brahmins (0.0130) show higher values of inbreeding coefficient than the Amma Kodava population [R e d d y 1974; C h a k r a v a r t h y 1968; R a o and S a h e b 1981 and D e v i, et al. 1981]. The

Table 10. Temporal trends in inbreeding frequencies and coefficients

Age group	No. of marriages	Consanguineous marriages		F ± S. E.	S. D. ± S.E.
		n	%		
50 and above	46	5	10.87	.005437 ± .002415	.016377 ± .001707
31 - 49 years	130	9	6.92	.003246 ± .001114	.012813 ± .000795
30 and below	121	2	1.65	.001033 ± .000724	.007969 ± .000512
Pooled	297	16	5.39	.002684 ± .000691	.011916 ± .000489

F = autosomal mean inbreeding coefficient

Table 10.A. *t* values for mean inbreeding coefficients

Age groups	31 - 49 years	30 years and below	Pooled
50 years and below	0.823823	1.746794	1.095978
31 - 49 years		1.665666	0.421583
30 years and below			1.649634

low values of inbreeding coefficient for autosomal loci observed in the Amma Kodava population are due to non-preference of consanguineous marriages. It is not out of place to point out that the occupational mobility and breakdown of joint family system in the population has considerably reduced the frequency of consanguineous marriages in recent years.

The present study does not reveal any significant effect of consanguinity on fertility in all the three age groups of Amma Kodavas measured in terms of conception, live birth and survival rate in consanguineous couples (tab. 11) as observed also by Reddy and Rao [1978],

Table 11. χ^2 values between consanguineous and non-consanguineous groups

Parameter	Rate		χ^2 value	Rate
	Consanguineous	Non-consanguineous		Pooled sample
Pregnancies	4.13	3.11	0.0976	3.16
Live births	3.94	3.03	0.4606	3.08
Surviving children	3.69	2.89	0.7100	2.93
Offspring mortality	0.19	0.14	0.1790	0.14
Reproductive wastage	0.31	0.09	5.7990+++	0.10
Total mortality	0.50	0.23	3.0355++	0.25

+++ Highly significant
++ Significant at 1% level of probability

Rao and Mukherjee [1975], Devi et al. [1981], Saheb et al. [1981], Rao and Inbaraj [1977, 1979a and 1979b] and Reddy [1974]. On the other hand some studies have revealed consistent increase of fertility with consanguinity [Schull et al. 1965, 1970, 1972, Mukherjee and Bhaskar 1974]. The average number of surviving children measured as net fertility of the consanguineous couples is lower than that of the unrelated couples. This results in increased reproductive wastage and infant mortality in consanguineous couples of the population. Differences between consanguineous and non-consanguineous groups of the population in reproductive wastage and total mortality are significant. The same trend has been observed in Vokkaliga caste population of Karnataka [Reddy 1974]. However, insignificant results in survival value and in live births are shown. The present data are in contrast with the Japanese [Schull and Neel 1965] and Tamil Nadu data [Rao and Inbaraj 1979b] suggesting that natural selection operates primarily at the post-natal level in Japanese and Tamil Nadu data whereas it operates in the present population at the level of fertilization and early embryonic development and is in good agreement with the Kodava population [Saheb et al. 1981]. The possible explanation for the significant difference in foetal loss may be due to the genetic factors involved, medical complication and methods of induced abortion leading to reproductive wastage. This however was partially compensated for by the greater fertility of consanguineous groups.

Literacy and occupational factors have considerably reduced fertility in Amma Kodavas. Their effect on fertility and mortality in consanguineous and non-consanguineous groups has been discussed elsewhere [Saheb 1979]. The insignificant difference in most of the above mentioned parameters in the population indicates that there is no consistent effect of consanguinity on the inbred offspring.

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Anthropological Survey of India
Southern Region
V. V. Mohalla, Mysore 570 002, India.

STRUKTURA DEMOGRAFICZNA MAŁEGO IZOLATU GENETYCZNEGO W STANIE KARNATAKA W POŁUDNIOWYCH INDIACH

S. YASEEN SAHEB

Amma Kodava są grupą endogamiczną liczącą około 2000 osób zamieszkujących górzysty teren okręgu Kodagu w stanie Karnataka. Populacja ta znajduje się w przejściowej fazie jeśli idzie o przyrost naturalny. Uwidacznia się to w jej strukturze płci i wieku. Średnia liczba urodzeń w rodzinach o zakończonym cyklu reprodukcyjnym wynosi 4,20, a liczba dzieci dożywających dorosłości 3,94. Składniki I_f i I_m wskaźnika sposobności do selekcji Crowa [1958] wynoszą odpowiednio 0,25 i 0,06. Ogólna wartość tego wskaźnika równa jest 0,33. Proporcja przepływu genów wynosi 0,856. Wskaźnik izolacji rozrodczej zmienia się od 3,53% do 5,19%. Wskaźnik dryfu genetycznego ma wartości od 0,00041 do 0,00061. Średnia odległość małżeńska wynosi 10,45 mili. Wskaźnik wsobności dla loci autosomalnych 0,002684 jest niższy niż w większości południowoindyjskich populacji. Nie stwierdzono żadnego istotnego wpływu kojarzeń wsobnych na płodność i wymieralność.

B. Hałaczek, Australopitekalna koncepcja antropogenezy. Studium historyczno-krytyczne. Akademia Teologii Katolickiej, Warszawa 1982

Polskie piśmiennictwo antropologiczne wzbogaciło się o nowe opracowanie ukazujące ponad półwiekową perspektywę rozwoju koncepcji antropogenezy, która wzięła swój początek od słynnego odkrycia R. Darta. B. Hałaczek, po zapoznaniu się z niezwykle bogatym piśmiennictwem przedmiotu i przeanalizowaniu powstania i rozwoju różnych teorii starających się wyjaśnić problemy ewolucji człowieka, postanowił rozważyć „czy australopitekalna koncepcja antropogenezy jest już historycznie wysłużoną, czy też nadal możliwą i poprawną, z faktami wykopaliskowymi niesprzeczną interpretacją ludzkiej przeszłości"?

Praca składa się z czterech rozdziałów. Pierwszy rozdział zatytułowany *Historyczne zaczątki australopitekalnej koncepcji antropogenezy* omawia interpretację R. Darta odkrycia z Taung, taksonomiczno-filogenetyczne kontrowersje wokół *Australopithecus africanus* Dart, odkrycie z Taung w kontekście współczesnych mu poglądów antropogenetycznych. Rozdział drugi poświęcony jest *Recepcji i afirmacji australopitekalnej koncepcji antropogenezy w latach 1940 - 1960*, a w szczególności omawia pierwsze wykopaliskowe potwierdzenia Dartowskiej interpretacji australopiteka, wzrost wiedzy o południowoafrykańskich *Australopithecinae*, hominidalny status *Australopithecinae* oraz problem czy australopitek jest filogenetycznym zaczątkiem człowieka. W rozdziale trzecim pt. *Dyskusyjność australopitekalnej koncepcji antropogenezy na tle danych wykopaliskowych lat sześćdziesiątych i siedemdziesiątych* przedstawiono chronologię plioceńsko-plejstoceńskich człowiekowatych Afryki i czasoprzestrzenną koegzystencję *Australopithecinae* i *Hominidae*. Australopitekalna koncepcja antropogenezy w kontekście współczesnej wiedzy paleoantropologicznej została omówiona w rozdziale czwartym. Omawia się w nim filogenetyczną pozycję *Australopithecinae* w ramach rodziny *Hominidae* oraz doktrynalne i metodologiczne uwarunkowania przyrodniczych koncepcji antropogenezy.

B. Hałaczek w podsumowaniu swych rozważań doszedł do wniosku, że „intuicja Darta okazała się z racji swej trafności genialna. Była taką chyba dzięki temu, że wyposażony w bogatą wiedzę anatomiczną Dart kierował się w swych hipotetycznych wywodach na temat ludzkiej przeszłości dyrektywami konsekwentnie wydedukowanymi z ogólnej teorii ewolucji. W genialności ocen Darta wolno przeto widzieć potwierdzenie genialności teorii Darwina". Ukazując historyczne losy Dartowskiej koncepcji antropogenezy dochodzi B. Hałaczek do wniosku, że „każda w ramach teorii ewolucji skonstruowana i pewien obszar faktów wykopaliskowych wyjaśniająca koncepcja antropogenezy jest tylko hipotezą. Jako taka zaś jest produktem zwrotnie z sobą sprzężonego oddziaływania konkretnych danych wykopaliskowych i określonych wyobrażeń ewolucyjnych". Jak się okazało gruntowna dyskusja różnych poglądów na ewolucję człowieka utwierdziła autora w przekonaniu, że australopitakalna koncepcja antropogenezy jest nadal aktualna, a „argumentację zwolenników nieaustralopitekalnego rodowodu człowieka obarcza błędne, gdyż wiodące do rezygnacji z wysiłków wyjaśnienia filogentycznego rozwoju człowieka, przeakcentowanie pewnej tylko grupy faktów wykopaliskowych".

J. Piontek (Poznań)