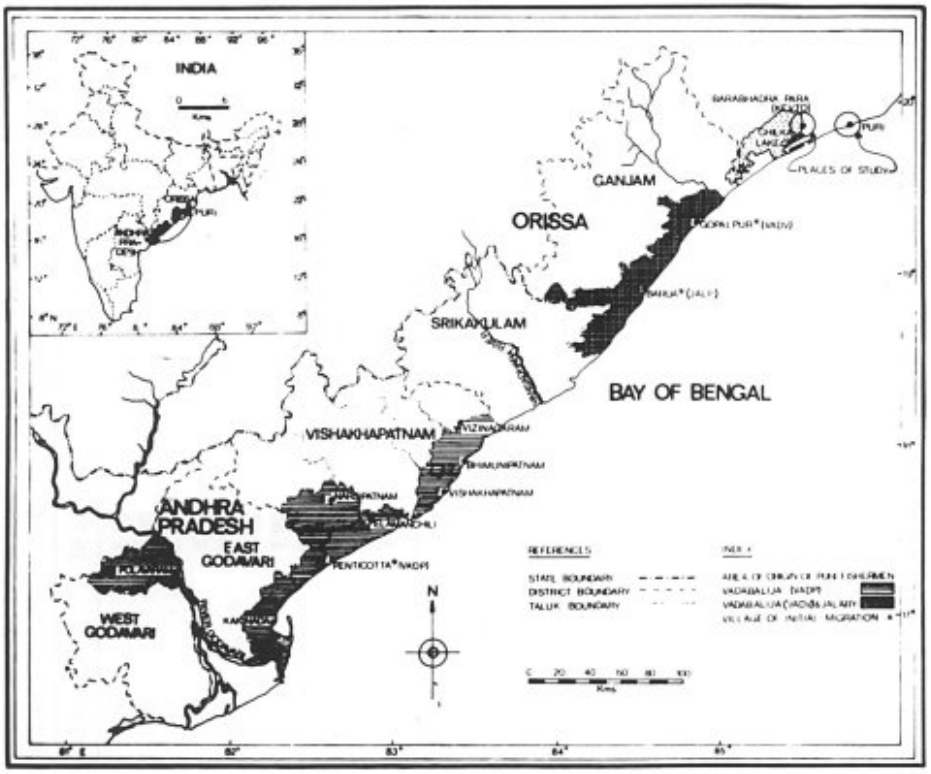

Fig. 1. Map showing the location of Puri and the parental areas of the fishing groups currently living at Puri.

Results and discussion

For the sake of brevity, the basic tables are not presented here. The tables are available upon request. The univariate chi-square values between populations are presented in Table 1. In case of males, except monomorphic patterns and hypothenar configurations, all other traits show significant population heterogeneity. The differences are more marked between the Jalari and the two Vadabalija groups, the VADP and VADV. In case of females, besides monomorphic patterns and configurations in hypothenar areas, mainlines C and D, and patterns in the 2nd interdigital area show no population heterogeneity. The most marked differences are observed in case of the finger patterns. A certain degree of sex difference is thus apparent in the extent and nature of population differences with reference to qualitative dermatoglyphics.

The Shanghvi's X^2-values obtained over the percentages for each of the traits, and the average distance between pairs of populations are presented in Table 2. The distance configuration (Fig. 2) in males is clearly conformatory to the caste affiliations: the smallest distance is between the VADP and VADV, the reproductive

Table 1. Values of chi-square for intergroup homogeneity in males and females.

Variable	Males			Females			df
	VADP × VADV	VADP × JALP	VADV × JALP	VADP × VADV	VADP × JALP	VADV × JALP	
Finger patterns	21.0**	6.4	6.6	39.1**	13.1**	16.5**	3
Monomorphic patterns	1.7	0.8	2.5	1.0	1.4	0.8	3
Triradius, t	16.5**	5.3	15.9**	9.6*	4.5	16.6**	4
Main line, B	0.2	42.2**	35.9**	7.6*	0.4	5.5	2
Main line, C	6.1*	21.7**	3.2	4.0	4.7	3.7	2
Main line, D	1.9	23.7**	9.0**	1.0	0.8	1.2	2
Hypothenar patterns	1.2	0.8	0.6	4.0	0.8	6.0	3
Th/I interdigital	0.3	13.9**	8.4**	9.4**	11.0**	1.7	1
II interdigital	0.4	6.5*	8.6**	0.4	0.0	0.4	1
III interdigital	6.7**	19.9**	2.3	7.6**	5.2*	0.0	1
IV interdigital	9.9**	4.7*	1.2	4.2*	2.7	0.0	1

Table 2. Values of Shanghvi's X^2 for individual variables and the pooled X^2 value of intergroup distances.

Variable	Males			Females			df
	VADP × VADV	VADP × JALP	VADV × JALP	VADP × VADV	VADP × JALP	VADV × JALP	
Finger patterns	1.61	0.48	0.58	3.82	2.14	2.58	3
Monomorphic patterns	1.30	0.52	2.17	0.83	1.92	0.99	3
Triradius, t	6.40	1.70	6.70	4.30	3.30	11.60	4
Main line, B	0.07	14.50	15.90	3.30	0.30	3.60	2
Main line, C	2.42	7.50	2.42	1.80	3.50	2.20	2
Main line, D	0.75	8.17	4.00	0.40	0.60	0.80	2
Hypothenar patterns	0.92	0.50	0.50	2.90	1.20	5.70	3
Th/I interdigital	0.12	4.90	3.60	4.00	9.30	1.30	1
II interdigital	0.15	2.30	3.55	0.16	0.01	0.22	1
III interdigital	2.65	6.80	1.00	3.40	3.90	0.02	1
IV interdigital	4.02	1.54	0.54	1.82	2.90	0.01	1
Pooled	20.41	48.91	40.91	26.73	28.25	29.02	23*
X^2-distance	0.8874	2.1265	1.7089	1.2150	1.2841	1.3191	

* df for females in monomorphic patterns is 2 and therefore the total degrees of freedom is 22 instead of 23.

isolates within Vadabalija caste and the largest distance is obtained between the VADP and JALP who belong to different castes, allopatric and have different migrational histories. The sympatric VADV and JALP, having similar migrational history but different caste affiliations, show intermediate distance. The distance configuration pertaining to females (Fig. 2) is not contradictory to this. However, the picture is less clear. The relative differences in the distance between different pairs of populations are too small and the populations can be said as placed at equidistance from each other in the multivariate space. Inconsistency in the pattern of dermatoglyphic distances with respect to sexes is not, however, unique to this study. Earlier, for example, we found more clearcut sex difference in case of quantitative palmar and finger dermatoglyphic variables (Reddy et al. 1988). Rudan (1978) among the Istrian populations of Yugoslavia, and Lin et al. (1984) among the Black Caribs also observed different patterns of interpopulation variation for males and females and offered difference in migratory patterns as a probable explanation. Although similar phenomenon could be responsible in the present context, in the absence of empirical evidence, it is not possible to infer conclusively. The magnitude of sex difference observed in different traits (Table 3) among the populations may offer some assistance in understanding the problem. For example, while the VADP show significant sex difference in 7 of the 11 traits, the VADV and JALP show only in 5 and 4 traits, respectively. Further, there is a great deal of variation in the extent of sex

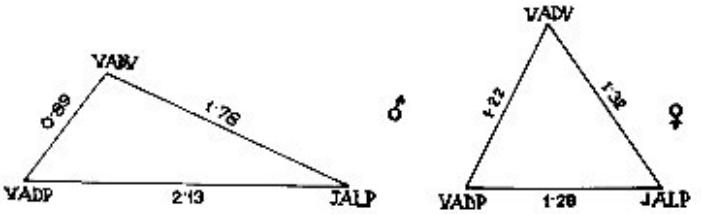

Fig. 2. Configuration of qualitative dermatoglyphic distances, for males and females.

Table 3. Values of chi-square for homogeneity of sexes.

Variables	VADP	VADV	JALP	d.f.
Finger patterns	19.6**	5.6	5.5	3
Monomorphic patterns	3.7	2.9	0.8	3
Triradius, t	14.4**	17.3**	16.2**	4
Main line, B	2.4	9.3**	19.9**	2
Main line, C	9.6**	4.9	19.3**	2
Main line, D	8.0**	2.6	0.7	2
Hypothenar patterns	10.3*	1.3	9.0*	3
Th/I interdigital	0.3	4.1*	0.5	1
II interdigital	0.7	4.0*	2.0	1
III interdigital	4.4*	5.4*	0.7	1
IV interdigital	4.3*	1.0	3.1	1

difference and also the traits that show the dimorphism. While this would make one understand that the nature of sex difference within each of these populations has been in some intricate way responsible for the observed difference in the distance configurations with reference to sexes, the reasons for such sex dimorphism leading to different distance configurations remain a puzzle. However, given the present context, effect of migratory patterns seems the most plausible explanation. All the three groups are recent migrants to Puri from about 100 villages situated along the 400 km coast. This might have affected the migratory patterns of females depending on the access of different populations to the ancestral sources and from among their comigrants.

Table 4 presents results for comparison on the relative distances between pairs of populations based on different sets of variables, quantitative finger and palmar dermatoglyphics, anthropometrics and genetic markers. It is clear, from the overall appraisal of distance configurations, that qualitative dermatoglyphic variables stand out in clearly reflecting ethnic affiliations of the groups. Quantitative palmar pattern in males come closer to this but the female pattern is contradictory. Although the differentiation is quite marked, anthropometric distances reflect a different aspect of interpopulation variation, i.e. conforming to geographical rather than ethnic proximity. This is the case with genetic distances as well. The history of separation of groups is rather short. This is reflected in the extent of genetic differentiation observed among them (Reddy et al. 1989). Given this, it is tempting to conclude that qualitative dermatoglyphics are useful markers in tracing population ethnic histories at the level of sub-castes, subject to the assumption that the groups at Puri represent the parental compositions. However, a final word can be said only when the statistical analyses of the representative data, recently collected from the parental populations, are completed.

Table 4. Values of interpopulation distances based on different sets of variables*.

Variable set	Sex	VADP × VADV	VADP × JALP	VADV × JALP
Qualitative Dermato-glyphics (Shanghvi's X^2)	(M)	0.8874	2.1265	1.7089
	(F)	1.2150	1.2841	1.3191
Quantitative palmar dermatoglyphics $(D^2)^2$	(M)	0.9938	2.1385	2.5908
	(F)	1.6270	1.1685	1.1133
Quantitative finger dermatoglyphics $(D^2)^3$	(M)	0.4713	0.3008	0.3585
	(F)	0.4599	1.1522	1.0298
Anthropometrics $(D^2)^4$	(M)	3.6843	6.5361	0.9727
Genetic markers (Nei's D)[5]	(M + F)	0.0042	0.0046	0.0035

*Source: [1]Present study, [2–4]Reddy et al. 1988, [4]Reddy et al. 1987, [5]Reddy et al. 1989.

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pattern of population configurations were observed earlier not only between dermatoglyphics and other sets of variables (Chai 1972; Rudan 1978; Jantz & Chopra 1983) but also within dermatoglyphics (Jantz & Chopra 1983) depending on whether the variables are qualitative or quantitative, whether only finger or only palmar variables or both together were used. Also, using 20 rather than the 10 larger finger ridge counts was found to be more useful in tracing population relationships (Jantz & Hawkinson 1980; Jantz & Chopra 1983). In the light of the foregoing observations, an attempt has been made here to examine if qualitative dermatoglyphics are useful markers in assessing population affinities.

Materials and methods

Finger and palm prints of 677 individuals (395 males and 282 females) collected during 1977 and 1978 were utilised for the present analysis. The subjects were aged between 8 and 75. Except for the C-line polymorphism (Plato 1970), all other qualitative variables were scored following Cummins & Midlo (1961). The list of variables considered for this analysis is given in Table 1. Since the right-left differences were generally found non-significant, they are not treated separately for the analysis. In view of the relatively less definite formulation of landmarks on the region where Mainline A generally ends, it is likely to introduce considerable amount of noice and is, therefore, excluded from the analysis.

The contingency chi-square is used to test the heterogeneity of populations with respect to individual traits. Inter-population distances were obtained using Sanghvi's (1953) X^2. The formula is

$$X^2 = \frac{100 \times \Sigma_i^n \Sigma_j^r \left\{ \frac{(p'_{ij} - q_{ij})^2}{q_{ij}} + \frac{(p_{ij} - q_{ij})^2}{q_{ij}} \right\}}{\text{Total number of degrees of freedom}}$$

where p_{ij} is the proportion of j^{th} class of i^{th} character for one population and p'_{ij} for the other population in a pair, and

$$q_{ij} = \frac{p'_{ij} + p_{ij}}{2} = \text{Expected proportion for the particular class.}$$

Population backgrounds

Marine fishermen of Puri are migrants and speak Telugu. Three endogamous groups namely, Vadabalija of Penticotta (VADP), Vadabalija of Vadapeta (VADV), and Jalari (JALP) were identified within the complex of Puri fisherfolk who are popularly known as the Nulia. While the VADP and VADV belong to the same caste, Vadabalija, the Jalari is a different caste and therefore inter-marriage with Vadabalija groups is socially prohibited and also not observed. On the other hand, admixture between the VADP and VADV is found to be only 1 % and are therefore considered as breeding isolates within the larger Vadabalija caste (Reddy 1984). However, the VADV and JALP were sympatric both at Puri and in the parental places, south of Puri coast in Orissa and contiguous areas in Andhra Pradesh. They migrated to Puri some 100 years ago. The VADP migrated from further South in coastal Andhra Pradesh around 1950. The VADP, VADV, and JALP number about 8000, 4000, and 800, respectively. For more details, one may refer to Reddy (1984). The location of Puri and the ancestral areas of the fishermen are depicted in Fig. 1.

Qualitative dermatoglyphic affinities between the migrant groups of fishermen of Puri Coast, India

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With 2 figures and 4 tables in the text

Summary: Finger and palm prints of 677 subjects (395 males and 282 females) were analyzed for 11 qualitative dermatoglyphic variables to study the relationship between the three migrant groups of fishermen of Puri. Sanghvi's X^2-distance gives configuration confirmatory to caste affiliations, quite clearly in males, but to a lesser degree in females. A comparison with distance configurations obtained for quantitative finger/palm variables and for anthropometric/genetic markers suggests that the qualitative dermatoglyphic traits stand out as useful markers in more convincingly portraying the affinities at the level of sub-castes.

Zusammenfassung: Finger- und Handabdrücke von 677 Individuen (395 Männer und 282 Frauen) wurden hinsichtlich 11 qualitativer Hautleistenmerkmale analysiert, um die Beziehungen zwischen den drei wandernden Fischerbevölkerungen der Puri Coast (Indien) zu untersuchen. Mit Hilfe des X^2-Abstandstests nach Sanghvi ergaben sich zwar für die Männer, nicht dagegen für die Frauen, deutliche Beziehungen zur Kastengliederung. Ein Vergleich mit auf quantitativen Finger- bzw. Handleistenvariablen und auf anthropometrischen Merkmalen bzw. genetischen Markern beruhenden Abstandsmessungen zeigte, daß die qualitativen Hautleistenmerkmale die genetischen Beziehungen auf dem Subkastenlevel überzeugend widerspiegeln.

Introduction

In a series of three papers (Reddy et al. 1987, 1988, 1989), we have examined the affinities between the migrant groups of fishermen at Puri, using anthropometrics, quantitative finger and palmar dermatoglyphics, and genetic markers. In quantitative dermatoglyphic traits the populations are found to be less differentiated compared to the anthropometrics, the distance configuration of which conforms to the geographical rather than the caste affiliations. Although dermatoglyphic configurations generally agree with the caste hypothesis, certain inconsistencies with respect to sex and/or type of variables used were observed. For example, unlike in males, females show the smallest distance between the two sympatric instead of the ethnically similar populations. Further, in finger dermatoglyphics of males, neither the differentiation is significant nor the distance configuration according to caste affiliations. On the other hand, although the configuration of genetic distances resemble the anthropometric pattern qualitatively, the differences in the distances between different pairs of populations are rather small to reflect a clear trend. Such inconsistencies in the