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Original Research Article

Genetic demographic profile of two endogamous sub-populations of Rellis

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ABSTRACT

Background: Relli caste group was chosen for the present population genetic study, as it is one of the scheduled caste groups. The present work was designed to be a descriptive study mainly aiming at unveiling a precise population genetic profile of Relli caste.
Methods: A community-based cross-sectional study was done among 428 Relli families belonging to two sub-sects (Relli-I: 208; Relli-II: 220) residing in different localities of Visakhapatnam city. The demographic information regarding age, occupation, economic status, marriage patterns and reproductive events were collected. The data was processed and analyzed by using software SPSS V.19.
Results: The age composition in both the subgroups of Rellis indicates a high proportion of children and a low proportion of older people which are the common characteristics of a rapidly growing population. The overall consanguinity is more among Relli-II (42.3%) than among the Relli-I (36.9). The highest mean marital distance is recorded in Relli-I (37.9 km). The mean ages at marriage, first conception, and menopause are found to be slightly higher among the Relli-I. Whereas, the mean ages of menarche and last conception were higher in Relli-II. Tubectomy records the highest frequency in Relli-II group and vasectomy registered the highest frequency among Relli-I group.
Conclusions: The demographic and reproductive structure of the Rellis in the present study indicates that observations made with regard to most of the variables fall well within the ranges observed for other caste populations of Andhra Pradesh.

Keywords: Genetic demography, Relli community, Endogamous sub-populations, Consanguineous and affinal matings

INTRODUCTION

Population Genetics assumes the existence of a mechanism for heredity and variation of characters and enquires into the way in which the genetic make-up of population is altered or held in equilibrium by the multiple influences of systematic factors such as mutation, selection, genetic drift, gene pool, migration, inbreeding structure.[1] In addition to these evolutionary processes, other non-systematic factors such as size, density, mate selection and distribution of population also influence the genetic composition. Usually, population geneticists give more importance to the parameters such as fertility, mortality, and effects of inbreeding. Some of the demographic works in the Indian context are known from census data, namely age and sex composition, population size, etc. From last few decades, different journals published papers in demography. Few studies are important contributions from Andhra Pradesh.[2-7]

The population of India is composed of many thousands of subpopulations, divided by geography, language,

religion, and caste or boundaries. From a genetic perspective, the population of India is unique in its size and level of subdivision, with 15 major languages and six main religions. Within the majority Hindu community, there are an estimated 3000 major castes, 1055 scheduled castes, and 572 schedules tribes.[8] The total population of Andhra Pradesh, as per the 2011 Census is 7,62,10,007. Of this, 1,23,39,496 (16.2 percent) are scheduled castes (SCs), forming a sizeable part of the State's population. Andhra Pradesh occupies the fourth position in India in terms of scheduled caste population. The SC population of the State constitutes 7.4 percent of the country's SC population. The scheduled caste constitutes 16.19 percent of the total population of Andhra Pradesh in 2001. Scheduled castes are known by different names in different parts of the state and comprise many sub-castes and communities. At present, there are 59 scheduled castes in Andhra Pradesh.

The present population genetic study was done on a caste population, known as Relli, which is categorized into two endogamous sub-castes, Relli-I (Fruit vendors) and Relli-II (scavengers). The Relli people are mainly concentrated in Andhra Pradesh. The term "Relli" means a kind of grass in the Telugu language, and the traditional occupation of the Relli community was to gather and sell grass. At present, the Relli sell fruits and seeds and also involved in other occupations, including street sweeping and scavenging. The main objective of the present study is to assess the genetic composition of these two subgroups and the extent of genetic differentiation among them with the help of various demographic and genetic variables.

METHODS

A community-based cross-sectional study was done among 428 Relli families (Relli-I: 208; Relli-II: 220) residing in different localities of Visakhapatnam city. The survey was carried out over a period of 14 months, from March-1992 to April-1993. A house to house visit of the area was done beginning from the randomly selected household and moving along the right-hand side till the required sample size was achieved. The women have explained the objectives of our study and were assured that their identities won't be disclosed. Consent was obtained from all the participants of the study. All the Relli families who completed the survey entirely and who were most willing to share genetic demographics and family history were included in the study. The newly married couples, participants who were least willing to share family history, fertility and mortality information and data with incomplete pedigree charts were excluded. A pre-tested, pre-designed and semi-structured proforma was used for the data collection. The demographic information regarding age, occupation, economic status, and reproductive events were collected. Also, information about the marriage type, i.e. consanguineous or non-consanguineous marriage was recorded by constructing pedigrees. Based on pedigrees, consanguineous marriages are classified as uncle-niece and first cousin marriages. First cousin marriages are further classified as marriage with father's sister's daughter (FSD) and mother's brother's daughter (MBD). Thus, collected data was processed and analyzed by using software SPSS V.19.

RESULTS

The age and sex composition are of fundamental importance in any demographic study. The trends in fertility, mortality, migration and marriage patterns influence the age and sex composition of a population. The age and sex composition of both the subgroups of Rellis are presented in Table 1.

Table 1: Age and sex wise distribution and tertiary sex ratio among surviving members of Rellis.

Age group (in years)	Relli– I		Relli– II		Pooled		Tertiary sex ratio		
	Males	Females	Males	Females	Males	Females	Relli-I	Relli-II	Pooled
0-10	134 (27.0)	125 (24.3)	124 (22.7)	148 (25.0)	258 (24.2)	272 (24.5)	107.2	83.8	94.9
11-20	80 (16.1)	106 (20.6)	114 (20.9)	115 (19.4)	294 (27.6)	221 (19.9)	75.5	99.1	133.0
21-30	84 (16.9)	138 (26.8)	119 (21.8)	167 (28.2)	203 (19.0)	305 (27.5)	60.9	71.3	66.6
31-40	106 (21.4)	79 (15.3)	86 (15.7)	79 (13.3)	141 (13.2)	158 (14.3)	134.2	108.9	89.2
41-50	45 (9.1)	28 (5.4)	46 (8.4)	49 (8.3)	66 (6.2)	77 (6.9)	160.7	93.9	85.7
51-60	19 (3.8)	21 (4.1)	35 (6.4)	20 (3.4)	54 (5.1)	41 (3.7)	90.5	175.0	131.7
61-70	15 (3.0)	12 (2.3)	08 (1.5)	09 (1.5)	23 (2.2)	23 (2.1)	125.0	88.9	100.0
71-80	10 (2.0)	04 (0.8)	07 (1.3)	05 (0.8)	17 (1.6)	09 (0.8)	250.0	140.0	188.9
>80	03 (0.6)	02 (0.4)	07 (1.3)	01 (0.2)	10 (0.9)	03 (0.3)	150.0	700.0	333.3
Total	496 (100)	515 (100)	546 (100)	593 (100)	1066 (100)	1109 (100)	96.3	92.1	96.1

The age composition in both the subgroups of Rellis (Relli-I and Relli-II) as well as pooled Rellis (both males and females) clearly indicates a high proportion of children and a low proportion of older people which are the common characteristics of a rapidly growing population. The proportions gradually decrease in both the subgroups of Rellis and as well as pooled Rellis. Relatively large proportions (Relli-I: 25.6%; Relli-II:

23.9%; Pooled: 24.4%) of the children are in the age group 0-10 years, followed by middle ages of 21-30 years (Relli-I: 22.0%; Relli-II: 25.1%; Pooled: 23.4%), potential reproductive stage of 31-40 years (Relli-I: 18.3%; Relli-II: 14.5%; Pooled: 13.7%). The ratio of males to females in a population at a specific age group or in all age groups together at a particular point of time is referred as tertiary sex ratio. The data on tertiary sex ratio among Rellis are presented in Table 1. The tertiary sex ratio of all living Relli (both males and females) individuals in both the subgroups (Relli-I: 96.3; Relli-II: 92.1; Pooled: 96.1) indicating an excess of females in the population.

The child-woman ratio is a simple relative measure of fertility ratio represented as the number of children aged 0-5 years per 100 woman of childbearing age who is usually defined as women between 15-49 years of age. The distribution of child-woman ratio among Rellis is presented in Table 2. The table indicates the child-woman ratio among both the subgroups of Rellis (Relli-I: 49.02; Relli-II: 50.34; Pooled: 49.67).

Table 2: Child-woman ratio among Rellis.

Population	Child-Woman Ratio
Relli-I	49.0
Relli-II	50.3
Rellis (Pooled)	49.7

Table 3: Distribution of marriage pattern among Rellis.

Mating type	Relli- I	Relli- II	Pooled
Consanguineous	83 (39.9)	93 (42.3)	176 (41.1)
UN	27 (12.9)	12 (5.5)	39 (9.1)
MCC	30 (14.4)	29 (13.2)	59 (13.8)
PCC	24 (11.5)	50 (22.7)	74 (17.3)
FCOR	2 (1.0)	2 (0.9)	4 (0.9)
SCOR	0 (0.0)	0 (0.0)	0 (0.0)
Affinal	125 (60.1)	127 (57.7)	252 (58.9)
Total marriages	208 (100)	220 (100)	428 (100)

UN=uncle-niece; MCC=Matrilateral cross cousins; PCC=Patrilateral cross cousins; FCOR= First cousins once removed; SCOR= Second cousins once removed.

Table 4: Marriage type, village endogamy, and exogamy among Rellis.

Mating type	Relli– I			Relli– II		
	Village endogamy (%)	Village exogamy (%)	Total	Village endogamy (%)	Village exogamy (%)	Total
Consanguineous	57 (68.7)	26 (31.3)	83 (39.9)	82 (88.2)	11 (11.8)	93 (42.3)
Affinal	77 (61.6)	48 (38.4)	125 (60.1)	93 (73.2)	34 (26.8)	127 (57.7)
Total marriages	134 (64.4)	74 (35.6)	208 (100)	175 (79.6)	45 (20.5)	220 (100)

Table 5: Distribution of marital distance among Rellis.

Marriage distance	Relli– I		Relli– II		Pooled	
	Consang	Affinal	Consang	Affinal	Consang	Affinal
Total	83	125	93	127	176	252
Village endogamous	57 (68.7)	77 (61.6)	82 (88.2)	93 (73.2)	139 (79.0)	170 (67.5)
Village exogamous (km)	26 (31.3)	48 (38.4)	11 (11.8)	34 (26.8)	37 (21.0)	82 (32.5)
1 – 50	9 (10.8)	7 (5.6)	4 (4.3)	7 (5.5)	13 (7.4)	14 (5.6)
51-100	6 (7.2)	14 (11.2)	3 (3.2)	9 (7.1)	9 (5.1)	23 (9.1)
101-150	8 (9.6)	15 (12.0)	3 (3.2)	8 (6.3)	11 (6.3)	23 (9.1)
>151	3 (3.6)	12 (9.6)	1 (1.1)	10 (7.9)	4 (2.3)	22 (8.7)
MMD±SE	30.25±6.23	42.90±6.01	8.20 ± 2.79	25.61 ± 4.73	18.60±3.38	34.19±3.85
MMD±SE (T)	37.86±4.39		18.25±3.03		27.78±2.68	

MMD = mean marriage distance; t =3.6769; d.f ∞; p<0.001

Table 6: Details of ages at women's reproductive events among Relli women.

Age at event	Relli- I	Relli- II	Pooled	t-test
	Mean±SE (years)	Mean±SE (years)	Mean±SE (years)	
Age at menarche	12.82±0.06	13.29±0.07	13.07±0.05	5.1581*
Age at marriage	17.10±0.21	16.84±0.18	16.97±0.19	3.2099*
Age at first conception	18.85±0.28	18.36±0.21	18.61±0.25	1.4045
Age at last conception	25.66±0.45	26.16±0.45	25.91±0.45	0.7862
Age at menopause	45.57±0.41	45.38±0.36	45.47±0.47	0.3590

Table 7: Distribution of family planning among Rellis.

Population	Tubectomy	Vasectomy	Total
Relli-I (208)	83 (40.0)	51 (24.5)	134 (64.4)
Relli-II (220)	99 (45.0)	45 (20.5)	144 (65.5)
Pooled (428)	182 (42.5)	96 (22.0)	278 (64.1)

Out of 428 married couples, 176 women had practiced consanguineous marriages (41.1%) and 252 women had adapted to non-consanguineous (58.9%) marriages. The subgroups of Relli population practiced five different types of consanguineous marriages and the incidence of each type is presented in Table 3. The frequency of consanguineous marriages in Relli-I (40.0%) are lesser than in Relli-II (42.3%), the value for the pooled Rellis being 41.1%. Among consanguineous marriages, uncle-niece marriages accounted for 13.0% of total marriages in Relli-I while the Relli-II and pooled Rellis recorded values of 5.5% and 9.1% respectively. Marriages between first cousins (MBD) record a value (Relli-I: 14.4%; Relli-II: 13.2%) in both the subgroups of Rellis, while the patrilateral cross cousin marriages record higher incidence in Relli-II (22.7%) than in Relli-I (11.5%), the value for pooled Rellis is 17.3% (Table 3).

It can be seen that the proportion of endogamous marriages are more than exogamous marriages in both Relli-I (64.4% and 35.6%) and Relli-II subgroups (79.6% and 20.4%) respectively. The same pattern was seen when observed for consanguineous and affinal marriages by village endogamy and exogamy (Table 4)

The distribution of marital distance and mean marital distance (MMD) in consanguineous and affinal marriages among Rellis are presented in Table 5. The distance ranges from 1-50 km to 151 and above km. The highest proportion of marriages in consanguineous mattings of both the subgroups of Rellis (Relli-I: 10.84%; Relli-II: 4.3%) occur at a marital distance of 1-50 km. While the lowest frequency occurs at a distance of 151 km and above (Relli-I: 3.6%; Relli-II: 1.1%). While in affinal matings the highest proportion of marriages in Relli-I (12.0%) occur at a distance of 101-150 km. Whereas, in case of Relli-II (7.9%) it occurs at 151 km and above and the lowest frequency occurs at 1-50 km (Relli-I: 5.6%; Relli-II: 5.5%).

The highest mean marital distance is recorded in Relli-I (37.86±4.39 km). The lower value of mean marital distance among Relli-II (scavengers) than Relli-I (fruit vendors) might be due to the fact that the Relli-II are comparatively economically poor and thereby cannot afford to go longer distances for marriages. The pooled Rellis record a value of 27.78±2.68 km mean marital distance. The mean marital distance in the consanguineous mating of both the subgroups of Rellis is relatively lower than that of affinal mating. The difference in the mean marital distance between the two subgroups of Rellis is significant as evidenced by the t-value ($t=3.6769$; $d.f \infty$; $p<0.001$).

The period between the menarche and menopause is the reproductive span in a woman's life. The mean age at specific phases of a reproductive cycle like age at menarche, age at marriage, age at first and last conceptions, and age at menopause of Relli women are depicted in Table 6. Menarche is a biological phenomenon representing the symbolic start of womanhood. Out of the two subgroups, Relli-I girls menstruate slightly lesser at age (12.82±0.06) than the Relli-II girls (13.29±0.07). The intergroup difference for both the subgroups of Rellis being significant, the mean menarcheal age for the pooled Rellis is 13.07±0.05 years, which can be considered to be early.

Age at marriage is a socio-cultural factor and is an important variable. The fertility performance of a woman starts with marriage. The age at marriage certainly influences the total fertility of the women, i.e. the women with early marriages get a privilege of having a longer period of fertility performance. The mean age at marriage is relatively higher in Relli-I (17.10±0.21) than that of Relli-II (16.84±0.18) and pooled Rellis with an average of 16.97±0.19 years. Age of woman at her first conception is an important stage of her fertility performance. The mean age at first conception is almost same in Relli-I (18.85±0.28) and Relli-II (18.36±0.21) and pooled Rellis with an average of 18.61±0.25 years,

which indicated that Relli women deliver within a year after marriage. The mean age of the last conception is slightly higher in Relli-II (25.66±0.45) than that of Relli-I (26.16±0.45) and pooled Rellis with an average of 25.91 ± 0.45. Menopause puts an end to the reproductive period of a woman and is a potential factor for the estimation of fertility performance. The mean age of menopause is the same in Relli-I (45.57±0.41) and Relli-II (45.38±0.36) and pooled Rellis with an average of 45.47±0.47. Thus, the mean ages at marriage, first conception, and menopause are found to be slightly higher among the Relli-I. Whereas, the mean ages of menarche and last conception wire higher in Relli-II.

The Table 7 indicates that tubectomy records the highest frequency in Relli-II group (45.0%) than the Relli-I group (40%). Whereas, vasectomy registered the highest frequency among Relli-I group (24.5%) followed by Relli-II group (20.5%). The pooled Rellis shows tubectomy (42.5%) and vasectomy (22.0%) respectively, accounting 64%.

DISCUSSION

A modest attempt is made in the present study to present demographic structure of two existing endogamous subgroups of Rellis by dealing with age and sex composition, sex ratio, marital distance, consanguinity and female reproductive details. The data on population by age and sex is vital for demographers, health administrators etc. for planning and evaluation of various developmental and health programs. The age composition is one of the most important factors to understand the fertility and/or mortality levels of a population. It reveals the growth trends of the past and present demographic process and predicts the future growth of a population. The age composition in both the subgroups of Rellis (Relli-I and Relli-II) as well as pooled Rellis clearly indicates a high proportion of children and a low proportion of older people as in the case of a growing population. The sex composition also plays a vital role in population analysis since it affects directly the incidence of births, deaths, and marriages. It is found from the data of census 2011[9] that the sex ratio of India, Andhra Pradesh and Visakhapatnam are 94.3, 99.6 and 100.6 respectively. The sex ratio of Scheduled castes in India, Andhra Pradesh and Visakhapatnam were 94.5, 100.7 and 102.3 respectively, while the sex ratio in Relli is 93.29, which is less than the Visakhapatnam district value as well as city values for scheduled castes. The tertiary sex ratio of Rellis agrees well with Kapu, Mangali Brahmin, Vadabalija and Yadava castes by showing a value less than 100. Kummari caste[4] records the highest sex ratio (125.00) while the lowest (89.31) is reported among the Vadabalijas.[6] These observations indicate considerable male mortality in these caste populations. The population of the state of Andhra Pradesh reported 992 females per 1000 males. It is interesting to note that majority of Andhra castes and urban populations also showed the slightly higher number of males than females.[4,10] Whereas, the present study indicates an excess of females (1108) over males (1042). The child-woman ratio as per 2001 Census is 51.5 in general Indian population and 43.7 in Andhra Pradesh.[11] The child-woman ratio in the tribes of Andhra Pradesh is usually high in castes Konda Reddy tribe[5] with the highest value (74.1) followed by the lowest value (45.6) in Manne Dora tribe.[12] The child-woman ratio among both the subgroups of Rellis and pooled Rellis fell within the range of other tribes. Highest ratio (58.1) of the child-woman ratio is recorded in the Madiga caste while Kalingas recorded the lowest ratio (8.2).[13,14]

The pattern of marriage is one of the primary factors that determine the distribution of genes and genotypes in a population. The frequency of consanguineous marriages is higher in Relli-II than in Relli-I. Marriages with patrilateral (marrying father's sister's daughter) are observed to be more compared to matrilateral cross-cousin marriages (marrying mother's brother's daughter) and uncle-niece marriages in Relli-II and pooled. The state of Andhra Pradesh is historically known for a high incidence of consanguineous marriages which is of a great biological significance in the genetic make-up of the human population. The present study on Rellis gives further proof to this contention. The incidence of consanguineous marriages is very high (47.1%) among Jalaris,[5] while it is lowest (13.9%) among the Brahmins.[15] The marital distance recorded a mean value of 37.9 km in Relli-I followed by Relli-II which recorded 18.3 km and the differences between two subgroups of Rellis is statistically significant. Village endogamy is higher in Relli-II (79.6%), while village exogamy recorded the highest frequency among Relli-I (35.6%). Majority of consanguineous couples in both the subgroups of Rellis belong to the same village (village endogamy). In case of affinal marriages, the village endogamous marriages account for 61.6% in Relli-I and 73.2% in Relli-II group. Compared with Andhra populations the present study Rellis (Pooled) recorded lower mean marital distance when compared to castes of Andhra Pradesh. According to Malhotra, consanguinities and village exogamy does not influence mean marital distance in any predictable direction.[16]

Age at menarche is an important aspect of population dynamics and is an important population variable trait that depends on heredity and ecology. Variation relating to age at menarche is having a considerable effect on the reproductive life of a woman.[17] The mean menarcheal age shows variation between Relli-I (12.8 years) and Relli-II (13.3 years) with significant intergroup differences. Further, the mean menarcheal age (13.1 years) for pooled Rellis is lower than in most of the upper caste populations like Brahmins, Karmas, Kshatriyas, Vysyas etc. This observed variation in the menarcheal age may be related to socio-economic, environmental and nutritional factors. Studies conducted on menarche and menopause show that the menarcheal age of a woman differs widely between populations because of differences in diet. For

instance, meat and fish-eating women menstruate earlier than vegetarian women.[18] These differences are likely due to the interplay of factors such as climate and topography. The hot open-air life coupled with cold high attitudes climate of the Hills are expected to make some observable differences in the period of puberty.[19] To understand the effect of climate and diet on the age of first menstruation, a study was conducted by Bhardwaj and Virmani.[20] According to them, the dietary habits are very positively associated with the age of first menstruation. The vegetarian girl's first menstruation occurs at 14.4 years, while, for non-vegetarian girl's first menstruation occurs at 14.0 years. The age at which the girl is given in marriage depends on social values. Age at marriage' is not only a crucial but also a decisive variable in limiting family size and fertility level. There is an inverse correlation between age at marriage and fertility level. If age at marriage increases, fertility level would decline. It has been found that a majority of them are aware of the legally prescribed minimum age for marriage. At the National level, the mean age at effective marriage for a female in the year 2011 is 21.2 years. The mean age at marriage is lowest (13.3 years) among Madiga- I females and is highest (17.9 years) among Kalingas.[14,21] The present study of Rellis records highest values in both the subgroups as well as pooled data in Andhra Pradesh. This mean age of marriage infers that the Relli girls get married approximately four years after they attain menarche (13 years), which is the minimum mandatory marriage age for girls in India and is more or less the same as the state average.

Age of the women at her first delivery is an important dimension of her fertility performance. Women with younger age at first delivery are endowed with a higher fertility. The mean age at first conception ranges from 17.92 years (Yadava) to 21.84 years (Kalinga).[6,14] The present study Rellis (18.6 years) fall well within this range of values. Age of the woman at her last conception is also an important indicator of an individual's total fertility performance. Higher age at last delivery indicates a longer period of reproduction and more number of children. The Yadava women reported their delivery as late as in the 36-37 years while it is during 23-24 years among Rajikas. Women belonging to the present Relli community has their last child during 25-26 years of age in an average. Menopause puts an end to the reproductive period of a woman and is a potential factor for the estimation of fertility performance of the human population. The mean age at menopause is recorded to be low among Palle (41.21 years) and Pattapu (41.58 years) caste groups, highest among Mala (48.98 years) and Brahmins (48.16 years).[22-24] The present study Rellis fall well within the range of values. Rellis control their family size by employing certain family planning measures like tubectomy and vasectomy. Tubectomy records the highest frequency in Relli-II group (45%) and vasectomy records higher frequency in Relli-I group (25%).

CONCLUSION

The above result and discussion lead to the conclusion that the present study agrees with that of the earlier studies from different castes of Andhra Pradesh. The child-woman ratio among both the subgroups of Rellis is relatively low. The frequency of consanguineous marriages and village endogamy were found to be high in Relli -II. The mean age at marriage and first conception were found to be higher in Relli-I whereas, the mean ages at menarche, last conception and menopause are found to be high among Relli-II. The subgroups of Rellis in the present study belong to low socio-economic conditions with a high rate of consanguineous marriages within the endogamous groups. Thus, the demographic and reproductive structure of the Rellis in the present study indicates that observations made with regard to most of the variables fall well within the ranges observed for other caste populations of Andhra Pradesh. It is quite interesting to note the family planning measures have been very much widely accepted among the Relli group probably on account of the effect of urbanization and popularity of Government publicity programs in this area. However, there is a lack of awareness and knowledge about the ill effects of consanguinity. Health education and genetic screening were suggested to curb consanguineous marriages in order to prevent adverse outcomes for better health.

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