

ERIC ABELLA ROTH AND K. BALAN KURUP

POLYGyny AS SOCIAL AND BIOLOGICAL
DIFFERENTIATION AMONG TOPOSA
AGRO-PASTORALISTS OF SOUTHERN SUDAN

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ABSTRACT. A demographic survey of eight Toposa villages in Southern Sudan was undertaken to delineate patterns of infant and childhood mortality. Among these predominantly egalitarian agro-pastoralists few standard socio-economic variables useful in the detection of demographic differentials were found. Instead, polygyny was used as a measure of social differentiation, hypothesizing that social differentiation induces demographic differences between polygynous and monogamous marriages. Analysis indicated social differentiation through gerontocracy, while significant differences in mortality and fertility levels were found between monogamous and polygynous marriages, with the latter featuring higher fertility and mortality levels. Underlying rationale for these differences were sought through consideration of social and biological factors.

The Toposa are a Nilo-Hamitic agro-pastoral group whose territory borders the tribal lands of Sudan's Jie, Didinga and Donyiro groups as well as Kenya's Turkana population. From May to October, 1984 a household survey of eight Toposa villages in Kapoeta District, Equatoria Province, Southern Sudan, was carried out by the Department of Statistics of the Democratic Republic of the Sudan, with assistance from the United Nations Children's Fund. Major goals of this survey were to delineate levels of infant and child mortality, search for mortality differentials and define socio-economic and/or biological factors underlying them. However, for this predominantly egalitarian agro-pastoral group many standardly used variables did not distinguish sub-groups within the total sample of 10 267 Toposa. For example, over 99% of the sample listed their religion as "tribal" (animism), none had any formal education, and hence all were illiterate. There were no toilet facilities, and the only sources of heat/lighting were wood and grass, and breastfeeding was universal. Finally, despite attempts to devise questions on family income relevant to Toposa society, e.g. measuring income in terms of livestock held and/or sacks of grain produced, these

variables also produced an overall invariant distribution, due in part to reluctance to discuss the first subject and the subsistence nature of Toposa agriculture.

Such homogeneity in the face of uniformly harsh health conditions has been reported previously in developing countries (Chowdhury, 1981). However, one notable feature of Toposa society is a high and variable incidence of polygyny. Spencer (1980) noted that polygyny can be used as a measure of social differentiation in sub-Saharan African populations, indirectly denoting the distribution of power and prestige between old and young males. This is expressed in the following quotations concerning the role of marriage in sub-Saharan Africa:

Marriage is . . . the doorway not only to the founding of a family and a household but also the goal which must be reached before an individual can acquire independent status within the community. (Colson, 1958: 95)

Where the traditional outlook still prevails, the possession of a number of wives is normally the mark of importance and success in life . . . monogamy is for the majority who are in fact monogamous, a matter of necessity, rather than of choice. (Phillips, 1953, p. xiv)

Viewed in this context marriage constitutes entrance into adulthood, while polygyny determines to some degree one's place in an adult world. Among the Toposa marriage is associated with brideprice, given in the form of cattle. However, additional wives translate into net economic gain due to the exclusive role of women in Toposa cultivation. Indeed, it is cultivation of millet which permits the Toposa to be Sudan's only sedentary Nilo-Hamitic group.

As Spencer (1980, p. 118) notes a society's polygyny rate may represent the extent to which elders maintain a monopoly over marriage and associated economic privileges at the expense of younger men. Specifically, it can be a measure of gerontocracy, implying social differentiation through a combination of age, prestige, and economic power. For East African pastoral societies social control arises from the relative power of age grades (Gulliver and Gulliver, 1963; Spencer, 1965; Schneider, 1979) which increases the probability of gerontocracy.

From this social differentiation biological differentiation in the form of fertility and mortality differentials can be hypothesized. The former has been investigated since Culwick and Culwick's (1939) findings of higher fertility in polygynous versus monogamous women in Tanganyika.

Similar findings have been attributed to the early and universal marriage pattern provided by polygyny (Sembajwe, 1979). Yet most studies note lower fertility levels relative to monogamous marriages (cf. Dorjahn, 1959; Van der Walle, 1968; Isaac, 1980). Proposed rationale for these findings include less frequent coitus, a postpartum abstinence period made feasible by the availability of other sexual partners and, the spread of venereal disease among multiple wives (cf. Page and Lesthaeghe, 1981).

Biological differentials have also been hypothesized for infant and child mortality. The thought that offspring of polygynous spouses would feature better survival patterns can be traced back to Albert Schweitzer (1941) and was recently tested by Schwartz (1978) and Isaac and Feinberg (1982). Proposed mechanisms for relatively lower mortality pressures include longer birth intervals due to postpartum abstinence periods and the presence of surrogate mothers. Isaac and Feinberg (1982) offered an alternative hypothesis; that infant and childhood mortality levels would be greater for offspring of polygynous marriages, due to increased exposure to infectious diseases from multiple unit households in the same compound.

From the above a series of null hypotheses can be formed to test the Toposa data:

1. H_0 — Polygyny will not differentiate male age — groupings within Toposa society.
2. H_0 — Fertility levels will be equivalent for polygynous and monogamous marriages.
3. H_0 — Offspring mortality levels will be equivalent for polygynous and monogamous marriages.

MATERIALS AND METHODS

In Spencer's model variability in the incidence of polygyny is defined via two factors. The first is mean number of wives per married male (m). The second is the ratio of variance of wives to mean number of wives, termed d ($d = S^2/m$). In the case of social differentiation the number of wives per married male should approximate a negative binomial distribution, denoting a large asymmetrical variance around a

relatively low mean. To test for these parameters in Toposa society the distribution of wives per married males was examined. Following Spencer's recognition that marriage is frequently universal in sub-Saharan Africa, the number of wives counted was defined as "additional" or "further" wives, that is additional to the minimum one wife needed for inclusion into this sample of married males ($n = 1\ 027$).

Fertility data representing mean parity were collected by maternal age and by marital period duration. The former were employed to calculate age-specific and total fertility rates via the P/F technique originally devised for sub-Saharan Africa by Brass and Coale (1968). The latter achieved the same through use of the P/P^* technique developed by Coale *et al.* (1975). Both techniques revealed a high degree of internal consistency and completeness for the data (Kurup and Roth, 1985). For the present study both were utilized to calculate mean parity. Availability of mean parity by marital duration overcame the problem of age differences between monogamous and polygynous spouses which has hampered other studies (cf. Olusanya, 1971). This problem relates to younger women predominating either in the monogamous sample, due to marriage to younger men who have not yet acquired brideprice for other spouses, or in the polygynous sample, due to younger women being monopolized by elder males. In addition, the technique of direct age standardization reduced possible age compositional effects between samples.

Indirect mortality estimation techniques were used to calculate infant and childhood mortality. These followed the basic formula devised by Brass and Coale (1968):

$$(1) \quad q(x) = K(i)D(i)$$

where:

$q(x)$ = cumulative probability of dying from birth to age x

$D(i)$ = proportion dead among children even born for maternal age i

$K(i)$ = a multiplying factor

In this relationship the rate and age of childbearing determine the distribution and exposure to risk of death for children classified by

maternal age. Multiplying factors fit mortality to fertility patterns, based on ratios of average parity of women 15–19 compared to those 20–24, and for women 20–24 compared to women 25–29 (P_1/P_2 , P_2/P_3). Improvements to this approach include multiple regression formulae devised by Trussell (1975) which fit observed mortality data to Coale and Demeny's (1968) model life tables. Generalized versions of these provided by the United Nations (1983) were used in the form:

$$(2) \quad K(i) = a(i) + b(i)(P_1/P_2) + c(i)(P_2/P_3)$$

where a , b , and c are regression coefficients. Specifically, those formulae for the "South" family of model life tables were used.

RESULTS

Analysis of 1 027 married Toposa males revealed a mean number of additional wives of 1.1295, with a variance of 2.1908. Figure 1 plots this sample with respect to mean number of further wives (m) and the ratio of variance to mean ($d = S^2/m$). Comparative data are provided by other East African pastoral groups from Ethiopia (Borana), Somalia (Somali), Tanzania (Maasai), Sudan (Baggara) and Kenya (Jie, Samburu, Turkana) (all data from Spencer, 1980). Of these the Toposa feature the highest measures of both parameters.

That Toposa polygyny resembles a negative binomial distribution is indicated by the sample's distance from the line depicting a Poisson distribution. An intrinsic test of observed frequencies to those predicted by the negative binomial revealed significant differences ($\chi^2 = 10.341$, $p < 0.05$). However, as Spencer (1980, p. 142) notes, this may be too exact a test for as large a sample as the Toposa.

To test the hypothesis that Toposa polygyny represents social gerontocracy the sample was divided into males less than age forty and those older than forty. Table I shows the distribution of wives for these sub-groups as well as the total sample. Analysis of the sub-groups by the Kolmogorov-Smirnov Two-Sample Test indicates a significant difference between the two distributions ($D = 0.328$, $p < 0.01$).

To determine if social differentiation extends to biological patterns Table II presents data on mean parity by maternal age, based on a total sample of 1 968 women and 7 343 offspring. This is further divided

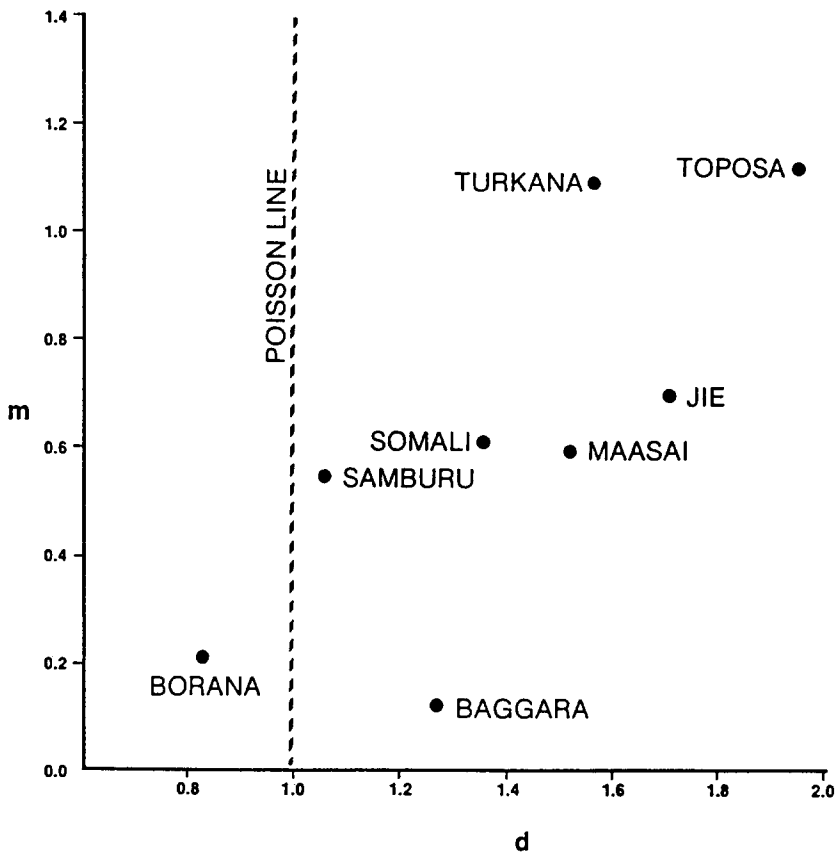


Fig. 1.

into monogamous and polygynous spouses. Mean parity is higher for the latter group. This difference increases when means are standardized on each other's age distribution. Analysis of expected birth distributions under age-standardized regimes revealed significant differences ($D = 0.072$, $p < 0.01$). The same pattern emerges when the data are based on marital duration, as shown in Table III. Note that sample sizes of women ($n = 149$) and offspring ($n = 8408$) are larger here, due to inclusion of women more than forty-nine years of age. Again a significant difference between monogamous and polygynous samples was indicated ($D = 0.092$, $p < 0.01$) between age-standardized parity distributions.

TABLE I
Distribution of spouses, total sample and age cohorts

Ages	0	1	2	3	4	5	6	7	8	9	10	Totals	\bar{x}	s^2
<40	297	95	30	10	1	4	1	1	0	0	0	439	0.9481	0.8989
≥40	154	179	140	53	34	12	5	1	5	3	2	588	1.5952	2.6502
Total sample	451	274	170	63	35	16	6	2	5	3	2	1027	1.1295	2.1908

To analyze mortality data Table IV presents children ever born, children died, and the proportional measure of children dead to children ever born ($D(i)$) by maternal age. In Table V this last factor is converted into cumulative probabilities of dying by age x ($q(x)$) and their inverse, survivorship values ($l(x)$). Results indicate higher survivorship values for offspring of monogamous marriages for all seven intervals, representing birth to the age interval 20–24. Linear interpolation of l_5 values with South model life tables yield average life expectancy at birth values of 52.7 for the monogamous sample and 42.7 for the polygynous (based on distribution of deaths, q_1 excluded due to small sample size, $X^2 = 18.655$, $df = 5$, $p < 0.01$).

DISCUSSION

Use of Spencer's (1980) model of polygyny as a measure of social differentiation in an otherwise apparently egalitarian agro-pastoral society revealed a distinct pattern of gerontocracy, with older males possessing an unequal number of wives relative to younger males. This is also evident in the measure of the Singulate Mean Age at Marriage (Hajnal, 1954), calculated on the proportions of married peoples in the eight five-year age classes 15–54. For Toposa women this figure is 19.99, for males 27.29. Thus . . . "a polygynous society is demographically associated with a queue of unmarried men who must wait as bachelors for a period, an underprivileged sector biding their time (Spencer, 1980, p. 118).

Analysis of fertility levels between female spouses in polygynous versus monogamous marriages revealed significantly higher average parity levels for the former, regardless of whether data were arranged by maternal age or marital duration. It is suggested that both social and

TABLE II
Fertility measures by maternal age, total sample and by marital form

Age	Total Sample			Monogamous			Polygynous		
	N Women	Children Everborn	\bar{x} Parity	N Women	Children Everborn	\bar{x} Parity	N Women	Children Everborn	\bar{x} Parity
15-19	56	25	0.446	12	3	0.250	44	22	0.500
20-24	301	430	1.429	82	113	1.378	219	317	1.461
25-29	579	1775	2.962	155	456	2.942	424	1259	2.969
30-34	326	1409	4.322	67	284	4.239	259	1125	4.544
35-39	361	1749	4.845	85	422	4.965	276	1327	4.808
40-44	164	940	5.732	35	225	6.429	129	715	5.543
45-49	181	1075	5.939	30	180	6.000	151	895	5.927
Totals	1968	7343		466	1683		1502	5660	
\bar{x} Parity			3.731			3.612			3.768
\bar{x} Standardized Parity						3.554			3.840

TABLE III
Fertility measures by marital duration, total sample and by marital form

Marital Duration (years)	Total Sample			Monogamous			Polygynous		
	N Women	Children Everborn	\bar{x} Parity	N Women	Children Everborn	\bar{x} Parity	N Women	Children Everborn	\bar{x} Parity
0-4	271	222	0.819	67	53	0.791	204	169	0.828
5-9	572	1507	2.635	160	413	2.581	412	1094	2.655
10-14	456	1888	4.140	96	422	4.396	360	1459	4.053
15-19	253	1316	5.202	54	282	5.222	199	1034	5.196
20-24	234	1288	5.504	49	277	5.653	185	1011	5.465
25-29	173	1039	6.006	31	185	5.968	142	854	6.014
30-39	190	1153	6.068	26	165	6.346	164	988	6.024
Totals	2149	8408	3.913	483	1797	3.720	1666	6609	3.967
\bar{x} Parity									
\bar{x} Standardized Parity						3.646			4.070

TABLE IV
Mortality measures, total sample and by marital form

Age	Total Sample			Monogamous			Polygynous		
	Children Ever Born	Children Died	Proportion Dead (Di)	Children Ever Born	Children Died	Proportion Dead (Di)	Children Ever Born	Children Died	Proportion Dead (Di)
15-19	25	3	0.1200	3	0	0.000	22	3	0.1364
20-24	430	66	0.1535	113	15	0.1327	317	51	0.1608
25-29	1775	338	0.1971	456	65	0.1425	1259	273	0.2168
30-34	1409	354	0.2512	284	53	0.1866	1125	301	0.2676
35-39	1749	479	0.2739	422	118	0.2796	1327	361	0.2720
40-44	940	271	0.2883	225	59	0.2622	715	212	0.2965
45-49	1075	331	0.3079	180	49	0.2722	895	282	0.3150
Totals	7343	1842		1683	359		5660	1483	

TABLE V
Life tables measures

Index (i)	Age (x)	Total sample				Monogamous				Polygynous			
		D_i^1	K_i^2	q_x^3	l_x^4	D_i	K_i	q_x	l_x	D_i	K_i	q_x	l_x
1	1	0.1200	0.5632	0.0676	0.9324	0.0000	0.9446	0.0000	1.0000	0.1364	0.4827	0.0658	0.9342
2	2	0.1535	0.9458	0.1452	0.8548	0.1327	1.0309	0.1368	0.8632	0.1608	0.9243	0.1486	0.8514
3	3	0.1971	1.0227	0.2016	0.7984	0.1425	1.0174	0.1450	0.8550	0.2168	1.0199	0.2211	0.7709
4	5	0.2512	1.0561	0.2653	0.7347	0.1866	1.0280	0.1918	0.8082	0.2676	1.0597	0.2836	0.7164
5	10	0.2739	1.0825	0.2965	0.7035	0.2796	1.0273	0.2872	0.7128	0.2720	1.0878	0.2959	0.7041
6	15	0.2883	1.0582	0.3051	0.6949	0.2622	1.0255	0.2689	0.7311	0.2965	1.0648	0.3157	0.6843
7	20	0.3079	1.0410	0.3205	0.6795	0.2722	1.0121	0.2755	0.7245	0.3150	1.0454	0.3293	0.6707
		$P_1/P_2 = 0.3121$		$P_2/P_3 = 0.4824$	$P_1/P_2 = 0.4824$	$P_1/P_2 = 0.1814$	$P_2/P_3 = 0.4684$	$P_2/P_3 = 0.4684$	$P_1/P_2 = 0.3422$	$P_1/P_2 = 0.3422$	$P_2/P_3 = 0.4921$		

¹ D_i = proportion of children ever born dead by age interval i

² K_i = Trussell multiplying factor

³ q_x = probability of dying from birth to age x

⁴ l_x = probability of surviving from birth to age x , $l_x = 1.0 - K_{iqx}$

biological factors contribute to this difference. In the first regard, marriage for Toposa females, the majority of whom are entering polygynous unions, is early and nearly universal, as denoted by the low SMAM value. In the latter, analysis of age-specific fertility curves calculated by both the afore-mentioned P/F and P/P^* techniques revealed a slow decline of age-specific fertility relative to the apex period (ages 20–24 in the P/F approach, 25–29 in the P/P^*). This indicates that sterility, widespread in other Southern Sudanese populations (cf. Frank, 1983), is not prominent for the Toposa. Since recent studies cite gonorrhoea as the prominent cause of sterility in sub-Saharan populations (cf. Caldwell and Caldwell, 1984) it appears that Toposa polygyny does not act to promote this fertility dampening condition.

The finding of elevated infant and child mortality levels for offspring of polygynous marriages do suggest that Toposa polygyny increases exposure to, and hence risk of, infectious disease by combining multiple unit households within a single compound as originally suggested by Isaac and Feinberg (1982). Certainly Toposa society, featuring sedentary villages with large polygynous families living in compounds analogous to South African *kraals* fits this model. In addition, proximity of livestock to these compounds increases exposure not only to human borne infectious diseases, but also to zoonoses, as previously shown for other livestock owning peoples (Smucker *et al.*, 1980).

Analysis of Toposa polygyny, fertility, and mortality differentials was not aimed as yet another volley in the ongoing polygyny-monogamy debate. Rather, emphasis was on viewing polygyny as a process of social differentiation in and otherwise largely egalitarian society. In doing so polygyny was considered a starting point from which to examine social differentiation, as well as focusing attention on possible biological concomitants of both male and female status differences. Future analysis will concentrate on examination of polygyny from the female point of view (cf. Ware, 1979) by studying possible demographic differences between senior and junior wives, as well as considering biological factors such as spousal age differences (cf. Bean and Mineau, 1986). In this manner it is hoped more insights into social and biological differentiation in this mainly egalitarian agro-pastoral society can be gained.

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E. A. Roth,
Department of Anthropology,
University of Victoria,
P.O. Box 1700,
Victoria, British Columbia,
Canada.

K. B. Kurup,
Executive Co-ordinator,
Socio-economic Units, Kerala,
P.O. Box 6519,
Vikhas Bharan P.O.,
Trivandrum
Kerala-India 695033.