CHANGING SCENARIO OF BIRTHWEIGHT IN SOUTH INDIA

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ABSTRACT

Reducing incidence of low birthweight and increasing mean birthweights are now considered seriously in the national action plans. Comparison of birthweights obtained over two decades from the representative random segments of rural and urban areas of North Arcot Ambedkar district, Tamil Nadu, India, were studied. Although statistically significant ($p<0.001$), the mean birthweight shows only a marginal increase, of 70 g from 2774.5 g (± 500.2) in 1969-73 to 2845.4 g (± 451.0) in 1989-93. The mean birthweight stratified by area and gender also revealed similar increase. On the other hand, the proportion of low birthweight (<2500g) newborns reduced significantly from 27.2% to 15.9% in rural and 19.1% to 10.8% in urban area over the decades ($p<0.001$). ..The increase in the mean birthweight and the decline in the percentage of low birthweight newborns over the years was greater in rural than the urban community, but the rural newborns continued to weigh lesser than their urban counterparts.

Key words: *Birthweight, Low birthweight, Secular trend.*

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The relationship between low birthweight (LBW) and the elevated risk of infant mortality, congenital malformation and other physical and neurological impairments is well established(l,2). Thus, birthweight and especially LBW are recognized as essential indicators for monitoring and evaluating maternal and child health and nutritional programs. Several studies have shown that the socio-economic and environmental factors influence the birthweight(3-8). However, the impacts vary and it is essential to assess the actual improvements in birthweight with changing socio-economic and environmental conditions over the years. Such evaluation becomes even more critical, when special programs are undertaken to increase birthweights(9,10). Temporal variations in birthweight based on community surveys are scanty in developing countries including India(ll-13). In a previous communication, we described the birth measurements of South Indian infants during early seventies(14). The present paper describes the changes in birthweight distributions of rural and urban south Indian live singletons that occurred during the two decades from 1969-73 to 1989-93.

Material and Methods

Data for this analysis were obtained from continuing longitudinal studies in human reproduction, growth and development established in 1969 in the representative segments of K.V. Kuppam and Vellore Town of North Arcot Ambedkar district in Tamil Nadu State, India, representing rural and urban areas. The description of the study areas and the representativeness have been presented earlier(2,14).

Each married woman in the reproductive age group of 15-44 years was visited once in five weeks to record her menstrua-

tion, incidence of pregnancy and its termination. All investigators were women, fluent in the local language, qualified, given adequate orientation towards the research project and also trained in interview techniques. Every liveborn was visited within 48 hours to record the details of birth, and to take birth measurements. This was possible since the interviewers were living in the study areas. Birthweight was measured using a beam balance upto an accuracy of 5 g. A 5% sample check was done by the trained supervisors to make sure that the collected data were correct.

The difference in the mean birthweight between 1969-73 and 1989-93 was tested using Z-test. Birthweights were categorized into three groups, *viz.,* below 2500 g, 2500-3249 g, 3250 g and above, and Chi-square test for trend was applied to examine the change in the birthweight distribution over the decades. The data were analyzed using Statistical Package for Social Sciences (SPSS) and EPIINFO.

Results

Birthweights were measured in 1969-73 for 2782 live singletons in rural area and 2302 live singletons in urban area. During 1989-93 birthweights were recorded for 2377 live singletons in the same rural area and 2407 live singletons in the same urban area.

The age distribution of mothers who delivered live singletons are presented in *Table I.* The proportion of the mothers in the age group of 20-24 years and 30 years and above were 29.9% and 29.7% respectively in 1969-73. On the contrary, these proportions became 48.9% and 12.1%, respectively in 1989-93. There may be several reasons for such a trend including small family norms, family planning practices, decline in the pregnancy wastage.

The distribution of birthweight groups and its mean in 1969-73 and 1989-93 are presented according to gender in *Tables II* and *III* for rural and urban areas, respective-

TABLE I -*Distribution of Mothers Age at Termination in* 1969-73 *and* 1989-93 *by Domicile*

Maternal age (years)	1969-73				1989-93			
	Rural		Ubran		Rural		Urban	
<20	346	(12.5)	207	(9.4)	265	(11.2)	262	(11.0)
20- 24	806	(29.1)	683	(30.9)	1180	(49.7)	1153	(48.2)
25-29	789	(28.4)	673	(30.5)	664	(28.0)	667	(27.9)
30-34	556	(20.0)	439	(19.9)	206	(8.7)	247	(10.3)
35-39	188	(6.8)	159	(7.2)	45	(1.9)	48	(2.0)
40-44	77	(2.8)	44	(2.0)	11	(0.5)	14	(0.6)
45 +	12	(0.4)	4	(0.2)	4	(0.2)	1	(0.0)
Total	2774	(100)	2210	(100)	2375	(100)	2392	(100)

Figures in parentheses indicate percentages.

TABLE II–*Birthweight Distribution of Live Singletons in 1969-73 and 1989-93: Rural*

Birth-weight (g)	Male				Female				Combined			
	1969-73		1989-93		1969-73		1989-93		1969-73		1989-93	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<1500	9	(0.6)	8	(0.6)	9	(0.6)	10	(0.9)	18	(0.6)	18	(0.8)
1500-1749	17	(1.2)	9	(0.7)	14	(1.0)	14	(1.3)	31	(1.1)	23	(1.0)
1750-1999	23	(1.7)	17	(1.3)	37	(2.7)	10	(0.9)	60	(2.2)	27	(1.1)
2000-2249	124	(8.9)	77	(5.9)	132	(9.5)	65	(6.1)	256	(9.2)	142	(6.0)
2250-2499	182	(13.1)	80	(6.1)	209	(15.0)	88	(8.2)	391	(14.1)	168	(7.1)
2500-2749	333	(24.0)	295	(22.6)	363	(26.0)	288	(26.8)	696	(25.0)	583	(24.5)
2750-2999	224	(16.1)	321	(24.6)	243	(17.4)	285	(26.5)	467	(16.8)	606	(25.5)
3000-3249	264	(19.0)	312	(23.9)	239	(17.1)	203	(18.9)	503	(18.1)	515	(21.7)
3250-3499	106	(7.6)	72	(5.5)	76	(5.5)	40	(3.7)	182	(6.5)	112	(4.7)
3500-3749	78	(5.6)	72	(5.5)	55	(3.9)	51	(4.7)	133	(4.8)	123	(5.2)
3750-3999	15	(1.1)	19	(1.5)	8	(0.6)	7	(0.7)	23	(0.8)	26	(1.1)
≥4000	13	(0.9)	21	(1.6)	9	(0.6)	13	(1.2)	22	(0.8)	34	(0.4)
	1388	(100)	1303	(100)	1394	(100)	1074	(100)	2782	(100)	2377	(100)
Mean(g)	2749.37		2827.93		2684.77		2754.46		2717.00		2794.74	
SD (g)	485.06		464.21		451.81		442.93		469.72		456.09	

TABLE III–*Birthweight Distribution of Live Singletons in 1969-73 and 1989-93: Urban*

Birth-weight (g)	Male				Female				Combined			
	1969-73		1989-93		1969-73		1989-93		1969-73		1989-93	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<1500	8	(0.7)	4	(0.3)	9	(0.8)	1	(0.1)	17	(0.7)	5	(0.2)
1500-1749	19	(1.6)	5	(0.4)	12	(1.1)	10	(0.8)	31	(1.3)	15	(0.6)
1750-1999	21	(1.8)	7	(0.6)	19	(1.7)	9	(0.8)	40	(1.7)	16	(0.7)
2000-2249	89	(7.6)	40	(3.3)	88	(7.8)	52	(4.4)	177	(7.7)	92	(3.8)
2250-2499	93	(7.9)	62	(5.1)	81	(7.2)	69	(5.8)	174	(7.6)	131	(5.4)
2500-2749	222	(18.9)	242	(20.0)	283	(25.2)	271	(22.7)	505	(21.9)	513	(21.3)
2750-2999	150	(12.7)	198	(16.3)	163	(14.5)	239	(20.0)	313	(13.6)	437	(18.2)
3000-3249	333	(28.3)	411	(33.9)	278	(24.7)	345	(28.9)	611	(26.5)	756	(31.4)
3250-3499	88	(7.5)	103	(8.5)	57	(5.1)	84	(7.0)	145	(6.3)	187	(7.8)
3500-3749	95	(8.1)	99	(8.2)	91	(8.1)	72	(6.0)	186	(8.1)	171	(7.1)
3750-3999	30	(2.5)	15	(1.2)	13	(1.2)	13	(1.1)	43	(1.9)	28	(1.2)
≥4000	29	(2.5)	27	(2.2)	31	(2.8)	29	(2.4)	60	(2.6)	56	(2.3)
	1177	(100)	1213	(100)	1125	(100)	1194	(100)	2302	(100)	2407	(100)
Mean (g)	2862.68		2922.17		2824.30		2868.88		2843.93		2895.74	
SD (g)	541.10		435.37		510.29		443.85		526.50		440.31	

ly. The mean birthweight increased by only 78 g in rural area and 52 g in urban area over the two decades. This modest change in mean birthweight was however, statistically significant both in rural and urban areas ($p<0.001$). The mean birthweight remained lower in rural area as compared to urban area in 1989-93 (Rural 2794.74 ± 456.09; Urban 2895.74 ± 440.31) as in 1969-93.

The mean birthweight stratified by gender revealed that 78.56g increase was found among rural male newborns ($p<0.001$) while it was 59.49 g among urban male newborns ($p<0.01$) over the decades. Similarly, an increase of 69.69 g among rural female newborns ($p<0.001$) and 44.58 g among urban female newborns ($p<0.05$) were noted. However, the female newborns continued to weigh lower than their counterparts in rural and urban areas.

The proportion of LBW infants declined over the decades from 27.2% in 1969-73 to 15.9% in 1989-93 in rural area ($p<0.001$) . and from 19.1% in 1969-73 to 10.8% in 1989-93 in urban area ($p<0.001$V In contrast, the proportion of newborns weighing 2500 g-3249 g increased by 12% in rural area and 9% in urban area ($p<0.001$). However, the proportion of newborns of 3250 g and above in both rural and urban areas was similar over the decades.

Therefore, marginal increase in mean birthweight was essentially due to the decline in the percentage of LBW infants. It was noted that the percentage of newborns weighing 3250 g and above was lower in rural community (12.4%) than in the urban community (18.3%) in 1989-93 as in 1969-73. The shift in the birthweight distribution based on three groups *viz.,* <2500 g, 2500-3249 g, 3250 g and above achieved statistical significance over the decades both in rural and urban area ($p<0.001$).

Discussion

The findings of only 10% decline in proportion of LBW and an increase in mean birthweight by about 50-70 g over two decades are disappointing. A study conducted in Ethiopia, reported the mean birthweight increase by 107 g from 3073 ± 585 g to 3181 ± 550 g and the decline in LBW by 5% from 13% to 8% over a period of 10 years (1973-82)(11). Similarly, a study in USA found the reduction of 14% LBW infants among whites and 3% among blacks between 1973 and 1983(12). In contrast, a study in Nigeria showed that the yearly incidence of LBW increased from 7% in 1984 to 13% in 1989(13).

It was interesting to find that the rise in the mean birthweight and the reduction in the percentage of LBW newborns over the decades was greater in rural area than the urban area with regard to both the gender. However, the* rural newborns could not attain the birthweight to the level of urban newborns over the decades. Similarly, female infants continued to weigh lesser than their counterparts.

Using 1969-73 data, significant risk of LBW in rural area was observed in female newborns, primipara, shorter gestation (<37 weeks), and maternal height (≤144 cm) and weight (≤40 kg) after adjustment with other variables. Similarly, in urban area, shorter gestation, low maternal weight, low paternal education and occupation were the significant risk factors associated with LBW (Antonisamy, unpublished Ph.D. Dissertation, 1991). Although other studies have corroborated some of these relationships(5,7,8), understanding the causal and potential importance of factors affecting birthweight or LBW needs critical review.

Studies on trends of LBW attributed

various reasons for the decrease or increase in the percentage of LBW: changes in demographic characteristics and unidentified medical treatment(ll), favorable changes in maternal characteristics (primarily increase in educational level) among whites(12) and economic recession(13). The observed decline in the percentage of LBW babies as found in the study might be due to the changes occurred in relation to several factors directly or indirectly. However, it is pertinent to discuss the changes occurred in some of the correlates of birthweight to the extent possible during the study period between 1969 to 1993. The public was increasingly aware of the need of health since the emphasis on health care particularly on maternal and child health had been changing over time in India with more medical facilities and social activities. For instance, a steep rise was seen in the hospital deliveries of the present study. The percentage of hospital deliveries was 18.3 in rural area and 53.0 in urban area in 1969-73(15) and increased to 57.4 and 84.2 for rural and urban areas, respectively in 1989-93 ($p<0.001$). With the intervention of family planning and welfare programs, people were motivated for birth spacing and small family norms and hence contributed to maternal and child health. The number of acceptors of family planning methods in Tamil Nadu increased from 1.33 lakh in 1967 to 6.11 lakh in 1984(16). It was also noted that Tamil Nadu state achieved the negative growth rate of -2.56 in 1991(17).

Educational status of the Indian community was positively changing over the years. The female literacy of the study district increased from 31.39% in 1971 to 42.25% in 1991(18). The per capita income of the Indian population increased from 88.3 in 1965-66 to 110.0 in 1980-85(19). As regards female age at marriage in Tamil Nadu state, its mean increased to 20.25 in 1981 from 18.37 in 1961(20). Inspite of changes during the last two decades including the intervention of maternal and child health programmes from the government and other agencies, the present scenario of birthweight is not satisfactory. This will require much greater thought and changes in strategy, especially if one wishes to accelerate the increase in average birthweight to 3 kg(9) and reduce LBW babies (<2.5 kg) to less than 10%(9,10) by 2000 AD.

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