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Influence of Maternal Bio-social Factors on Birthweight

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Summary

Kemiki AO and Akindele JA. Influence of Maternal Bio-Social Factors on Birthweight. *Nigerian Journal of Paediatrics* **1993; 20:6.** Influence of maternal bio-social factors, including age, pre-pregnancy weight/height, social class, birth-order, birth-spacing, educational level and use of antenatal-care facilities, on birthweights of 1,238 singletons was studied over a period of six months at three hospitals in Ibadan. There was a significant ($p<0.001$) influence on birthweight by the age of the mother, such that teenage mothers gave birth to lighter babies than older mothers. The study also revealed that the most appropriate period in life for a woman to have normal size babies was between 25 and 29 years of age. There was a significant difference ($p<0.05$) between the mean birthweight of babies delivered by mothers weighing less than 70kg and those whose weights were 70kg and above. The difference between the mean birthweight of babies born by mothers in the upper social classes with or without university degree and that of babies born by secondary school girls was significant ($p<0.05$). Among illiterate mothers, the incidence of low birthweight (LBW) was 13.1 percent, while it was 5.2 percent among mothers with university education. In order to improve upon infant birthweights and thus reduce the prevailing high incidence of LBW in developing countries, it is suggested that adequate nutrition be promoted during child-bearing age; teenage marriages and pregnancies be discouraged and women education be promoted and encouraged.

Introduction

BIRTHWEIGHT, one of the determinants of perinatal mortality rate, which is influenced by genetics and also environmental and maternal factors, has been described as the most important means of assessing the health and maturity of a newborn child.[1] In the past, several studies on birthweights of babies in the developing countries have been carried out.[2-9] In Nigeria, for instance, analysis of predisposing factors to low birthweights has highlighted the effects of some maternal characteristics.[7,8] The present prospective study was undertaken so as to assess the effects of some of these maternal characteristics on the birthweight of babies born in Ibadan.

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Subjects and Methods

The study was carried out on all consecutive singletons born in three large hospitals in Ibadan, namely: University College Hospital

(UCH), Oluyoro Catholic Hospital (OCH) and Adeoyo Maternity Hospital (AMH), during a six-month period (June, 1987 to November, 1987, inclusive). All the mothers had received antenatal care at the respective hospitals where delivery also took place. At each antenatal visit, each mother underwent physical examination; weight was taken and urinalysis performed. Pyrimethamine malarial prophylaxis, iron and folic acid were prescribed. Information that was collected and recorded about each mother included age, parity, occupation, educational attainment, weight, height and birth intervals; particular note was taken of the weight before pregnancy (if this was known) at the first antenatal visit and immediately after delivery. All the above data were obtained through a questionnaire.

All the babies were weighed by staff midwives in the delivery room immediately after birth. The weighing scales in the three hospitals were of the same make (Waymaster); the scales were checked and standardized, using standard weights, by a technician and they were also checked daily, for zero error throughout the period of the study. The sex as well as the outcome of the babies (survival or death) were also noted. The socio-economic classification of the mothers used here was that designed and used by the Biostatistics division, department of Preventive and Social Medicine, UCH, Ibadan.

Data abstracted from the questionnaires were computerized, using an IBM XT (personal) computer for correlation analysis. The first computer programme provided the overall means, standard deviation and simple correlation co-efficient (r) for maternal factors in relation to birthweight. Chi-square test was used to assess the effect of maternal educational attainment on birthweight, while the Student's 't' test was used to compare the means. Statistical differences at the five percent level ($p<0.05$) were taken to be significant.

Results

There were 1238 mothers and the same number of singletons in the study. Of this number, 222 mothers (17.9 percent) were booked, followed up and delivered at the UCH, while 406 mothers (32.8 percent) were similarly delivered at OCH and 610 mothers (49.3 percent) at AMH. Table I shows the maternal ages and the mean birthweights of the babies; the highest mean birthweight (2983 ± 630gm) was among babies delivered to mothers in the age group 25-29 years, while the lowest mean birthweight (1893 ± 832gm) was among babies delivered to mothers in the age-group 16 years and below. There was a corresponding increase in the mean birthweight with increasing maternal age, until the age-group 25-29 years, after which a fall in the mean birthweight occurred (Table 1). A significant positive correlation was found between birthweight and maternal age ($r = 0.178$; $p<0.001$).

TABLE I

Maternal Age and Mean Birthweights of 1238 Babies

Age (years)	*No. of Births*	*Mean Birthweight (gram)*	*SD*
≤ 16	8 (0.7)	1893	832
17 - 19	171 (13.8)	2682	685
20 - 24	367 (29.6)	2842	612
25 - 29	415 (33.5)	2983	630
30 - 34	177 (14.3)	2979	596
≥ 35	87 (7)	2542	618
Unknown	13 (1.1)	3032	858

Pearson's correlation co-efficient (r) of birthweight and maternal age ($r = + 0.178$, $p<0.001$). Figures in parentheses represent percent of total births.

SD = Standard deviation

Table II shows the effect of pre-pregnancy weights on the mean birthweights of babies. The mean birthweight increased progressively from 2715 ± 511gm among mothers with pre-pregnancy weight less than 50kg, to 3280 ± 566gm in those whose pre-pregnancy weight was between 70 and 80kg. Thereafter, the mean birthweight decreased in babies delivered to mothers whose pre-pregnancy weights were above 80kg; these differences in the birthweight with the different pre-pregnancy weights were significant ($r = 0.160$; $p < 0.05$). Maternal heights and the mean birthweights of the babies (Table III) show that there was no significant difference ($r = 0.033$; $p > 0.05$) between the two parameters. The largest mean birthweight (3134 ± 621gm) was however, found in babies of mothers who were more than 164cm tall and the lowest (2693 ± 654gm) in babies of those who were less than 155cm tall.

TABLE II

Maternal Pre-Pregnancy Weights and Mean Birthweights of 1238 Babies.

Weight (kg)	*No. of Births*	*Mean Birthweight (gram)*	*SD*
< 50	62	2715	511
50 - 59	320	2832	538
60 - 69	266	2969	546
70 - 79	113	3280	566
≥ 80	51	3216	558
Unknown	426	2688	751

r = 0.160; p<0.05
SD = Standard deviation

No definite trend occurred between birth order and birthweight, although a slight increase in mean birthweight occurred with increasing order (Table IV) such that the mean birthweight (2759 ± 668gm) was lowest among the first-borns and highest (2953 ± 596gm) among the fourth-borns. Thereafter, the weight dropped with the fifth-borns to 2923 ± 618gm and 2908 ± 614gm with the sixth born; then an increase (2956 ± 704gm) occurred with those over sixth-born. These differences were not significant (r = ± 0.07; p>0.05). In Table V are listed the mean birthweights in relation to birth intervals. It is

TABLE III

Maternal Heights and Mean Birthweights of 1238 Babies

Height (cm)	*No. of Births*	*Mean Birthweight (gram)*	*SD*
< 155	386	2693	654
155 - 164	648	2902	625
> 164	121	3134	621
Unknown	83	2928	531

Pearson's correlation co-effeciiient (r) for the maternal factor of height and birthweight (r = 0.033; p>0.05).
SD = Standard deviation.

TABLE IV

Birth Orders and Mean Birthweights of 1238 Babies

Order	*No. of Births*	*Mean Birthweight (gram)*	*SD*
1	353	2759	668
2	212	2812	694
3	189	2946	598
4	165	2953	596
5	127	2923	618
6	112	2908	614
> 6	73	2956	704
Unknown	7	2931	435

r = + 0.07 - p>0.05
SD= Standard deviation.

evident that the mean birthweight was highest (2962 ± 493gm) in the two-to-three-year interval and lowest (2754 ± 561gm) among babies with interval less than one year ($p>0.05$).

Table VI shows the socio-economic classes of the mothers and the mean birthweights of the babies. As can be seen, the highest mean birthweight (3290 ± 487gm) was among babies delivered by mothers in the professional class with university degrees, while the lowest mean birthweigth (2613 ± 900gm) was among secondary school girls, the difference between these two classes being significant ($t = 3.81$; $p<0.05$). There was also a difference ($t = 2.67$; $p<0.05$) between the professional class that required no university degree and that which required a degree; there was a significant difference ($t = 4.814$; $p<0.01$) between professional class without university degree and those in the semi-skilled class (typists, clerks, artisans, etc). There was no difference between the mean birthweight of babies delivered by unemployed mothers and those by unskilled working mothers ($t = 1.65$; $p>0.05$); similarly, there was no difference ($t = 0.45$; $p>0.05$) between the mean birthweight of babies of unskilled mothers and those of semi-skilled mothers.

TABLE V

Mean Birthweights of 1238 Babies in Relation to Birth Intervals

Interval (Years)	*No. of Births*	*Mean Birthweight (gram)*	*SD*
<1	166 (13.4)	2754	561
1	58 (4.7)	2594	597
2	602 (48.6)	2962	493
3	304 (24.6)	2887	630
4	39 (3.2)	2859	656
5	27 (2.2)	2959	476
Unknown	42 (3.4)	—	—

Figures in parentheses represent percentage of total births
Correlation co-efficient between birth interval and birthweight $r = +0.071$; $p>0.05$.

TABLE VI

Socio-economic Classes of Mothers and mean Birthweights of 1238 Babies

Class	*No of cases*	*Mean Birthweight (gram)*	*SD*	*t*	*P*
Unemployed	164	2884	611		
				1.65	>0.05
Unskilled (cleaners, food vendors, etc.)	681	2793	642		
				0.45	>0.05
Semi-skilled (typist, clerk, artisan)	131	2850	679		
				4.814	<0.01
Professionals without university degree	191	3016	607		
				2.67	<0.05
Professionals with university degree	40	2903	487		
				3.81	<0.05
Students	24	2613	900		
Others/Not known	7	3290	480		
Total	1,238	-	-	-	-

SD = Standard deviation
t = Student's 't' test

Maternal educational levels and the mean birthweights of the babies (Table VII) show a general trend of progressive increase in the birthweight with higher maternal educational attainment.

TABLE VII

Maternal Educational Attainments and Birthweights of 1238 Babies

Attainment	*No of cases*	*No of Babies with Birthweights*	
		Less than 2,500gm	*2,500gm or more*
Illiterate	245	32 (13.1)	213 (86.9)
Primary	354	54 (15.3)	300 (84.7)
Secondary	373	47 (12.6)	326 (87.4)
Post-secondary but less than university	201	14 (7.0)	187 (93.0)
University or equivalent	58	3 (5.2)	55 (94.8)
Others	7	2 (28.6)	5 (71.4)
Total	1238	152 (12.3)	1086 (87.7)

Numbers in parentheses represent percent of total

Birthweight was below 2500gm in 32 (13.1 percent) of the 245 illiterate mothers as well as in 54 (15.3 percent) of the 354 mothers who had up to the primary school educational level. In contrast, the birthweight was below 2500gm in only three (5.2 percent) of the 58 mothers with university or equivalent education. The mean birthweight of babies of those mothers with university educational attainment was 3290 ± 487, that of illiterate mothers was 2758 ± 651 (x^2 = 11.14; p = 0.025). Table VIII lists the number of antenatal visits undertaken by the mothers and the mean birthweights of the babies. The mean birthweight increased progressively from 2,468gm with one-to-two visits, to 3044gm and above with seven-to-above nine visits. The mean birthweight of babies delivered by mothers who undertook nine or more visits was 3311 ± 470gm and that of babies by mothers with one or two visits was 2468 ± 867gm (r = 0.113; p<0.05).

TABLE VIII

Number of Antenatal Visits and mean Birthweights of 1238 Babies

Visit	*No. of Babies*	*Mean Birthweight (gram)*	*SD*
1 - 2	206	2468	867
3 - 4	263	2775	577
5 - 6	297	2944	514
7 - 8	417	3044	550
≥ 9	55	3311	470

Discussion

In the present study, the two most important maternal biological factors that had positve influence on the birthweights of the infants, were age and pre-pregnancy weight, respectively. A significant (p<0.001) positive influence occurred between maternal age and the mean birthweights of the babies. As has been observed by other workers,[10,11] there was a tendency for teenage mothers to give birth to lighter babies than those of older mothers. The present findings on the relationship between age and birthweight are also in agreement with those of Morrison *et al,*[12] who further suggested that the differences in pregnancy outcome were attributable to the personal characteristics of weight, height, parity and the life style of the woman. Our study has further shown that the most appropriate period in life for a woman to have a baby with normal birthweight and hence, an excellent chance of survival, is between 25 and 29 years of age. During this age period, the potential mother would have become fully mature; her necessary biological and psychological adjustments would have taken place and she would have had adequate education and training to enable her appreciate and use available healthcare facilities.

The pre-pregnancy weights in the present study may be regarded as a reflection of maternal nutritional status. Thus, women who weighed below 70kg could reasonably be considered as being underweight and perhaps, undernourished, while those weighing 70kg and above may be said to have had optimum nutritional intake. The mean birthweights of babies born by this group of women with pre-pregnancy weights below 70kg were significantly below (p<0.05) those of women weighing 70kg and above. Although there was no difference (p>0.05), between maternal height and birthweight, the largest mean birthweight was found among babies whose mothers were taller than 164 centimeters and the lowest, in babies of those mothers shorter than 155 centimeters.

With regard to other maternal factors, neither the birth order nor birth-spacing significantly (p>0.05) influenced the birthweight; however, the mean birthweight was highest among babies whose spacing was between two and three years, thus suggesting this to be per-

haps, the optimum period for birth-spacing. Factors that had strong positive influence on the birthweight included the socio-economic class of the mothers, maternal educational attainments and antenatal visits to clinics and use of available health-care facilities by the mothers. The difference between the mean birthweight of babies born by mothers in the upper social classes with university degree and that of babies born by secondary school girls was significant ($p<0.05$). Similarly, there was a difference ($p<0.01$) between the mean birthweight of babies of professional mothers without university degree and that of mothers in the semi-skilled class, including typists, clerks, etc.

Maternal level of education had some influence on the birthweights. Thus, in the present series, 13.1 percent of illiterate mothers delivered babies with low birthweight (LBW), in contrast to 5.2 percent of mothers with university, or equivalent educational attainment. The importance of educational level on the incidence of LBW has been emphasized by other workers.[7 9] Similarly, professional and other literate women delivered babies with significantly higher ($p = 0.025$) mean birthweights than those of illiterate mothers. Hedayat *et al*[13] and Harrison[14] have also found an increasing birthweight of babies with increasing level of maternal education. The significantly higher ($p<0.05$) mean birthweight of babies whose mothers undertook more antenatal visits to the clinics may indeed, be related to the level of formal education that the mothers might have received. The benefits, including nutritional advice, prophylactic antimalarials and supplemental vitamins and iron, of regular antenatal clinic attendances, have been reported by others.[15 16]

The findings of positive influences, comprising favourable maternal age of between 25 and 29 years of age, pre-pregnancy weight of 70kg and above, high social class, adequate level of education and regular and frequent antenatal clinic attendances on birthweight, have all suggested a number of strategies that should be adopted by various arms of health-care management authorities in order to improve upon infant birthweights and thus, reduce the prevailing high incidence of LBW in Nigeria and indeed, throughout the developing world. These strategies include promotion of adequate and satisfactory nutrition during child-bearing age, discouragement of teenage marriages and pregnancies and promotion and encouragement of women education, at least, up to secondary level.

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References

1 Osuhor PC. Birthweights in Malumfashi, North Central State of Nigeria. *Nig Med J* 1976; **6**: 327-31.

2 Latham MC and Robson JRK. Birthweight and prematurity in Tanzania. *Trans Roy Soc Trop Med Hyg* 1966; **60**: 791-6.

3 Morley D and Knox G. The birthweights of Yoruba babies. *J Obstet Gynaecol Brit Emp* 1960; **67**: 975-80.

4 Effiong CE, Laditan AAO, Aimakhu VE and Ayeni O. Birthweights of Nigerian children. *Nig Med J* 1976; **6**: 63-8.

5 Dawodu AH and Laditan AAO. Low birthweight in an urban community in Nigeria. *Ann Trop Paediatr* 1985; **5**: 61-6.

6 Ogbeide O and Alakija W. Birthweights of babies in Benin, Bendel State of Nigeria. *J Trop Pediatr* 1985; **31**: 139-42.

7 Osuhor PC and Yakasai BA. Low birthweight in Kano City, Northern Nigeria. *Publ Hlth, London* 1981; **95**: 36-42.

8 Wright EA. Low birthweight in the Plateau region of Nigeria. *E Afr Med J* 1990; **67**: 894-9.

9 Rossiter CE, Chong H, Lister UG, Bano Q, Briggs ND, Ekwempu CC and Memberr TT. Antenatal care, formal education and child bearing. *Br J Obstet Gynaecol* 1985 *Suppl* **5:** 14-22.

10 Jayant K. Birthweight and some other factors in relation to infant survival. A study on an Indian sample. *Ann Hum Genet London* 1964; **27:** 261-7.

11 Nair NS, Najar V and Thanhen M. A study of term infants in Calicut (Kerale). *Indian J Obstet Gynaecol* 1963; **13:** 485-9.

12 Morrison J, Najinem JM, Williams GM, Keeping JD and Andersen MJ. Socio-economic states and pregnancy outcome. An Australian Study. *Br J Obstet Gynaecol* 1989 *Suppl* **5:** 298-307.

13 Hedayat SH, Kooshestani AP, Ghassemi H and Kamali P. Birthweight in relation to economic status and certain maternal factors based on an Iranian example. *Trop Geogr Med* 1971; **23:** 355-64.

14 Harrison KA. Better Perinatal Health - Nigeria. *Lancet* 1979; **2:** 1229-32.

15 Effiong CE. Care of the low birthweight infant in Nigeria. *Tropical Doctor* 1978; **8:** 141-5.

16 Harrison KA and Ibeziako PA. Maternal anaemia and foetal birthweight. *J Obstet Gynaecol* 1973; **80:** 798-804.