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Effects of Maternal Nutritional Status on Birth Weight of the Baby

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Summary

This study was started with the following question in mind – What is the effect of the maternal nutritional status on the birth weight of the baby? A prospective study was conducted in two hospitals, based in an urban area. Participants were pregnant women attending the antenatal clinics at the corporation hospital and a private hospital, at 28 weeks of gestation. The sample size consisted of 281 apparent healthy women of 28 weeks of gestation, attending ANC OPD.

The variables that were studied included maternal height, maternal weight gain, haemoglobin estimation, calorie and protein intake of mother and birth weight of the baby. Chi square test and analysis of variance were applied for statistical analysis.

It was observed that the current nutritional status indicated by calorie and protein intake and maternal weight gain during third trimester are directly related to the mean birth weight. Maternal height also has a positive correlation with the mean birth weight. The better the maternal nutritional status, higher is the birth weight and lower is the proportion of low birth weight babies.

Introduction

Growth of the foetus is affected by genetic, maternal and environmental factors and the mechanism of interaction is poorly understood.

Intrauterine growth retardation and consequently the low birth weight is a major perinatal problem, assuming public health importance in developing countries because of associated high perinatal as well as early childhood morbidity and mortality. It is expected that the nutritional status of the mother will have some effect on the birth weight of the baby.

A study was therefore undertaken to find out the relationship between the birth weight of the baby and the nutritional status of the mother.

The nutritional status of the mother was determined by considering factors like maternal weight gain in pregnancy (after 28 weeks), maternal weight at 28 weeks, dietary intake during pregnancy, maternal haemoglobin and height of the mother.

Material and Methods

A prospective study was carried out from January 1992 to January 1993.

Women attending antenatal clinics at:

a) Kamala Nehru Hospital – A corporation hospital catering to the lower socio-economic class in Mangalwar Peth Pune; and
b) Shintre Hospital – Catering to a higher socio economic class in Sadashiv peth Pune (A private hospital) were studied.

281 apparently healthy women of 28 weeks gestation from various socio-economic classes using modified Prasad Classification (1987) were identified and included in the study. All abnormal pregnancies associated with any major illness were excluded from the study.

Information regarding socio-economic

background, physical activity, dietary history, previous medical and obstetic history was collected by interview technique on pretested proforma.

Protein and caloric intake of each mother was estimated by 24 hours recall method and estimating cooked food values of amounts specified by simple household measures, like cup, wati, and spoon with the help of charts prepared by MACS, Pune. (1992).

Anthropometric measurements were taken as follows:

- Maternal height: Height was measured to the nearest 1 cm.
- Maternal weight: weight was recorded on a standard beam balance with a platform to the nearest 50 gms.
- The laboratory investigations consisted of estimation of haemoglobin by Sahli's method.
- Anaemia was classified as mild (10 to 11 gm %), moderate (7 to 10 gm %) and severe (<7 gm%) as per WHO classification. (De Maeyer et al (1989).

Antenatal follow up was carried out at 28, 30, 32, 34, 36, 38 and 40 weeks of gestation and each time the mother's weight was recorded. The birth weight of the newborn infant was recorded within 24 hours of delivery on an electronic weighing machine.

Results and Discussion

There were 193 women from Kamala Nehru Hospital and 92 women from Shintre Hospital included in the study. Of these four pregnancies resulted in still births and were excluded from the study.

Table I: Distribution of birth weight

Birth Weight (gm)	Number	Percentage	MBW (g)	SD (g)
<2000	2	0.7	1900	70.7
2000-	56	19.9	2285.1	127.6
2500-	124	44.2	2722.2	150.6
3000+	99	35.2	3210	197.8
Total	281	100	2801.1	384.4

MBW: Mean Birth Weight

The mean birth weight of the study population was 2801.1 with SD of 384.4 (Table I).

The mean caloric intake of the group was 1443.6 with a SD of 426.02 calories (Table II, Graph 1).

The mean birth weights showed direct relationship with higher consumption of caloric intake whereas proportion of LBW was inversely related

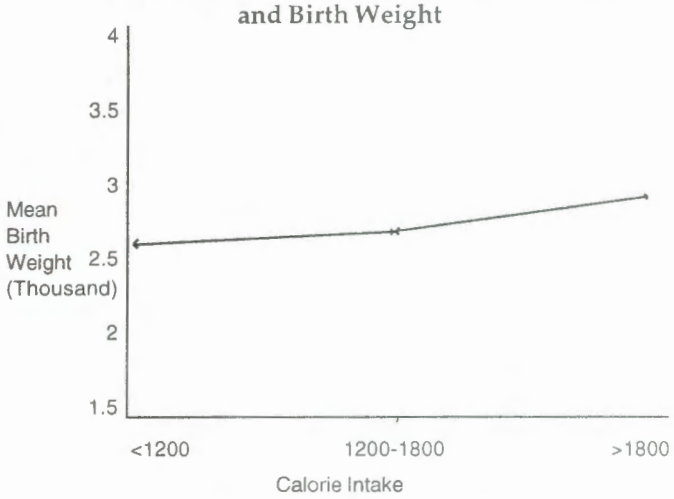
Table II: relationship of MBW and Proportion of LBW with Calorie intake of mothers

Calories	No.	%	MBW* (g)	SD (g)	LBW** (g)	%
<1200	72	25.6	2677.9	363.2	23	31.9
1201-1800	140	49.8	2758.5	373.3	29	20.7
>1800	69	24.6	3016.1	345.3	6	8.7
Total	281	100	2801.1	384.4	58	20.6

*ANOVA test (MBW) F = 17.1156, P = 0.0000

** X^2 = 11.65, d.f. = 2, P = 0.003, significant.

Graph 1 : Relationship Between Calorie Intake and Birth Weight



Mothers showing protein deficiency were also deficient in calories. The mean protein intake of the group was 48 gm with SD of 10.75. The birth weight increased with increased daily protein consumption upto a level of 69 gms and showed a decline thereafter. This distribution was highly significant (Table III, Graph 2).

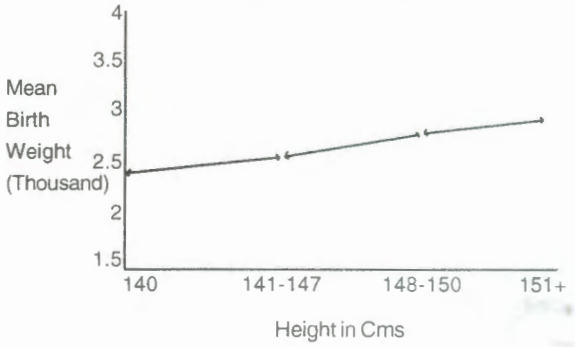
Table III: Relationship of MBW and Proportion of LBW with protein intake of mothers

Protein Intake	No.	%	MBW* (g)	SD (g)	LBW** (g)	%
<40 gm	57	20.3	2646.0	314.9	19	33.3
40-<55 gm	143	50.9	2774.3	383.7	30	21.0
55-70 gm	78	27.7	2972.4	375.1	7	9.0
>70 gm	3	1.1	2572.0	289.3	2	66.7
Total	281	100	2801.1	384.4	58	20.6

* ANOVA test (MBW) F = 9.6616, P = 0.0000

** LBW – X^2 = 15.97, d.f. = 3, P = 0.00

Graph 2 : Relationship between height of mother and birth weight



The high proportion of LBW in low protein intake group was statistically significant. Three mothers had high protein intake i.e. above 70 gm per day. Two of these three mothers gave birth to LBW babies and the mean birth weight was lowest among all protein intake groups.

Out of 263 women whose haemoglobin could be estimated 140 (53.2%) were in some grade or other of anaemia.

The mean birth weight of babies born to severely anaemic mothers (HB<7 gms) was lowest and that of babies born to mothers with normal haemoglobin was highest (Table IV).

Table IV: Relationship of MBW and Proportion of LBW with haemoglobin percentage of mothers

Haemo-Globin %	No.	%	MBW* (g)	SD (g)	LBW** (g)	%
<7	5	1.9	2627.2	445.1	1	20
7-<10	52	19.8	2828.7	342.6	7	13.5
10-<11	83	31.5	2698.9	389.5	26	31.3
>11	123	46.8	2855.2	379.5	21	17.1
Total	263	100	2796.31	381.86	54	20.5

*ANOVA test (MBW) F = 3.31, P = 0.02

** X^2 = 8.28, d.f. = 3, P = 0.04

Babies of moderately anaemic mothers (HB 7-10 gms) had a mean birth weight higher than the babies of both severely and mildly anaemic mothers. This difference in the mean birth weight was statistically significant. The proportion of LBW was also observed to be more among the babies born to severely and mildly anaemic mothers. This difference was also statistically significant.

Table V : Relationship of MBW and Proportion of LBW with height of mothers*

Maternal Height (cm)	No.	%	MBW** (g)	SD (g)	LBW (g)	%
< 140	5	1.9	2450.0	223.6	2	40.0
141-147	32	12.2	2664.4	311.7	7	21.9
148-150	43	16.3	2795.6	363.2	9	20.9
151+	183	69.6	2851.1	395.4	36	19.6
Total	263	100	2811.6	385.1	54	20.5

* Measurement of height was not possible in 18 mothers.

** ANOVA test F = 3.81, P = 0.01.

The mean birth weights increased and the proportion of LBW decreased with increasing height (Table V). The difference in mean birth weight was statistically significant.

There was an apparent decrease in the proportion of LBW babies with increase in the height of mother. This difference however was not statistically significant.

Table VI: Relationship of MBW and Proportion of LBW with weight gain of the mother in the last trimester

Weight Gain (kg)	No.	%	MBW* (g)	SD (g)	LBW** (g)	%
Reduction in weight	5	1.9	2370.0	381.8	4	80.0
No weight gain	4	1.5	2460.5	317.9	1	25.0
<2	15	5.7	2562.7	329.9	5	33.4
2-	143	54.6	2789.4	383.2	31	21.7
4-	78	29.8	2912.7	371.7	10	12.8
6-	12	4.6	2801.8	365.4	2	16.7
8+	5	1.9	2960.0	376.5		
Total	262	100	2803.9	388	53	20.2

* ANOVA for MBW F = 3.9756, P = 0.0008

** X^2 = 16.92, d.f. = 6, P = 0.009.

Out of 281 mothers, weight gain values for 19 mothers could not be computed. The mean gain during third trimester for the remaining group was 3.3 kg. Weight gain during third trimester correlated well with the mean birth weight of the babies (Table VI). Reduction in the weight of the mother was associated with lowest values of mean birth weight (MBW) and higher weight gains of 8 kg or more were associated with highest values of MBW. This association was statistically highly significant.

The proportion of LBW babies was lowest for good weight gain categories and highest for reduction in maternal weight category. This difference in the proportion of LBW babies was also statistically significant.

The influence of current nutritional status as indicated by caloric and protein intake, weight gain in the third trimester and haemoglobin percentage are directly related to mean birth weight and inversely related to the proportion of low birth weight. Maternal height as an indicator of past nutritional status also has a positive correlation with mean birth weight. Many other workers (Browne et al 1981, Dougherty and Jones 1982, Ramachandran 1985) have reported similar findings indicating positive influence of good diet during current pregnancy as well as during non-pregnant periods.

Initial advantage of higher protein intake upto a level of around 70 gms seems to disappear after this threshold level.

Our results of highly deficient caloric intake are not surprising. Major problem during pregnancy thus appears to be that of a food gap. Special supplementary feeding programmes during pregnancy are ongoing under different schemes at national and regional levels. Such feeding programmes are costly, cumbersome and may not reach the most vulnerable groups; hence cannot be looked upon as a permanent solution to the problem of food gap during pregnancy.

Considering staple food pattern in India which is based on varied combinations of cereals and pulses containing sufficient amounts of calories and proteins, consumption of one more meal a day can be considered as a practical solution to the problem of the observed food gap during pregnancy. Health education about nutrition during pregnancy may influence mothers favourably and remove the doubts related to diet during pregnancy.

Conclusion – As all the parameters showed positive correlation with mean birth weight and negative correlation with proportion of low birth weight, simple intervention like advocating one more meal a day and health education would effectively bridge the food gap.

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