MATERNAL FACTORS AFFECTING BIRTH WEIGHT OF UNCOMPLICATED PREGNANCY

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ABSTRACT

Two hundred full-term pregnant mothers with no complication of pregnancy and no associated disease selected from Jinnah Postgraduate Medical Centre were studied for their nutritional status and other characteristics. The effect of these factors on birthweight of their new-born was determined. Total calorie intake per capita per day was low being 1913. The mean birthweight was 2.9kg, 26% weighed 2.5kg or less. No significant sex difference was observed in the birthweight. Variables having a significant positive influence on birthweight were maternal age at first delivery, upto 25 years, beyond which correlation was not significant; maternal weight and maternal total calorie intake (irrespective of source) upto an intake of 2500 calorie per day, beyond which correlation was not significant. Combined effect of these three maternal factors on birthweight was highly significant. Coefficient of correlation, A being 0.81 (JPMA 41: 164, 1991).

INTRODUCTION

Birthweight is a possible crucial factor in perinatal mortality and retarded child development, both physical and mental[1-3]. Variation in birthweight occurs in last trimester and is influenced to a great extent by factors in the maternal environment. This cross-sectional study was designed to identify these various etiological factors responsible for low birthweight deliveries in our subjects.

SUBJECTS AND METHODS

Karachi is a cosmopolitan city inhabited by different ethnic groups. Jinnah Postgraduate Medical Centre UPMC) is one of the largest general hospitals (1000 beds) of this city and gives medical coverage to a large fraction of the population especially of middle and low income groups. This study fairly represents the Karachi population and comprises subjects of middle and low income groups. Full term pregnant mothers with a single foetus and no complication of pregnancy (normal pregnant mothers) were included in this study. If any complication arose during pregnancy, case was excluded. A total of 200 normal pregnant mothers were selected from obstetric department JPMC. The following information was obtained from each subject and recorded on a special proforma-age, age at marriage, age at first delivery, parity, occupation, husband's occupation, total monthly income, total family members, total number of earning family members (from the last three information income per person per day was calculated) number of working hours, type of work and number of helping hands at work. Nutritional status was determined clinically by the technique of Jeliffe4 and by dietary intake. Maternal anthropometric measurement (taken between 1-6 days before delivery) included height, weight, mid-upper arm circumference and triceps skin-fold thickness (Table-I).

TABLE I. Anthropometric data of mothers.

MEASUREMENTS		MEAN ± S.D.	RANGE
Height	(cms)	152.9 ± 18.8	138-170
Weight	(kg)	54.5 ± 7.9	37-85
Arm circumference	(cms)	28.8 ± 2.3	16.5-30
Skinfold thickness	(m.m)	13.6 ± 4.6	66-24

Anthropometric measurements of new-born taken within first 24 hours of delivery included in addition to the above measurements, chest and head circumference (Table II).

TABLE II. Anthropometric data of newborn babies.

MEASUREMENTS		MEAN ± S.D.	RANGE
Height	(cms)	48.9 ± 13.8	37 - 57
Weight	(kg)	2.9 ± 0.55	1.5 - 5
Head	(cms)	33.5 ± 1.58	29 - 37.6
Chest	(cms)	31.5 ± 1.83	27 - 37
Arm circumference	(cms)		
Skin fold thickness	(m.m)	3.5 ± 1.0	1.5 - 6

Mothers

The weight was taken in kilogram nearest to 0.1kg by spring scale which was checked for zero error before weighing each subject. The height was recorded in cms nearest to 0.1cm by scale fixed to a wall. Subject was bare foot, standing on a flat floor by the scale with feet parallel and with heels, buttocks, shoulders and back of the head touching upright, the arms hanging at the side in a natural manner. The head piece which was a wooden block, was lowered gently, depressing the hair and making contact with the top of the head. The mid-upper arm circumference was measured to the nearest 0.1cm with a

tape. The arm was hanging freely by the side and measurement was taken halfway between tip of the acromion process of scapula and the olcrenon process of the ulna. Tricep skin fold thickness was measured nearest to 0.1cm by the Harpenden caliper. The skin fold parallel to the long axis was picked up at mid point, selected as described before, between the thumb and fore finger of the left hand, clean away from the under lying muscle and measured.

Newborn

Weight was taken by beam balance scale, which was corrected for zero error each time before weighing. The weight was taken nearest to 0. 1kg with no clothes on the baby. The height (crown heel length) was measured nearest to 0.1cm by a tape by holding the new born with the feet, so that fiexion at lower extremities was undone and measurement was taken between heel and crown. Head circumference was taken (nearest to 0.1cm) by placing the tape firmly around the frontal bones just superior to the supraoibital ridges passing it round the head at the same level on each side, and laying it over the maximum occipital prominences at the back (occipitofrontal diameter). The chest circumference was measured at nipple line by a tape nearest to 0.1cm. The mid upper arm circumference and triceps skin fold TABLEIII. Foal in take of 200 pregnant women thickness were measured as described for mothers. Dietary history was taken by one week recall method in a single sitting and intake recorded as food intake per capita per day from food composition tables[5] (Table III).

TABLE III. Food intake of 200 pregnant women per capita/day.

FOOD ITEMS	AMOUNTS (gms)
Meat	36.4
Egg	3.0
Milk	146.0
Pulses	24.2
Wheat Flour	249.0
Rice	21.0
Sugar	37.5
Fat	74.5
Vegetable (mixed)	113.0
Vegetable (green)	3.0
Fruits	48.0
Total Amount	755.0

Statistical analysis

The effect of maternal height, weight, age at first delivery, total calorie intake and protein intake on birthweight was studied by unvariate analysis. The combined effect of these variables on birthweight was further examined by multiple regression analysis[6].

RESULTS

Ml the subjects were from middle and low socioeconomic group. Income per person per day was Rs. 8.90. Family size ranged between 2-13, mean 7. Mean parity was 3.7 (range 0-10), period of gestation was between 37-40 weeks (mean 38 weeks). The average age of mothers at the time of registration was 26.6 years (range 16-45) age at marriage 18.5 years (range 12-34 years) and age at first delivery was 19.6 years (range 14-32 years). Clinical anaemia was present in 64%. Anthropometric measurements (Table I) were below the Harvard standard[7].

Dietary assessment

Dietary history revealed that over 70% of mothers took no fish, no eggs and vitamins supplement was minimal. Total caloric intake was mostly from carbohydrate, protein intake was minimal.

Nutrient intake

From the daily/capita consumption of food mean calorie, protein, fat, minerals and vitamin were calculated (Table IV).

TABLE IV. Nutrient intake of 200 pregnant women per capita / day.

NUTRIENT	INTAKE	RECOMMENDED INTAKE
Calories	1913 K. Cal	2510 K. Cal
T. Protein	59.4 gms	69.7 gms
Animal Protein	12.9 gms	38.6 gms
Fat	74.5 gms	-
Carbohydrates	263.0 gms	-
Calcium	471.4 mg	1200 mg
Iron	13.5 mg	40 mg
Vitamin A	467.4 mcg	750 mcg
Thiamin	1.27 mg	1.4 mg
Riboflavin	0.88	1.3 mg
Niacin	12.04 mg	17.3 mg
Vitamin C	47.0 mg	30.0 mg

*Planning Div., 1980

Compared to recommended daily intake assigned by Pakistan Planning Division 1980 (Table IV), the diet was low in calorie, protein, vitamin A, riboflavin and niacin and deficient in animal protein, calcium and iron. Vitamin C intake was good.

Newborn

Anthropometric measurement (Table II) showed mean weight as 2.9kg and 26% of the newborn were <2.5kg (Table V).

TABLE V. Birth weight distribution of 200 neonates (weight in grams).

1001 to 1500	1501 to 2000	2001 to 2500	2501 to 3000	3001 to 3500	3501 to 4000	4001 to 4500
1	10	41	82	48	14	4
0.5%	5%	20.5%	41%	24%	7%	2%

Multiple regression analysis

The combined effect of maternal weight, maternal age at first delivery and total calorie intake on birthweight as examined by Multiple Regression analysis was highly significant ($P < 0.01$). The value of R coefficient of multiple correlation, being 0.81, which is quite a high value of correlation.

DISCUSSION

Mean birthweight of singleton normal pregnancies in this study is 2.9kg. The weight distribution showed that 26% of the newborn were low birthweight, weighing <2.5kg which is less than 33.3% reported from South India[8] and 29.9% reported by Bhatia et al[9], but is very high as compared with the developed countries[10]. A comparatively lower incidence (21.3%) was also reported from Nigeria[11,12], but these studies included multiple pregnancies, prematurity, preeclampsia, whereas the present study included singleton uncomplicated pregnancies delivering at term. Of the various factors responsible for low birth weight (LBW) in our subjects malnutrition is perhaps the most contentious which is in line with the findings of other workers in this field[2,3,5,13-20]. According to Birmingham study[14] on Asian and European mothers, if Asian mothers have a high nutritional status in the second trimester of pregnancy, they can achieve their full genetic potential for intra-uterine growth, that is a rate comparable to the Europeans. Nutritional status of mothers in this study is far from satisfactory as evident by anthropometric measurements (Table I) and dietary intake (Table III). The combined effect of maternal total calorie intake, maternal weight and maternal age at first delivery on the birth weight of babies as examined by multiple regression analysis was highly significant. Correlation between maternal total calorie intake and birth weight was significant only upto a total calorie intake of 2,500 cal/day beyond which the significance did not exist. Same is the case with maternal weight and birth weight, the correlation significance disappearing after a certain point of mother's weight. Probably the effect of increased calorie intake by mother improves birth weight if mother is under-nourished, but once the requirement of pregnancy is fulfilled, increase in calorie intake may improve mother's weight alone but had no effect on baby's weight. This threshold effect of calorie intake, also reported by other workers[16-18] may be the reason for conflicting results in various studies[15,19]. According to this study, as also reported in the past[21-23], maternal weight appears to have a positive influence on birth weight. The correlation between maternal age at first delivery and birth weight both in primiparas and multiparas observed in this study is in agreement with the reported correlation[12,24-30]. Van den Berg[24], observed that teenage mothers are more likely to have low birth weight infants than the older mothers, and that subsequent infants born to women who started child-bearing at an early age had an increased incidence of low birth weight. Positive effect of maternal age on birth weight was not significant after age 25 years, among our subjects. A similar effect of maternal age on birth weight was also seen among house mothers[12] and in few other studies[25-26]. It has been postulated that among rapidly growing teenagers nutritional requirements of pregnancy may be greater than those of older women and this increased requirement competes with the growth needs of the foetus[30]. Some workers do not consider

age as an important variabl[23,31]. The effect of parity on birth weight is not well established. Some studies have shown an influence[12,22,24,26] while others, like the present study were not able to establish it[32]. Certain cross sectional studies have shown au-shaped dependence on parity in which second and third pregnancies are the safest[21]. Short interval between pregnancies and hard physical work during pregnancy may also be responsible for our low birth weight babies[21,33-37]. No sex difference was observed in the birth weight in this study. Possible explanation is that our subjects were under-nourished and intrauterine growth which is faster in male foetus during the last trimester of pregnancy was affected[38]. The finding is supported by the fact that various supplementation studies[29,33] and studies on well nourished mothers show a sex differentiation in birth weight but not the studies on under-nourished mothers[17,20]. Various factors adversely affecting birth weight, seen in present study are preventable and it is therefore possible to reduce the frequency of low birth weight babies among our subjects.

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