

INFLUENCE OF MATERNAL FACTORS ON THE BIRTH-WEIGHT OF FULL TERM NEW BORN BABY

by

LT. COL. NIRMAL AHUJA,* A.M.C., M.B.B.S., M.D.

and

LT. COL. S. D. KHANNA,** A.M.C., M.B.B.S., D.G.O., M.D., F.R.C.O.G.

Summary

A sample of 600 completely normal births was studied to determine the influence of maternal factors like age, parity, height, weight, weight gain during pregnancy and socio-economic status of the mother on the birth weight of the full term new born baby.

There is a definite relation between age of the mother and babies' birth weight. Birth weight tends to increase with increasing parity of the mother reaching a peak in 4th parity and then shows a decline. Progressive increase in maternal height and weight was paralleled by increase in the mean birth weight. Mothers who gained more weight during pregnancy had babies of higher birth weight, and birth weight increased in high socio-economic group mothers.

Introduction

One of the most important factors in the assessment of physical status of the new born is its weight at birth. Growth represents a continuum of interactions between innate genetic potential on the one hand and environment on the other. Genetic factors which are often thought of as establishing final limits to biologic potential are inextricably interwoven with the environment.

Penrose (1952) stated that birth-weight depends mainly on environmental influences (70%) and on genetical or hereditary influences (30%). The present study was carried out in the Command Hospital, Poona and Cantonment General Hospital. Specialist obstetrical cover to both these hospitals is provided by the department of obstetrics and gynaecology, Armed Forces Medical College. The Command Hospital caters for the families of Army Jawans and officers and in addition forty free beds are provided for civilians to attract additional teaching material. The Cantonment General Hospital caters exclusively for the civilian population of the Cantonment.

Material and Methods

A sample of 600 completely normal births was selected by eliminating births in which there was any medical, surgical or obstetrical complication of pregnancy.

For each mother the following data were collected.

1. *Age in years:* Most of the patients could tell their exact age.
2. *Parity:* This was found out by direct questioning. Abortions were excluded in considering the birth order of the child.
3. *Height:* Height of the mother was recorded in centimeters without shoes.
4. *Weight:* Since the pre-pregnancy weight of this group of women was not

*Gynaecologist, Military Hospital, Meerut.

**Professor of Obstetrics & Gynaecology, Armed Forces Medical College, Poona-1.

available, they were weighed 3 days after delivery. The weight was taken on spring type of weighing machine in kilograms. This weight has been considered as the base line weight.

5. Socio-economic Status of the Mother: Total income of the family was found out by direct questioning. Income of all the earning members of the family was taken into account and dependents included children, parents, brothers, sisters or any other relatives living on that income. From this per capita income per month was calculated. Army jawans besides their pay have certain other benefits like food allowance, free uniforms, free housing, and electricity and free medical aid. Rs. 100 per month were added to their income before calculating the per capita income. Patients were divided into five socio-economic groups according to B. G. Prasad's (1970) recommendations.

Group I: Rs. 300 and above per capita per month.

Group II: Rs. 150 to 299 per capita per month.

Group III: Rs. 70 to 149 per capita per month.

Group IV: Rs. 30 to 69 per capita per month.

Group V: Below Rs. 30 per capita per month.

6. Weight gain during pregnancy: Weight gain during pregnancy could not be recorded throughout pregnancy in these 500 cases as most of these patients attended antenatal clinic only in the last trimester of pregnancy. However, a study of weight gain in pregnancy in various socio-economic groups was earlier carried out by Capt. P. S. B. Menon from the same department in the year 1969-70 which will be the subject of a separate paper under publication. It was an easy

matter to check back the birth weight of the neonates of this group of mothers from the birth register.

A total of 150 cases were studied out of which records of 139 cases who delivered single babies without complications were utilised to study relationship of maternal weight gain on birth weight of the newborn.

It will be noticed that Capt. P. S. B. Menon has used a simple classification of socio-economic group into high income group consisting of officers' wives, middle income group consisting of wives of J.C.O.'s and other ranks and low income group consisting of civilians admitted on free beds. This classification has had to be retained for this group.

7. All new born babies were weighed in the labour room within an hour after birth without clothing on a lever type of weighing machine and weight recorded in kilograms.

Observations

Age

The average Birth Weight in Relation to Maternal Age with Distribution of Cases in Each Group.

In age group below 18 years, there are only 2.3% cases whose babies weighed more than 3000 grams. In age group 18-21 years, 3.8% weighed are in birth weight group more than 3000 grams. In age group 21-25 years this percentage is 16% and reaches its maximum (40.7%) between age groups 25-30 years. After 30 years there is a decline in percentage of babies above 3000 grams, being 18.8% between 30-35 years and 22.4% between 35-50 years. Of the cases in the age group 40 years and above, 1 baby was 2400 grams and 2 between 2501 to 2750 grams.

Maximum mean birth-weight (2960.1

grams) is between age group 25-30 years. Below 18 years it is 2487.3 grams. Between 18 to 21 years the mean birth weight is 2694.4 grams, between 21 to 25 years 2759 grams; between 30 to 35 years 2883 grams and 35 to 40 years 2792 grams.

The effect of maternal age on birth weight has been studied by various authors in the past (Mukherji & Biswas 1969; Basu & Puri 1962; Nair, Nayar 1963; Sen 1956; Saigal 1969).

The present study suggests optimal child bearing age between 25-30 years.

Low birth weight in young mothers according to Hammond (1938) is due to their competing metabolism.

Parity

Relationship of Birth Weight to Parity of the Mother.

In primipara, only 5.7% babies weighed above 3000 grams. In second para, the percentage is 19.1, third para it is 16.7%, 4th para had highest (45%) of babies weighing more than 3000 grams and then there is a decline, being 34.9% for 5th para; 25.7% for 6th para and 23.1% for 7th para and above.

Minimum mean birth weight is in primipara (2605 grams) and then there is a gradual increase reaching its maximum of 2994 grams in para 4. Difference between birth weight of para 4 and 5 is negligible. After para 5 there is a decline in mean birth weight. Difference of mean birth weight between para I and para 2 is 109.4 grams and between para I and para 4 it is 389 grams.

There is no unanimity amongst workers about the influence of parity on birth weight. Tendency to increased percentage of birth weight with parity upto 6th has been noticed by Mills (1954), Lala Prasad (1956), and Khalap (1956).

On the other hand, Mukherji and Biswas (1959), conclude that relationship between parity and birth weight did not appear to be consistent.

According to the present study there is a gradual increase of birth weight upto 5th parity. How much is the influence of age in this is difficult to state.

Maternal Height

Relationship of Maternal Height to the Mean Birth Weight of Babies.

In height upto 140 cm there are no babies above 2750 grams weight. In height group 140-145 only 1.25% are above 3000 grams, between 145-150 cms this percentage has gone upto 10.3, between 150-155 cms it is 21.9, between 155-160 cm 36.5 and reaching maximum of 62.8% in height group 160 and above.

Mean birth weight (2398 grams) is in mothers whose height was below 140 cm. After that there has been a steady increase in birth weight upto 3094 grams in cases where maternal height was 160 cm and above. Difference of mean birth weight between maximum and minimum recorded is 676 grams.

Correlation co-efficient between birth weight and maternal height is 0.46 which is highly significant ($P < 0.01$). Our findings are similar to those of Bhatt & Joshi (1967) excepting that the mean birth weights of our series are comparatively higher. The reason may be the inclusion of the higher socio-economic group in our study, whereas they have dealt with only the lower socio-economic group.

Relationship of the Socio-economic Group of the Mother to her Height.

In the present study in the high socio-economic group I there are no mothers whose height is below 150 cm. Of the 31

cases in this group, 6 (19.4%) were between 150-155, 12 (39%) between 155-160 and the largest number 13 (41.6%) in height group of 160 cm and above. In group II, of the 11 mothers only 2 (18.2%) were below 150 cm, 2 (18.2%) between 150-155 cm, 3 (27.3%) between 155-160 cm and 4 (36.3%) between 160 cm and above. In socio-economic group III out of 155 cases, 1 (0.64%) was less than 140 cm, 15 (9.7%) between 140-145 cm, 23 (15%) between 145-150 cm, 52 (33.6%) between 150-155 cm, 53 (34%) between 155-160 cm and 11 (7.06%) had their height 160 cm and above.

In socio-economic group IV, of 206 cases, 82 (40%) were below 150 cm, 82 (40%) between 150 and 155 cm and only 42 (20%) above 155 cm.

In group V, out of 197 cases, 126 (63.9%) had their height below 150 cm, 56 (28.4%) between 150-155 cm and 15 (7.7%) between 155-160 cm. There are no cases in the height group 160 cm and above. The observations of Baird (1960) on the Aberdeen population on this point are well known, but, to our knowledge, no work on height of Indian women in various socio-economic groups is available.

Maternal Weight

The average weights of infants in relation to maternal weight taken 3 days after delivery. In cases below 40 kg, there are no babies whose birth weights are above 3000 grams. In the weight group 40-45 kg; 5.9% have birth weight above 3000 grams; between 45 to 50 kg, 7.3%; between 50-55 kg, 35.6%; between 55-60 kg the percentage of babies above 3000 grams has gone upto 50% and reaching its maximum of 55% in cases where maternal weight is 60 kg and above.

There was a significant correlation between the weight of the mothers and the birth-weight. The co-efficient of correlation being 0.61 (P/0.01).

None of the women belonging to high socio-economic group (I and II) weighed less than 45 kg. Of 42 cases in these groups, 3 (7.4%) weighed between 45-50 kg; 11 (23.8%) between 50-55 kg; 13 (29.8%) between 55-60 kg and 15 (38.8%) weighed 60 kg and above.

In group III, of 155 cases, 27 (17.4%) weighed below 45 kg; 24 (15.5%) between 45-50 kg; 58 (37.4%) between 50-55 kg; 36 (23.2%) between 55-60 kg and 10 (6.5%) 60 kg and above.

In group IV, out of 206 cases, 87 (42.3%) weighed less than 45 kg and only 23 (11.1%) more than 55 kg. Rest weighed between 45-55 kg.

In group V, of 197 cases, 138 (69.5%) weighed less than 45 kg and 13 (6.8%) above 55 kg. Rest were between 45-55 kg weight group. This shows that a large number of higher weight group mothers belonged to high socio-economic groups.

Maternal Weight Gain in Pregnancy

As mentioned earlier, observations on relationship of maternal weight gain in pregnancy and birth weight of babies is based on a group of women studied by Capt. P. S. B. Menon regarding various factors affecting weight gain in pregnancy.

Total cases studied were 139; 47 in high income group; 45 in middle income group and 47 in low income group. Fifteen cases gained less than 15 kg; 58 gained between 5 to 7 kg; 38 between 7 to 9 kg; 25 between 9 to 11 kg and only 3 gained more than 11 kg. In high income group maximum number gained between 9 to 11 kg. In middle income group and low income group largest number of cases gained between 5 to 7 kg.

Mean gain in weight in high income group is 8.6 kg; middle income group 7.5 kg and low income group 6.1 kg. Overall mean weight gain is 7.9 kg.

Relationship of Babies' Birth Weight to Maternal Weight Gain During Pregnancy

Mothers who gained between 7 to 9 kg had largest number 31.6% of babies between 2751 to 3000 grams and 36.9% had babies weighing more than 3000 grams.

Those who gained weight between 9 to 11 kg, the largest number of babies (48%) weighed between 2751 to 3250 grams, and 52% had babies weighing more than 3000 grams.

There were only 3 cases who gained more than 11 kg, 2 had babies between 3001 to 3250 grams and one weighed 3300 grams.

Mean birth weight in those mothers who gained less than 5 kg is 2625 grams; those between 5 to 7 kg 2797.4 grams; between 7 to 9 kg 2927.6 grams; between 9 to 11 kg 3035 grams and those who gained more than 11 kg 3035 grams and those who gained more than 11 kg it was 3042 grams.

Co-efficient correlation between maternal weight gain and birth weight is highly significant ($P/0.01$). These findings are similar to those of Devi & Bakhru (1963), Love & Kinch (1965), Eastman & Jackson (1968). On an average, according to these authors, birth weight of a baby born to a mother who gains less than 4.5 kg during pregnancy is about 0.5 kg less than that of a baby whose mother gained 10 kg or more.

Socio-Economic Status of Mother

Distribution of Babies According to Birth Weights in Various Socio-economic Groups.

It is seen that in group I, 44% babies

are above 3000 grams; 48.4% between 2701 to 3000 grams and only 6.4% below 2700 grams. Mean birth weight in group I is 3012.8 grams.

In group II, there are 4 (36.3%) between 2701 to 3000 grams and 7 (63.7%) between 3001 to 3300 grams. Mean birth weight in this group is 2975 grams. The number in this group is very small.

In group III, 44.2% babies are above 3000 grams, 40% between 2701 to 3000 grams and 14.2% below 2700 grams. Mean birth weight in this group is 2971.5 grams.

In group IV, only 11.2% babies weighed above 3000 grams. Mean birth weight in this group is 2697.5 grams.

In group V, 3.8% babies are more than 3000 grams in weight. Mean birth weight in this group is 2561.7 grams i.e. 451.1 gram (nearly 1/2 kg) less than that in group I.

Table 1 shows the mean birth weight of females and males in the five socio-economic groups. The mean birth-weights are highest for both sexes in group I and lowest in group V.

As is seen there is not much difference in the mean birth weights of babies belonging to socio-economic Group I (Per capita income above Rs. 300/- per month, Group II (Rs. 150/- to 289/-) and Group III (Rs. 70/- to Rs. 140/-). It is our impression that the dietary habits amongst Indians in this income bracket are more or less the same and moving in the higher socio-economic scale beyond a certain level does not generally entail adjustment of diet and other factors conducive to optimal improvement of the progeny.

Below this level the financial limitations make themselves felt. There is a difference of 316 grams in the mean birth weight in Group I and Group IV (Per

TABLE I
Showing Mean Birth Weight in Each Socio-economic Group

Socio-economic group	Females			Males		
	No. of Cases	Mean Weight	S.D.	No. of cases	Mean weight	S.D.
I	14	2935.7	362	17	3090	249
II	6	2900.0	200	5	2050	114
III	60	2901.0	260	95	3042	278
IV	93	2621	232	114	2774	223
V	112	2477	342	84	2646.6	214

capita income of the family Rs. 30/- to Rs. 69/- per month).

Group V (Per capita income below Rs. 30/- per month) constitute the poor and the destitutes admitted on the free teaching beds in the Command Hospital and Cantonment General Hospital. Even a declared income of Re. 1/- per day per member of the family does not mean that this amount is available for expense on the expectant woman daily. The husband is often a drunkard and a gambler and wife's needs have a very low priority in the scheme of things.

Poverty is more than an absence of income. It is entirely a different way of life. The poor perceive, judge, value and understand things quite differently. Constructive planning for the future, so characteristic of the middle socio-economic group and so essential for successful adaptation, is entirely foreign to the way of life of the poor. They live from day to day, from crisis to crisis. Medical care is sought only when disability or discomfort becomes severe enough to constitute a crisis. Pregnancy in the majority of instances does not achieve a crisis status until the third trimester and for many not until labour begins.

Conclusion

Maternal factors have a very definite influence on the birth-weight of the new born.

As maternal factors like health, physique and nutritional status are so important in producing children of proper birth weight, the problem is more socio-economic than medical. There must be higher standard of living, adequate supply of food, particularly quality food like animal protein, minerals and vitamins and also better education of the public so that they can utilise the cheaper protein containing food stuffs. Only by improving the health of the mother we can expect improvements in birth weight. The average birth weight of children among the most prosperous section of Indian mothers is lower than that of Western average in general. There may be some racial or hereditary factors playing their role besides nutritional factor, but our feeling is that even in the higher socio-economic group in this country the dietary habits are not conducive to bring out the optimal growth potential of the foetus in utero.

The Indian population perhaps from the diet point of view can be divided into those below the starvation line and those above the starvation line and according to the present study the line roughly seems to fall at the level of Rs. 70/- per person per month (per capita income).

Birth weight is a guide to subsequent life in childhood. Hence, improvement in birth weight will ensure better condition of health in infancy and childhood, and

lead to better adulthood in future. This is certainly the ideal which should be aspired for.

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