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RESEARCH ARTICLE

# Effect of maternal body size and socioeconomic status on the outcome of pregnancy

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## ABSTRACT

**Background:** The outcome of pregnancy is strongly influenced by the maternal biosocial factors, intrauterine age, and genetic and biological characters of the fetus. **Aims and Objectives:** Effect of maternal body size and socioeconomic status on the outcome of pregnancy. **Materials and Methods:** This was a hospital-based prospective study carried out at Dr. B.R. Ambedkar Medical College Hospital and K.C. General Hospital, Bengaluru, during the period of October 2001–September 2002. The subjects for the study were pregnant women delivering at full term. Majority of the pregnant women participated in the study were in the age group of 20–30 years. **Results:** Women (20–30 years) belonging to low- and lower middle-income groups gave birth to babies with relatively low birth weight. The placental size exhibited a demonstrable influence on the birth weight of male and female babies. The birth weight of the babies showed an increase with that of the abdominal circumference and fundal height. **Conclusion:** An attempt was made to establish influence maternal socioeconomic status and placental size on the outcome of pregnancy in the age group of 20–35 years.

**KEY WORDS:** Socioeconomic Status; Newborn Weight; Hemoglobin; Placental Size; Fundal Height; Midarm Circumference; Abdominal Circumference

## INTRODUCTION

The woman develops capacity to reproduce from the time of menarche which occurs around 10–14 years. At that age, the reproductive organs are not fully developed to cope up with the stress of pregnancy. Therefore, the maternal age at the time of conception could be an important factor influencing the outcome of pregnancy. It is reasonable to postulate that the extremes of age could have an adverse influence on the development of the fetus and the birth weight of the baby.

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Inadequate nutritional supply to the mother as a result of poor socioeconomic status, lack of knowledge about the balanced diet consequent to the cultural or poor educational background can result in the morbid consequences such as severe anemia and malnutrition. The severity of anemia, coupled with demonstrable malnutrition during pregnancy, can frequently predispose to the toxemia of pregnancy.[1]

The anthropometric characters of the expectant mother like the pre-pregnancy weight and height can be an important factor influencing the birth weight. However, it is not very clear whether the weight gain during pregnancy has any impact on the outcome of pregnancy. There is no direct connection between the maternal and fetal circulation. The placenta is an organ to which the fetus is attached by means of an umbilical cord; this is a structure to which exchange of nutrition, gases, and waste products take place from the early pregnancy to its termination. Thus, the size of placenta in terms of the weight and the diameter

could act as a critical factor in determining the outcome of pregnancy.

In view of multiplicity of the maternal and fetal factors, we have attempted to establish the correlation between maternal factors such as socioeconomic status, age, placental size, fundal height, abdominal circumference, and midarm circumference with the birth weight of the baby.

## MATERIALS AND METHODS

This was a hospital-based prospective study carried out at Dr. B.R. Ambedkar Medical College Hospital and K.C. General Hospital, Bengaluru, during the period of October 2001–September 2002: Permission for the study was obtained from the college authorities before commencement.

### Inclusion Criteria

Normal healthy pregnant women attending AMC Hospital and K.C. General Hospital below the age of 35 years and healthy normal full-term babies/vaginal delivery were included in the study.

### Exclusion Criteria

Twins are excluded from the study. Pregnant women >35 years. Pregnant women with bad obstetric history. Pregnant women with previous history of Pre-Eclamptic Toxaemia Subjects with the H/o, major illnesses or clinical examination indicating the possibility of the disease was excluded from the study.

### Newborn

Congenital anomalies, stillbirth, 108 subjects satisfied the criteria put forth and were included in the study.

### Method of Data Collection

The relevant details pertaining to the subjects were obtained by a questionnaire. The personal details of the subject such as name, age, address, educational status, and occupation were noted. The socioeconomic status was determined by noting the type of family (nuclear or joint) and its size. The total family income and per capita income of members of the family were estimated.

The subjects were categorized as belonging to low, lower middle, upper middle, high, and >Rs. 86,000/- P.A. based on the recommendation of the National Council of applied economic research, New Delhi 1993-94. Majority of the subjects belong to the first three groups.[2]

A detailed menstrual and obstetric history was taken. In the obstetric history, attempts were made to elicit information regarding the previous pregnancies with reference to abortion, complications during pregnancy, and childbirth.

The personal history focused on the habit of smoking, consumption of alcohol, and tobacco chewing. None of the subjects considered for the study had a habit of smoking or consuming alcohol.

A detailed system-wise clinical examination was conducted to rule out any organic illness.

### Symphysis Fundal Height

The upper border of the fundus was located by the ulnar border the left hand and this point was marked. The distance between the marked point and the upper border of symphysis pubis was measured in centimeters by a flexible tape in supine position.[3]

### Abdominal Circumference

Abdominal circumference was measured using a flexible tape to the nearest centimeter at the level of the umbilicus in supine position.[3]

### Midarm Circumference

Midarm circumference is measured by a flexible tape at a point midway between the tip of the acromion process of the scapula and the olecranon process of the ulna with the flexion at the elbow joint.[4]

### Placental Measurement and Cord Length

Although the number of subjects participated in the study was 108, we were able to measure the various parameters pertaining to the placenta in only 100 cases. The parameters, namely placental weight, placental diameters, and cord length, were measured immediately after the delivery.

Placenta was blotted several times with a mopping cloth, and then, the weight of the placenta was recorded by an electronic balance having a sensitivity of +/−5 gm.[5]

Two pins were fixed on the placenta at its greatest diameter and the distance between the pins was measured by a flexible tape. Cord length was measured using a flexible tape to the nearest centimeter. The parameters, namely birth weight, crown-to-heel length, head circumference, and chest circumference, were measured immediately after delivery.

Weight of the baby was recorded using an electronic balance which has sensitivity ±5 gm (Electromedical Pvt., Ltd.).

Head circumference of the baby was measured to the nearest centimeter using soft tape at the level of most prominent part

of the occiput posteriorly and just above the supraorbital ridges anteriorly.[6]

Chest circumference of the baby was measured to the nearest centimeter by a soft tape at the level of nipples anteriorly and midway between inspiration and expiration in the supine position.[6]

2 ml of blood was collected and allowed to clot, the serum separated out by centrifugation for 30 min at 3000 rpm was used for evaluating total serum protein. Total serum protein was estimated using biuret method.[7]

### Statistical Analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS) package. Analysis of variance and Student's "*t*" test of statistical analysis have been used. *P* value >0.05 was taken to be statistically significant.

## RESULTS

Mothers belonging to low-income group gave birth to male babies with a mean birth weight (in kg) of 2.71 ± 0.13 or female babies with a mean birth weight of 2.35 ± 0.43. Mothers with lower middle-income group gave birth to male babies with a mean birth weight of 3.04 ± 0.27 or female babies with a mean birth weight of 2.62 ± 0.37. Mothers with upper middle-income group gave birth to male babies with a mean birth weight of 3.01 ± 0.22 or female babies with a mean birth weight of 2.98±0.29 [Table 1]. There was a significant correlation between maternal socioeconomic status and birth weight of both male and female babies in Groups I and II ($P < 0.05$).

Women aged <20 years gave birth to male babies with a mean birth weight (in kg) of 3.05 ± 0.31 or female babies with a mean birth weight of 2.47 ± 0.46. Women in the range of 21–29 years gave birth to male babies with a mean birth weight of 2.99 ± 0.26 or female babies with a mean birth weight of 2.66 ± 0.37. Women aged >30 years gave birth to female babies with a mean birth weight of 2.28 ± 0.56. However, there were no male babies [Table 2]. There was a no significant correlation between maternal and birth weight of male or female babies in all the three groups ($P > 0.05$).

**Table 1:** Comparison of maternal socioeconomic status and birth weight

| Group | Maternal age (in years) | Mean birth weight (in kg)±SD | | | |
|---|---|---|---|---|---|
| | | *n* | Male | *n* | Female |
| I | ≤20 | 18 | 3.05±0.31 | 12 | 2.47±0.46 |
| II | 21–29 | 32 | 2.99±0.26 | 42 | 2.66±0.37 |
| III | ≥30 | 0 | 0 | 4 | 2.28±0.55 |

The mean placental diameter (in cm) for the male babies in Groups II and III was 16.9 ±0.69 and 18.2 ± 1.05, respectively. The mean placental diameter (in cm) for the female babies was 15.8 ± 1.01, 17.0± 0.81, and 17.2 ± 0.76, respectively [Table 3]. There was a significant correlation between placental diameter with body mass index of the newborn in Groups II and III for male babies and Groups I and II for female babies ($P < 0.05$).

Mothers with uterine fundal height (in cm) of <34 gave birth to male babies with a mean birth weight (in kg) of 3.05 ± 0.26 or female babies with a mean birth weight (in kg) of 2.49 ± 0.31; mothers with uterine fundal height (in cm) of >34 gave birth to male babies with a mean birth weight of 2.91 ± 0.30 or female babies with a mean birth weight of 2.89 ± 0.51.

Mother with abdominal circumference (in cm) of <92 gave birth to male babies with a mean birth weight of 3.02 ± 0.27 or female babies with a mean birth weight of 2.51 ± 0.40. Mothers with abdominal circumference of more than 92 gave birth to male babies with a mean birth weight of 3.00 ± 0.30 or female babies with a mean birth weight of 2.75 4 ± 0.39. There was no significant correlation found between abdominal circumference and birth weight of male babies ($P > 0.05$).

Mothers with midarm circumference (in cm) with <23 gave birth to male babies with a mean birth weight of 2.98 ± 0.30 or female babies with a mean birth weight of 2.44 ± 0.32. Mothers with midarm circumference with >23 gave birth to male babies with a mean birth weight of 3.09 ± 0.21 or with female babies with a mean birth weight of 2.94 ± 0.40. There was no significant correlation between midarm circumferences with birth weight of male babies ($P > 0.05$) and there was significant correlation between midarm circumferences with birth weight of female babies ($P < 0.05$).

## DISCUSSION

Mothers belonging to low-income group gave birth to male babies with a mean birth weight (in kg) of 2.71 ± 0.13 or female babies with a mean birth weight of 2.35 ± 0.43. Mothers with lower middle-income group gave birth to male babies with a mean birth weight of 3.04 ± 0.27 or female babies with a mean birth weight of 2.62 ± 0.37. Mothers with upper middle-income group gave birth to male babies with a mean birth weight of 3.01 ± 0.22 or female babies with a mean birth weight of 2.98 ± 0.29. Our studies indicate that mother belonging to low socioeconomic status had low birth weight babies. The reduced per capita income of the family coupled with poor educational status and health consciousness will not only deprive the buying capacity of the mother but will also have unsatisfactory influence on the choice and type of nutrition supplementation to be consumed during pregnancy.

**Table 2:** Correlation of maternal age and birth weight

| Group | Maternal socioeconomic class income group (rupees/p.a.) | Mean birth weight (in kg)±SD | | | |
|---|---|---|---|---|---|
| | | *n* | Male | *n* | Female |
| I | Low (up to 20,000) | 8 | 2.71±0.13 | 14 | 2.35±0.43 |
| II. | Lower middle (20,001–40,000) | 30 | 3.04±0.27 | 37 | 2.62±0.37 |
| III | Upper middle (40,000–62,000) | 12 | 3.15±0.22 | 7 | 2.98±0.29 |

**Table 3:** Comparison of body mass index of the newborn and mean placental diameter

| Group | Body mass index of newborn (kg/m²) | Mean placental weight ( in gm)±SD | | | |
|---|---|---|---|---|---|
| | | *n* | Male | *n* | Female |
| I | <10 | - | - | 13 | 15.8±1.01 |
| II | 10–13 | 28 | 16.9±0.69 | 34 | 17.0±0.81 |
| III | >13 | 18 | 18.2±1.05 | 7 | 17.2±0.76 |

A poor nutrition and inadequate supplementation during a stressful condition like pregnancy could retard the placental development, reducing its size with a poor fetoplacental perfusion. These changes ultimately will result in a low birth weight baby.[8] In our study, maternal age was predominantly between 20 and 30 years with a very few cases >30 years. In these age groups, the birth weight did not show significant variation with respect to age. However, it is reported in earlier studies that extremes of age could adversely influence weight of the newborn.

Thus, competition between mother and fetus for the available nutrients results in higher incidence of intrauterine growth retardation.

The retarded growth of the newborn could also be attributed to the improper skeletal growth of the mother and underdeveloped reproductive organs.

The older mothers also gave birth to small babies with or without the congenital abnormalities due to higher incidence of metabolic disorders such as diabetes, with hypertension, and other cardiovascular disorders. Low birth weight babies in elder women could also be attributed to the condition of the uterus and endometrium which is not conducive for a satisfactory fetal development.[9]

The mean placental diameter (in cm) for the male babies in Groups II and III was 16.9 ± 0.69 and 18.2 ± 1.05, respectively. The mean placental diameter (in cm) for the female babies was 15.8 ± 1.01, 17.0 ± 0.81, and 17.2 ± 0.76, respectively. Placental size as influenced by weight and diameter is a critical factor influencing the outcome of pregnancy. The larger size placenta and the heavier placenta are demonstrated to have greater number of chorionic villi, this increased number of chorionic villi, increases the surface area of the placenta resulting in better fetoplacental perfusion.

Thus, the adequate supply of requirements to the growing fetus will ensure a good development and a satisfactory birth weight.[4]

It has been observed that there is a significant correlation between in the increase in fundal height and gain in the abdominal circumference during pregnancy.

The relationship was more pronounced for the female babies weighing far <3 kg's. It can be presumed that fetal weight of 3 kg's could be a critical factor above which these anthropometric measurements do not seem to significantly correlate with the fetal development and hence the birth weight. The female babies generally weighed around 2.5 kg and the male babies weigh around 3 kg. The size of the female baby correlated well with the fundal height. However, a similar correlation did not exist for the male babies. Analysis of these results indicates that the size of the uterus and babies' weight could be acting as critical and complementary factors in influencing the progressive increase in the fluidal height.

## CONCLUSION

It was concluded that women belonging to low- and lower middle-income groups gave birth to babies with relatively low birth weight. However, there was no significant relationship between the birth weight and socioeconomic status in the middle-income group. Women considered for the study predominantly belong to the age group from 20 to 30 years. The placental size (weight and diameter) exhibited a demonstrable influence on the birth weight of male and female babies. The birth weight of the babies showed an increase with that of the abdominal circumference and fundal height.

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