"A STUDY OF NUTRITIONAL STATUS AND OTHER RELATED MATERNAL FACTORS ON PREGNANCY OUTCOME"

ABSTRACT

THESIS

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ABSTRACT

Pregnancy is the most exciting period of expectation and fulfillment in women folk. It is a period of great anabolic activities and physiological stress when the most rapid rate of growth in human development takes place in the fetus at the expenses of the mother's health (Jayshree and Kavitha, 2004). Because of nurturing a growing fetus, pregnancy is the most nutritionally demanding time of a woman’s life (Foster, 2006). Pregnant women are a vulnerable risk group because women in developing countries like India have many pregnancies on average, their life time risk more accurately reflects the overall burden of these women. Pregnancy risk factors are all the aspects that endanger the life of the mother and the baby (Mosha and Philemon, 2010).

In a study, Ghate et al. (2001) reported that the growth of the fetus is affected by genetical, maternal and environmental factors. 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. Haggarty et al. (2009) also revealed that the low birth weight is associated with poor obstetric outcome and long-term disadvantage including reduced stature, poor cognitive function and increased risk of coronary heart diseases.

It is expected that the poor nutrition of the woman, child spacing, maternal age (under 15 years and over 35 years), body mass index, maternal education, anemia, blood pressure, inadequate prenatal care, lifestyle behaviours e.g. smoking, alcohol consumption, obesity, poverty, parity, marital status, birth weight, gestational age, labour complications, antenatal care and previous unfavourable outcomes e.g. stillbirth, neonatal deaths, maternal morbidity will have effect on the pregnancy outcome in terms of birth weight, mode of delivery, period of gestation, crown heel length and so on. Like the physical problems associated with the prenatal period, the psychological problems can have persistent effects on the individual’s development and can influence the postnatal environment and the treatment the child receives from significant people during the early, formative years.
Worthingston and Williams (1993) emphasized that the maternal status is an important determinant in the course and outcome of the pregnancy and 75% of the fetal growth is related to maternal nutritional status.

Keeping in mind, the adverse consequences (which cannot be altered once established) of negligence in the care of pregnant women throughout their gestational period, the present study, particularly aims to study the status of pregnant women throughout their gestational period and its effect on the newborns. The few prospective cohort studies done in India on pregnant women covered only second and third or third trimester and have focused mostly on weight of newborn. The effect of maternal factors on her gestational period, mode of delivery and crown heel length of newborn that indicates a broader definition of the outcome of pregnancy is needed than birth weight alone. Therefore, investigations on status of pregnant women and their outcome among communities are important. In view of the above discussion, present study was under taken in Aligarh city because no such study has been done so far in this region. Thus, this prospective cohort study was conducted over a period of one year from April 2009 through March' 2010 in Aligarh city with an objective to know the effect of the maternal nutritional status and other related factors on gestational period, length of newborn, birth weight and mode of delivery.

This study was conducted in the hospitals of Aligarh city, Uttar Pradesh. The study subjects were selected by stratified purposive sampling. At first, Aligarh city was stratified into five specific zones based on the geographical layout to ensure that the study approximately covers the entire city. Based on the highest delivery data of last one year, one hospital from each specific zone irrespective of government or private hospitals were identified. Hospital authorities were approached for seeking necessary permission to conduct the survey. Based on the consent and active cooperation of the hospital authorities; five hospitals one each from identified zones of Aligarh city were selected. Apparently healthy women who were pregnant with second month between ages 15 to 35 years were selected purposively for the study until the desired number of subjects was reached. The pregnant women were recruited at the first trimester and followed up to term.
The sample size was calculated on the prevalence of Low Birth Weight in India which was 30% in 2008. Based on this assumption, by applying the formula of sample size \( \frac{PqZ^2}{E^2} \), the sample size came to about 323, at 95% confidence level and 5% allowable error. A total of 323 pregnant women were enrolled from identified hospitals within the first three months (April 2009 to June 2009) in their first trimester (second month) to follow them till delivery. The purpose of the study was clearly explained to the pregnant women. Information was collected during the second month for first trimester, fifth month for second trimester and eighth month for third trimester of pregnancy for the purpose of uniformity in the analysis. From these, 292 pregnant women were analyzed in the study whose detailed pregnancy outcome information could be collected. The rest 31 were excluded due to the cases of multiple pregnancies, abortion, still birth and not reporting for subsequent check-up.

The study was carried out using a pre-designed and pre-tested interview schedule. The interview schedule was prepared carefully in consultation with medical experts and was improved over several administrations. Interview schedule was used to collect information regarding maternal age, age during marriage, education and occupation of the respondent, education and occupation of respondent's husband, socio-economic status, birth interval, place of previous delivery, last menstrual period, obstetric history, type of family, complications during present pregnancy and anthropometric measurements such as height, weight, Body Mass Index. For assessing the socio-economic status, B. G. Prasad Method of socio-economic classification (modified as per 2004) was used. Dietary intake of the pregnant women was assessed by 24-hour dietary recall method. Behavioral factors such as stress, happiness, fear, habit to chewing tobacco or supari were recorded by interview schedule.

Clinical examination, blood pressure, hemoglobin concentration were recorded of each subject in all three trimesters on each meeting at regular interval. Anemia was graded according to hemoglobin level in the blood as expressed in NFHS-2 (1998-99) and Sahli’s method was used for hemoglobin measurement. Blood pressure of all subjects in each trimester was measured
using a standard sphygmomanometer on the left arm with the sitting posture. Stethoscope was used to monitor the blood flow.

Delivery data were also recorded regarding complications during delivery, gestational period, mode of delivery, sex of new born, type of birth, number of offspring. The health status of the new born was assessed by the weight, crown-heel length and complications of new born. Period of gestation was calculated on the basis of the number of weeks that have elapsed between the first day of the LNMP and the date of delivery. Mode of delivery was recorded as the birth in natural condition, head first position recorded as normal birth and if birth was made surgically due to the complications and other related factors, and it recorded as caesarean delivery.

Crown heel length and weight of newborn was measured by using an infantometer and a beam-type weighing scale respectively. The birth weight was measured by doctors or well trained nurses in the delivery room of the hospitals.

On the basis of above mentioned techniques the following results were observed: The average gestational period at delivery was found to be 37.01±1.33weeks. This gestational period was lower than reported in earlier national and international studies. The average crown heel length of the newborns in this study was 47.89±1.74cm. In the present study, the crown heel length was lower than reported in earlier international studies. The mean birth weight was found to be 2.54±0.44kg which in order to some national studies. The 90.4 and 9.6 per cent of pregnant women were delivered newborn through normal and caesarean delivery, respectively.

On assessing the association between anthropometric measurements in each trimester of pregnancy and pregnancy outcome, it was noted that the mean height of the respondents was 154.40±5.44cm in the study. Maternal height was found to be positively correlated to length (r=0.758) and weight of newborn (r=0.238) with significant at the 0.01 level. The maternal height was also significantly associated with mode of delivery. On the other hand, maternal height was found to be insignificantly (p>0.05) correlated to gestational period (r=0.071).
The findings revealed that the mean values of maternal weight during 1st, 2nd and 3rd trimesters were 48.50±9.56kg, 52.378±9.63kg and 55.96±9.66kg respectively. Maternal weight was found to be positively correlated to weight of newborn in 2nd (r=0.149) and 3rd trimesters (r=0.215) with significant at the 0.05 and 0.01 level respectively. Whereas, weight of pregnant women were found to be insignificantly correlated to gestational period and length of newborn. The maternal weight during all trimesters was also significantly associated with mode of delivery.

Body Mass Index was calculated for assessment of nutritional status and it was classified as Asian perspective (WHO, 2000). During 1st, 2nd, and 3rd trimesters, the mean values of maternal BMI were 20.35±3.92kg/m², 21.97±3.92kg/m² and 23.48±3.94kg/m² respectively. Maternal BMI was found to be negatively correlated to length of newborn in all trimesters at the 0.01 significant level. On the other hand, BMI of pregnant women were found to be insignificantly correlated to gestational period and weight of newborn in all trimesters. The maternal BMI in all trimesters was also significantly associated with mode of delivery.

Weight gain was calculated by subtracting the weight during first trimester from weight during third trimester. The mean value of total weight gain during pregnancy was 7.48±2.32kg. Weight gain in the present study was higher than a national study of Lucknow in India and lower than the International studies. Weight gain during pregnancy was found to be positively correlated to length (r=0.163) and weight of newborn (r=0.479) at the 0.01 significant level. There was no correlation between weight gain and gestational period. But, the maternal weight gain during pregnancy was insignificantly associated with mode of delivery.

On correlation of the mother's dietary intake during each trimester of pregnancy with pregnancy outcome, it was found that the average consumption of different nutrients of pregnant women was very low as compared to RDA except fat intake during 3rd trimester of pregnancy. The average energy consumption of pregnant women was 58.01%, 48.69%, 44.86% deficit than RDA in 1st, 2nd, 3rd trimesters respectively. In this study,
the mean protein intake was 54.06%, 43.64%, 40.21% deficit than RDA in 1st, 2nd and 3rd trimester. Mean calcium intake of the mothers was lesser by 59.0%, 43.49%, and 35.55% than RDA in 1st, 2nd, 3rd trimesters respectively. The average consumption of iron was lower (78.73%, 75.76%, 71.47% during 1st, 2nd, 3rd trimesters respectively) when compared with RDA. The average fat consumption of pregnant women was considerably low (20.43%, 0.9% in 1st and 2nd trimesters) as compared to RDA. Only fat intake during 3rd trimester of pregnancy was 7.13% excess than RDA. The mean intake of folic acid was deficit in 1st, 2nd and 3rd trimesters by 78.51%, 75.86% and 75.52% respectively than RDA.

Maternal calorie intake was found to be positively correlated to crown-heel length and weight of newborn in all trimesters. Where as, no correlation was found between calorie intake and gestational period and mode of delivery.

Maternal protein intake was found to be positively correlated to weight of newborn in all trimesters and crown-heel length (1st trimester) with significant values at the 0.01 level. On the other hand, protein intake of pregnant women was insignificantly correlated with gestational period (during 1st, 2nd and 3rd trimesters) and length of newborn (during 2nd and 3rd trimesters). Protein intake of pregnant women in all trimesters was insignificantly associated with mode of delivery.

An increasing trend was found in the length and weight of newborn with increased calcium intake of pregnant women during all trimesters of pregnancy. Therefore, maternal calcium intake in all trimesters was positively correlated to length and weight of newborn. But, calcium intake during 3rd trimester was negatively correlated to gestational period. So, as calcium intake during 3rd trimester increased, gestational period was decreased. No relationship was found between calcium intake during each trimester and mode of delivery.

An increasing trend was found in the weight of newborn with increased iron intake of pregnant women during all trimesters of pregnancy. Thus, maternal iron intake was positively correlated to weight of newborn in all trimesters.
As the maternal iron intake during 1st trimester increased, the mean gestational period was found to be increased. Therefore, gestational period was positively correlated with iron intake during 1st trimester of pregnancy. Similarly, Mean crown heel length of newborn was increased as maternal iron intake during 2nd and 3rd trimesters increased. So, maternal iron intake during 2nd and 3rd trimesters was positively correlated to crown-heel length. On the other hand, iron intake in all trimesters was insignificantly associated with mode of delivery.

An increasing trend was found in the weight of newborn with increased fat intake of pregnant women during all trimesters of pregnancy. Therefore, maternal fat intake in all trimesters was positively correlated to weight of newborn. Similarly, as maternal fat intake during 2nd trimester increased, the mean crown heel length of newborn was also increased. Thus, length of newborn was positively correlated to fat intake in 2nd trimester.

Mean gestational period was decreased as maternal fat intake during 3rd trimester increased. So, fat intake during 3rd trimester was negatively associated with gestational period. Where as, the fat intake of pregnant women during 2nd trimester was significantly associated with mode of delivery.

Maternal folic acid intake was found to be positively correlated to weight of newborn in all trimesters with significant values at the 0.01 level. Whereas, folic acid intake during 2nd trimester was negatively correlated to gestational period (r=-0.136) with significant at the 0.05 level. There was no correlation found between folic acid intake and mode of delivery.

An increasing trend was found in the weight of newborn with increased meal pattern during all trimesters of pregnancy. So, maternal meal pattern during all trimesters was positively correlated to birth weight. Crown heel length of newborn also showed the progressive trend with increase in meal pattern during 3rd trimester. Thus, meal pattern during 3rd trimester was found to be positively correlated to length of newborn.

Mean gestational period was decrease as maternal meal pattern during 1st and 3rd trimesters increased. Therefore, meal pattern during 1st and 3rd trimesters
was negatively correlated to gestational period at the 0.01 and 0.05 significant levels, respectively. Where as, meal pattern in 1\textsuperscript{st} and 3\textsuperscript{rd} trimesters were found to be positively correlated to mode of delivery.

On analyzing the influence of maternal factors in terms age, age at marriage, socio-economic status, education, gravida, parity, number of children, and birth interval on pregnancy outcome, findings revealed that the mean age and age at marriage of the respondents was 24.58±3.75 years and 20.41±3.22 years respectively in this study. Maternal age was found to be positively correlated to weight of newborn with significant at the 0.05 level. Where as, there was no relationship found between age and gestational period, length of newborn and mode of delivery.

Maternal age at marriage was also found to be positively correlated to weight of newborn and mode of delivery with significant at the 0.01 level. Whereas, there was no correlation found between age at marriage and gestational period and length of newborn.

The findings reported that the mean value of per capita income was 1337.70±1887.17 rupees. That is, most of the pregnant women belonged to poor socioeconomic status in the present study. Maternal socioeconomic status was found to be positively correlated to crown-heel length, weight of newborn and mode of delivery. Where as, no correlation was found between socioeconomic status and gestational period.

In the present study, 32.9 per cent pregnant women were illiterate and 67.1 per cent had educational from primary to post graduation level. Maternal educational level was found to be significantly correlated to gestational period, crown-heel length, birth weight and mode of delivery.

In addition to the above factors, obstetric factors of pregnant women also influence the pregnancy outcome. The mean value of gravida was 2.22±1.27 that is most of the respondents were pregnant for the second time. Maternal gravida was found to be negatively correlated to weight of newborn. On the other hand, maternal gravida was found to be insignificantly correlated to gestational period, length of newborn and mode of delivery.
The mean value of parity was found to be $0.92\pm1.05$ which revealed that most of the respondents were primipara i.e. women who delivered one viable child. Maternal parity was also found to be negatively correlated to weight of newborn with significant at the 0.01 level. Similarly, maternal parity was found to be positively correlated to length of newborn and mode of delivery. But, there was no relation found between parity and gestational period.

Number of children of respondents was found to be negatively correlated to weight of newborn. Similarly, number of children of respondents was found to be positively correlated to length of newborn. On the other hand, number of children was found to be insignificantly correlated to gestational period and mode of delivery.

The result also shows that the birth interval from last birth was below 2 years ($22.38\pm26.13$ months). There was no relation found between birth interval from last birth and gestational period, crown-heel length, birth weight and mode of delivery.

On investigating the relationship between maternal hemoglobin status during each trimester and pregnancy outcome, present study recognized that only 2.4, 0.7 and 1.4 percent women had normal hemoglobin level during 1st, 2nd and 3rd trimesters, respectively. Whereas, 33.6, 28.1 and 31.8 per cent women were mildly anemic during 1st, 2nd and 3rd trimesters, respectively. In 1st, 2nd and 3rd trimesters, 55.8, 19.9 and 44.2 per cent women were moderately anemic, respectively. 1.4, 1.0 and 1.0 per cent women during 1st, 2nd and 3rd trimesters were found with severe anemia, respectively. Whereas, 6.8, 50.3 and 21.6 per cent women during 1st, 2nd and 3rd trimesters did not undergo the measure of the hemoglobin level.

The findings revealed that the mean values of maternal hemoglobin level during 1st, 2nd and 3rd trimesters were $9.41\pm0.94$g/dl (moderate anemia), $9.59\pm0.99$g/dl (moderate anemia) and $9.54\pm0.89$g/dl (moderate anemia), respectively. Maternal hemoglobin level during 1st trimester was associated with length of newborn, birth weight and mode of delivery. Whereas, hemoglobin level during 2nd and 3rd trimesters was significantly associated with length of newborn.
On evaluating the effect of maternal blood pressure during each trimester on pregnancy outcome, the findings revealed that the mean values of maternal SBP during 1st, 2nd and 3rd trimesters were 111.01±9.45mmHg, 111.44±8.78mmHg and 114.89±9.03mmHg respectively. That is, systolic blood pressure (SBP) during pregnancy was in normal range (≤120 mmHg). Similarly, mean values of DBP during 1st, 2nd and 3rd trimesters were 73.66±6.83mmHg, 74.36±7.29mmHg and 75.89±7.14mmHg respectively. During pregnancy, diastolic blood pressure (DBP) was also found to be in normal range (≤80 mmHg). But during 3rd trimester, the mean values of SBP and DBP were higher than the 1st and 2nd trimesters.

The systolic and diastolic blood pressure during 3rd trimester was positively correlated with gestational age, crown-heel length, birth weight and mode of delivery.

Significant variables were found by applying the correlation coefficient test with pregnancy outcome at 5% level of significance. The variables with p-value<0.001 are among the most significant factors. The results revealed that the diastolic blood pressure during 3rd trimester was only the most significantly correlated variable with the gestational period. Whereas, maternal height, BMI in all trimesters, hemoglobin level during 1st and 2nd trimesters and systolic blood pressure during 3rd trimester were the most significantly correlated variables with the crown heel length of newborn.

The most significantly correlated variables with the weight of newborn were maternal height; weight in 3rd trimester; weight gain; meal pattern, calorie, protein, calcium, iron, fat intake during all trimesters; folic acid intake during 1st and 2nd trimesters; maternal age at marriage; socioeconomic status; gravida and SBP during 3rd trimester.

A stepwise multiple regression analysis was performed to determine the combination of factors that best predicted gestational period, crown heel length and weight of newborn. The results reported that the combined effect of most significant factors on crown heel length of newborn was found to be 64.1 per cent followed by the 46.0 percent and 14.0 percent effect on weight of newborn and gestational period, respectively.
Maternal DBP in 3rd trimester ($r^2=0.050$) contributes as the most confounding regression variance, followed by meal pattern in 1st trimester ($r^2=0.038$), iron intake 1st trimester ($r^2=0.019$), calcium intake 3rd trimester ($r^2=0.020$) and hemoglobin level 3rd trimester ($r^2=0.013$) for period of gestation.

Maternal height ($r^2=0.574$) contributes as the most confounding regression variance for crown heel length, followed by parity ($r^2=0.025$), BMI 1st trimester ($r^2=0.014$), meal pattern 3rd trimester ($r^2=0.009$), DBP 3rd trimester ($r^2=0.008$), hemoglobin level 1st trimester ($r^2=0.005$), iron intake 2nd trimester ($r^2=0.006$).

The most confounding factor for weight of newborn was found to be the meal pattern in 3rd trimester ($r^2=0.279$) followed by weight gain during pregnancy ($r^2=0.069$), iron intake in 1st trimester ($r^2=0.047$), SBP 3rd trimester ($r^2=0.027$), fat intake 3rd trimester ($r^2=0.011$), hemoglobin level 1st trimester ($r^2=0.011$), fat intake in 1st trimester ($r^2=0.009$) and maternal age at marriage ($r^2=0.007$).

After analyzing the data, it was found that the adverse consequences (which cannot be altered once established) of negligence in the care of pregnant women throughout their gestational period affects the newborn’s health in terms of birth weight, crown-heel length, gestational period and mode of delivery. A special emphasis on the examinations of nutritional status of pregnant women and its outcome has been made in the present study because good nutritional status of pregnant women contributes significantly to attainment in a healthy newborn. Improvement in nutrition and health status during pregnancy is of great importance as it is inextricably linked with the quality of life of next generation and will go a long way in improving national health. Despite many health policies and programmes focused on the health of expectant mothers and their newborn, mortality and morbidity rates are still high and the goals set by the world health agencies are still at bay. Thus there is room for much more to be done to ameliorate the plight of women particularly during their pregnancy at the grass root level.