STUDY OF MATERNAL AND NEONATAL NUTRITIONAL STATUS IN AN URBAN SLUM AREA

A DISSERTATION

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LIST OF ACRONYMS

ANC = Antenatal Care

BBS = Bangladesh Bureau of Statistic

BMI = Basal Metabolic Index

BMR = Basal Metabolic Rate

BP = Blood Pressure

CED = Chronic Energy Deficiency

dl = Deciliter

et.al = et allies

FP = Family Planning

g = Gram

g/l = gram per liter

Hb = Hemoglobin

HAZ = Height for Age by Z score

IMR = Infant Mortality Rate

INFS = Institute of Nutrition and Food Science

Kg = Kilogram

LBW = Low Birth Weight

MAC = Mid Arm Circumference

MMR = Maternal Mortality Rate

OR = Odd Ratio

RDA = Required Daily Allowance

RR = Relative Ratio

SD = Standard Deviation

TT = Tetanus Toxoid

WAZ = Weight for Age by Z scoring

WHO = World Health Organization

ABSTRACT

A cross sectional descriptive study was conducted on pregnant women and their newborns in an urban slum, Geneva Camp. The objective of this research was to conduct in-depth study on nutritional status of the pregnant women and their newborns by anthropometry, biochemical, clinical and dietary assessment and also to find out the association among the different variables.

The number of sample was taken 309 pregnant women, among which 306 mothers delivered live born children and the rest of them gave birth still born babies. The mean body weight of the pregnant women who were in between 18 and 45 years of age was 46.35±7.96 kg. The association between maternal age and weight is statistically significant at 5 percent level. The mean arm circumferences of 85.62% of the pregnant mothers were <23.5cm. There is positive association between weight and MAC (P<0.41). The sensitivity and specificity of weight and MAC of the pregnant women was 96.9% and 37.9%. The sensitivity and specificity of MAC <23.5cm to low birth weight was 46% and 93% and these two indicators have significant association (Chi-square=22 P<0.05). The hemoglobin level was estimated and 91.3% pregnant women was found anemic (<11gm/dl). Mean cord hemoglobin level of the newborns was 13.89 g. The correlation between mothers' hemoglobin level and that of the babies was not very significant (r = 0.18).Correlation between birth weight and hemoglobin level was found highly significant (r=0.42 P<0.01). The BMI of the mothers was calculated and 11.65% mother's BMI was <18.5, so they were suffering from chronic energy deficiency (CED). Correlation between CED and low birth weight (LBW) is highly significant (Chi-square=41 P<0.001). Sensitivity and specificity of CED and LBW is 94% and 66% respectively. Birth weight of 306 new born babies was taken, among which 38.56% were below 2.5kg, 41.8% were in between 2.5kg and 3kg and 20.26% were above 3.1 kg. Mother's weight <45kg is significantly associated to babies' low birth weight (Chi-square=173 and P<0.001). Sensitivity and specificity of LBW and mother's weight 87% and 88% respectively. Mothers' age is significantly associated with birth weight (P<0.04). According to Z score 53.39% by weight for age, 85.53% by height for age and 87.17% by weight for age of the newborn babies were malnourished (<-2SD).

The neonatal nutritional status is significantly related to maternal age, weight, height, parity, BMI, protein intake and hemoglobin level. So health service especially antenatal care with nutritional guide is recommended for better pregnancy outcome.

CHAPTER-ONE

1.1 INTRODUCTION

Maternal nutritional status prior to and during pregnancy is a critical determinant of pregnancy outcomes for both mother and her infants. This is true in industrialized and developing country settings. It is generally agreed that the health and nutritional status of the mother largely determine the health, survival and vitality of the newborn[1].

Bangladesh is a poor country with a large number of population of 109.87 million in an area of 1,48,393 square meter and a large number of population are living below the poverty line. Maternal and child death rates are extremely high in Bangladesh, of every 1000 children born 78 die during the first year. [2] Maternal mortality rate is 4.4, which is one of the highest in the world accounts for one third of the all deaths of women aged 15 to 49 years. [3]

In Bangladesh virtually all low-income pregnant women weigh less than 50kg, so high percentage has been suffering from malnutrition for years. Malnutrition in many respects the common denominator of the disease and deprivation process that affects mother and children. Malnutrition begins during fetal development and can be traced back to that of the mothers since their childhood. The weight and height of the women shows how pervasive the problem is, further evidence is provided by low birth weight of the babies.[4] A recent study on prenatal nutrition in Bangladesh revealed that 48.4 percent of the rural newborn are found to weight less than 2.5 kg. [5]

Government of Bangladesh has set a target to reduce this rate by 15% by the year of 2020. Birth weight is used as a yardstick of maturity of newborn and it also reflects maternal nutritional status. Data from national survey of Bangladesh indicates that 70 percent of the women of reproductive age were anemic [6]

Recent studies suggest that during gestation mothers provide the whole of the biological and physical environment for the fetus Maternal anthropometry, age intrauterine environment, birth order, and number of pregnancy serve in express the nature of that environment. During pregnancy such anthropometric measures as maternal weight gain, weight-for-height as a percent of standard, or arm-circumference have been shown to be good predictors of infant outcomes such as birth weight and survival. Although less research has focused on the relationship between maternal nutritional status and maternal outcomes of pregnancy, studies have shown that anthropometric measures such as maternal height or arm-circumference are useful in predicting such outcomes as cephalopelvic disproportion or poor maternal energy stores postpartum, respectively. [7]

1.2 JUSTIFICATION OF THE STUDY

The causes of low birth weight have been the focus of a vast number of investigations over the last few decades. It is now acknowledged that many factors can influence the length of gestation or the rate of intrauterine growth.[8] The association between child health and certain socio-economic indicators such as maternal education and family occupation has been well documented in various studies. Maternal variables affecting fetal growth and birth weight have also been identified.[9] However relationship between the nutritional status of the mother and that of the child has not been precisely defined.

The present study is undertaken to determine the nutritional status of the pregnant women and their newborn in an urban slum called Geneva Camp in Mohammedpur area, where population density is very high and people are living in a very unhygienic and subhuman condition. This type of study has not been done in this area, where peoples have been living in camp situation for last twenty-five years. The culture and practice of this minority group of people is different from the other slum area of the city[10]. This study was conducted to find out the nutritional status of the pregnant women and their newborns and to find out the relation between these two indicators.

1.3 OBJECTIVES OF THE STUDY:

1.3.1 General Objective:

The main purpose of this research was to conduct an in-depth study on the nutritional status of pregnant women and their newborn by anthropometric measurement, biochemical, clinical and dietary assessment and to determine the relations between mothers nutritional status and that of the newborns.

1.3.2 Specific objectives:

- To illustrate obstetrical history of the pregnant women.
- To find out the dietary intake pattern for identification of chronic energy deficiency.
- To assess the different anthropometric measurements such as height, weight, MAC and BMI of the pregnant mothers and birth weight, length, head and chest circumference of the newborn babies.
- To explore the co-relation among the anthropometric measurements of the pregnant women and their newborns.
- To determine the hemoglobin level in the blood of the pregnant women and that of the umbilical cord of the newborn and to determine relationship.
- To measure the blood pressure, edema, urinary sugar and albumin for determination of high-risk factors.
- To provide recommendations for improvement of the present maternal health care services in Bangladesh.

1.4 KEY VARIABLES:

- Socio-economic condition
- Age of the pregnant women
- Parity of the pregnant women
- Dietary intake by 24 hours recall of food
- Weight of the pregnant women
- Height of the pregnant women
- MAC of the pregnant women
- Basal Metabolic Rate
- Hemoglobin status
- Blood pressure
- Oedema of the pregnant women
- Urinary content of albumin and sugar
- Pregnancy outcome
- Full term live born babies
- Weight of the newborn
- Length of the newborn
- Head circumference of the newborn
- Chest circumference of the newborn
- Umbilical cord hemoglobin level
- Sex determination
- Neonatal mortality
- Maternal mortality
- Nutritional status by Z Scoring

1.5 OPERATIONAL DEFINITIONS

1.5.1 Pregnant Woman:

Women of age between 18-45 years in third trimester of pregnancy.

1.5.2 Antenatal check-up:

Check-up that was done by medical personals of a pregnant women during their pregnancy period.

1.5.3 Parity of a woman:

Number of live births and birth after 27^{th} week of pregnancy of a woman.

1.5.4 Normal labor:

Delivery of child without any interference within given period of time.

1.5.5 New born babies:

The babies after delivery within one hour.

1.5.6 Anthropometric Measurement:

The technique that deals with different measurements of the size, weights and proportion of the human body. The anthropometric measurements taken in this study are weight, height, MAC of the pregnant women and birth weight, length, and head and chest circumference of the new born.[11]

1.5.7 Weight of the pregnant women:

The body weight of pregnant women measured in kilogram unit by a simple weighing machine.

1.5.8 Height of the pregnant women:

The height of the pregnant women measured in centimeter by a marked measuring scale on a wall in bare footed and standing position.

1.5.9 Mid Arm Circumference:

The circumference of the mid portion of the distance from Acremion and Olecranon Process, measured by a flexible centimeter marked measuring tape.

1.5.10 Basal Metabolic Rate:

The basal Metabolic Rate is the energy expenditure of an individual at complete rest for the activities of the internal organs and to maintain the body temperature [12].

1.5.11 Weight of the Newborn:

The baby just after delivery was placed in a baby weighing scale and determined the birth weight in grams up to 0.1g approximation.

1.5.12 Length of the Newborn:

The newborn babies were placed in a wooden box, which has got a moveable part and marked in centimeter. The length of the newborn is measured from crown to heel distance.[13]

1.5.13 Head Circumference:

Circumference of head of newborn around the parital emminance measured by a flexible plastic tape marked in centimeter.[13]

1.5.14 Chest Circumference:

Circumference of chest of the newborn around the nipple level, measured by a flexible plastic tape marked in centimeter.[13]

1.5.15 Hemoglobin Level:

Hemoglobin level of blood measured in grams or percentage by Cynmethhemoglobin method [14].

1.5.16 Low Birth Weight:

According to World Health Organization less than 2500 grams birth weight is low birth weight[15].

1.5.17 Maternal Mortality:

Number of maternal death from puerperal cause during child bearing time and within forty days after delivery[16].

1.5.18 Neonatal mortality:

Deaths of the baby that occurred within four weeks or 28 days of birth[16].

1.5.19 Urban Slum:

More than twenty families live in an area in bamboo shaded huts without proper water supply and sanitation [17].

1.5.20 Nutrition:

Nutrition is a dynamic process concerning with ingestion, digestion, absorption and assimilation of food substance by which growth, repair and maintenance of activities in the body as a whole or any of its parts are accomplished [18].

1.5.21 Nutritional status:

The condition of the body resulting from the utilization of the essential nutrients available to the body is termed as the nutritional status. The dietary history, clinical examination, anthropometric measurements, biochemical and other laboratory test can measure nutritional status [19].

1.5.22 RDA:

Recommended daily allowances for protein, vitamins and minerals are estimated with an extra safety margin to ensure that the whole population's needs are covered. Allowance for a nutrient is a value estimated to cover the needs of 97% of the population. This value is calculated by estimating a mean ±2Sdof the observed requirements in a group of individual.[20]

1.5.23 Sensitivity:

Sensitivity is the proportion of true positive that are correctly identified by the test [21].

1.5.24 Specificity:

Specificity is the proportion of true negatives that are correctly identified by the test [21].

1.5.25 Correlation Co-efficient:

The relationship or association between two quantitative variables [21].

1.5.26 Z Score:

The Z score is simply a position score in terms of standard deviation with reference to the mean. The Z score = value- mean value/SD[21].

1.5.27 Regression:

Regression means the dependence of one variable on the other[21].

1.6 LIMITATION OF THE STUDY:

When the obstetrical history of the pregnant women was taken some of them could not remember their last date of menstruation, so the duration of pregnancy could not calculated accurately in some cases. Clinical findings and assumption of the women did it. Parity of the mothers was easy to find out but some times they did not remember the age of last child. The interviewer had to use some indirect methods for caculation of age of the baby such as, during Eid or Ramadan festival or after some natural disaster, to get their actual age.

It was very difficult to collect blood sample from some of the subjects for hemoglobin estimation and some of them refused to give blood. The paramedic had to explain about the study to convince them an then they gave blood.

CHAPTER-TWO

2.1 REVIEW OF LITERATURE:

Fariduddin Ahmed, Das and Golam Mustafa conducted a retrospective study in an Urban Maternity Centre to explore association of maternal biological factor with birth weight of 2849 singleton live births. The mean birth weight was 2667gm and 27% of babies were low birth weight (<2500gm).Of the total mothers 16% were teenagers Thirty percentage of teenage pregnancies resulted in low birth weight deliveries, representing 21% of total low birth weight sample. There is a common positive association between first birth and low birth weight irrespective of maternal age. In contrast negative association was found between birth interval and incidence of low birth weight. The occurrence of low birth weight was found inverse relationship to maternal weight. The mean maternal weight gain during pregnancy was 5.48 kg with a range of minus 2kg to 20kg and 9% of mothers attained the expected weight gain of 10-12kg. The coefficient correlation between maternal weight gain during pregnancy and birth weight was found to be significant ($r=0.1813$. $p<.002$). More than 60% of mothers were found severely anemic and birth weight was found positively associated with mother's hemoglobin level[22].

A study was done by Nargis Rowshan and Ahmed on "Effect of maternal nutrition and socio-economic factors on birth weight of babies in Bangladesh." They have studied the birth weight of 100 newborn babies and its relationship with the physical parameters of mothers and their socio-economic situation. A consistent relation appears to exist between mother's weight and birth weight of infants. A significant relationship also exists between birth weight and socio-economic status of mothers as well as her parity. In this study, the incidence of low birth weight was found to be 36%. The poor socio-economic status reflects economic conditions resulting in maternal malnutrition which in turn produce low birth weight of infant. On the other hand it was found that low birth weight is common in first issues.

As parity increases the incidence of low birth weight diminishes. It has shown that the mothers studied who has less than 11gm per cent of hemoglobin were considered anemic but no conclusion could be drawn relating mother's hemoglobin level with the birth weight of their new born. It concludes, as the improvement in nutritional status during pregnancy would lead to a substantial decrease in the incidence of low birth weight infants in this country [23].

A study was done on "Birth weight, length, head and chest circumference and hemoglobin level of new born." by Khan, Najmun Nahar, Emdadul Haque and Mahmud. The purpose of the study was to determine the normal birth weight, length, head and chest circumference and hemoglobin level of full term newborn. The study was done on 1002 new born babies in Azimpur Maternity center and Dhaka Medical College Hospital. The weight, length and head circumference is recognized indices of in intrauterine growth development. The birth weight of newborn was found 2574gm(male) and 2281gm(female). This study revealed that the birth weight of the newborn who were studied were similar to those of the newborns from India. The crown-heel length, which was found 47.41cm (male), and 46.85cm(female) agreed favorably with the data from India and Indonesia. The head circumference that was found 33.41cm(male) and 32.91cm(female) were almost equaled to those of the newborn from Srilanka, Jamaica and India[24].

A study was done on "Maternal nutritional status as a determinant of Child Health". by Rahman, Roy et al to determine the relationship between the nutritional status of the mother and that of the child. 339 children aged 3-36 months and their mothers in two urban hospitals and a community outpatient's clinic were studied. The weight and height of both children and mothers were measured, and body mass index of the mother was calculated. Socio-economic status, maternal educational level and dietary information were recorded in a predesigned questionnaire.

The child's nutritional status, as indicated by weight for age, was associated with the body mass index of the mother ($p<0.001$), socio-economic condition of the family ($p<0.001$), and breast feeding status of the child ($p<0.005$) in a multivariate analysis after adjusting for several prognostic factors. The results indicate that maternal nutritional status is a proximate determinant of a child's nutritional status[25].

A study was done on "The nutritional status of expectant and newborn babies" by Hussain and Khan and Abedin et al. This study was undertaken to define certain nutritional and biochemical parameters of pregnant women and their newborn infants. Heights, weights, hemoglobin, total protein and albumin-globulin ratio of 157 pregnant women in their third trimester of pregnancy are reported along with the same of the newborn babies. The average weight of the pregnant mother studied was found to be only 47.5kg during their third trimester, which was much lower than the expected weight for height. In Bangladesh frequent pregnancy causes nutritional drain on maternal tissue, as a result mothers gain very little or no weight gain in successive pregnancies. In this study difference in weight between successive pregnancies were found to be statistically insignificant[26].

A study was conducted by Venkatachalam, in a low socio-economic group of South India on "Maternal nutritional status and its' effect on the newborn. The dietary, clinical and biochemical investigations in this study revealed that a large majority of the subjects pregnant women of the low socio-economic group in South India underwent the nutritional stress of gestation without adequate preparation or protection before or during pregnancy. The subjects suffered from different degrees of calorie-protein deficiency and a large number showed manifestations of vitamin B complex deficiency and anemia[27].

A total of 125 low birth babies and their were studied for a period of one year in Dhaka Medical College Hospital to find out maternal risk factors contributing low birth weight by Shahawaz Bin Tabib, Khan and Nazmun Nahar. The incidence of low birth weight babies were more among poor economic status comprising 46.4%. Incidence was more in primipara and young mothers of less than 20 years comprising 57.6% respectively. Incidence of low birth weight babies decrease with increase of maternal height and weight showing significant correlation in this study. Among the impact of various known maternal conditions on loe birth weight babies eclampsia (17.6%), maternal anemia (53.6%), and maternal infection (16%) were determined[28].

Rahman, Begum, and Rashid examined a total of 496 consecutive cases from different Institution, which included 45 cases from rural areas. About 21% of the babies born to urban high group were less than 2500gm compared to 50% of the home delivered rural babies. Only a few of the rich group mothers had more than 50kg weight after delivery. None of the rural mothers could cross the 50kg mark[29].

Kasimuddin, Haque and Abdun Noor did a study by using the health cards designed in Indonesia. These cards kept record of 300 pregnant mothers who visited different MCH centers in Dhaka City. 81.45% mothers gave birth to babies weighing more than 2.5kg and 18.55% delivered babies below 2.5kg. It was observed that the height and weight gain during pregnancy was highly co-related with the weight of the newborn[30].

Monwarul Islam and Rokya Siddique did a study, which shows the biochemical investigation and nutritional status in a group of 132 pregnant women aged between 20 and 30 years. Anemia was found in 46% of pregnant women and it was more prevalent in the third trimester of pregnancy. Iron deficiency with or without anemia, as judged from serum transferrin saturation percentage was evidence in 59.2% of pregnant women with an incidence of 70.3% in the third trimester of pregnancy[31].

Ancri and Morse studied on 98 pregnant mothers, aged 12-32 years, to determine factors influencing the outcome of pregnancy. A comparison of the nutritional status of pregnant adolescents with adult pregnant women was done. A significantly higher weight gain was recorded for the youngest group of mothers (12to17) and the lowest gain for the oldest group (25to 32 years). Calorie intake was unrelated to the amount of weight gained. Weight gain was a function of length of gestation. Calorie and protein intake of the mother was an insignificant factor affecting the infants' birth weight. Low birth weight is about 10% of the infants was untracked to any single factor studied[32].

Frisanco, Klayman and Martos did a study on "Influence of maternal nutritional status on prenatal growth in a Peruvian urban population". Anthropometric measurement was made on 4952 mothers and their neonates. The followings were included among the findings: 1) Tall and short mothers had newborns with similar birth weight and recumbent length; 2) Mothers characterized by high subcutaneous fat had heavier, but not longer, newborns than mothers with low subcutaneous fat; 3) Mothers with high arm muscles area had heavier and longer newborns than mothers with low upper arm muscle area. On the basis of the subcutaneous fat and arm muscle area reflect protein and calorie reserve respectively. It was concluded that an increase in maternal calorie reserves results in increase in fetal fatness but a lesser increase in linear growth. Increase in protein reserve enhances both birth weight and prenatal linear growth[33].

Vijayalakhmi and Devaki studied on nutritional status of expectant mothers belonging to different income level. Fifty low-income groups and fifty from middle income group women in 4th and 5th month of pregnancy was assessed. The mean nutritional intake of low-income mothers was significantly below nutritional requirements. There was a 33% deficit of calories and a 25% deficit of protein. The mean nutritional intake of middle income group was somewhat better. However their diet was 18% deficit in calorie and but protein intake was adequate. After delivery anthropometric measurement of the infants were taken. Middle-income babies had significantly higher birth weight and longer length than lower income group[34].

Huffman, Pebley, Chowdhury and Stupp did a study to investigate the relationship of maternal health status with intrauterine mortality in a population of chronically malnourished rural Bangladeshi women. There are various factor responsible for fetal death and maternal nutrition is a demonstrable important factor as well. This study was conducted at 14 rural villages in Bangladesh. THe analysis included 1318 observed pregnancies. Results demonstrate clearly, however, that stillbirth rates are higher in South Asia than among women with access to better health care. Maternal age, maternal nutritional status, and season of conception all appear to be related significantly to fetal mortality[35].

Hussain and Omulolu did a study on the relationship between maternal nutritional status before and during pregnancy and birth weight of infants in a Nigerian village. Birth weight was found to be strongly correlated with maternal height and weight at 20th week and after 20 weeks of pregnancy. Correlation between birth weight and maternal weight at 20th week of pregnancy and weight gain after 20th week remained significant even after elimination of the effect of maternal height and parity[36].

Michael Kogan, Alexander and David observed in a study that after controlling for other sociodemographic, utilization, medical and behavioral factors, women who reported not receiving all types of advice of prenatal care were more likely to have a low birth weight infant compared with women who reported receiving optimum level of advice (odd ratio=1.38; 95% confidance interval, 1.18 to 1.60). These data suggest that women who reported receiving sufficient health behavior advice as part of their natal care be at lower risk of delivering a low birth weight infant[37].

Maternal anthropometry; its predictive value for pregnancy outcome was studied by Rey, Ortiz, Fajardo and Pradilla in Cali. The main objectives of the study were to investigate associations in maternal anthropometry (height, pre-pregnancy weight and weight gain during pregnancy) and the presence of perinatal complication in the mother and neonate. The critical cut-off points for risk of full-term low birth weight babies was observed when mother's height was <148cm and prepregnancy weight <45kg[38].

Rahman, Visweaswar Rao, Adinarayayna and Rawal carried out a prospective study in an urban slum area in India on the effect of various maternal factors on birth weight of infants. This study indicates that maternal age (<18years), parity (<2), maternal prepregnant weight (<41kg), and maternal BMI (<18.5) were associated with a higher incidence of low birth weight. It was also observed that mean birth weight shows a progressive increase with: age up to 21 years, prepregnant weight up to 50kg, maternal height up to 150cm and BMI up to 21[39].

Pelletier and et al observed in their study on 954 pregnant mothers that there are statistically significant relationship with BMI, MAC and prepregnancy weight, all in expected direction (more intra-uterine growth retardation among women with low anthropometric value). The odd ratios were highest in the third trimester for all the indicators specially weight followed by BMI and arm circumference respectively. The prediction of prematurity from maternal anthropometry is weaker than the prediction of intra uterine growth reterdation. The most promising predictor of prematurity are related to arm circumference rather than weight or BMI[40].

Kirksey and Hsiu-Chen Wang did a study on maternal anthropometry as a risk predictor of pregnancy outcome in a village of Egypt on 121 pregnant women. They observed that maternal anthropometry during early pregnancy was a significant indicator of pregnancy out-come. On the other hand it was not significantly related to maternal anthropometric changes observed in later pregnancy and lactation[41].

Backstand did a study on 76 births and associated pregnancy in the rural Solis Valley of the central Mexican highlands. The result of the study revealed that the anthropometric measures, weight and body mass index have highest association with birth weight. It was observed that the lightest mother tended to have the lowest weight infants. However, there was little apparent effect from maternal height. There is correlation between birth weight, skinfold thickness and upper arm circumference between the early and third trimester measurements[42].

Huffman et al, in 1987 did a study in Matlab and found that at pregnancy termination, 74% of women were below 43 kg with 24% weighing less than 38kg. Thirty five percent of women were under 145.2 cm tall and 53 percent were between 145.2 and 151.5cm.[43]

Shah and Shah found that among the many environmental factors, maternal nutrition had a significant relationship to birth weight. The pre-pregnancy maternal weight is the determining factor affecting fetal nutrition. The birth weight of the infants whose mothers weight 38kg or below before pregnancy were significantly lower than those of new born whose mothers weighted 41kg. The major factor contributing to lowbirth weight of infants is thus the mother's chronic malnutrition, probably since their childhood. Malnutrition begins during fetal development, but can be traced back to the malnutrition of the mothers since childhood. The weight and height of pregnant mothers shows how pervasive the problem is. Further evidence is provided by the low birth weight babies[44].

A study was done on " Maternal anthropometry as a risk predictor of pregnancy outcome" by Neuman, Ferguson and Bwibo in Kenya. A sample of 290 EMBU household was selected. Height, weight, mid arm circumference and hemoglobin level was measured. Anemia due to nutritional deficiency was prevalent with endemic malaria and hookworm contributing heavily to this condition. Some 37-40% of all the women were found to be anemic, with serum ferritin low in 35% of the women[45].

A study was done on "Maternal anthropometry and pregnancy outcome in Indonesia" by Husaini, Sandjaja, Kartono, Jahari, Bariji and Karyadi. This study was conducted in Indonesia from April 1983 to March 1985. In that study area maternal mortality rate was 4.5 per 1000 live births, with an infant mortality rate of 71 per 1000 live birth and low birth weight of 14%. The main objective of the study was to identify indicators of maternal risk at delivery and to develop anthropometric indicators useful for predicting mother and infant outcome of pregnancy[46].

Keramat Ali and Yunus Halim did a study on "Maternal nutritional status and birth weight" on 700 pregnant women in their third trimester of pregnancy. The women having low birth weight babies were weighing 43.5kg, MAC of<23cm and BMI ranged from 16 to 18.5. Low birth weight of babies is more associated with rural mothers who take 1,339 kcal per day[47].

A study was done on "Birth weight and its association with maternal nutrition and socioeconomic variables in Bangladesh" by Alam and Yunus on 675 pregnant women at 5 to 7 months of gestation. The findings suggests that poor maternal nutritional status, but not the socio-economic status, is the major determinant of birth weight in rural Bangladesh[48].

A study was done on "Assessment of nutritional status in pregnancy, use of a reference table of weight-for-height" by Gwebu ET, Mtero S, Dube N and Mugwagwa N. The purpose was to construct a table of weight for height data obtained in order to use it as a method of nutritional surveillance for pregnant women. Data collected included age, weight, height and date of the last menstrual period of the mother and weight and date of birth of the newborns. This study demonstrated that this is possible to identify women likely to have low birth weight babies using these parameters[49].

Jesudason and Ambujadevi did a study on " Relationship between socio-economic factors, demographic characteristics and nutritional status of pregnant mothers. Nutritional deficiency was found higher among older than among the younger women and in each age higher the parity the higher the nutritional deficiency. A casual model was proposed that postulated socio-economic factors, and family structure determine fertility behavior and nutritional status of the women[50].

CHAPTER-THREE

3.1 MATERIALS AND METHODS

3.1.1 Study Population:

The study population comprises of pregnant women who belong to a Bihary minority group lived in an urban slum area called 'Geneva Camp', which was built in 1972 by the International Committee of the Red Cross Society based in Geneva. The total population in this camp was near about twenty seven thousand and among this population reproductive age group (14-45years) of women was thirteen thousand six hundred and thirty six. The sample was taken from the pregnant women of this age group of population.

3.1.2 Study Subjects:

The study subjects were the pregnant mothers among reproductive age group of women attended a mother and child health care center located in the Geneva camp named 'Al–Falah Model Clinic' in between January 1996 and December 1996. The pregnant women at third trimester of pregnancy during the labor period were the study subjects. The study was conducted on 309 pregnant women and their 306 newborns. The following details of the mothers were carefully recorded in all cases: parity, age, height, MAC, BMI and weight. The blood pressure, hemoglobin level, dietary history, urinary sugar and albumin and edema were also determined

Their newborn babies were also the part of the study and within one hour after delivery they were examined. The weight, length, heads and chest circumference was measured. The cord hemoglobin level was determined. Among 309 pregnant women 306 were live births and the rest were still births.

3.1.3 Type of the Study:

This is a cross sectional and descriptive type of study giving information about the nutritional status of the pregnant women and their newborn of the community.

3.1.4 Study Area:

Geneva camp was identified as study area, which is situated in the north-eastern part of Dhaka city in Mohammedpur area. This camp was built on six acres of land in 1972 by the International Committee of Red Cross for temporary residence of strandard Pakistanies, because it was believed that Pakistan would take them back very soon. They have been living here in a subhuman condition in an average 8-10 people in an 8by 10 feet hut without any toilet and safe drinking water facilities for last twenty seven years.

3.1.5 Selection criteria of Subjects:

Pregnant women, including the high risk pregnancies such as primipara, shorter than 4'10", grand multipara, bad obstretic history who came for delivery conduction at third trimester of pregnancy from an allocated area and identified population, were selected for this study.

The criteria of normal labor was selected as spontaneous vaginal delivery of a singleton baby after 36 weeks and before 41 weeks of gestation. All the babies, who were born to those pregnant women, were also selected as sample.

3.1.6 Exclusion Criteria of Subjects:

Subjects who were referred to other referral hospitals for obstetrics complications and delivered there by cesarean section or by any other assistance were excluded from the study. The babies born to these women were also excluded from the study. Subjects who had preterm labor were also excluded from the study.

3.1.7 Study design:

The nutritional status in the third trimester of pregnancy of the study population was assessed cross-sectionaly. Obstetrical history and anthropometric measurements, which includes height, weight and mid-upper arm circumference was taken. Blood pressure, hemoglobin percentage, urinary content of Albumin and sugar was measured in third trimester before delivery. The birth weight, length, head and chest circumference of full term new born was also taken. The cord hemoglobin percentage of newborn babies was determined by cynmeathomoglobin method. Dietary analysis of pregnant women was done to relate the nutritional status of the pregnant women.

The inter-relationship of various factors, such as maternal nutritional status, age, parity and BMI with birth weight of newborn, maternal hemoglobin percentage with that of the newborn babies and different anthropometric measurement to that of the standard was investigated. Multivariate analysis of the various determinants was done to establish relationship between mother's factor and the nutritional quality of their babies.

3.1.8 Duration of the Study:

The duration of this study was one year. It was conducted at Al-Falah Model Clinic from January1996 to December 1996.

3.1.9 Sample Size Determination:

The minimum sample size was estimated by using the following formula[51].

$$x^f = \frac{n}{1 + n \div N}$$

Where x^f =Expected sample size when N < 10,000

n = Expected sample size when N > 10,000

$$n = \frac{z^2 pq}{d^2}$$

Where z = Standard normal deviate = 1.96 (95% confidence level)

p= Prevalence rate (unknown). So it is on the safe side to take p=0.50

q= 1 – p = 0.50

d = 0.05. The maximum allowable error.

$$\therefore n = \frac{(1.96)^2 (0.50) (0.50)}{(0.05)^2} = 384$$

Total married women aged 15-44 years under the Health Center of Mohammadpur Geneva Camp were 13636.

Estimated proportion of pregnant mother was 11.06 rounded 11.

Total pregnant mother was 13636 x 0.11 = 1500

Which our expected population. i.e. N =1500

$$\therefore n^f = \frac{384}{1 + 384 \div 1500} = 306$$

The estimated minimum sample size was 306 but we have taken 309.

3.1.10 Development of questionnaire:

A questionnaire was developed to obtain relevant information of the pregnant women on the socio-demographic data, such as age family income, family size, housing, sanitary condition and dietary history.

Details about obstetrics history like gestational age, parity, antenatal checkup, supplementation of iron and vitamins and TT vaccination was also included in the questionnaire. The main parts of the questionnaire were as following:

- Identification of the study population
- Determination of the socio-economic condition
- Dietary habits
- Clinical examination
- Anthropometric measurements
- Biochemical test

3.1.11 Pre-testing:

This questionnaire was pre tested before finalization on 25 subjects. Necessary correction and modification was done according to the pre test.

3.1.12 Consents:

Written consent was taken from the authority of the Al-Falah Model Clinic after explaining the purpose and objectives of the study. Consent from the study subjects was also taken .

3.1.13 Collection of Data and Specimen:

Obstetrical and dietary data was collected from each of the subjects. Different clinical examination and biochemical investigations was done. The examination of the newborn was done within one hour of birth.

3.1.14 Anthropometric Measurements:

3.1.14.1 Body Weight:

A bathroom scale was used to record body weight of the women. Body weight was recorded to the nearest 0.5 kg bare footed and lightly dressed.

3.1.14.2 Height:

Height of the mother was taken in standing position by a standard adjustable height scale, which has got perfection up to .1cm.

3.1.14.3 Mid-Upper Arm Circumference Measurement:

Mid upper arm circumference was measured in centimeters by a flexible plastic tape placing around mid position of the upper arm.

3.1.14.4 Weight of the Newborn:

The baby was accurately weighed in grams, by placing the nude baby on a standard baby-weighing machine.

3.1.14.5 Length of the Newborn:

The baby was placed on the infantometer with legs completely stretched by applying moderate pressure on the knees. The fixed piece of measuring scale just touch the most prominent of the head, i.e. the crown and then the sliding piece was slid close so as to touch the heels. The crown-heel length in centimeter was recorded.

3.1.14.6 Head and Chest Circumference of the Newborn:

A plastic tape passed round the head at the largest circumference did the head circumference measurement. This level was taken at the supercilliary margin in front, parietal eminence laterally and occipital protuberance behind.

Chest circumference of the babies was measured by rounding a tape at the level of nipples. Both the measurements were taken in centimeters.

3.1.15 Hemoglobin Estimation:

After proper cleaning a finger prick was done and 20mm of blood was taken in a Hemoglobinometer pipette and it was immediately transferred on a strip of filter paper (2.5 ×2cm). The paper was dried for 10 minutes at room temperature.

In the laboratory of INFS those papers was soaked for 30 minutes in test tube containing 5ml-cyanomethaemoglobin reagent. After centrifugation the pink supernatant solution was used for estimation of hemoglobin with a spectrophotometer at 540-wave length.

The blood collection from the newborn was the same except it was collected from umbilical cord of the baby just after delivery. The hemoglobin was estimated by the same Cyanmetheamoglobin method.[14]

3.1.15.1 Calculation:

Obtain the concentration (C) of hemoglobin in blood from the table of values to calculate as follows c=36.77 ×A (gm/100).

Where A= Absorbency.[14]

3.2 Urine Analysis:

3.2.1 Albumin:

Two third of a test tube was filled with urine and it was heated in the upper level of the urine up to the boiling point. The result was observed; if a cloudy appearance came out two or three drops of Acetic Acid was added in the tube. If the cloudy appearance disappeared the urine did not contain any albumin and if it persist it interpreted that the sample contains albumin[52].

3.2.2 Sugar:

5ml of Benedict's solution were taken in a test tube and a dropper added 8 drops of urine in it. The test tube was heated on a spirit lamp up to boiling point and color change was observed to determine the extent of sugar content[53].

3.3 Data Analysis:

The obtained data were transferred to coding sheets and verification was carried out. The coded data were entered into an IBM personal computer with 40-megabyte capacity. The statistical package for the social sciences (SPSS/PC), EPI Info and Harvard Graphics. Analysis includes simple descriptive analysis through the use of univariate frequency tables. Bivariate tables were used for the determination of relationship and associations. Chi-square, Odd-ratio, Relative Risk, sensitivity, specificity, positive and negative predictive value t-test and Z-test were used for this purpose. Correlation coefficient was calculated to find the correlation and regression analysis was done to find out the best sub set of the study variables with birth weight.

3.4 Test of significance:

Student's 't', proportion test and Chi-square test were used to determine statistical significance where necessary. Statistical difference was tested at 5% level of significance.

CHAPTER-FOUR

4.1 RESULTS

Table-1

4.1.1 Percentage Distribution of Body Weight (kg) of Pregnant Women by Age Group

Age of the Women	Number	Percent	Weight of the Women(Mean±SD)
18-20	77	24.9	45.01± 6.56
21-25	62	20.1	45.95± 7.71
26-30	130	42.1	46.38± 6.48
31-35	26	8.4	48.42± 6.93
36-40	14	4.5	51.46 ±11.03
Total	309	100	46.35±7.96

The percentage distribution of body weight of pregnant women by age group is shown in table-1. In this study population 24.9% were between 18-20 years, 20.1%were between 21-25 years, 42.1% were between 26-30 years and 12.9% were between 31-40 years. The mean±SD weight of the pregnant women were 46.35±7.96kg among them 24.9% were 45.01±6.56kg, 20.1% were 45.95 ±7.71, 42.1% were 46.38±6.48kg and the rest 12.9%were between 48.42 ±6.93 to 51.46 ±11.03 kg.

4.1.2 Fig-1: Curvilinear Relationship Between Maternal age and weight

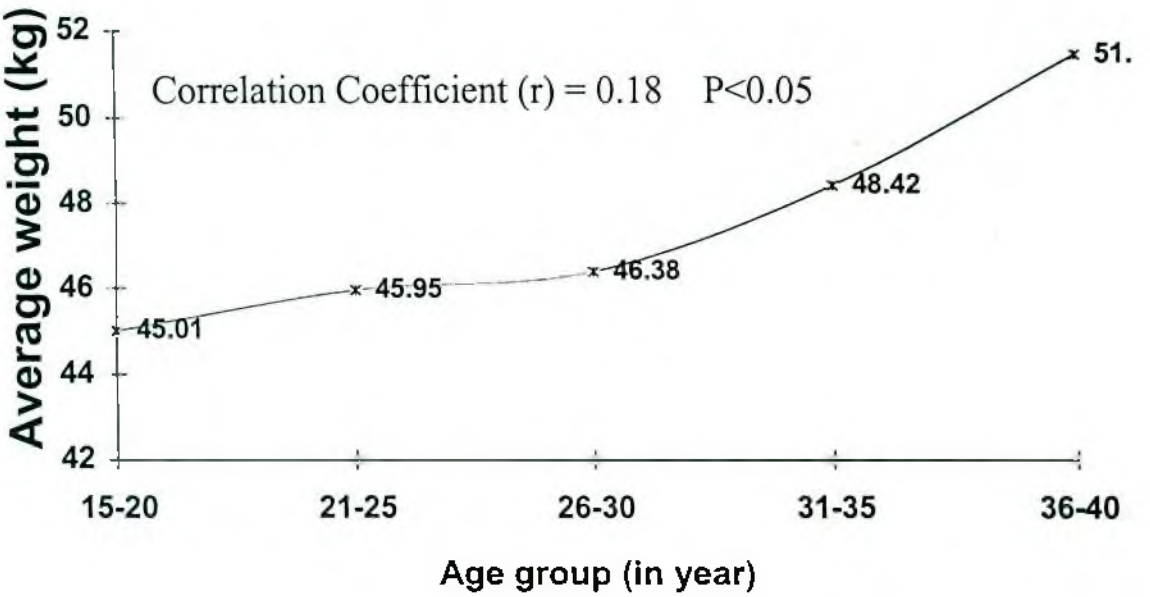

Figure-1 shows the curvilinear relationship between maternal age and weight of the study population. From this figure it can be seen that the weight of the mothers were positively associated with maternal age. The correlation coefficient r=0.18. The test is statistically significant at five percent level (P<0.05).

Table - 2

4.1.3 Height of the Pregnant Women (n=309)

No of pregnant women	Percentage	Height of the pregnant women (cm)
7	2.2	<140
34	11	140-144
155	50.16	145-149
148	47.8	150-154
17	5.5	155-159
3	0.97	160 & above
309	100	

Table-2 shows the distribution of height of the pregnant women. According to this table the height of 41 women were less than 144cm, 155 women were between 145 to149cm, 148 women were between 150 to 154cm and only 20 women were between 155 to 160cm and above. This table also shows that 50.16% of the mothers were between145 to 149 cm and 47.8% of the mothers were between 150 to 154 cm. On the other hand only 0.97% pregnant mothers' height was above 160 cm and above.

Table - 3

4.1.4 Mid-Arm Circumference (MAC) of Pregnant Women According to the Standard Values

Status of MAC	Number	MAC(cm) Mean	Percentage
Normal	2	26.0± 0.6	0.66
Mildly depleted	91	23.53± 0.63	29.84
Moderately depleted	212	20.94± 0.93	69.50
Severely depleted	0	-	-
Overall	305	21.75± 1.50	100

Not depleted: Above 90% of standard.

Mildly depleted: 80-89.91% of standard.

Moderately depleted: 60-79.91% of standard.

Severely depleted: Below 60% of standard.

Standard value for adult female =28.5cm.

Table -3 shows the distribution of measurements of middle upper arm circumference of pregnant women and those was compared to the standard values. Among 305 subjects 29.84% women's mean MAC were 23.53±0.63 cm and 69.50% women had 20.94±0.93 cm mean MAC. Therefore 69.50% women's mean MAC was moderately depleted and 29.84% women's mean MAC were mildly depleted.

Table - 4

4.1.5 Respondents by Weight and Mid Arm Circumference (n=305)

Mid-Arm Circumference (cm)	Weight (kg)			
	<37	37-43.4	≥43.5	total
<20.8	1.3% (4)	13.4% (41)	5.4% (18)	20.7% (63)
20.7-22.9	0.7% (2)	5.2% (16)	42.4% (130)	48.5% (148)
≥23.5	0.3% (1)	0.6% (2)	29.8% (91)	30.8% (94)
Total	2.0% (7)	14.4% (59)	83.6% (239)	100.0% (305)

Table–4 shows the distribution of respondents by their weight and mid arm circumference. According to this table the women whose mid-arm circumference was less than 20.8 cm 13.4% of them weigh between 37and 43.4 kg. 42.4% women who were weighing ≥ 43.5kg their mid-arm circumferences were in between 20.7 and 22.9 cm. The women whose mid-arm circumferences were more than or equal to 23.5 cm 29.8% of them weigh ≥ 43.5 kg.

4.1.6 Fig-2: MAC of Pregnant Mother Compared to Standard (28.5 cm)

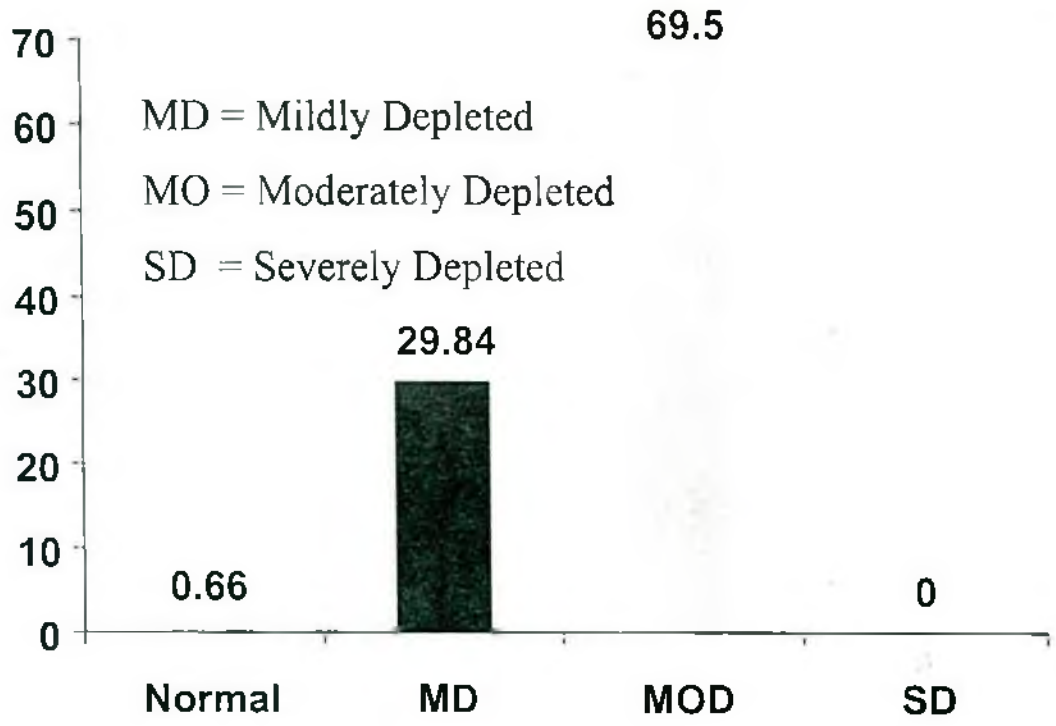

Figure-2 shows the bar diagram that describes the percentage of mid-arm circumference of the pregnant women compared to the standard value of Harvard Standard. It can be seen from this bar diagram that only .66% of the mothers' MAC was within normal limit. 29.84% of mothers' MAC was mildly depleted and the majority group i.e. 69.5% mothers' MAC was moderately depleted compared to the standard value.

Table - 5

4.1.7 Maternal Body Mass Index (BMI) and Chronic Energy Deficiency (CED) Prevalence by Age Groups.

Age	Maternal BMI		Chronic energy deficiency prevalence (BMI< 18.5)	
	No.	Mean	No.	%
18-20	77	21.27	11	14.29
21-25	62	20.98	7	11.29
26-30	130	20.71	13	10.0
31-35	26	21.68	4	15.38
36-40	14	22.66	1	7.69
Overall	309	21.48	36	11.65

Table -5 describes the maternal body mass index according to the age distribution of the pregnant women. The mean BMI was 21.48 of pregnant women. It is shown that 77 pregnant women were between 18-20 years and their mean BMI was 21.27, 62 mothers were between 21and 25 years and their mean BMI was 20.98, 130 mothers were between 26-30 years and their mean BMI was 20.71. It can be also seen from this table that over all 11.65% of the pregnant women were suffering from chronic energy deficiency and most of them were from the age group of 31-35 years.

4.1.8 Fig-3: Curvilinear relationship between maternal age and Chronic Energy Deficiency

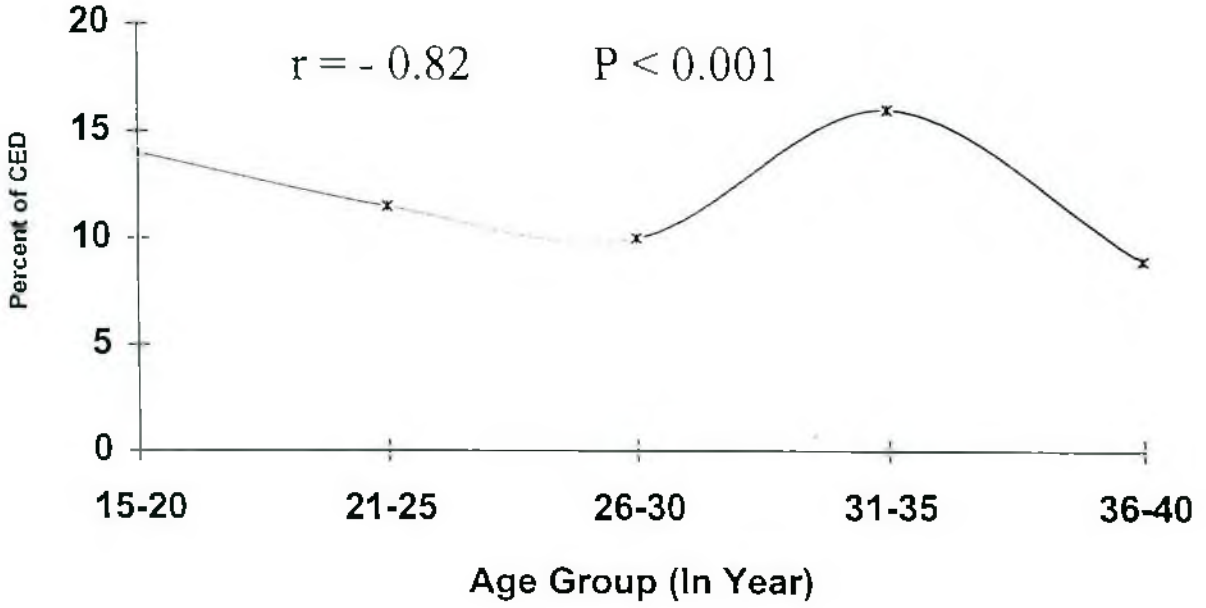

Figure-3 is the linearized graph of the relationship between maternal age and percentage of chronic energy deficiency. This graph shows that the percentage of chronic energy deficiency in pregnant women were more in 15 to 20 years and 31 to 35 years. It decreased during 21to 30 years of age and also 36 to 40 years.

Table - 6

4.1.9 Parity of the Pregnant Women and Birth weight of the Newborns.

Parity	Birth Weight (kg)					Total
	1-1.5	1.6-2	2.1-2.5	2.6-3	3.1-4.1	
0	1	4	52 (60.46)	23	6	86
1		1	27 (45.76)	19	12	59
2		3	18 (38.29)	13	13	47
3		2	14 (41.17)	11	7	34
4	2	1	7(23.33)	8	5	30
5			7(31.81)	6	9	22
6 and more			9(32.14)	8	11	28
Total	3	11	141	88	63	306
	1%	3.5%	46.1%	28.8%	20.6%	100%

Table- 6 shows the birth weight of the babies in kg. according to the parity of the pregnant women. According to this table 86 of the total babies was born to the primigravid women and among then them 52 i.e. 60.46% was weighing between 2.1 and 2.5 kg. 59 of the total babies were born to the mothers who have got one child and the birth weight of 27 babies i.e.45.76% was between 2.1 and 2.5 kg. The mothers who were third and forth gravid gave birth to babies weighing up to 2.5 kg was 41.17% and 23.337%. Again the percentage of low birth weight was increased in fifth and sixth and more parity.

4.1.10 Fig-4: Linearized Relationship Between Parity and baby's weight

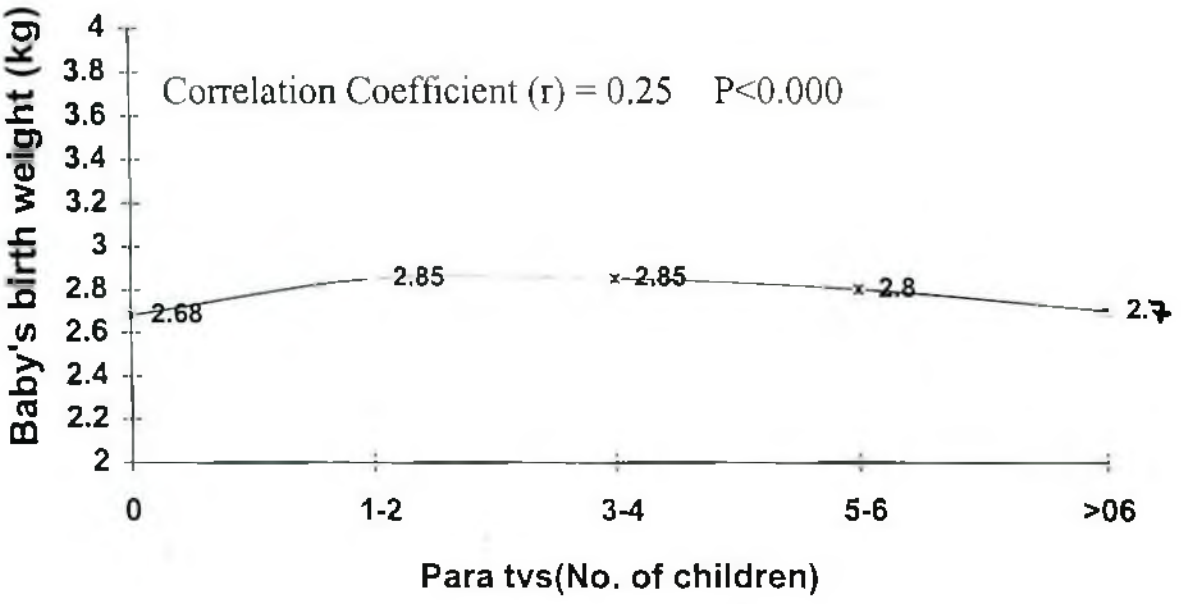

Figure-4 shows the relationship between the parity of the pregnant women and the birth weight of their newborn babies. When the mother was primigravida the birth weight of her baby was the lowest. As the parity increased the birth weight of the babies also increased.

Table -7

4.1.11 Hemoglobin Level of the Pregnant Women.

(n=219)

Hemoglobin Level	Number	Mean ±SD	Percent
5-7g/dl	14	6.22 ±1.23	6.4
8-10g/dl	186	9.16±1.56	84.9
11g/dl and above	19	13.16± 1.22	8.7
Total	219		100

Table–7 shows the distribution of hemoglobin level of the pregnant women. 6.4% mothers' hemoglobin level was 5-7g/dl and 8.7 % mothers' hemoglobin level was 11g/dl and above. The majority group i.e. 84.1% mothers' hemoglobin level was in between 8 and 10 g/dl.

4.1.12 Fig-5: Hemoglobin Level of the Pregnant Women

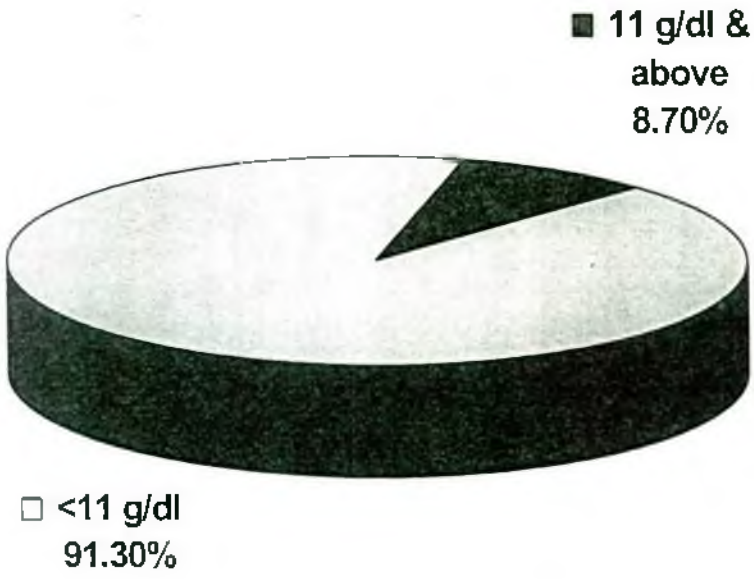

Figure-5 is the Pie chart of percentage of pregnanat women's hemoglobin level in g/dl. According to this chart 91.30% pregnant womens' Hb. was less than 11g/dl and only 8.70% of pregnant womens' Hb. level was 11g or more/dl.

Table - 8

4.1.13 Albumin and Sugar Level in Urine of the Pregnant Women.

Variables	Normal	Mild	moderate	Total of %
Albumin (n=309)	81.6%	16.8%	1.6%	100.0
Sugar (n=309)	95.8%	3.9%	0.3%	100.0

Albumin level is determined by the presence of opacity. Mild= +, Moderate = ++, normal=absent

Sugar level is determined by colour change. Normal = Blue, Mild=green, moderate =orange.

Table –8 shows the albumin and sugar level in urine of the pregnant women. The albumin level in urine of the pregnant women was normal in 81.6%, mild in16.8% and moderate in only 1.6%. The sugar level in urine of the pregnant women was normal in 95.8%, mild in 3.9% and only 0.3% cases were moderate.

Table - 9

4.1.14 Blood Pressure of the Pregnant Mothers

Blood Pressure Status	Number	Percent
Normal	268	86.7
Hypertensive	41	13.3
Total	309	100.0

Mean Systolic Blood Pressure 123.39± 15.92 mm of Hg.
Mean Diastolic Blood pressure 82.5 ±12.00 mm of Hg.
Normal = Diastolic 60-90 mm of Hg
Hypertensive = Diastolic >90 mm of Hg
Normal =Systolic 110-140 mm of Hg.
Hypertensive = " > 140 mm of Hg.

Table–9 shows the distribution of blood pressure among pregnant women. According to this table 86.7% of the pregnant women was normal regarding to their blood pressure and 13.3% had been suffering from hypertension. The mean systolic and diastolic pressure were 123.39 ± 15.92 mm of Hg and 82.5 ± 12.00 mm of Hg.

Table - 10

4.1.15 Edema of the Pregnant Women

Edema	Number	Percent
Normal	265	85.8
Mild	23	7.4
Moderate	14	4.5
Severe	7	2.3
Total	309	100.0

Normal = no pitting

Mild = +

Moderate = + +

Severe = + + +

Table–10 shows the presence of edema in the pregnant women. From this table it can be seen that 85.8% of the mothers has got no edema. 7.4% has got mild edema, 4.5 % has got moderate edema and only 2.3 % of the mothers have been suffering from severe edema.

Table - 11

4.1.16 Per Capita per day Nutrient Intake of Pregnant Women

Nutrient	*Intake*	*RDA*	*% of RDA*
Calorie(Kcal)	1880	2350	80.0
Protein(g)	39.44	66	68.0
Animal Protein	-	-	-
Fat(g)	36.50	50	73.0
Animal Fat(g)	3.63	-	-
CHO	291.5	369	78.99
Calcium (mgm)	715	1100	65.0
Iron(mgm)	20.76	33	62.91
VitA(umg)	560	750	74.67
Vit B1(mg)	0.96	1.0	98.0
Vit B2(mg)	1.01	2.3	77.69
Vit C(mg)	30.0	50	60.0

Table-11 describes the per capita nutrient intake of pregnant women and the percentage of intake in relation to RDA. According to this table, the calorie intake of the pregnant women were 1880 Kcal, which is 80% of RDA. The protein intake of the mothers was 39.44 g. that is 68% of the RDA. The intake of vitamins and minerals were also less than the required daily allowances such as, Calcium intake was 65%, Iron intake was 62.91%, Vitamin A intake was 74.67%, Vitamin B2 intake was77.69% and Vitamin C intake was only 60%[54].

4.1.17 Fig-6: Percent of RDA of Nutrients Intake of the Pregnant Women

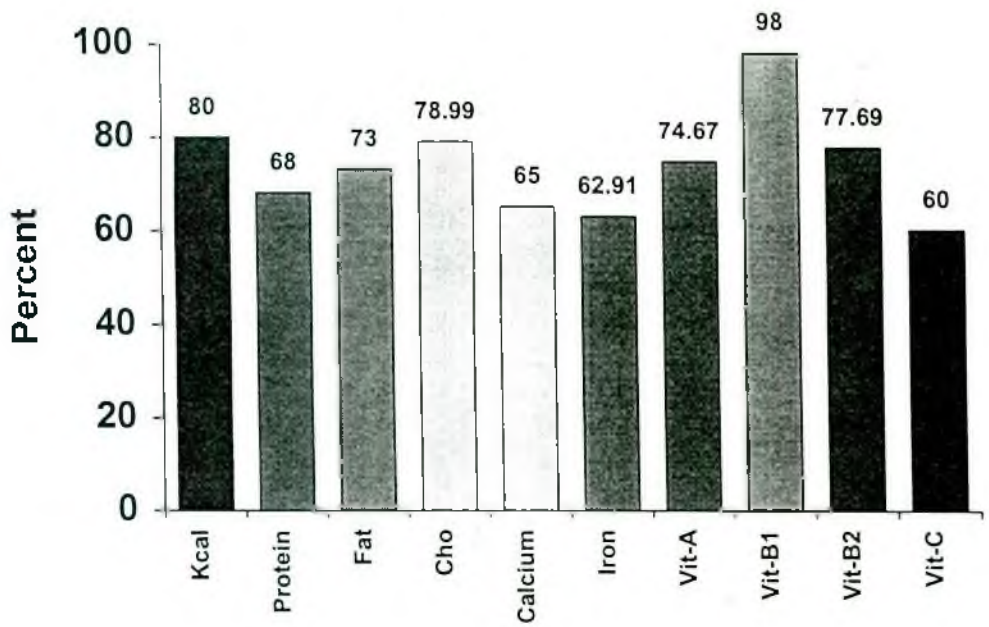

Figure-6 represents bar diagram of percentage of nutrients intake of the pregnant women in comparision to recommended daily allowence. This figure shows that on average the pregnant mothers were taking 80% calory and 78.99% of carbohydrete of the recommended daily allowence. The intake of vitamin C and calcium was low only 65% and 58% of the RDA. The other nutrient intakes were low while intake of vitamin BI was satisfactory i.e. 98%.

Table - 12

4.1.18 Twenty-four Hours Re-call of foods of the Pregnant Women. (n=50)

Food	Morning		Noon		Evening		Night	
	Yes	%	Yes	%	yes	%	yes	%
Bread	37	74	-	-	1	2	9	18
Vegetables (green)	2	4	7	14	-	-	5	10
Vegetables (non-leafy)	19	38	38	76	-	-	34	68
Rice	12	24	50	100	-	-	41	82
Pulse	2	4	22	44	-	-	11	22
Fish	1	2	17	34	-	-	14	28
Meat	3	6	5	10	-	-	9	18
Egg	12	24	4	8	1	2	7	14
Milk	6	12	-	-	-	-	8	16
Tea	29	58	-	-	13	26	-	-
Snacks Cakes, biscuits	-	-	-	-	3	-	-	-
Fruits	-	-	-	-	-	-	-	-

Table-12 shows the distribution pattern of food intake of the pregnant women by 24 hours recall method. According to this table they usually took food thrice daily and some of them took one extra meal in the evening.

Table 13

4.1.19 Pregnancy Outcome of the Pregnant Women

(n=309)

Pregnancy Outcome	Number	Percent
Live Birth	306	99.02
Still Birth	3	.32
Maternal death	0	-
Neonatal Death	11	3.5

Table-13 shows the percent distribution of the pregnancy outcome of the pregnant women. Among 309 normal vaginal delivery there were three still births, eleven neonatal deaths and no cases of maternal death was found. So the neonatal death was only 3.5% and still birth was only 0.32 % of the total delivery.

Table - 14

4.1.20 Birth Weight and Maternal Weight According to their Family Monthly Income

Monthly Income (taka)	Weight of the Pregnant Women (kg)	Number	Birth Weight(kg) (Mean± SD)
1000-1500	**35-40**	**76**	**2.55 ±0.41**
1500-2000	**41-45**	**62**	**2.62± 0.46**
2000-2500	**46-50**	**128**	**2.72± 0.51**
2500-3000	**51-55**	**26**	**2.74± 0.58**
3000 & above	**55-60**	**14**	**2.87± 0.45**

Table–14 shows the distribution of birth weight and maternal weight by monthly income of the family. The families monthly income was 1000-1500 taka, the weight of the pregnant mother was in between 35 and 40 kg and the mean birth weight of this group was 2.55k±0.41kg. When the monthly income of the family was in between 1500 and 2000 taka, the weight of the pregnant women was 41 to 45 kg and the mean birth weight of the newborns was 2.62±0.46 kg. From this table it can be seen that the weight of the pregnant women and newborn babies increases with the monthly family income.

Table 15

4.1.21 Birth Weight of the Newborn Babies

Birth Weight	Number	Percent
≤ 2kg	**13**	**4.25**
2.1-2.4kg	**105**	**34.31**
2.5-3.0	**126**	**41.18**
3.1kg and above	**62**	**20.26**
Total	**306**	**100.0**

Table–15 shows the distribution of birth weight of the newborn babies and their percentages. Among 306 newborns 13 i.e. 4.25% was weighing two 2 kg or less and 34.31%of the newborn babies were weighing in between 2.1 and 2.4 kg. 41.18 % babies birth weight was 2.5 to 3.0 kg and 20.26 % were weighing 3.1 kg and above.

4.1.22 Fig-7: Linear Graph of Babies Birth Weight

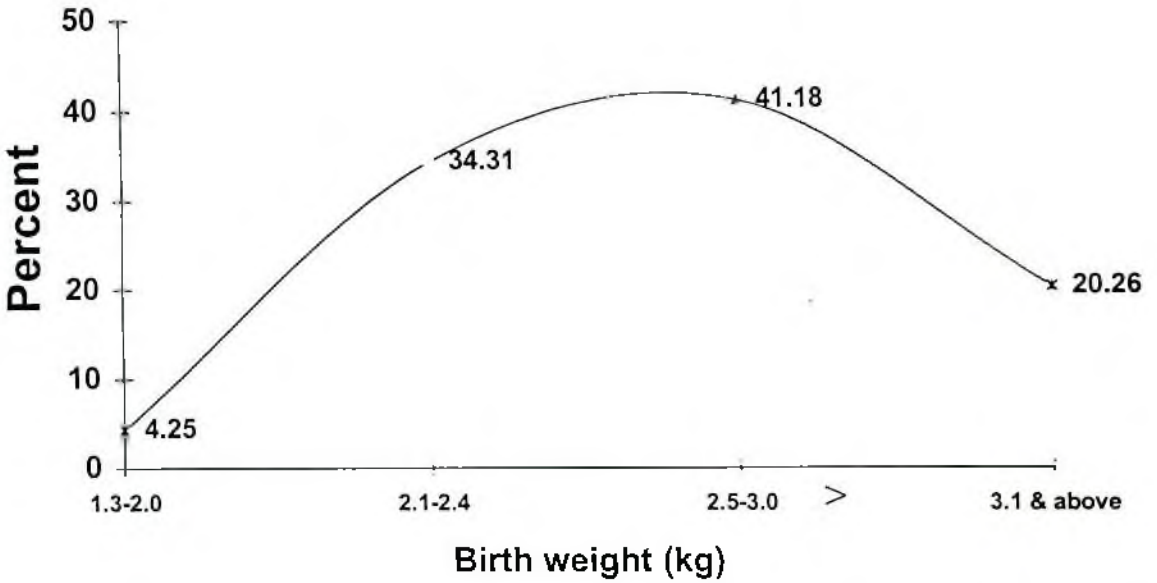

Figure-7 is the linearised graph of birth weight of the newborn babies. According to this figure 4.25% babies were weighing 1.3 to 2 kg, 34.31 % babies were weighing in between 2.1 and 2.4 kg. 41.18% babies weigh in between 2.5 and 3kg. 20.26% babies were weighing 3.1 kg and above.

Table –16

4.1.23 Birth Weight of the Newborns by Maternal Age

Age of the Mothers (in years)	Number	Birth weight (kg) (mean± SD)
18 –20 years	76	2.55± 0.41
21 –25years	62	2.62 ±0.46
26 -30 years	128	2.72± 0.51
31 –35 years	26	2.74± 0.58
36 –40 years	13	2.86± 0.45
41 –45 years	1	3.0
Total	306	2.67± 0.49

Table -16 describes the distribution of birth weight of the newborn babies by maternal age. The table shows that mothers who were between 18-20 years of age gave birth to babies whose mean weight was 2.55±0.41 kg. Mothers of 21-25years gave birth to the babies whose birth weight was 2.62±0.46 kg. Babies who were weighing 2.72±0.51kg, 2.74± 0.58 kg and2.86± 0.45kg were respectively born to the mothers who were 26-30 years, 31-35 years and 36-40 years of age.

4.1.24

Fig-8: Linearized Regression Relationship Between Birth Weight and Maternal Age

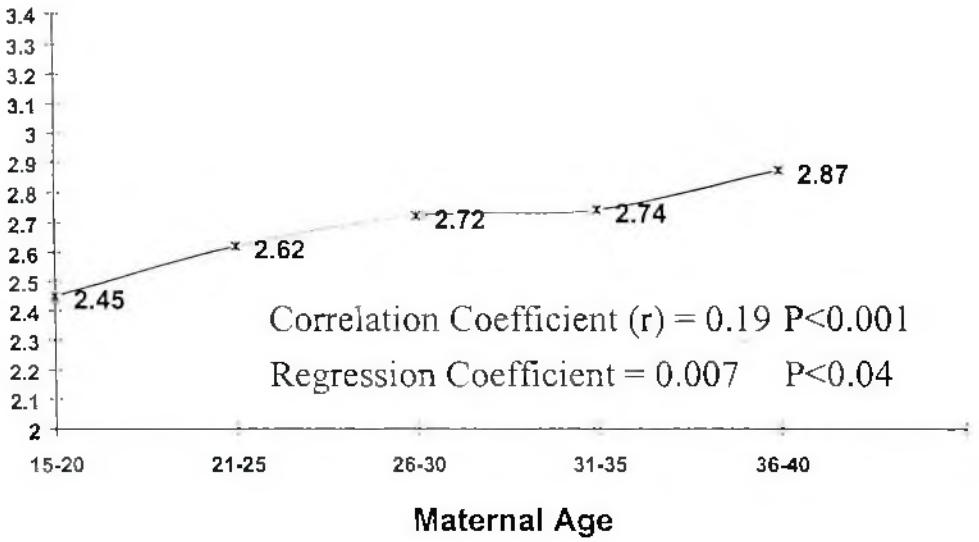

Figure-8 shows the linearized relationship between the birth weight of the newborn babies and maternal age. According to this graph the weight of the new born babies was related to the age of the mothers. Mothers whose age was in between 15 and 20 years, their babies were weighing 2.45 kg and the mothers who were 31 to 35 years old the birth weight of their babies was 2.74kg. Corellation coefficient r= 0.19 (p< 0.001)and regression coefficient =.0007.

Table -17

4.1.25 Birth weight, Length, Head Circumference and Chest Circumferences of the New Born Babies

Number of Babies.	Babies' birth weight (kg) Mean± SD	Babies' Length (cm) Mean± SD	Babies' chest Circumference (cm) Mean ±SD	Babies' head Circumfernce (cm) Mean± SD
18	**2.24± 0.69**	**41.26± 10.88**	**27.37± 9.98**	**31.39 ±3.35**
97	**2.33 ±0.21**	**44.56± 7.18**	**31.54± 5.28**	**32.97 ±2.30**
142	**2.75± 0.38**	**45.49± 3.59**	**32.25 ±3.20**	**33.06± 3.58**
75	**2.93± 0.39**	**45.28± 3.94**	**32.64 ±2.95**	**33.08 ±3.22**
29	**2.95± 0.50**	**46.57 ±3.79**	**32.46 ±3.06**	**33.07± 3.38**
20	**3.18 ±0.49**	**46.65± 2.52**	**33.55 ±2.28**	**33.80± 2.48**

Table-17 shows the distribution of the birth weight, length, head and chest circumference of the newborn babies. According to this table the birth weight of 18 babies were 2.24±0.69, their length, chest and head circumferences were 41.26 ±10.88, 27.37±9.98 and 31.39±3.35 cm. It also shows that 142 babies mean weight was 2.75±0.38 kg and their corresponding length, head and chest circumference were 45.49± 3.59 cm, 32.25± 3.20cm and 33.06 ±3.58 cm.

Table - 18

4.1.26 Birth weight, Length, Chest Circumference and Head Circumferences of the Babies by Mother's Weight.

Mothers' weight (kg)	No	Baby's birth weight (kg) Mean± SD	Baby's length (cm) Mean± SD	Baby's chest Circum. (cm) Mean ±SD	Baby's head Circum. (cm) Mean ±SD
35-39	18	2.24± 0.69	41.26± 10.88	27.37± 9.98	31.39 ±3.35
40-44	97	2.33± 0.21	44.56 ±7.18	31.54± 5.28	32.97 ±2.30
45-49	142	2.75± 0.38	45.49± 3.59	32.25± 3.20	33.06± 3.58
50-54	75	2.93± 0.39	45.28 ±3.94	32.64± 2.95	33.08± 3.22
55-59	29	2.95± 0.50	46.57± 3.79	32.46± 3.06	33.07± 3.38
60& above	20	3.18± 0.49	46.65± 2.52	33.55 ±2.28	33.80± 2.48

Table-18 shows the birth weight, length, chest circumference and head circumference of the newborn babies in relation to the mothers' weight. According to this table it can be seen that the mothers whose weight were less, their babies were low in birth weight, smaller in length, head and chest circumference than those who were the babies of heavy mothers.

4.1.26.A

Fig-9: Linearized regression relationship between Mother's weight and baby's birth weight

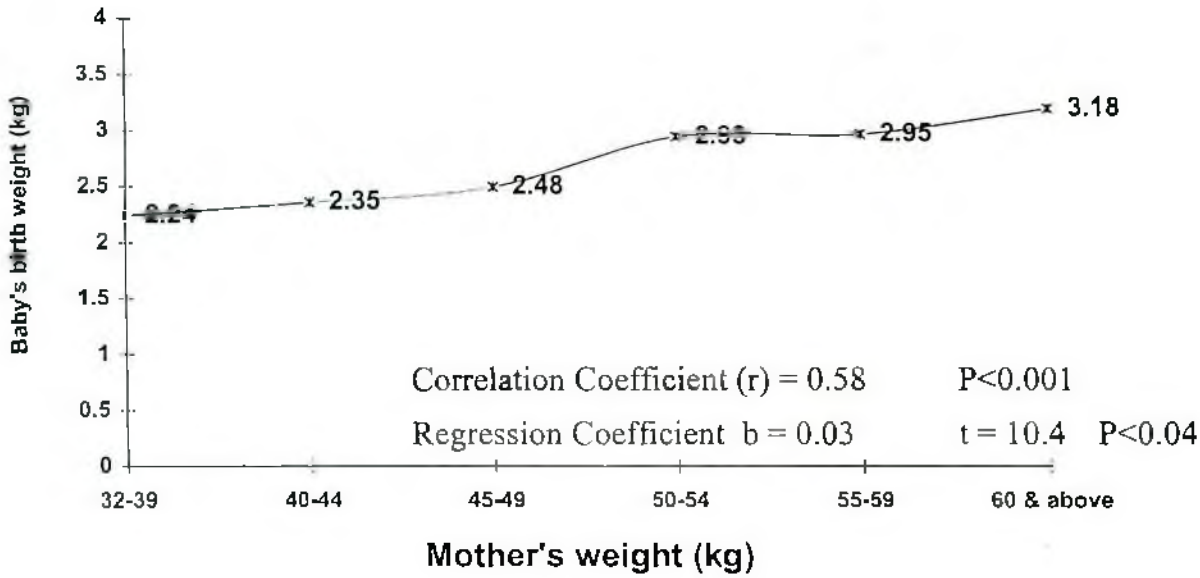

Figure-9 shows the linearized regression relationship between mother's weight and baby's birth weight. This linear graph exibits that the weight of newborn babies was related to the weight of the mothers. When the mothers weight was the lowest (32-39kg)newborn babies birth weight was also lowest (2.24kg).On the other hand if weight of the mother was highest (60 and above) the birth weight was also highest (3.18kg). The relationship is statistically significantly associated (r=o.58 and P< 0.001).

4.1.27 Fig-10: Curvilinear relationship between mother's weight and baby's length

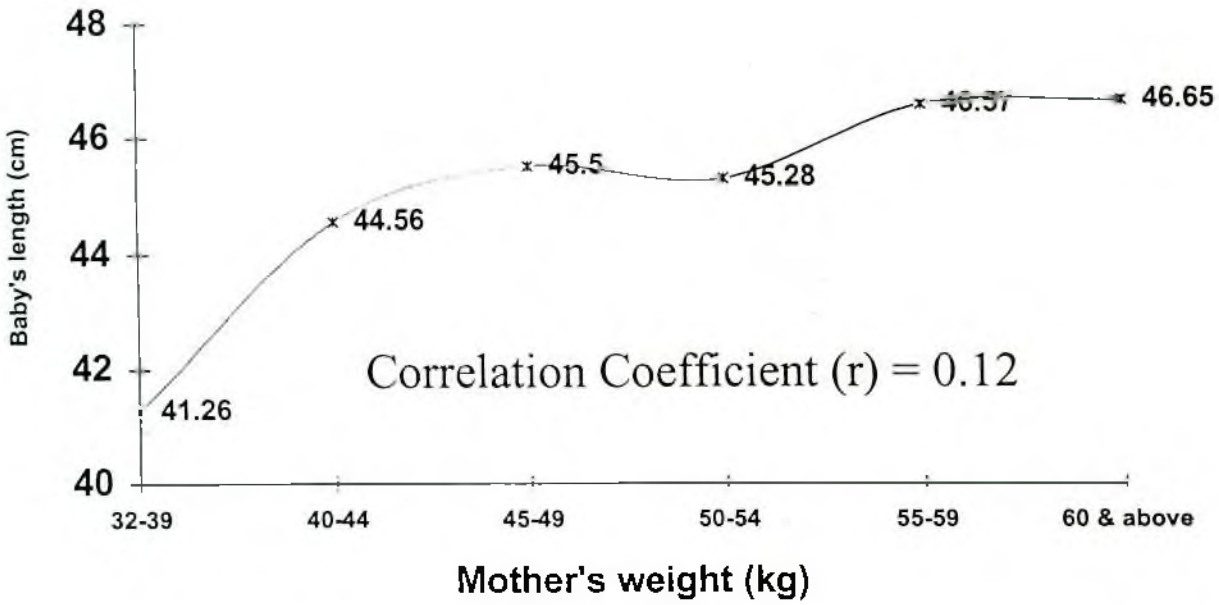

Figure-10 shows the curvilinear relationship between mother's weight and baby's length. When the mother's weight was 32 to 39 kg the length of their newborn babies was 41.26 cm. The graph shows the upward trend of birth length with the increased of maternal weight. According to this linear graph baby's length at birth is related to the mother's weight (Correlation coefficient r=0.12).

4.1.28 Fig-11: Curvilinear Relationship Between Mother's Weight and Baby's Chest circumference length

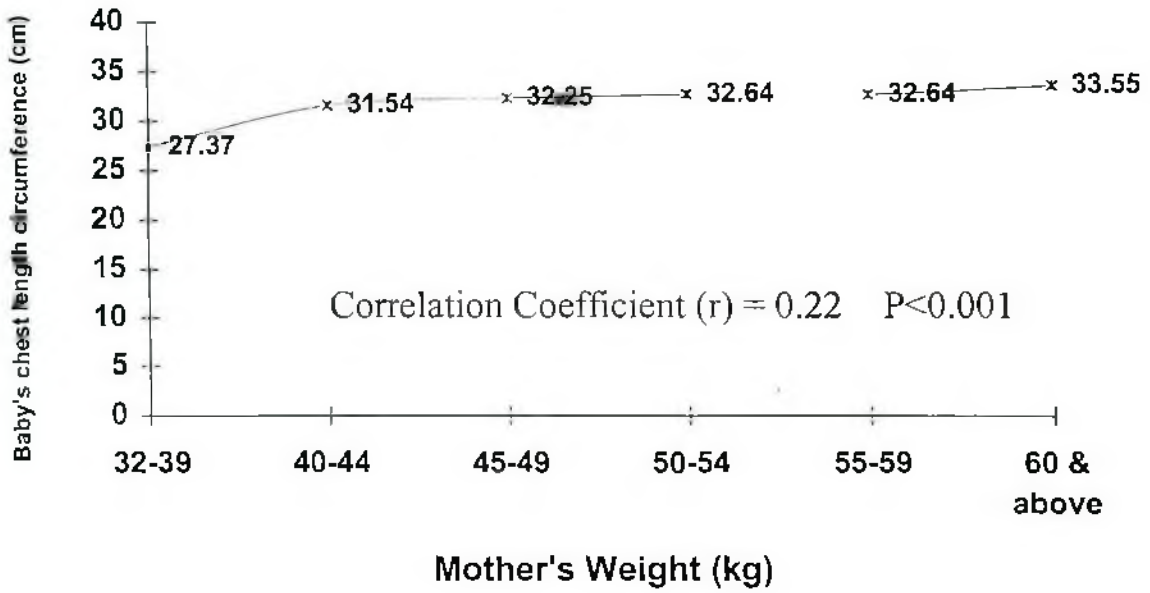

Figure-11 shows the curvilinear relationship between mother's weight and baby's chest circumference length. According to this graph baby's chest circumference length increased with mother's weight. The indicators are significantly associated (Correlation coefficient r=0.22 P<0.001).

4.1.29 Fig-12: Curvilinear Relationship Between Mother's Weight and Baby's Head circumference

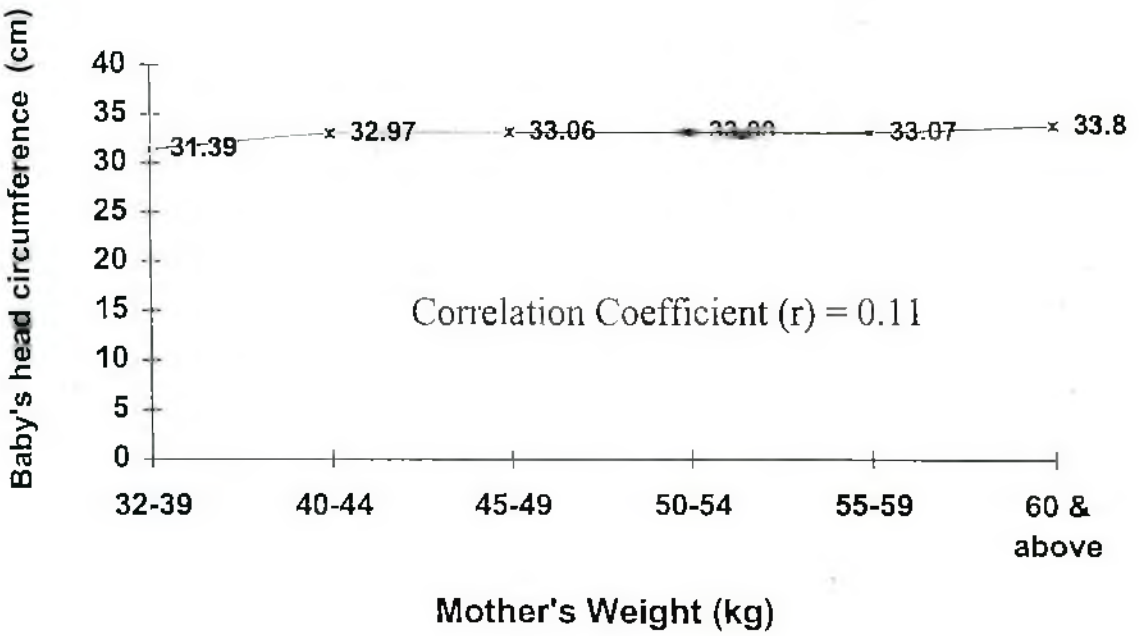

Figure-12 shows the curvilinear relationship between mother's weight and babies head circumference length. From this figure it can be visualized that babies head circumference lenght was not significantly related to the weight of the mothers. Here correlation coefficient r=0.11.

Table - 19

4.1.30 Birth Weight, Length, Chest Circumference and Head Circumference of the Babies by Mother's Height.

Mother's height (cm)	No.	Baby's birth weight (kg) Mean ±SD	Baby's length (cm) Mean ±SD	Baby's chest Circum. (cm) Mean ±SD	Baby's head Circum. (cm) Mean ±SD
<140	7	2.51± 0.32	46.20± 2.36	32.43 ±0.53	32.71± 1.4
140-144	20	2.53± 0.32	45.06 ±3.69	31.94 ±2.12	32.88± 3.81
145-149	124	2.57± 0.43	45.50± 3.23	32.32 ±3.16	33.06 ±3.22
150-154	135	2.76 ±0.54	46.11 ±4.23	32.70±2.93	33.11± 2.59
155-159	17	2.79 ±0.44	45.35± 5.42	32.71± 3.50	33.21± 1.79
160 & above	3	3.10± 0.87	47.00±3.61	32.67±3.21	33.0± 3.0

Table-19 describes the distribution of baby's birth weight, length, chest circumference and head circumference by maternal height. It can be seen from here that the height of the pregnant women is related to birth weight of newborn babies. Mothers' height has also influence on baby's length, head and chest circumference. The minimum height of the women was found<140cm and the babies they gave birth was weighing only 2.51± 0.32 (kg). The height of 135 women were between 150-154cm the corresponding birth weight, birth length, chest circumference and head circumference of the newborn babies were2.76± 0.0.54 (kg), 46.11± 4.23 (cm), 32.70± 2.93 (cm) and 33.11± 2.59 (cm).

4.1.31 Fig-13: Linearized Regression Relationship Between Mother's height and Baby's birth weight

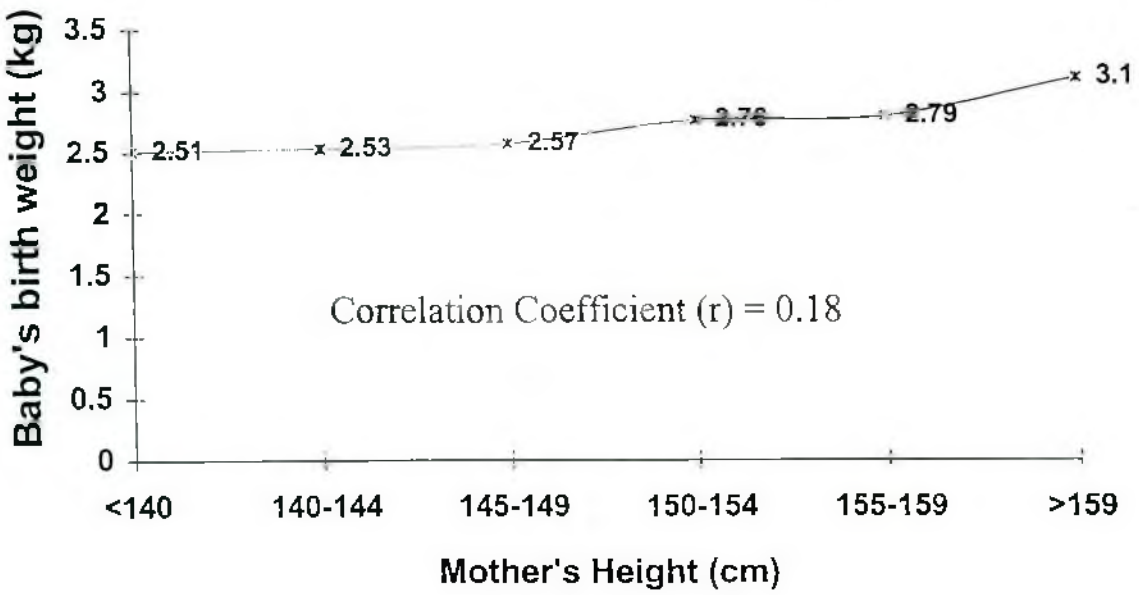

Figure-13 shows the lincarized regression relationship between mother's height and baby's birth weight. According to this graph the baby's birth weight shows a upward trend with the increased of mother's height. When mother's height was the highest i.e.>159cm the birth weight of the baby was also the highest 3.1 kg (Correlation coefficient r=0.18).

4.1.32 Fig-14: Curvilinear relationship between mother's height and baby's length at birth

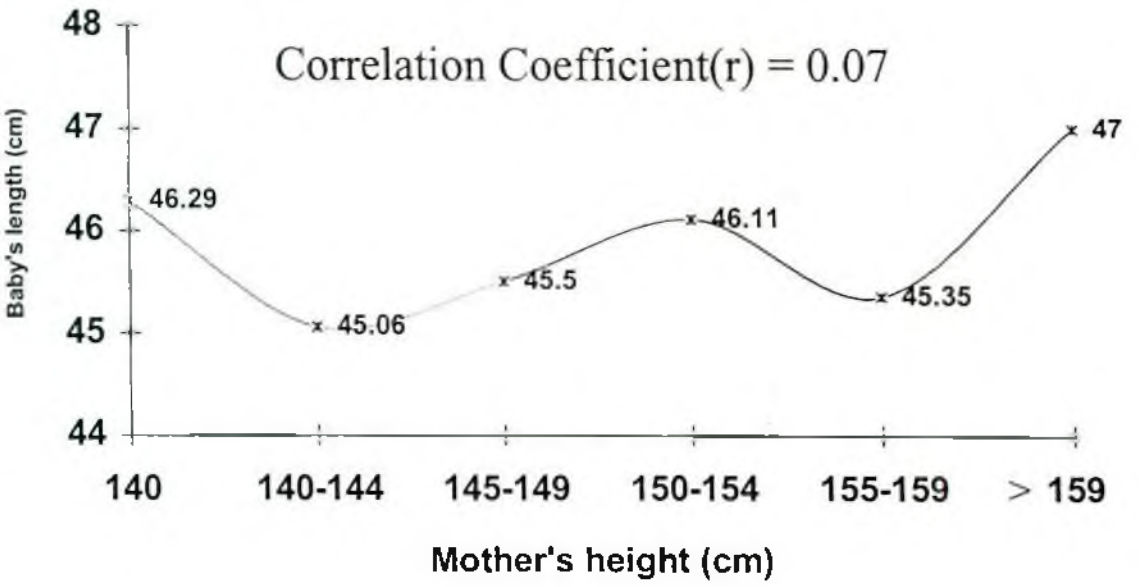

Figure-14 shows the curvilinear relationship between the mother's height and baby's length at birth. According to this figure, baby's length at birth was not influenced by the height of the mother and showed various inclination and declination of the linear graph (Correlation coefficient r=0.07).

Table - 20

4.1.33 Distribution of Mothers Hemoglobin Level and Birth Weight of the Newborn

Hemoglobin Level	Birth Weight	
(g/100ml)	No.	(Mean±SD)
5-7	14	2.45±0.34
8-9	14	2.46± 0.62
10-11	12	2.52 ±0.45
12-13	10	2.54± 0.36
14 and above	6	2.65± 0.42

Table-20 narrates the relationship between the hemoglobin level of the pregnant women and birth weight of the newborn babies. According to this table the mothers who has got hemoglobin level between 5-7gm gave birth to the babies whose mean birth weight was 2.45g±0.34g. On the other hand whose hemoglobin level was 14 and above gave birth to the babies weighing 2.65±0.42g.

4.1.34 Fig-15: Linearized Regression Relationship Between Birth Weight and Mother's Hemoglobin level

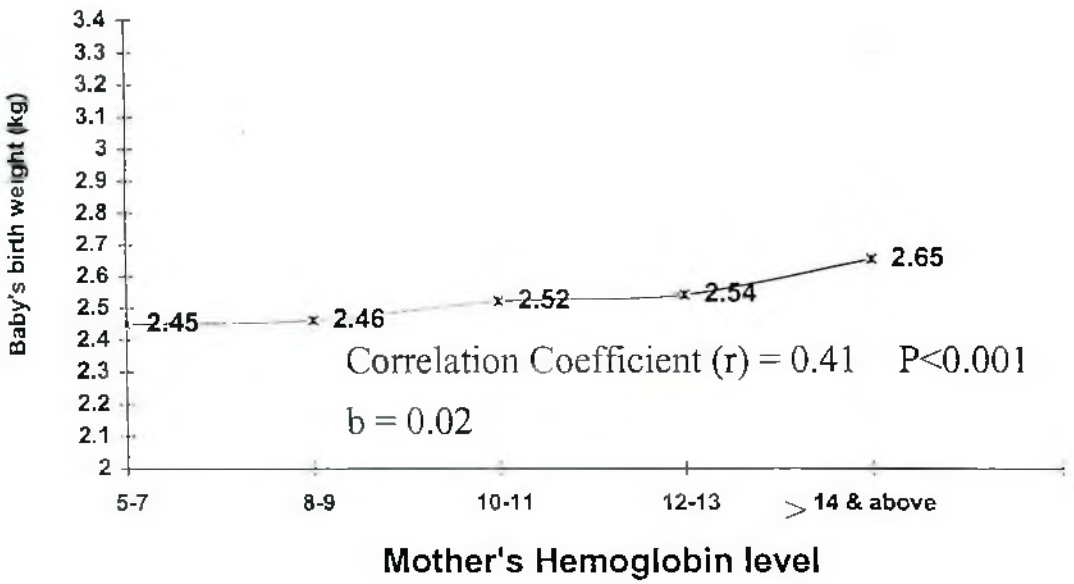

Figure-15 shows the linearized regression relationship between baby's birth weight and mother's hemoglobin level. This graph had a upward trend of baby's birth weight with the increased of the hemoglobin level of the mother. The association between these two indicators is highly significant (Correlation coefficient r=0.41 P<0.001).

Table -21

4.1.35 Distribution of Pregnant Women's Hemoglobin Level and Newborn Baby's Cord Hemoglobin Level.

Pregnant Women's Hemoglobin Level	Newborn Baby's Cord Hemoglobin Level	
g/100 ml	No.	(Mean ±SD)
5-7	14	13.45 ±2.32
8-9	14	13.19 ±2.62
10-11	12	14.37±4.31
12-13	10	13.75 ±2.34
14 and Above	6	16.40 ±1.62

Table-21 shows the relationship between the hemoglobin level of the pregnant woman and their newborn baby. It can be seen from this table that hemoglobin level of 14 pregnant mothers was between 5-7gm and mean hemoglobin level of their babies' was 13.45±2.32g. The mothers, whose hemoglobin level was in between10-11, the mean hemoglobin level of their babies' was 14.37±4.31g and the mothers whose hemoglobin level were 14 and above has got babies whose hemoglobin level was 16.40±1.62g.

4.1.36 Fig-16: Curvilinear Relationship Between Mother's Hb level and Babies cord Hb level

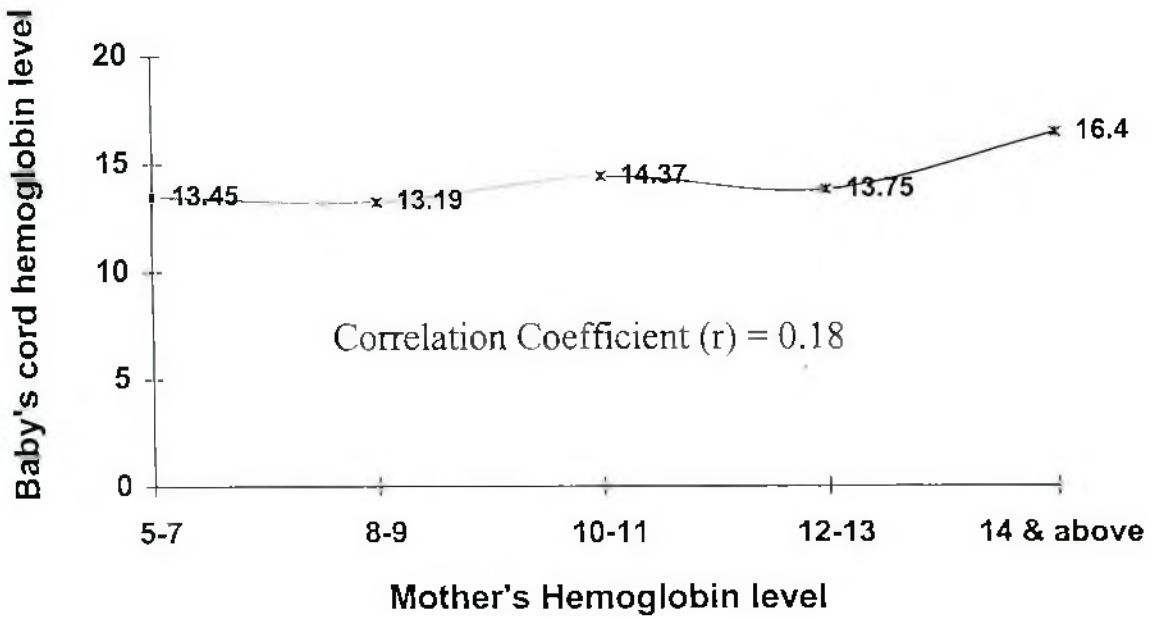

Figure-16 shows the curvilinear relationship between mother's hemoglobin level and cord hemoglobin level of newborn baby. The correlation between these two indicators was found but it is not that much significant (r=0.18).

Table - 22

4.1.37 Relationship between Anthropometric and Biochemical Variables.

r	Mother Age	Mother Height	Mother Weight	Mother MAC	Baby's Weight	Baby's Height	Baby's Head Circum.	Baby's Chest Circum.
Mother Age	1.00	0.12	0.16*	0.05	0.19**	0.04	0.07	0.06
Mother Height	0.12	1.00	0.35**	0.18*	0.21**	0.07	0.08	0.06
Mother Weight	0.17*	0.35**	1.00	0.41**	0.58**	0.12	0.11	0.22**
Mother MAC	0.05	0.18*	0.41**	1.00	0.33**	0.13	0.16	0.17*
Mother Hb.	-0.07	-0.03	0.07	0.10	0.41*	0.0	0.0	-0.01
Baby's Weight	0.19**	0.21**	0.38**	0.33**	1.00	0.29**	0.21**	0.41
Baby's Height	0.04	0.08	0.12	0.12	0.29**	1.00	0.15*	0.26*
Baby's Head Circum	0.07	0.0	0.11	0.17*	0.21**	0.15*	1.00	0.43**
Baby's Chest Circum	0.06	0.05	0.22*	0.17*	00.41**	0.26**	0.43**	1.00

*Significant P<0.01 ** Significant P> 0.001.

Table-22 describes the statistical analysis of the different variable of the pregnant women and that the newborn babies. It shows that the relationship between the mothers age and baby's birth weight is significantly related i.e. P=0.19 and it is also significantly related to mother's weight (P=0.58). Mother's weight has a significant relationship with mother's height and MAC here P=0.35 and P=0.41.Mother's MAC has got a significant relation with baby's birth weight P=0.33. Hemoglobin levels of the pregnant women are significantly related to the birth weight of the newborn babies P=0.41. The anthropometric variables of the newborn i.e. weight, length, head circumference and chest circumference all is very significantly interrelated. The relationship with baby's weight to height, head circumference and chest circumference is very significant i.e. P=0.29, P=0.21 and P=0.41.

Table - 23

4.1.38 Respondents' Age, Weight, Height and Birth Weight by Maternal BMI.

Category	Maternal BMI range				
	16.0-17.0	17.1-18.5	18.51-20	20.1-25.0	>25
Mean Birth wt.(kg)	1.98	2.22	2.41	2.79	3.04
% of low birth wt.	39.82	32.52	26.75	15.20	7.60
Mothers' mean Age (yrs)	25.75	25.92	25.49	26.49	27.33
Mothers' mean height (cm)	151.13	149.77	150.13	148.77	149.68
Mothers' Mean wt. (kg)	36.50	40.31	43.83	49.07	61.83
Number	8	26	63	179	3

Table-23 shows the relation between the Maternal anthropometry, BMI and Pregnancy Outcome in terms of birth weight of the newborn babies. It describes that 39.82% of the low birth weight babies were born to the mothers whose BMI was between 16-17 on the other hand only 7.60% babies were low birth weight whose mother's BMI was >25. The mean birth weight of the newborn was 1.98 kg and their mothers' BMI were in between 16.0 and17.0. The mothers those have BMI between 20.1and 25.0 gave birth to babies whose mean birth weight was 2.79kg and 179 mothers were in this category.

Table - 24

4.1.39 Association between Mothers' Height and birth weight of the Babies.

Birth weight(kg)	Mother's Height (cm)		Total
	<140	>141	
<2.5	77	46	123
> 2.5	15	168	183
Total	92	214	306

Standard height is 140cm for weight 45 kg.
Chi-square=101, P<0.001 OR=19, RR=8
Sensitivity=84 Specificity=78.

Table-24 narrates the association between mother's height and birth weight of the newborn babies. The table shows those mothers whose height was less than 140 cm gave birth to 92 babies and 77of them weigh less than 2.5 kg. and 15 of them were more than 2.5kg. On the other hand 214 children were born to the mothers whose height were more than 141cm and among them168 babies weight was more than 2.5kg. It was calculated from this table that the 141cm cut off point of height of the mothers has the sensitivity of 84% and specificity of 78% identifying the babies with LBW. Based on chi-square test it was also found that maternal height was positively associated with birth weight of the babies (χ^2 =101, P<0.001).

Table- 25
4.1.40 Association between Maternal Weight and Birth Weight of the Newborn.

Birth weight	Mother's weight(kg)		Total
	<45	>45	
<2.5	101	22	123
			40.20%
>2.5	14	169	183
			59.80%
Total	115	194	306
	37.58%	62.42%	100%

Chi-square=173, P<0.001,OR=55, RR=11
Sensitivity=87 Specificity=88

Table–25 shows the association between mother's weight and birth weight of the newborn babies. According to this table, mothers whose weight were less than 45 kg gave birth to 101 babies weighing less than 2.5 kg and 14 babies were above 2.5 kg. On the other hand the mothers whose weight was more than 45 kg gave birth to the 169 babies weighing more than 2.5 kg and only 22 newborn babies were less than 2.5kg. Chi-square test (χ^2 = 173, P<0.001) showed that maternal weight was highly associated with birth weight of the newborns. It was calculated that cut off of maternal weight has the sensitivity of 87% and specificity of 88% in detecting of newborn who were at higher risk of low birth weight. The prevalence of low birth weight was more common in the mother's weight <45kg. The incidence gradually diminishes as the weight of the mothers' increases.

Table -26

4.1.41 Association between Mother's MAC and Birth Weight of the Babies

Birth weight(kg)	Mother's MAC		Total
	<23.5	>23.5	
<2.5	120	3	123
			59.20%
>2.5	142	41	183
			59.80%
Total	262	44	306
	85.62%	14.38%	100.00

Chi-square=22, P<0.05, OR=11, RR=1.26
Sensitivity=46 Specificity=93.

Table–26 presents the association between pregnant women arm circumference and birth weight. This table shows that the mothers whose MAC was less than23.5 cm gave birth to 120 babies whose birth weight was less than 2.5kg.Three children whose weight was below2.5 kg were born to the mothers whose MAC was above 23.5cm and 41 of them were above 2.5 kg. Based on chi-square test it was found that arm circumference of the mothers was significantly associated with birth weight of the babies (χ^2 =22, P<0.05). Arm circumference cutoff point 23.5 cm has the sensitivity of 46% and the specificity of 93% detecting babies who were at higher risk of low birth weight (<2.5kg).

Table -27

4.1.42 Association between Maternal Chronic Energy Deficiency and Birth Weight

Birth weight	Body Mass Index (BMI)		Total
	<18.5	>18.5	
<2.5	31	92	123
			40.20%
>2.5	2	181	183
			59.80%
Total	33	273	306
	10.78%	89.22%	100%

Chi-square=41, P<0.001, OR=30, RR=23
Sensitivity=94, Sepecificity=66.

Table–27 shows the association between maternal chronic energy deficiency, which measured by body mass index and birth weight of the newborns. According to this table mother's BMI below 18.5 gave birth to babies weigh less than2.5 kg 31 and more than 2.5 kg only two. On the other hand mother's BMI above 18.5 gave birth to babies weigh more than 2.5 kg181 and less than 2.5kg 92. According to chi-square test (χ^2 =41,P<0.05) it was found that CED was significantly associated with low birth weight. It was also found that 10.78% of the pregnant mothers were suffering from CED. It was calculated that the 18.5 cut off point of BMI have the sensitivity of 94% and specificity of 66% in identifying the babies with LBW.

Table -28

4.1.43 Newborns' Birth Weight and Hemoglobin Level by Hemoglobin Level of the Mothers'.

Hemoglobin Level of Mothers	Birth Weight of Babies (kg)		Babies' Hemoglobin Level (g/100 ml)	
(gm/ 100 ml)	No.	(Mean ± SD)	No.	(Mean ± SD)
5-7	14	2.45 ±0.34	14	13.45 ±2.32
8-9	14	2.64± 0.62	14	13.19± 2.62
10-11	12	2.52± 0.45	12	14.37± 4.31
12-13	10	2.54± 0.36	10	13.75 ±2.34
14& above	6	2.65± 0.42	6	16.40 ±1.62

Correlation (r) between mother's Hb. level and birth weight =0.41
P< 0.01

Correlation (r) between mother's Hb. level and babies Hb.=0.18 P<0.18.

Table-28 shows the distribution of birth weight and hemoglobin level of the newborn babies by the hemoglobin level of the mothers. It can be seen from here that 14 mothers had hemoglobin level of 5-7gms, the mean birth weight of their babies was 2.45±0.34 kg and the mean hemoglobin level of those 14 babies was 13.45±2.32 kg. On the other hand the mothers who had higher level of hemoglobin i.e. 10-11 g gave birth to babies whose mean birth weight was 2.52±0.45 kg and their mean hemoglobin level was 14.37±4.31 g/100 ml. Similarly the mothers, whose hemoglobin level was the highest had babies whose mean birth weight was 2.65±0.42 kg and hemoglobin level was 16.40±1.62 g/100 ml.

Mother's hemoglobin level is significantly associated with the birth weight of the newborns (P<0.01).

Table - 29

4.1.44 Logistic Regression Analysis showing effect of Independent Variables on Birth Weight

Variables	Regression Coefficient (b)	P
Mother's age	0.82	P<0.05
Mother's height	0.64	P<0.05
Mother's weight	0.91	P<0.05
Mother's Hemoglobin	0.46	P<0.05
Mother's MAC	0.44	P<0.05
Mother's BMI	0.31	P<0.05
Albumin	0.0	NS
Edema	-0.37	P<0.05
Parity	0.39	P<0.05
Blood-pressure	0.0	NS
Protein Intake	0.64	P<0.05

Table -29 narrates the result of logistic regression analysis, which was done to see the effect of eleven factors on birth weight of the newborns. The factors, which might influence the birth weight, were taken as independent variables and the birth weight as dependent variable in the logistic regression analysis. Mother's age, height, BMI, MAC, parity, protein intake of the mothers, hemoglobin level and edema are significantly associated with birth weight ($P<0.05$).

Table-30

4.1.45 Comparison of Anthropometric and Biochemical variables between Boys and Girls.

Variables	Boys		Girls		Z-Test
	No.	(Mean ±SD)	no.	(mean± SD)	
Birth weight (kg)	154	2.70 ±0.51	152	2.63± 0.44	P<0.18
Length (cm)	154	45.99 ±4.08	152	45.55± 3.41	P<0.31
Head circum. (cm)	154	33.25 ±3.27	152	32.85± 2.65	P<0.23
Chest circum. (cm)	154	32.44 ±3.12	152	32.40 ±2.77	P<0.90
Hemoglobin (g/100 ml)	28	13.37± 3.15	28	14.41± 2.84	P<0.20

Table-30 shows the comparison of anthropometric and biochemical variables between boys and girls. According to this table the mean birth weight of 154 boys and 152 girls are 2.70±0.51 kg and 2.63±0.44kg. The birth length of the same number of children was respectively 45.55±3.41cm and 45.99±4.08cm. The mean head circumference and chest circumferences of 154 newborn boys were 33.25±3.27cm and 32.44±3.12cm. The same measurements of the newborn girls were 32.85±2.65cm and 32.40±2.77cm. The cord hemoglobin level (mean) of 28 newborn boys was 13.37±3.15g and that of the 28 newborn girls was 14.41±2.48g. So it can be seen that except the hemoglobin level all the other measurements were slightly more for the boys than the girls. Test of significance Z-test was done to determine the validity, which shows that the association is not significant (P>0.05).

Table - 31

4.1.46 Newborns by Nutritional Level According to Weight for Age by Z-scoring.

Nutritional Level.	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below median – 2SD	82	56.16	80	50.13	162	53.29
Above Median – 2SD	64	43.84	78	49.32	142	46.71
Total	146	100	158	100	304	100

Association between nutritional level of weight for age by sex

Chi-Square=0.72 <0.39

Odds Ratio=1.25 (0.78<OR<2.01)

Relative Ratio=1.12 (0.89<RR<2.20)

Nutritional Level is not associated with sex.

Table-31 shows that in this study there were 146 newborn girls and 158 new born boys and it also shows that among these boys and girls 162 were below median –2SD and 142 children were above median -2SD. According to this table 56.16% of boys and 50.13% of girls were below median-2SD. On the other hand 43.84%of boys and 49.32%of girls were above median –2SD.

Table- 32

4.1.47 Nutritional Level of Newborns According to Weight for Height by Z-scoring

Nutritional Level	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below Median –2SD	133	91.10	132	83.54	264	87.17
Above Median –2SD	13	8.90	26	16.46	39	12.13
Total	146	100	158	100	304	100

Association between nutritional level of Weight for Height by sex

Chi-square =3.22 P<0.07

Odds Ratio =2.02 (0.94<OR<4.35)

Relative Risk=1.07 (0.75<RR<1.51)

Table-32 shows the nutritional level of the newborn boys and girls according to weight for height. It can be seen from this table that 91.10% newborn girls and 83.54% newborn boys were below median –2SD. Whereas only 8.90% newborn girls and 16.46% newborn boys were above median –2SD. This table indicates that nutritional status according to weight for height is at birth associated with sex.

Table- 33

4.1.48 Nutritional Level of the newborns According to Height for Age by Z-scoring.

Nutritional Level	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below median – 2SD.	126	83.30	134	84.81	260	85.53
Above median – 2SD.	20	13.70	24	15.19	44	14.47
Total	146	100	158	100	304	100

Association between nutritional level of Height for age by sex

Chi-square =0.04 P<0.83

Odds Ratio =1.13 (0.57<OR<2.25)

Relative Risk = 1.07 (0.75<RR<1.51)

Table-33 shows the distribution of the nutritional level of the newborns according to their height for age by sex. Among the girls 83.30%were below median –2SD and 84.81% of the boys were in this group. 13.70% of the girls and 15.19% boys were above median –2SD. The total sample was 304 newborn babies, 260 of them were below median –2SD and only 44 of them were above median –2SD. This table also indicates that nutritional level is not associated with sex.

4.1.49 Fig. 17: Nutritional Status of the Newborns by Z-Score

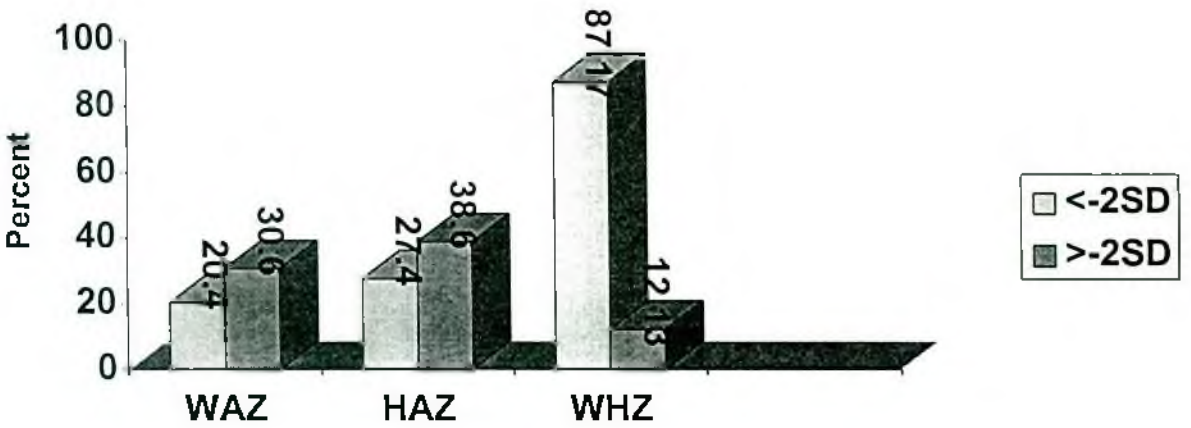

Figure-17 shows the bar diagram of the nutritional status of the newborns by Z-scoring. According to this diagram 30.6% of the babies nutritional status in weight for age were more than -2SD and 20.4% were less than -2SD. When the nutritional status was measured by height for age 38.6% were more than -2SD and 27.4% were less than -2SD. If the calculation was done in weight for height Z-scoring 87.17% of the babies were more than -2SD and 12.13% of the babies nutritional status was less than -2SD.

CHAPTER-FIVE

5.1 DISCUSSION:

This study was carried out on the nutritional status of the pregnant mothers and their newborn babies in an urban slum area of Dhaka City. In this study investigations were done on the 3rd trimoster pregnant women about their socio-economic condition, dietary pattern, clinical examination, biochemical investigations and anthropometric measurements. The anthropometric measurements such as weight, length, head and chest circumferences were taken of the newborn babies of those mothers and the cord hemoglobin level was also measured. Special emphasis was given on to establish ment of relationship between the nutritional status of the pregnant women and low birth weight of the newborn babies.

The sample size of the present study was 309 pregnant women and 306 newborn babies. Among 309 mothers 24.9% were 15-20 years of age and their mean ±SD body weight was 47.01± 6.56 kg (Table-1). The age of 42.1% of the mothers were between 26-30 years and their mean ±SD bodyweight was 46.38 ±6.48. The mean ±SD of the pregnant mother's weight was 47.75± 7.96 (Table-1) in third trimester of pregnancy which was much lower than the expected weight in pregnancy. Studies in India by Venkatachalam, Shankar, and Gopalan have shown that under nutritional stress the pregnant women do not gain physiologically their normal weight, and usually store very little reserve fat in their body[1]. The current study correlates with the study of Hussain, Karim, Zainul Abedin, Ferrdous and Ahmed where they found that the mean weight of the pregnant women in age group of 18 years was 46.7kg and in age group of 29.7 years the mean weight was 48.7kg.[26]

The height of 50.16% pregnant women's was in between 145-149cm and only .97% was above 160cm. 47.89% of the pregnant mothers i.e. 148 mothers' height was 150-154cm (Table–2). Among 305 subjects 29.84% women's mean SD± MAC was 23.53± 0.63 cm and 69.50% of women had 20.94±0.93cm mean ±SD MAC, which is moderately depleted.(figure-2) There is a relationship between arm circumference and body weight. Various studies suggest that arm circumference could be a useful indicator of weight [46]

Huffman et. el. found a high correlation ($r=0.80$, $p<0.0001$) between the mean arm circumference and mean weight in Bangladeshi women.[43] In this study 20.7% (63in number) mother MAC was less than 20.7 cm and 14.7% of them is weighing 37-43.4kg. 48.5% mothers' MAC were between 20.7 to 22.9 cm and among them 42.4% were weighing more than or equal to 43.5 kg (Table 4). The sensitivity among the weight of the pregnant mother and the MAC measurement was 96.9 and the specificity was 37.9 in moderate level. In a study of rural women in Bangladesh found that arm circumference was strongly related to other anthropometric measures.[7] Correlation between arm circumference and weight ($r=0.68$-0.79) were high in all stage of pregnancy [43]

The association between mother's mid arm circumference and birth weight of the babies is highly significant. When the MAC was <23.5cm, the birth weight of 120 babies was less than 2.5 kg. Based on Chi-square test it was found that arm circumference of the mother significantly associated with birth weight (Chi-square=22,$P<0.05$). Arm circumference cut-off point 23.5cm has the sensitivity of 46% and the specificity of 93% detecting babies who were at higher risk of low borth weight.(Table-26). Based on work, recommends an armcircumference cut-off point at any time during pregnancy in combination with other indicators to predicts risk of low birth weight. [26] Lechtig studied that an arm circumference of <23.5 cm at any time during pregnancy had a similar sensitivity (76%), specificity (69%) and relative risk as weight during pregnancy for gestational age in identifying women at risk of delivering low birth weight infant in Brazil[3].

Among the total sample i.e. 309 pregnant women the mean Body Mass Index (BMI) was 21.48. In Table 5 it can be seen that 77 pregnant were between 18 and 20 years and their mean BMI was 21.27, 62 mothers were between 21-25 years and their mean BMI was 20.98. Over all 11.62% of the pregnant women were suffering from chronic energy deficiency and many of them were from the age group of 15-20, the percentage of this group was 14.29. The other affected group was between age group 31-35 (figure-3). This study also pays attention to the relation ship between the maternal BMI and birth weight of the newborn babies (Table-23). Mothers whose BMI was in between 16.0and17.0 gave birth to babies whose mean birth weight was 1.98 kg, babies'mean birth weight was 2.22kg and their mothers' BMI was between 17.1 and18.5. Mothers' BMI between 20.1and 25.0 gave birth to the babies whose mean birth weight was 2.79kg and mothers' BMI more than 25 gave birth to the babies' whose birth weight was 3.04kg. Information from National Institute of Nutrition in India revealed that 44% of women who were low BMI (<18.8) had low birth weight infants, compared to 32% of women with BMI between 18.8 and 23.2, and 19% of women with BMI >23.2 and BMI was reported to be a better indicator of risk for low birth weight than weight for height alone.[19] Conversely, women with the highest BMI had the highest incidence (26%) and women with the lowest BMI had the lowest incidence (12%) of infants with birth weight >3000gm. Rahman and Visweaswar Rao in their study also indicates that maternal BMI <18.5 is associated with higher incidence of low birth weight[39]

In this study hemoglobin level of the pregnant women during their last trimester of pregnancy was measured, which shows that 200 mothers' hemoglobin level was below 11g/dl and only 19 was more than 11g/dl (Table-7). In conformity with the Pan American Health Organization Scientific Group on the nutritional anemias, it was considered that hemoglobin level below 11g/dl should be regarded as signifying anemia during pregnancy [26]. The mean ±SD hemoglobin level of 91.3% mothers was 8.22 ±1.23 and in 8.7% of mothers mean ±SD hemoglobin level was 13.16 ±1.22. The correlation between mother's hemoglobin level, birth weight of the newborn and cord hemoglobin level was determined in this study. Correlation (r) between mother's hemoglobin and birth weight was found = 0.41 P<0.01 and correlation between mother's hemoglobin level and baby's cord hemoglobin level was r= 0.18 (Figure-15).

The blood hemoglobin level of 14 mothers was 5-7gs, the mean birth weight of their babies was 2.45 kg and the mean hemoglobin level of those babies was 13.45g. On the other hand the mothers who had higher level of hemoglobin i.e. 10-11g gave birth to babies whose mean birth weight was 2.52 kg and their mean hemoglobin level was 14.37 g.(Figure-14) Similarly the mothers whose hemoglobin level was high gave birth to babies whose mean birth weight was 2.65 kg and mean hemoglobin level was 16.40 (Table-20). Statistical analysis has shown that the correlation coefficient $r=0.41$ and $P<0.01$ between birth weight and mothers hemoglobin level, which indicates significant correlation between the indicators (Figure-14). A study by Fariduddin Ahmed [22] has the similar findings that more than 60% of 2849 pregnant mothers were severely anemic and birth weight of was found to be positively correlated with mother's hemoglobin level.

The content of urinary sugar and albumin was measured to determine the high risk of pregnancy and it was found that 81.6%of pregnant mother's urine did not contain any albumin, 16.8% had mild albuminurea and only 1.6% had moderate albuminurea. 95.8%of pregnant mother's urine did not contain any sugar and only 4.2% were suffering from glycusuria (Table-8).

Blood pressure of the pregnant women has a significant role on pre-eclampsia and it was determined in this study. 85.4% of the mothers' blood pressure was normal and 13.3% were hypertensive. The Mean±SD systolic blood pressure was found 123.39±15.92 and mean ± SD diastolic pressure was 82.5±12.00 (Table-9). No generally accepted definition for hypertensive disorder of pregnancy exists. The WHO Hypertensive Collaborative study[55] recommended the following diagnostic criteria: diastolic pressure >90mm of Hg. proteinurea and/or presence of edema in pregnant women confirm the diagnosis of preeclampsia, which is in high-risk pregnancy category. In this study it was shown that 14.2% of the women had some sort of dependent edema, 13.3% of the women were suffering from hypertension and 18.4% of them were passing albumin through urine.

Age and parity of the pregnant women have influence on the birth weight of the babies in Table 6 it can be seen that among the total 86 women of the were primigravida and 57 of them delivered babies were weighing within 2.5kg. Similar findings also presented by Nargis and Ahmed in their study.[23] They found the correlation between parity of the mothers and birth weight of the babies. The incidence of low birth weight is maximum in the early issues and it diminishes as the parity increases. This association is statistically significant at 1percent level.

The calorie intake of the pregnant women in this study on average was 1880.70 Kcal, which is 80 % of the required daily allowance (RDA). The protein intake of the mothers was 39.44gm that are 68% of the RDA. The intake of vitamins, minerals and trace elements were also far less than the required daily allowances such as, Calcium intake was only 65%, Iron intake was 62.91 %, Vitamin A intake was 47.67 %, Vitamin B2 intake was 77.69 % and Vitamin C intake was only 60 % of the RDA (Table-11).

This findings co-relates with the low anthropometric measurements and high prevalence of anemia in the pregnant women of the study sample. According to Rosenberg et.al. among the nursing and pregnant mothers of Bangladesh, 45 % suffer from protein deficiency, 83 % from low hemoglobin and 42 % from vitamin A deficiency [56]

The weight of 306 new born was taken just after delivery. 13 babies among 306 babies were weighing <2kg and 105 babies birth weight was in between 2.1to 2.4 kg. 41.18% babies were in between 2.5 to 3.0 kg and 20.26% i.e.62 babies were weighing 3.1 kg and above (Table-15). According to WHO definition low birth weight is a birth weight of <2500grams so 38.56% of the new born babies of this study population were low birth weight.[19] Falaki and El-Aloosy observed a mean birth weight of newborns of Iraq to be 3160 gms. In their report, these authors compared the average birth weight of the other countries – USA, 3400gm (male) and 3180 gm (female); Switzerland, 3500gm (male) and 3300 gm (female); China, 3420gm. and Nigeria 2890 gm[57]. Naeye et.al in their study found the birth weight of newborn ranging between 2494 to 2850gm[58]. In Bangladesh M.R. Khan and Najmun Nahar et.al observed in their study that the mean birth weight of the male babies were 2574 gms and female babies were 2281gm.[24] In our study the mean birth weight of male babies was 2.70 kg and that of the female babies was 2.63 kg.(table-29)

Maternal age is an important factor of determination of birth weight of the newborns. Our study shows that mothers who were between 18-20 years of age gave birth to babies whose mean SD birth weight was 2.55 ±0.41 and mothers of 21- 25 years gave birth to babies whose mean SD birth weight was 2.62± 0.46 kg. On the other hand the older mothers gave birth to heavier babies e.g. mothers who were 26 –30 years of age gave birth to babies who were weighing 2.72± 0.51kg (table-15). Here correlation coefficient r=0.19 and P<0.001 so the relation is highly significant and maternal age is positively related to birth weight. Regression coefficient =0.007 and P<0.04 also indicates the significance (Figure-9). Frisanco, Klayman and Mathos did a study on 1256 adolescent mothers ranging in age from 12 –25 years, which indicates that these mothers had smaller and thinner babies than those born to older women.[33]

Apart from the birth weight of the newborns this study included the length, head circumference and chest circumference of them. According to this study the mean SD birth weight of 18 babies were 2.24± 0.69 kg and their mean SD length, chest and head circumference were 44.56 ±7.18 cm, 27.37± 9.98 cm and 31.39 ±3.35 cm. It also shows that 142 babies i.e. about 50% of the study subjects mean SD birth weight was 2.75± 0.38 gms and their corresponding length, head and chest circumferences were 45.49± 3.59 cm, 32.25 ±3.20 cm and 33.06 ±3.58 cm (table-17). According to Handbook of Normal Physical Measurements from Oxford Medical Publication the length at birth 48cm is 50th percentile and 50 cm is 75th percentile, the normal range of chest circumference is 31 to 36 cm and the mean is 32 cm and according to this reference the head circumference of the newborn babies 34cm is in 50th percentile, 35 cm 70th percentile and 35.5cm is on 90th percentile[59]. Compare to this standard except the chest circumference all other measurements are below. A study was done by M.R. Khan et. al. on 1002 newborn babies which shows that the length of 433 babies out of 1002 were within 46.1 to 49 cm, the mean length of the male babies was 47.41 ±2.73 cm and that of the female babies was 46.85 ±2.52cm, the mean head circumference of the male babies was 33.41± 1.8cm and that for the female babies was 32.91 ±1.79cm and the mean chest circumference of the male babies was 32.08± 2.44cmand that for the female babies was 31.73 ±2.54cm[6]. These findings correspond to that of the present finding.

The mothers who were 35-40 kg gave birth to babies whose mean birth weight was 2.24 ±0.69 kg and mothers who were 45-45 kg had babies of mean birth weight 2.75 ±0.38 kg (table-17). The correlation coefficient (r) and regression coefficient of mothers' weight and babies' birth weight was calculated and found very significantly correlated, here the value of r =0.58 and P<0.001 and regression coefficient b=0.30 t=10.4 where P<0.00 (figure-10).

Nargis and Ahmed in their study showed that the prevalence of low birth weight was more common in mothers weighing between 30-45 kg. They found a highly significant correlation between maternal weight and birth weight, this association is statistically significant at the one percent level[23]. The incident of low birth weight, an update weekly epidemiological review also confirms that the incidence of low birth weight is more prevalent in low body weight pregnant women[60].

Height of 124 pregnant women out of 309 women was in between 145-149cm. The mean birth weight of their babies was 2.57 kg. The height of 135 mothers was in between 150-154cm and the mean birth weight of their babies was 2.76 kg. The minimum height of the women was <140cm and the babies born to them was weighted only 2.51. Whereas the women who were height in height gave birth to the babies whose mean birth weight was 3.10kg. (Table-19). It indicates a positive relationship between the mother's height and birth weight of the babies. Statistical analysis was done and correlation coefficient (r)=0.21 and P<0.001, which indicates highly significant correlation (Figure-13). Studies in both industrialized and developing countries have shown that taller mothers have heavier birth weight infants than shorter mothers [44]. Genri et.al observation was maternal height is a phenotypic expression of genetic endowment and the environment during childhood, which also influence the weight of their babies[61].

Statistical analysis of the each explanatory variable with birth weight was done. The variables were age, height, weight, hemoglobin level, blood pressure, Albumin content of urine, edema and antenatal visits of the pregnant mother. Mother's age is significantly associated with the birth weight of their newborns, P<0.04. Weight of the pregnant mother is another very significant indicator of influencing birth weight of the newborns, P<0.0001. Hemoglobin level and edema of the pregnant mother have association with birth weight here the association is P<0.02 and P<0.04 respectively (Table-29). In a recent review and meta-analysis of studies reported that the most important established determinants of low birth weight taken together is maternal nutritional factors such as low calony intake, pregnant [62].

The analysis of sensitivity, specificity, odds ratio, relative risk and chi-square with the different mothers' indicator to the birth weight of the newborn was done. When the maternal weight is less than 45 kg its sensitivity to low birth weight is 82% and the positive predictive value is 88%. The sensitivity of MAC and hemoglobin level less than 11gms are 98% and 89%, the specificity is 22% and 11% respectively. Chronic energy deficiency of the mother's i.e. BMI below 18.5 has 25% sensitivity and 99% specificity (Table 27).

Knasovee estimates that the BMI of two groups of women would be approximately 23.6 and 18.7 and revealed that women with a BMI <18 were 174 times as likely to have children who were under weight than heavier women[63].

The weight, length and head circumference at birth is recognized indices of intrauterine growth development. This study has done the comparable study of the various anthropomtetric and biochemical variables of the newborn male and females. The total number of newborn boys was 154 and number of girls was 152. The mean birth weight of the boys was 2.70 kg and mean birth weight of the girls was 2.63 kg. The birth length of the same number of the boys and girls are respectively 45.99 cm and 45.55 cm. The mean head and chest circumference of 154 newborn boys were 33.25 cm and 32.44cm the same measurements of the girls were 32.85cm and 32.40 cm. The cord hemoglobin level (mean) of the boys was 13.37 gms and that of the newborn girls was 14.41gm.(table-30) So it can be seen that except the hemoglobin level all the other measurements of are slightly high for the boys than the newborn girls. M.R. Khan and Prof. Najmun Nahar et.al. observed in their study that the mean birth weight of the male babies was 2574 gm and that of the female babies was 2281g, the mean length of their observation was 47.41cm (male) and 46.85cm (female) and the average head circumference of the babies was 33.41cm (male) and 32.91 cm (female) [24]. These findings correspond to our observation. They observed hemoglobin level of 677 babies, the mean hemoglobin level of the male babies was 16.36 gm and that for female babies was 16.36 gm[64]. Chowdhury, Rajlal and Akter found that anemia was present in 46.1% of pregnant mother in comparison with 19% in non pregnant women[64].

Nutritional status according to the weight for age by sex 162 children was below median –2SD and 142 children were above median. 56.16% of the boys and 50.13% of the girls were below median –2SD.On the other hand 43.84% of the boys and 49.32 % girls were above median. It indicates that nutritional level is not associated with sex (table-31). According to height for age 83.30% of the girls were <-2SD and only 13.70% of girls were >-2SD. Among the boys 84.81% were <-2SD and 15.19% were >-2SD(table-33). Association between nutritional level and sex by birth was not highly significant (Chi-square0.04 P<0.85). According to weight for height 87.17% were <-2SD and 12.13% were >-2SD i.e. majority of them were malnourished.(figure-17). According to Nutrition survey of INFS, in the age of 0-60 months the nutritional status was normal in 36.08%, stunted 43.92%, wasted 7.06% and both stunted and wasted were 12.94%. [65]

5.2 CONCLUSION:

The study of nutritional status of the pregnant women and their newborn babies in an urban slum area revealed the following features:

The highest number of pregnant women (42.1%) were in age group of 26 to30 years and their mean body weight was 46.38± 6.48 kg, which corresponds with the standard weight for our country and the mean height of 50.16% pregnant women was between145 and 149cm. In this study it was found that the younger mothers gave birth to low birth weight babies than the older mothers. Correlation coefficient between mothers' age and birth weight $r=0.19$ $P<0.001$.

Middle arm circumference measurement could be an easy method of nutritional status assessment of the pregnant mothers. This study shows that 69.50%women's arm circumferences were moderately depleted. Mothers' weight and MAC is closely associated $P<0.41$. Sensitivity and specificity of MAC and body weight is 96.9 and 37.9. There is a significant association between pregnant women's MAC and birth weight of the newborns $P<0.33$.

According to WHO standard of blood hemoglobin level 91.3% of the pregnant women were suffering from anemia that is hemoglobin level less than 11g/dl. The hemoglobin level has a positive effect on the birth weight of the babies. The mothers whose hemoglobin level is less than or equal to 11gm/dl gave birth to babies weighing less than 2.5kg. On the other hand who had hemoglobin level above 11gm/dl gave birth to babies weighing more than 2.5kg. So these indicators exerts a significant correlation, here correlation coefficient $r=0.41$ and $P<0.01$.

Malnutrition begins at fetal development but can be traced back to the malnutrition of the mothers since childhood. 38.56% of the children that was 128 out of 306 children were low birth weight according to WHO definition. After logistic regression analysis it was found that the variables such as mother's age, height, weight, maternal body mass index, MAC, edema, hemoglobin level and parity had significant influence on birth weight of the newborn. So casualty of low birth weight is multifactoral.

This study included 146 newborn girls and 158 newborn boys. The nutritional level of the newborn girls and boys according to Z scoring by height for age was 83.30% and 84.81% below median –2SD.13.70% of the girls and 15.19% of the boys were above median –2SD.

5.3 RECOMMENDATIONS:

1. Nutrition education should be given in an effective method with special emphasis on female nutrition from childhood.
2. To establish health care center for the slum dwellers to provide proper antenatal care, delivery care and postnatal with neonatal care. Emergency obstetric care should be an integrated part of the health care center with the facilities of emergency transportation and blood transfusion.
3. Special health education session on women's right, reproductive health and importance of mothers' nutrition should be given to male and elderly female members of the family.
4. Quality of the services for the pregnant women and children should be maintained a standard to serve them best.
5. Family planning motivation and birth spacing should be encouraged. Early marriage should be discouraged.

5.4. SUMMERY

A cross sectional study was done on three hundred and nine pregnant women and on their newborn babies in an urban slum area called Geneva Camp in Mohammedpur area of Dhaka city. The study sample was taken at the third stage of pregnancy before the delivery in between one year when the mothers came for delivery in a Maternal and Child Health Care Center. The objectives were to conduct in depth study on determining the nutritional status of those pregnant women and their newborn babies. The nutritional status of those women was determined by anthropometric measurement, which includes height, weight, middle arm circumference and Basal Metabolic Index (BMI). Some biochemical investigations such as blood hemoglobin level, urinary sugar and albumin content was done. Dietary history was also taken to assess the nutrition intake of the mothers. The nutritional status of the newborn babies was determined by measuring birth weight, length, head and chest circumference and cord hemoglobin estimation. After determining the nutritional status of the groups, different associations and relations was searched out.

Among 309 pregnant women the pregnancy outcome of 306 mothers were live birth and only three mothers gave birth to still born babies. The mean body weight of the pregnant women was 46.35 kg and the body weight is significantly related with the age of the mothers. Moreover the weight and age of the pregnant women are highly related to the birth weight of the newborns (Chi-square=173 and $P<0.001$). The mean arm circumference of 85.62% mothers was less than 23.5 cm. The sensitivity and specificity of mid arm circumference to low birth weight was found 46% and 93% and these two indicators have significant association (Chi-square=22 $P<0.05$).

The mean BMI of 11.65% mothers was less than 18.5 that is they were suffering from chronic energy deficiency. Correlation between CED and low birth weight is highly significant (Chi-square=41 and $P<0.001$).

The mean hemoglobin level of 91.3% pregnant women was <11gm/dl and mean cord hemoglobin of the newborns was estimated 13.89gm/dl. The correlation between mothers' hemoglobin level and that of the babies cord was found positive ($r=0.18$). However the correlation between birth weight and mothers' was found more positive here ($r=0.42$).

Birth weight of 306 newborn babies was taken among which 38.56% of the babies weight was less than 2.5kg, 41.8% were in between 2.5 and 3 kg. Rest of them that is 20.26% were above 3 kg. In addition to the birth weight determination the length, head and chest circumference of the newborn babies was taken and all these variables was significantly associated with the pregnant mothers' weight. According to Z score, 53.39% by weight for age (WAZ), 85.53% by height for age (HAZ) and 87.17% by weight for height (WHZ) of the newborn babies were <-2SD that is malnourished.

Considering all the factors it could be the conclusion that at birth the nutritional statuses of the just born baby is significantly related to maternal age, weight, mid arm circumference, basal metabolic index and hemoglobin level. So improvement of these factors will ensure better nutritionally healthy newborn baby.

CHAPTER-SIX

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QUESTIONNAIRE
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Title: Nutritional status of the pregnant women and their newborn babies in an urban slum.

House Hold no.---------- Study Code No.----------

PERSONAL INFORMATION:

1. Name of the pregnant women:----------
   Age: ---------- Gravid:----------
2. Educational Level:----------
   Illiterate: ☐ First to Fifth Class: ☐ Five to Eighth Class: ☐ Above: ☐
3. Name of the Husband:----------
4. Educational Level:----------
   Illiterate: ☐ First to Fifth Class: ☐ Five to Eighth Class: ☐ Above: ☐
5. Number of Children:----------

SOCIO-ECONOMIC INFORMATION:

1. Number of family Members:----------
2. Type of House:----------
   Pucca: ☐ Semi-pacca: ☐ Bamboo-thatched: ☐ Others: ☐
3. Type of Latrin Used:----------
   Pucca: ☐ Chancha: ☐ Open space: ☐
4. Occupation of the Husband:----------
5. Occupation of the Woman:----------
6. Total Income of the Family:----------
   <500tk.☐ 500-1000tk. ☐ 1100-1500tk. 1600-2000tk.☐ 2100-3000tk☐ >3000tk.☐

TWENTY FOUR HOURS FOOD INTAKE OF THE PREGNANT WOMEN:

Food	Morning			Noon			Night		
	6am-9am	9am-10am	10am-12n	12-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm 12pm
Rice									
Bread									
Vegetables(Leafy)									
Vegetable(non-leafy)									
Fruits									
Tea with milk & sugar									
Pules									
Fish									
Meat									
Egg									
Milk									
Milk Product									
Biscuits									
Puffed Rice									
Sweets									
Beetle nuts									
Parata									
Haluwa									

Signature of the Interviewer:

Date:

Physical Examination of the mother:

Height

Weight

Anaemia

Oedema

Jaundice

Middle Arm Circumference

Pulse

Blood Pressure

Heart

Lung

Local Examination:

Height of the Uterus

Engagement

Fetal Heart Rate

Biochemical Examination:

Hemoglobin level

Urinary Sugar

Urinary Albumin

Examination of the Newborn Baby:

Weight

Length

Head Circumference

Chest Circumference

Cord Hemoglobin

Date of Delivery:

Signature: