PRENATAL NUTRITION AND PREGNANCY OUTCOME

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LIST OF ABBREVIATIONS

ANC	Antenatal Care
BBS	Bangladesh Bureau of Statistics
BMI	Body Mass Index
BP	Blood Pressure
BW	Birth Weight
CED	Chronic Energy Deficiency
CHL	Crown Heel Length
CHO	Carbohydrate
CC	Chest Circumference
DMCH	Dhaka Medical College Hospital
HA	Height for Age
HAZ	Height for Age Z-score
Hb	Hemoglobin
HC	Head Circumference
HFRCH	Holy Family Red Crescent Hospital
HSC	Higher Secondary Certificate

INFS	Institute of Nutrition and Food Science
LBW	Low Birth Weight
LMP	Last Menstrual Period
MAC	Mid Arm Circumference
MCH	Maternal and Child Health
MCHI	Maternal and Child Health Institute
MUAC	Mid Upper Arm Circumference
NPNL	Non Pregnant non Lactating
OR	Odds Ratio
PBMI	Percent Body Mass index
PHC	Primary Health Care
PI	Ponderal Index
PNSS	Pregnancy Nutrition Surveillance System
PPH	Post Pertum Hemorrhage
PAHO	Pan American Health Organisation
RDA	Recommended Daily Allowance
RR	Relative risk
SSC	Secondary School Certificate
UNICEF	United Nations Childrens Fund

Vit.	Vitamin
WA	Weight for Age
WASA	Water And Sanitation Authority
WAZ	Weight for Age Z-score
WH	Weight for Height
WHZ	Weight for Height Z-score

ABSTRACT

In any community mother and children constitute priority group and are particularly vulnerable to malnutrition. Urban maternal nutrition and pregnancy was studied to find out the association between prenatal nutrition with pregnancy outcome . A sample of 400 women in their 3rd trimester of pregnancy was drawn from Dhaka Medical college Hospital, Maternal and Child Health institute, Azimpur; Holy Family Red Crescent Hospital, and Private Clinic.

Data on Maternal nutrition was gathered at the third trimester of pregnancy through interview, 24 hours dietary recall, anthropometry, clinical and biochemical tests.

Outcome of pregnancy was assessed through history, observation and anthropometric measurements of the newborn.

Average age of mothers was 24.41±6.75 year and maternal pregnancy weight was 47.44±6.49kg. The literacy rate was 85%, 70% lived in the building and 49.50% women's husbands were service holders. There was a highly significant correlation ($r = 0.35$, $p<0.05$) between age and maternal

pregnancy weight. RDA of Vit. A and Vit. B of pregnant mother was above 90% and protein, fat, CHO and vit.B_2 were above 80%. Iron deficiency was 75.76% and Vit. C deficiency was 76.0%, (hemoglobin level of 12% was found >11gm/dl). Mean BMI in young mothers was much lower than the BMI of the older ones. It was observed that BMI tends to increase with ages. The incidence of CED was also higher in very young mothers than in older ones. In Mid Arm Circumference (MAC) of pregnant mothers compared to standard (28.5cm), 15% was found normal, 45% was mildly depleted, 39% was moderately depleted and 1% was found severely depleted. Live birth was 91.5% and still birth rate was 8.5%. Mother's age, height, weight, BMI, MAC, BP, Hb level and skin fold thickness had no significant influence on still birth. More then forty six percent mothers (46.5%) experienced normal delivery others had breech, forceps and cesarean section. Mother's age, weight, CED, and MAC had significant influence on complicated delivery. Eighty eight percent mothers accomplished full term delivery. Mothers age weight, CED, MAC had significant influence on preterm of pregnancy. The mean birth weight was 2.74±0.56 kg. The prevalence of low birth weight was 22.13%. There was a highly significant correlation ($r= 0.95$, $p<0,001$) between BMI and birth weight of infants. Birth weight of babies increased progressively ($r= 0.42$, $p<0.05$) with increasing maternal age. There was a

significant correlation (r=0.32, P< 0.05) between maternal height and birth weight of babies and between maternal weight and birth weight infants (r=0.87,P<0.001). The birth weight of infants' was significantly associated with MAC (x^2=167,P<0.001). Significant positive association was found between mother's arm circumference and babies' arm circumference (r=0.81,P<0.001). Out of 336 newborn, 54.64% were found having normal length and 45. 36% stunted. Regarding weight for height, 46.17% of infants were above the cut- off point. Weight for age was not associated (x^2 1.36, P>0.05) with sex. Mother's age, education, income, maternal pregnancy weight, maternal body mass index, MAC, mothers height and husband's education had significant influence on birth weight of infants.

CHAPTER I

INTRODUCTION

1.1 INTRODUCTION:

In mammals anatomical and physiological changes occur in the mother during pregnancy, thus creating an environment suitable for the growth of the fetus. A complex series of endocrinological & metabolic changes also take place to facilitate the handling of nutrients by the body tissue of the mother as well as their transfer to the fetus[1]. Nitrogen balance studies in healthy primigravidae indicate that a positive nitrogen balance is established after twelfth week of gestation, with a significant change in maternal body weight occur between 25th and 40th week of pregnancy. The growth of fetus is the result of an interaction between genetic potential and intrauterine environment. The mother who enters pregnancy in good health, with sound reproductive physiology, and who have no ill-health or nutritional deprivation in childhood, will have larger and healthier infant than mothers who do not have such advntages[2].

The state of the mother's physiology, especially reproductive physiology, at the time when she commences a pregnancy, has considerable influence on the growth of fetus[3]. It is axiomatic that preparation for pregnancy should begin with good nutrition and health care in childhood so that women enter motherhood having achieved optimal growth and health.

Recent studies suggest that during gestation the mother provides the whole of the physical and biological environment for the fetus[4]. Maternal anthropometry, maternal age, intrauterine environment, birth order and number of pregnancies serve to express the nature of that environment. Apart from these, the foetal growth is also influenced by socio-economic status of the mother[5]. It is a fact that a large number of people in Bangladesh suffer from malnourishment. The main victims are the women, infants and the children.

Outcome of pregnancy is also influenced by other factors operating during pregnancy such as quality of Maternal and Child Health (MCH) services available, emotional and psychological conditions and above all the maternal nutrition. Lack of appropriate MCH care, nutritional deprivation and psychological stresses adversely influence the growth of fetus through their adverse effect on mother, or by interfering transport of nutrients to the fetus. Due to inadequate care facilities girls in general are deprived of proper health care at their need. Therefore nutritional needs in pre-pregnancy is not given importance. When these girls become pregnant and the needs of special nutritional care for the mother and their fetus become great. In antenatal period the appropriate nutritional measures are not taken and adequate nutrition care is not given to the pregnant mothers. There is overall a casual approach in the health institutes which is not convenient. Hence, prenatal care becomes a priority where nutrition in pregnancy is concerned. In developing

countries not more than a third of the pregnant women receive any antenatal care, and the number of women receiving skilled assistance in labor is even smaller. National health programs in most countries have continued to emphasize institutional care at the cost of coverage with basic services so that improvements in health and nutrition status have been disappointing.

The pregnancy weight gain is a product of life time eating and what is being eaten during pregnancy. In adequate weight gain pregnancy, low birth weight of babies is an index of nutritional status of mother. In any community, mothers and children constitute a priority group. In sheer numbers, they comprise approximately 70 percent of the population of the developing countries[6]. In Bangladesh, women of the child-bearing age (15 to 45 years) constitute 19 percent, and children under 15 years of age about 40 percent of the total population[7]. Together they constitute nearly 59 percent of the total population. By virtue of their numbers, mothers and children are the major consumers of health services, of whatever form.

Mothers and children not only constitute a large group, but they are also a "vulnerable" or special-risk group. The risk is connected with childbearing in the case of women; and growth, development and survival in the case of infants and children. Whereas 50 percent of all deaths in the developed world are occurring among people over 70, the same proportion of deaths are occurring among children during the first five years of life in the developing

world[6]. Global observations show that in developed regions maternal mortality ratio averages at 30 per 100,000 live births; in developing regions the figure is 480 for the same number of live births[8]. From commonly accepted indices, it is evident that infant, child and maternal mortality rates are high in many developing countries. Further, much of the sickness and deaths among mothers and children is largely preventable. By improving the health of mothers and children, we contribute to the health of the general population. These considerations have led to the formulation of special health services for mothers and children all over the world.

Seventy four percent of non-pregnant and lactating (NPNL) women & 70% mother were found anemic during Nutrition Survey of rural Bangladesh in 1996-97[9]. [7] In Bangladesh acute poverty is the root-cause of malnutrition which is very much related to this problem. The poor people of Bangladesh belong to two types of poverty -- poverty and acute poverty. Those who cannot lead a normal life with their earnings belong to the general poverty level and those cannot meet the basic needs with their earning belong to the acute poverty level.

Number and Production of Population below Recommended Calorie Intake and "Hard Core" Poverty Lines[10]

	Poverty		Acute Poverty	
Absolute Number of Poor (million)				
Year	Town	Village	Town	Village
1988-89	6.3	43.4	3.5	26.0
1990-91	6.8	44.9	3.5	25.9

Average Food Intake Ratio[10]

class	Half Fed (No. of days in a year)	Once a day (No. of days in a year)	without food	Total day in year
Landless	98	53	14	44
Poor	84	54	29	76
Lower Middle Class	47	7	4	233
Middle Class	25	8	1	213
Upper Middle Class	--	--	--	360
Rich-1	--	--	--	360
Rich-2	--	--	--	360
Total	254	124	48	1646

Per Head Calorie Intake Ratio[10]

Class	Daily calorie in-take
Land less	1848
Poor	1934
Lower Middle Class	1923
Middle Class	2108
Upper Middle Class	2477
Rich-1	2528
Rich-2	2584

There are evidences that various factors influence the pregnancy outcome. Epidemiological studies show significant difference in average birth weights between babies born in affluent societies and those born in the developing countries. Within a society birth weights tend to be higher in upper socio-economic groups compared with the lower and this is also true for several other health indices in the groups.

Distribution of Birth Weight Among Different Socio-economic Group[11]

Place	Population	Subject	Mean birth weight (g)
Madras	Indian	Well-to-do	2985
		Mostly poor	2736
Bombay	Indian	Upper class	3246
		Upper middle class	2945
		Lower middle class	2796
		Lower class	2578
Ghana	African	Prosperous	3188
		General population	2897
Tanzania	African	Upper class	3150
		Lower class	2700
Britain	National	Social class I-II	3380
	Cohort 1985	Social class V	3290

Probable reasons for the problem are mainly economic and social conditions of the class. In our society women have an inferior status. This is reflected in the high mortality rates of infant and young girls compared to boys, a shorter

life-expectancy at birth for females as well as higher prevalence rates of nutritional deficiencies in women. Thus the nutrition of mother during pregnancy is often no different from the deplorable state of nutrition in the non-pregnant woman. In developing countries not more than a third of the pregnant women receive any antenatal care, and the number of women receiving skilled assistance in labor is even smaller. National health programs in most countries have continued to emphasize institutional care at the cost of coverage with basic services so that improvements in health and nutrition status have been disappointing. In view of the fact studied it is worth while to study of nutritional situation of urban pregnants and its effects on the delivery outcome.

1.2 JUSTIFICATION OF THE STUDY:

In developing countries, where health resources are meagre and a large number of families exist on marginal nutrition, it is necessary to identify the minimum energy required for normal fetal growth and survival.

In Bangladesh there have been also some studies on maternal nutrition during pregnancy, socioeconomic status and pregnancy outcome. However, little information is available on how and to what extent the nutrition have influenced the pregnancy outcome.

This study has been conducted as an attempt to find out the association of maternal nutrition during pregnancy, with the pregnancy outcome for planning long term measures to combat problem of mortality and morbidity related to child birth.

1.3 OBJECTIVES OF THE STUDY :

GENERAL OBJECTIVE:

To illustrate the nutritional status of pregnant women and their pregnancy outcome in Dhaka city.

SPECIFIC OBJECTIVES:

(1) To find out the socio-demographic characteristic of pregnant mothers.

(2) To determine the nutrient intake of pregnant mothers .

(3) To determine the maternal anthropometric measurements.

(4)To determine the anthropometric measurements of new born baby.

(5) To find out the association between maternal anthropometric measurements with birth weight.

1.4 LIMITATION OF THE STUDY

It was difficult to calculate accurately the duration of pregnancy for some of the pregnant women who could not remember their 1st day of last menstrual period.

While taking dietary history by 24 hours recall method mothers were shy to tell what they eat exactly. The interviewer had to establish rapport, explain the purpose of the study to convince them. As only those respondents who were willing to deliver at the institutions were included in the study. So it took much longer than the estimated time in data collection and hence completion of the study.

1.5 MATERIALS AND METHODS

SUBJECT

Pregnant mother were drawn as subjects of this study who have been attending for antenatal care during the third trimester of their pregnancy at Dhaka Medical College Hospital, Maternal and Child Health Institute, Azimpur, Holy Family Red Crescent Hospital and a Private Clinic of Dhaka city representing cross section of population.

STUDY SITE:

- Dhaka Medical College Hospital
- Maternal And Child Health Institute, Azimpur
- Holy Family Red Crescent Hospital, Dhaka
- Private Clinic

SELECTION CRITERIA :

- Pregnant women of third trimester and willing to participate in the study.
- Pregnant women who are willing to be delivered at the particular health facility
- Mothers who are resident of Dhaka city

DURATION OF THE STUDY:

The study was conducted by taking 400 pregnant women and their newborn babies who attended for delivery at Dhaka Medical College Hospital, Maternal and Child Health Training Institute, Azimpur; Holy Family Red Crescent Hospital, Dhaka and Private Clinic from January 1995 to December 1996.

SAMPLE SIZE DETERMINATION:

The sample size was estimated by using the following formula.

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

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 of error.

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

The estimated minimum sample size was 384 but we have taken 400.

From each Institute a sample of 100 mothers have been taken .

DEVELOPMENT OF QUESTIONNAIRE:

A questionnaire was developed to obtain relevant socio-demographic data, such as age, education, family income, housing and dietary history.

The main elements of the questionnaire were as following:

- ❑ Identification of the respondent
- ❑ Determination of the socio-demographic condition
- ❑ Dietary History
- ❑ Clinical history, observation & examination of pregnants and new borns.
- ❑ Anthropometric measurements
- ❑ Biochemical tests

PRE TESTING:

The questionnaire was pretested before finalization on 25 subjects. Necessary correction and modification was done accordingly.

CONSENTS:

Written permission was taken from the authority of Dhaka Medical College Hospital, Holy Family Red Crescent Hospital, Azimpur Maternity and Child Health Care Training Institute, and the Private Clinic after explaining the purpose and objective of the study. Consent from the study subjects was also taken before history taking and examination.

THE INSTITUTES:

Four institutes have been covered under this study. The institutes are :

I) Azimpur Maternity and Child Health Care Training Institute (MCHTI) ,

ii) Dhaka Medical College Hospital (DMCH),

iii) Holy Family Red Crescent Hospital (HFRCH), and

iv) The Private Clinic.

I) Azimpur Maternity and Child Health Care Training Institute (MCHTI):

It is a government training institute under the Ministry of Health and Family Welfare. This institute is chosen to trace out pregnant mothers who used to take government facilities during their pregnancy and delivery time. The institute offers short training for the physicians and the paramedics. The services available in the institute are: institutional delivery service, outdoor ante-natal care, emergency obstetric care and basic laboratory facilities. Professional services mainly depend on the nurses and the medical graduates. There is no specialist for regular service. But the services of doctors and specialists are available in hour of need. The laboratory and other facilities are not up to the standard level although the basic services are free of cost.

ii)Dhaka Medical College Hospital (DMCH):

It is mainly a teaching hospital for medical graduates and nurses. All sorts of medical facilities are available here as DMCH is a teaching and training hospital. It is staffed by total range of medical professional. Ante-natal facilities are provided through outdoor service. Ward and cabin facilities are also available here. Ward is free of cost while paying ward and cabin are available for the comparatively richer section of the patients. Usually the middle and the lower middle class people avail themselves of the ward facilities. While the upper middle class avail themselves of the cabin facilities. Most of the middle class people including government service holders do come here. Class division is not exclusive. Relatively poor and the lower middle class people come here. Besides, other strata people do come here for pregnancy and delivery service.

iii) Holy Family Red Crescent Hospital (HFRCH):

This name carries the status level of the patients. It is the largest private hospital of the country. The rich people mainly upper middle class people do come here. Whereas the poor and the lower middle class people cannot afford the facilities of HFRCH. All sorts of modern facilities are available here. But

everything has to be paid relatively in higher rate. For ante-natal care the patients have to enroll themselves first time entry .After that they get the treatment accordingly.

iv) Private Clinic:

The private clinics have been selected as the affluent section of the society do not want to go at all to government hospitals. All sorts of facilities are available in the private clinics with high charge.

DATA COLLECTION PROCEDURE:

Socio demographic data have been collected through interview schedule and secondary sources from Hospital and clinical records.

Nutrition intake data have been collected through 24 hour food intake recall method.

Height, weight, skin fold thickness and chest circumference have been collected by direct measurement and Hospital and clinical records.

PROCEDURES:

Skin fold thickness has been measured by Harpenden Calipers over triceps at a point equidistant from the tip of the acromion & the olecranon.

MOTHER'S WEIGHT : Mother's weight was taken by bath room weighing scale up to nearest 0.5 kg.

Pre-pregnancy weight was calculated by using method described by Haffman.

MOTHER'S HEIGHT: Mother's height was taken by measuring scale up to nearest centimeter.

Mid Arm Circumference : Mid Arm Circumference (MAC) was measured with Spring tape at a Point midway between the tip of the acromion and the ulnar process with the arm having vertically and the forearm supinated

HEAD CIRCUMFERENCE: It is taken with a tape measure at the maximum circumference of the Head in the occipito-fontal diameter

BIRTH WEIGHT : The birth weight was taken within first hour of life. Naked baby was placed on a clean towel on the scale pan. The child is weighted to the nearest 100g.

LENGTH : Length was taken at the time of taking weight i.e. within first hour of life with infantometer. On which the infant lies supine with legs fully extended and the feet flexed at right angles to the lower legs. Length is taken to the nearest 0. I cm.

HEMOGLOBIN ESTIMATION : Hemoglobin was estimated by acid haematin method using Sahlis Haemoglobinometer.

CHEMICAL EXAMINATION OF URINE : Urine was tested by Heat and acetic acid test .2/3 full test tube was boiled in upper part for two minutes. In case of turbidity few drops of 10% acitic acid was added. Persistence or development of turbidity implies proteinuria.

TESTS FOR GLUCOSE : Glucose was tested by Benedict's Qualitativ (semi-quantative) Method. To 5 ml of Benedict's qualitative reagent, 8 drops of urine was added and heated on a flame of 2 minutes.

READING :

Blue to cloudy green color	Negative
Green color	+
Yellow - green	+
Greenish yellow	++
Yellow	+++
Orange to brick red	++++

STATISTICAL ANALYSIS :

The obtained data were verified and transferred to coding sheets. The coded data were entered into personal computer. With statistical package for the social science (SPSS/PC), EPI Info and Harvard Graphics Program were used to analysis data. Analysis includes simple descriptive analysis through the use univariate frequency tables. Bivariate tables were used for the determination of relationship and associations. Chi-square, Odd-ratio, Relative Risk, sensitively, specificity, positive and negative predictive value were used for this purpose. Correlation and regression analysis was done to find out the best sub set of the study variables with birth weight.

1.6 KEY VARIABLES :

The variables on which information was collected include :

Socio Demographic Variable

-Age of the respondents

-Housing Condition

-Source of income

-Husband's occupation

-Husband's education

-Education of the respondent

MATERNAL ANTHROPOMETRIC MEASUREMENT:

-Height

-Weight

-Mid Arm Circumference

-Skin fold thickness

ANTHROPOMETRIC MEASUREMENT OF THE NEW BORN

-Birth Weight

-Length

-Arm circumference

-Head circumference

-Chest circumference

-Dietary intake

Examinations

-Blood pressure

-Hemoglobin level

-Edema,

-Sugar in urine,

-Albumin in urine

Outcome of Pregnancy:

-Mode of delivery (Normal, Breech, Forceps, cesarean, episiotomy)

-Outcome of pregnancy (live birth, still birth)

-Duration of pregnancy (Pre term, full term)

1.7 OPERATIONAL DEFINITIONS :

-Respondent

-Illiterate

-Service

-Skilled Labor

-Unskilled Labor

-Antenatal Check up

-Prenatal Care

-BMI

-Pre Term

-Term

-Normal Labor

-Weight of the Pregnant Women

-Low Birth Weight

-Still Birth

-RDA

-Sensitivity

-Specificity

-Correlation Co-efficient

-Regression

RESPONDENT:

The pregnant women (in 3rd trimester) who come to the Azimpur Maternity and Child Health Care Training Institute (MCHTI), Dhaka Medical College Hospital (DMCH), Holy Family Red Crescent Hospital (HFRCH) and the Private Clinic in Dhaka city.

ILLITERATE :

Those who don't have the knowledge of three Rs (Reading Writing and Arithmetic).

SERVICE :

Occupation of the respondents who are employed under various organisations and get salary on monthly basis.

SKILLED LABORER:

The laborers who are experienced, efficient and specialized i.e. good at their profession.

UNSKILLED LABORER:

The laborers who do not have enough experience and are apprentices in their respective occupations.

ANTENATAL CHECK UP:

The check-up that was done by medical personnel for the pregnant mothers during their pregnancy period.

PRE-NATAL CARE :

The cares of pregnant mothers which are taken during pre-delivery period.

BMI = Weight(kg)/Height(m)^2=kg/m^2

i.e. Body Mass Index (BMI) is the body weight in kg divided by power of height in m2 178-180 .

PRE TERM : Babies born before the end of 37 weeks gestation (less than 259 days)

TERM : Babies born from 37 completed weeks to less than 42 completed weeks (259 to 293 days) of gestation

NORMAL LABOR:

Giving birth to a child without any interference per vagina within given period of time.

WEIGHT OF THE PREGNANT WOMEN:

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

LOW BIRTH WEIGHT:

According to World Health Organisation less than 2500 grams birth weight is low birth weight.

STILL BIRTH:

The death of fetus weighing at least 500 g (or when birth weight is unavailable, after 22 completed weeks of gestation or with a crown-heel length of 25 cm or more), before the complete expulsion or extraction from its mother.

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 ±2 SD of the observed requirements in a group individual.

SENSITIVITY:

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

SPECIFICITY:

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

CORRELATION CO-EFFICIENT:

The relationship or association between two quantitatively

REGRESSION:

Regression means the dependence of one variable on the other.

CHAPTER II

REVIEW OF LITERATURE

LITERATURE REVIEW

Wynn et al. in their book on, "Nutrition of Women" in anticipation of pregnancy that further empirical support is provided, particularly in relation to the impact of maternal nutrition around the time of conception of very early pregnancy. It is urged that the hypothesis that maternal nutrition has no connection with birth weight is very easily refuted. It is suggested that there should be a new category of recommended dietary allowances; "women in anticipation of pregnancy". The diet of 513 pregnant London women was recorded for 7 days during the first trimester of their pregnancy. Birth-weight and nutrient intakes were found to be significantly correlated but only over the lower half of the birth weight range. The optimum birth weight range with the lowest prenatal and infant mortalities is 3,500-4,500 g and it is suggested that the nutrient intake of the 165 women who had babies in this optimum weight range provide tentative values for nutrient intake recommendations in anticipation of pregnancy, but are not claimed to be representative[12].

Kim-et al. pointed out in their research on Pregnancy nutrition surveillance system--United States, 1979--1990 that since 1979, the CDC Pregnancy Nutrition Surveillance System (PNSS) has monitored behavior and nutritional risk factors among low-income pregnant women participating in public health programs. Pre-pregnancy body mass index (BMI, defined as kg/m^2) showed

marked changes from 1979 through 1990; the prevalence of underweight (BMI< 19.8) declined steadily and the prevalence of overweight (BMI> 26) increased steadily. In 1990, 39.3% of the women had gestational weight gains below levels recommended by the National Academy of Sciences. Both pre-pregnancy underweight and inadequate gestational weight gain were associated with greater risk for low birth weight in the Pregnancy Nutrition Surveillance System (PNSS). The prevelence of anemia at each trimester has remained stable since 1979. In 1979, 9.8%, 13.8%, and 33% of the women reported by the PNSS were anemic in the first, second, and third trimesters, respectively. Anemia in the first trimester appeared to be strongly associated with a high risk of low birth weight; this association was attenuated in later trimesters. These findings indicate the need to improve iron nutrition among low-income women[13].

It is said on Nutrition during pregnancy that a woman's prepregnant BMI and her total weight gain during pregnancy are important determinants of newborn weight. A woman's pregnant BMI determines the total weight gain and the rate of weight gain per month recommended during her pregnancy. Both are under maternal control, but can be influenced by the health care provider. Both lend themselves to nutritional assessment, prophylactic recommendations, and therapeutic interventions in the preconceptional and prenatal periods.

Nutritional advice during pregnancy includes a balanced daily diet containing approximately 35 kcal for each kilogram of optimal body weight plus 300 kcal. The food plan should be consistent with the women's food preferences if it is to be followed. Within this context, an appropriate diet is selected from protein-rich foods, whole-grain breads and cereals, dairy products, and fruits and vegetables. Of the minerals, only iron is recommended as a supplement, to maintain body stores and minimize the occurrence of iron deficiency anemia. Postpartum maintenance of balanced nutrition with the woman consuming at least 1,800 kcal daily will facilitate breast-feeding. Vitamin and mineral supplementation during lactation is not required routinely. A puerperal weight loss of no more than 0.9 kg (2 1b) a month will no affect nursing performance[14].

Sachdeva observed in their study on Impact of nutrition education and medical supervision on pregnancy outcome, in Punjabi women from low and lower middle income groups were selected from eight villages of Ludhiana district. The supplements of iron, folic acid and calcium in the form of Folifer and Calcium Sandoz tablets were regularly supplied to experimental (E) group from second trimester onwards. A pamphlet about the diet during pregnancy was distributed to the E group along with four individual and three group contacts during the second half of pregnancy. The control (C) group was

provided iron and folate supplements as per Government practice. Body height, weight, mid- arm circumference (MAC) and skin fold thickness of the subjects were recorded. Weight gained during pregnancy and post partum weight were also recorded and body mass index was calculated. In addition, crown heel length (CHL), birth weight (BW), skin fold thickness, MAC, head circumference (HC), Chest circumference (CC) and ponderal index (PI) of the neonates were recorded within eight hours of their birth. The gain in weight during pregnancy was 6.30 kg and 5.7 kg in Experimental (E) and Control (C) groups respectively. The study revealed that BW, CHL, skin fold thickness and PI of the newborns were significantly ($p< 0.01$) higher in E group. The mean BW of newborns in E and C groups was 2700 g and 2300 g respectively. Weight gained during pregnancy had significant ($p < 0.05$) correlation to MAC, BW and skin fold thickness of the newborn[15].

Durnin mentioned in his writing on Energy requirements in human pregnancy, in human nutrition and parasitic infection that the energy requirement of pregnancy reflects a problem which contains a great deal of uncertainty. To supply the theoretical energy needs for the increases in maternal and foetal tissues and to cover the elevated basal metabolic rate involves an amount equivalent to an extra 250-300 kcal/day on average but in real-life situation there is seldom a rise in dietary energy of a comparable quantity. Data from

coordinated longitudinal studies in four countries, together with results from other published papers, show energy intakes increasing by only 100-150 kcal/day, and only in the third trimester. Although it is difficult to demonstrate, the probability is that there are energy savings in reduced physical activity which compensate for the larger energy needs[16].

Arch-Pediatr conducted a study on Folic acid and pregnancy. (Societe francaise de pdiatrie -Comite de nutrition) and opined that epidemiological studies have shown a relationship between maternal folic acid status and the incidence of neural tube defects, prematurity, abortions. Based on the actual data, the Committee of Nutrition recommends that all women at age of procreation should be encouraged to regularly eat fresh fruits and vegetables in order to increase their reserve of folic acid, and that pregnant and lactating women should be supplemented with a daily dose of 200 micrograms of folic acid. In addition, the Committee is in favor of a folacin enrichment of some food which would allow to cover the needs of pregnant and lactating women. Those women who have given birth to a child with neural tube defects must be informed of the high risk of recurrence and be encouraged to take a treatment of 4 mg/day of folic acid, ideally starting one month before the beginning of pregnancy and to be maintained during the first 3 months[17].

Lekea- et al carried out a study on antenatal care received and its association with preterm birth in Greece. Their research deal with a total population sample of singleton births to mothers with certain dates of last menstrual period (LMP) was identified from the Greek National Prenatal Survey of April 1983. Two groups of mothers were considered separately, 3116 primigravidae and 6524 multigravidae, with pre-term birth rates of 5.9% and 8.4% respectively. Of all the antenatal care factors tested, primigravidae showed significant associations (unadjusted) with haematocrit level and with drugs taken during pregnancy. The logistic regression analysis which followed showed that the only factor independently associated with preterm delivery for the group of mothers was drugs taken during this period: women taking no drugs (including vitamins and iron) had the highest risk of preterm delivery. In contrast, multigravidae showed significant unadjusted associations with a great variety of parameters of antenatal care. Nevertheless, in the logistic regression analysis only three proved to have independent significant associations: drugs taken during pregnancy (reduced risk among mothers taking vitamins and iron), hospital admission during pregnancy (mainly for cervical cleavage) and the pattern of antenatal care during the first two trimesters (those attending the recommended number of times having least risk)[18].

Blondel B et al carried out a research on poor antenatal care and pregnancy outcome with the objectives to characterize women receiving poor antenatal care and assess their prenatal risk. And they reached to the conclusion that women with poor antenatal care have a greater risk for adverse pregnancy outcome. This risk cannot be attributed to unfavorable living conditions only[19].

Menown-et al in their article on Prenatal outcome and antenatal care in a black South African population said that the relationship between prenatal outcome and antenatal care was investigated at King Edward VIII Hospital, Durban, by a case control retrospective study of pregnancy records in 165 prenatal deaths and 156 infants surviving the prenatal period. Eighty two percent of the mothers of live infants had booked for antenatal care compared with only 60% of those who experienced a prenatal death. Hospital booking was associated with a higher infant birth weight. For those who booked earlier there was no reduction in total prenatal mortality or the stillbirth : neonatal death ratio, and many of the mothers of highest risk failed to book. This suggests that the better prenatal outcome in booked mothers may have been satisfactory to the type of mother who chose to book, rather than the actual antenatal care. To help reduce prenatal mortality, methods must be employed which reach those mothers who are most likely to fail to book[20].

Gissler et al conducted a research on Amount of antenatal care an infant outcome and found that the connection between the amount of antenatal care and pregnancy outcome was studied using the 1987 Finnish Birth Registry. A total of 57,108 women were included in the analysis. The timing of initiation of antenatal care and the relative number of antenatal visits (adjusted by gestation length), were used as measures of amount of antenatal care. Nine outcome variables measuring infant health and interventions were studied. Logistic regression was used to adjust for differences in maternal background characteristics. Women beginning antenatal care after the 16th week of gestation had the poorest outcome. Early attending multiparaous women had a higher risk of low birth weight, premature infants, caesarean section and instrumental delivery than did those with average timing of their first attendance. For primigravidas, the increased risk was of prematurity only. A U-shaped curve was found for most of the outcome variables in regard to relative number of visits. The women with many visits had the poorest outcome, and also the highest rates of caesarean section and induction labour. One reason for the unexpectedly high risks for early attenders may be connected with the content of antenatal care. In Finland, it might be possible to reduce the total number of antenatal visits without having any negative effect on infant heath[21].

Chadwick J. said in his paper on Prenatal mortality and antenatal care that prenatal mortality rates are higher in lower social classes. In terms of health, there is no evidence of disappearing social class differentials. Antenatal care has followed the same 'routine' for most of this century. Antenatal care does not meet the needs of those already disadvantaged. Effectiveness and efficiency of antenatal care are poorly researched and evaluated[22].

Huffman et al conducted a longitudinal study of over 2000 married women in Matlab, Bangladesh, to determine the association of fertility with nutritional status. This paper reports the results on nutritional status among non-pregnant women. The average weight and height of the study women was 40.4 kg and 147.9 cm. Weight fluctuated throughout the 2.5 yr. study period corresponding to seasonal food shortages. Maternal weight (controlling for height) was consistently lower for older, higher parity women, illustrating the negative impact of increasing numbers of births on the mother's nutrient stores. Older women were also shorter than younger women, due to greater deficits in growth during childhood. Older, higher parity women had slightly lower hematocrits than younger women with an overall mean of 35%. Aside from biological factors, socioeconomic and socio-cultural factors are likely to influence nutritional status. Increases in maternal education are shown to be associated with higher maternal weight residuals for women at education

levels of 5 year or more, as compared to women with only 0, or 1-4 yr of education. Higher education is associated with improved socioeconomic status and therefore implies better living conditions for these women, which in turn causes them to have slightly higher levels of current nutritional status[23]. From this study it is found that the relative importance of biological and socio cultural factors affecting maternal nutritional status in Bangladesh. These finding include the association of the maternal depletion syndrome, seasonal influence, and socio-cultural factors.

Maternal nutritional status is a key mechanism by which socioeconomic and cultural factors influence maternal and child morbidity and mortality. Studies have shown positive association between socioeconomic status and maternal nutritional status (Krasovec, 1991a; Matorell, 1991)[24]. Prevalence of maternal stunting and wasting have been consistently observed to be higher in developing countries than in a developed countries (Guueri, 1982; Gopalan, 1985; Krasovec,1989)[25]. Chronic under nutrition, during and since childhood, high parity resulting in maternal depletion and inadequate caloric intake during pregnancy and lactation are important determinants of poor maternal nutrition (Hamilton, Popkin & Spicer, 1984; Merchant and Martorell, 1988; Garn1991; Martorell,1991)[26]. There is aboundant evidence of the deleterious effect of low maternal weight and short stature on maternal morbidity and pregnancy

complications, such as obstructed labor, cephalo-pelvic disproportion (Thompson, 1959; Krasovec,1991)[27] and on prenatal and infant morbidity and mortality (Chowdhury,1982; Kramer, 1987; Liljestrand, Bergstorm & westman, 1985; Naeye, 1989)[28].

Baqui et al (1994) in their study to determine the levels and correlates of maternal nutritional status found that mother's weight ,BMI and MAC were significantly positively correlated with mother's years of schooling and household economic status. Mother's height was significantly positively correlated with years of schooling, but not with household economic status[29].

Niswander et al. observed that the amount of weight gained in pregnancy is particularly important for women who begin pregnancy in a nutritionally disadvantaged state. The combination of low pre-pregnancy weight and low weight gain during pregnancy puts women at the greatest risk of delivering an LBW infant[30].

Krasovec et al observed that in developing countries, where most women are considered nutritionally disadvantaged in pre-pregnancy compared to their industrialised country couterparts, and where infants of such women experience high rates of prenatal mortality, weight gain during pregnancy should be an important determinant of pregnancy outcomes[27].

The effect of maternal weight gain in pregnancy on both maternal and fetal outcomes of pregnancy. Naeye (1979) found no important differences in the frequency of maternal pregnancy complications studied (amniotic fluid infection, abruption placenta, large placental infracts, placental previa, Rherythroblastosis fetalis, umblical cord compression, hypertention, gestational acetonuria, and edema for women with different weight gains. However there was a large increase in fetal mortality among both low and high weight gain groups once the pregnancy comlication was established[31]. Kramer (1987) found the causal effect of weight gain on intrauterine growth retardation (IUGR) to be well established and sensitive to modification in the term[28].

Numerous studies have found that weight gain in pregnancy affects fetal, prenatal and neonatal mortality. Naeye (1979) found that weight gains are different for women who begin pregnancy at different weight-for height levels. Underweight women experienced the lowest fetal and prenatal mortality at weight gains of 27-30 lbs (12.3-13.6kg)[31].

Rush et al. found that maternal height did not have an effect on birth weight independent of pre-pregnancy weight, but that the influence of height on birth weight was a reflection of body mass or weight, not height[32].

Studies in both industrialised and developing countries have shown that taller mothers have higher birth weight infants than shorter mothers Thomson et al.

In a study in Dakar Senegal, Briend (1980), found the maternal height was positively correlated with a comprehensive growth index (Z^1) of infants, while maternal arm circumference at parturition was negatively correlated with a wasting index (Z^3)[33].

Chowdhury (1982) found neonatal mortality and postneonatal mortality rates of 36.8 and 50.0/11000 live births for infants of Bangladeshi women<147cm, compared to rates of 26.6 and 29.6/1000 live births for women with heights between 147 and 150cm, and 30.4 and 38.0/1000 live birth for women>150cm[34].

Ahmed et al explored association of maternal factor with birth weight of 2849 singleton live births. The mean birth weight was 2667 gm and 27% of babies were low birth weight (<2500 gm). Sixteen percent were teenagers, thirty percentage of teenage pregnancies resulted in low birth weight (LBW) deliveries representing twenty one percent of total LBW sample. The mean maternal weight gain during pregnancy was 54.8 kg with a range of minus 2 kg to 20 kg and 99%t of mothers attained the expected weight gain of 10 -12 kg. The coefficient correlation between maternal weight gain during pregnancy and birth weight was found to be significant (r=0.1813.p<.002). More than sixty percent of mothers were found severely anemic and birth weight was found to be positively with mothers' hemoglobin level. [35]

Rawshan et al. showed the 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 thirty six percent. The birth weight of newborn was found 257 gm (male) and 2281 gm (female) [36].

Rahman et al to determine 339 children aged 3 - 36 months. 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 ($p<0.005$) in a multivariate analysis after adjusting for several factors. Results indicate that maternal nutritional status is a proximate determinant of a child's nutritional status[37].

Hussain Karim et al the average weight of the pregnant mother studied was found to be only 47.5 kg during their third trimester, which was much lower than the expected weight for height. In Bangladesh frequent pregnancy causes nutritional drain on material tissue, as a result mothers gain very little or no weight gain in successive pregnancies. In this study difference in weight between successive pregnancies was found to be statistically insignifacant[38].

A total of 125 low birth babies and their weight studied for a period of one year in Dhaka Medical College Hospital to find out material risk factors contributing low birth weight by Dr. Shahawaz et al. 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. Low birth weight (LBW) babies decrease with increase of maternal height and weight showing significant correlation in this study. Among the impact of various known maternal conditions on LBW babies eclampsia (17.6%), maternal anemia (53.6%), and maternal infection (16%) were determined[39].

Rahman et al 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 2500 gm compared to 50% of the home delivered rural babies. Only a few of the rich group mothers had more 50 kg weight after delivery. None of the rural mothers could cross the 50 kg mark[40].

Kasimuddin et al in their revealed that 81.45% mothers gave birth to babies weighing more than 2.5 kg and 18.55% delivered babies below 2.5 kg. It was observed that the height and weight gain during pregnancy was highly co-related with the weight of the newborn[41].

Islam et al in their study shows that 46% of pregnant women are anaemic and it was more prevalent in the third trimester of pregnancy. Iron deficiency with or without anemia, as judged from serum transferring saturation percentage was evidence in 59.2% of pregnant women with an incidence of 70.3% in the third trimester of pregnancy[42].

Hussain et al in their explored the relationship between maternal health status and infant vitality. Selected physical, nutritional and biochemical parameters were measured in 157 pregnant women and 71 newborn infants at the Azimpur maternity center. The result shows that the pregnant women had a mean height of 150 cm mean weight of 47.5 kg and in third trimester hemoglobin level averaged 10.53%. Overall 66% of women had hemoglobin level below 11 gm and could be considered as anemic. The mean birth length among infant in the study was 47.6 cm and birth weight for males was 3.02 kg whereas for females it was 3.08 kg. These are significantly lower than western standard reflecting the low nutritional status of Bangladesh women[43].

CHAPTER III

TABLES AND FIGURES

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Table 1. Characteristics of the Study Subjects.

Age in years	Number	Percentage
<21	118	29.50%
21-25	125	31.25%
26-30	110	27.50%
31-35	37	9.25%
36 & above	10	2.50%
Total	400	100.00%
Age limit 20-39 years		
Educational status of mother		
Illiterate	60	15.00%
Primary	46	11.50%
S.S.C.	162	40.5%
H.S.C.	48	12.0%
Graduate	47	11.75%
Post Graduate	37	9.25%
Total	400	100.00%
Educational status of Husband		
Up to S.S.C	72	18.0%
H.S.C.	103	25.75%
Graduate	162	40.5%
Post Graduate	63	15.75%
Total	400	100.00%
Income		
≤ 4000 Tk. (Low)	127	31.75%
> 4000 Tk. (High)	273	68.25%
Total	400	100.00%
Husband's occupation		
Service	198	49.50%
Business	126	31.50%
Agriculture	8	2.0%
Labor	18	4.50%
Other	50	12.5%
Total	400	100.00%
Housing condition		
Building	280	70.0%
Tinshed	103	25.75%
Thatch	17	4.25%
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Table 2. Maternal Pregnancy Weight (kg) by Age Group [44]

Age in year	Number	Percent	Height (cm)	Weight (Mean±SD)	[23] Predicted weight
<21	118	29.50%	148.40	45.75±7.15	40.37
21-25	125	31.25%	148.38	46.78±6.32	40.36
26-30	110	27.50%	148.26	46.99±5.91	40.30
31-35	37	9.25%	148.10	47.87±6.38	40.22
36 & above	10	2.50%	147.04	49.80±8.71	39.69
Overall	400	100.00%	148.04	47.44±6.49	40.19

Average age 24.41±6.75 years, Mean weight gain in pregnancy was 7.25 kg and Mean height was 148 cm. The average mother's weight gain was 9.6 per day.

* W = – 33.83 + 0.50 H cm. [23]

Where W = woman's predicted non pregnant weight. H = woman's height

Fig. 1:Curvilinear Relation Between Maternal Weight and Age

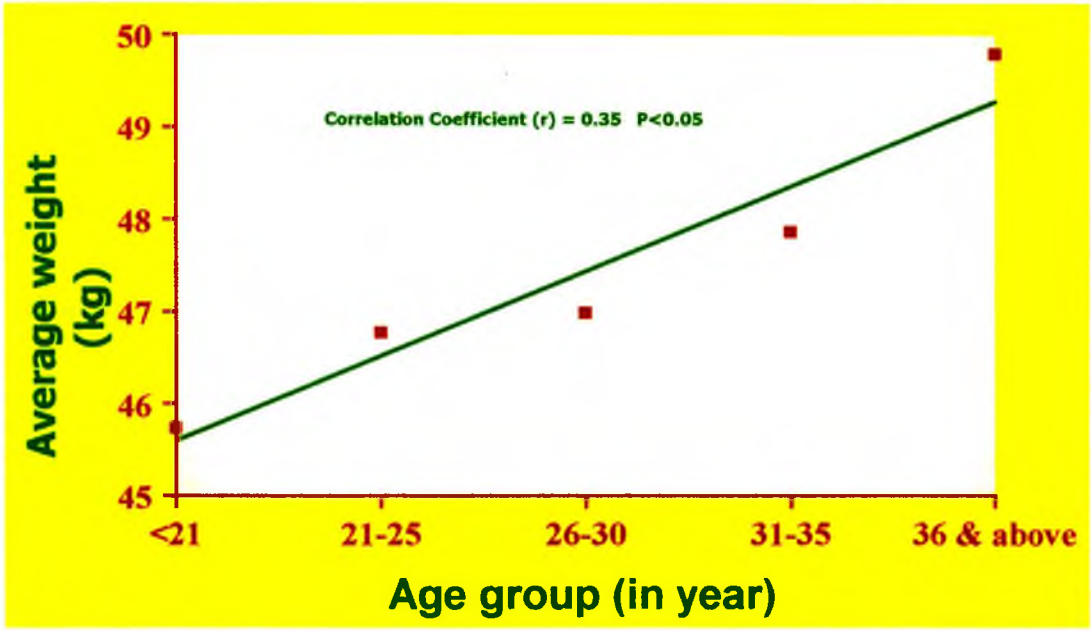

Table 3: Nutrient Intake of Pregnant Mothers [45]

Nutrients	*Intake*	*RDA*	*% of RDA*
Calorie (Kcal)	2009	2350	85.49%
Protein (gm)	56	66	84.85%
Fat (gm)	41	50	82.0%
CHO (gm)	314	369	85.10%
Calcium (mg)	750	1100	68.18%
Iron (mg)	25	33	75.76%
Vit. A (mg)	690	750	92.0%
Vit. B_1 (mg)	0.91	1.0	91.0%
Vit. B_2 (mg)	1.90	2.3	82.61%
Vit. C (mg)	38	50	76.0%

Table 4. Maternal Body Mass Index (BMI) and Prevalence of CED [46]

Age in year	Maternal BMI		Chronic energy deficiency prevalence (BMI <18.5)	
	No	Mean	No.	%
<21	118	20.28	35	29.66
21-25	125	20.98	34	27.20
26-30	110	21.78	29	26.30
31-35	37	22.18	9	24.32
36 & above	10	22.98	2	20.0
Overall	400	21.65±0.87	108	27.0

Table 5: Relationship Between Maternal Pregnancy Weight and Arm Circumference

Arm Circumference	***Weight (kg)***			
(cm)	< 37	37-43.4	≥ 43.5	Total
< 20.7	1.75%	13.25%	5.50%	20.50%
	(7)	(53)	(22)	(82)
20.7-22.9	0.50%	5.50%	21.0%	27.0%
	(2)	(22)	(84)	(108)
≥ 23	0.25%	2.50%	49.75%	52.5%
	(1)	(10)	(199)	(210)
Total	2.50%	21.25%	76.25%	100.0%
	(10)	(85)	(305)	(400)

moderate level

Arm circum (cm).	Weight (kg)			
	< 43.5	≥ 43.5	Total	Sensitivity =84/95=88.4
< 23	21.0% (84)	26.50% (106)	47.50% (190)	
≥ 23	2.75% (11)	49.75% (199)	52.50% (210)	Specificity =199/305=65.2
Total	23.75% (95)	76.25% (305)	100.0% (400)	

severe level

Arm circum (cm).	*Weight (kg)*			
	<37	≥ 37	Total	Sensitivity =7/10=70
< 20.7	1.75% (7)	18.75% (75)	20.50% (82)	
≥ 20.7	(0.75) 3	78.75% (315)	79.5% (318)	Specificity =315/390=81
Total	2.50% (10)	97.5% (390)	100.0% (400)	

Figure within parentheses indicates the number of subjects

Fig. 2: Nutritional Status of Pregnant Mothers
by Arm Circumference

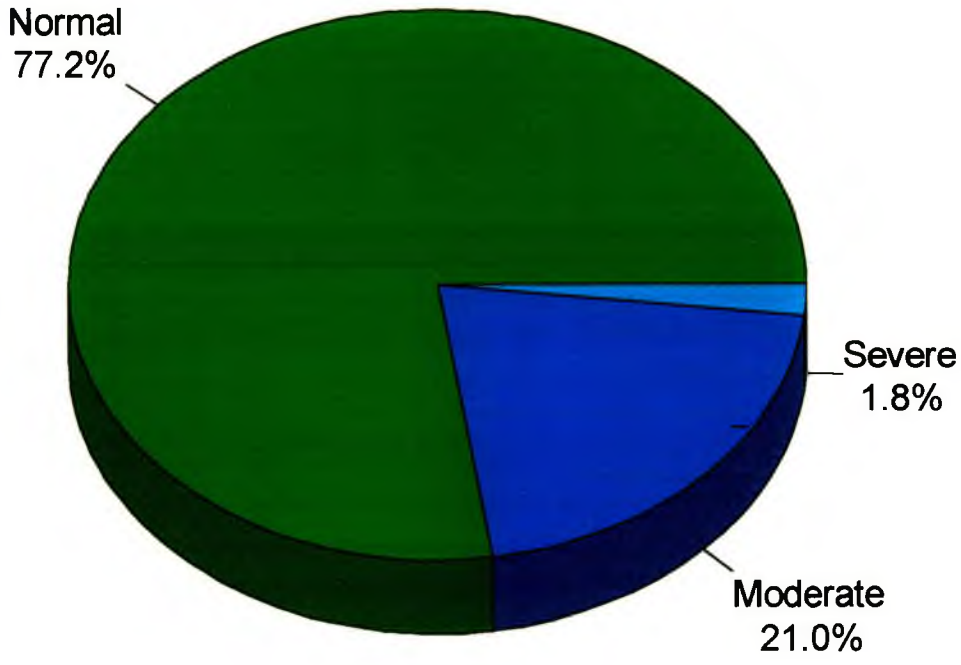

Fig.2a: Mid Arm Circumference (MAC) of Pregnant Mothers Compaired to Standard (28.5 cm)

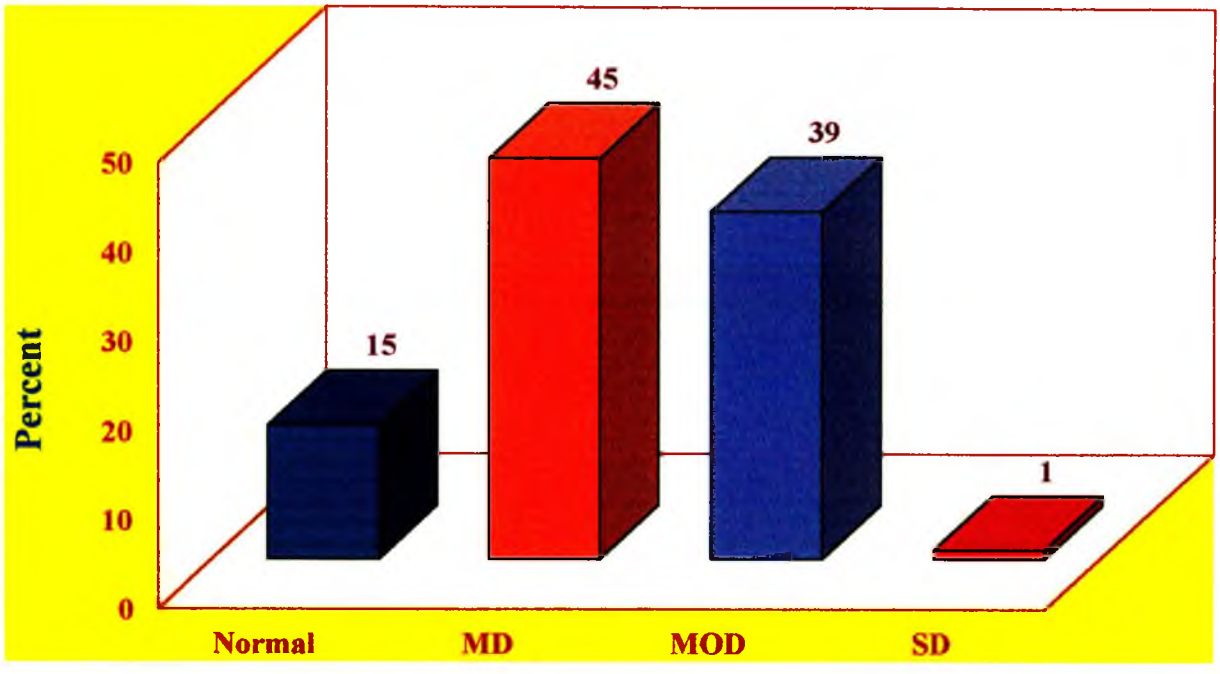

Fig.3: Status of Pregnants Blood Pressure

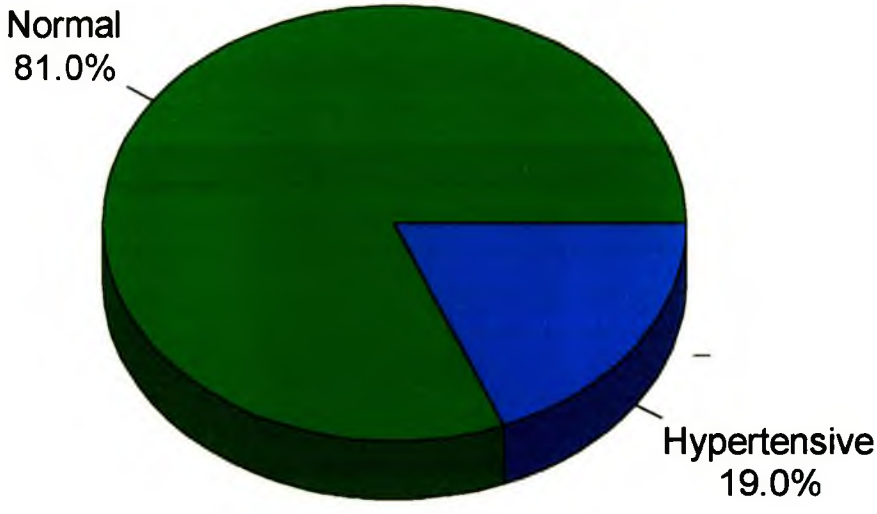

Fig. 4: Hemoglobin Level of the Pregnant Mother

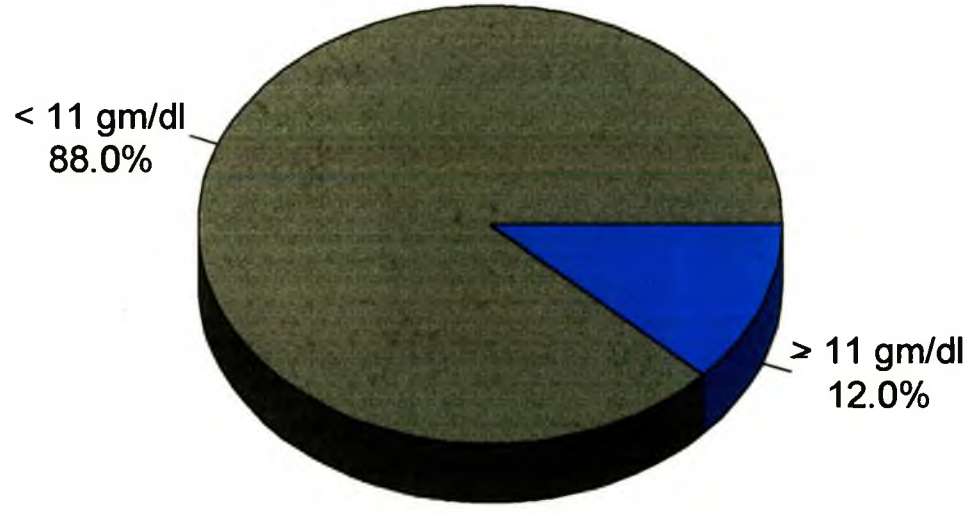

Table 6: Minor Problem of Mothers During Pregnancy Period

Problem	*Nil*	*Percent*
Edema	91%	9%
Sugar in Urine	97%	3%
Albumin in Urine	92%	8%

Fig. 5: Percent Distribution of Investigation (blood test, urine test, ultrasonogram, stool, x-ray) Done in Antenatal Care

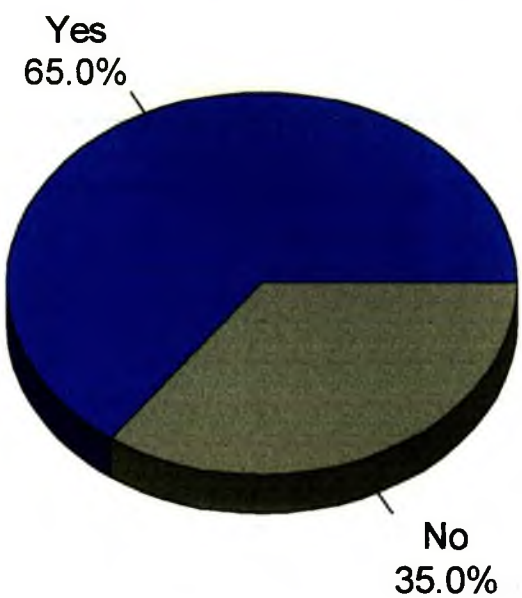

Table 7: Distribution of Pregnancy Outcome

Outcome	*Number*	*Percent*
Live birth	366	91.5%
Still birth	34	8.5%
Total	400	100%

Table 8: Logistic Regression Analysis Showing Effect of Independent Variables on Still Birth

Independent variables	*Regression Coefficient (b)*	*P*
Mothers age	0.0	**NS**
Mother's height	0.0	**NS**
Maternal pregnancy weight	0.0	**NS**
Maternal body mass index	0.0	**NS**
MAC	0.0	**NS**
Mother's hemoglobin level	0.0	**NS**
Mothers Skin fold thickness	0.0	**NS**
Blood pressure	0.0	**NS**

NS = Not significant

Table 9: Percent Distribution of Pregnant Mothers by Type of Delivery

Type of delivery	*Number*	*Percent*
Normal	186	46.5%
Breech	70	17.5%
Forceps	61	15.25%
Cesarean	30	7.57%
Total	400	100%

Table 10: Logistic Regression Analysis Showing Effect of Independent Variables on Complicated Delivery

Independent variables	*Regression Coefficient (b)*	*P*
Mothers age	– 0.34	P<0.05
Maternal weight	–0.41	P<0.05
CED	0.52	P<0.05
MAC	–0.39	P<0.05
Mother's height	0.0	NS
Mother's hemoglobin level	0.0	NS
Mothers Skin fold Thickness	0.0	NS
Blood pressure	0.0	NS

NS = Not significant

Table 11: Duration of Pregnancy

Type of delivery	*Number*	*Percent*
Full term	341	85.25%
Pre term	59	14.75%
Total	400	100%

Table 12: Logistic Regression Analysis Showing effect of Independent Variables on Pre term of Pregnancy

Independent variables	*Regression Coefficient (b)*	*P*
Mothers age	– 0.37	P<0.05
Maternal pregnancy weight	–0.39	P<0.05
CED	0.42	P<0.05
MAC	–0.44	P<0.05
Mother's height	0.0	NS
Mother's hemoglobin level	0.0	NS
Mothers Skin fold Thickness	0.0	NS
Blood pressure	0.0	NS

NS = Not significant

Table 13 : Distribution of Newborn Babies by Birth Weight

Birth Weight	*Number*	*Percent*
<2.5kg	81	22.13
2.5-2.7kg	90	24.59
2.8-3.0kg	117	31.97
>3kg	78	21.31
Total	366	100.0%

Average birth weight = 2.74±0.56 kg

Prevalence of low birth weight 22.13%

Fig. 6: Percent Distribution of Birth Weight

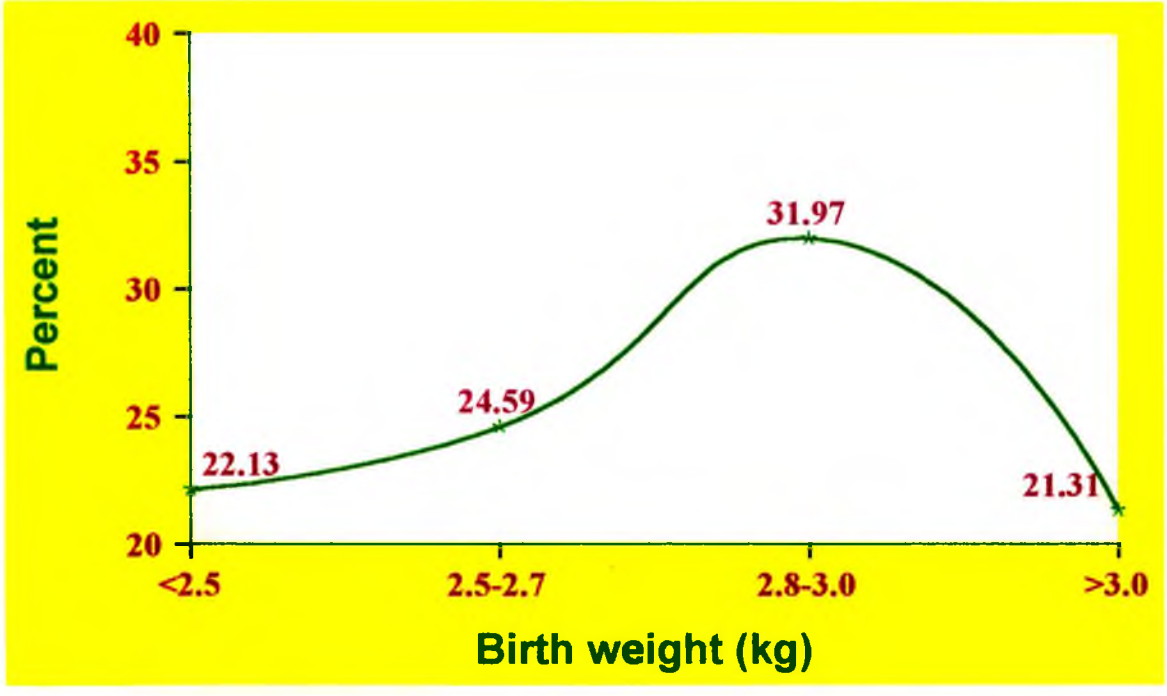

Table 14: Maternal Chronic Energy Deficiency and Birth Weight of Babies

Birth weight (kg)	***Body mass index (BMI)***		***Total***
	< 18.5	≥ 18.5	
<2.5	75 (%)	6(%)	81
≥ 2.5	8(%)	277(%)	285
Total	83	283	366

Chi-square (χ^2) = 284 P<0.001 Odds ratio (OR) = 432 (131<OR<1543)

Relative risk (RR) = 32 (16<RR<65)

Sensitivity = 90 Specificity = 98

Fig. 7: Linearized Regression Relationship Between Maternal BMI and Birth Weight of Infants

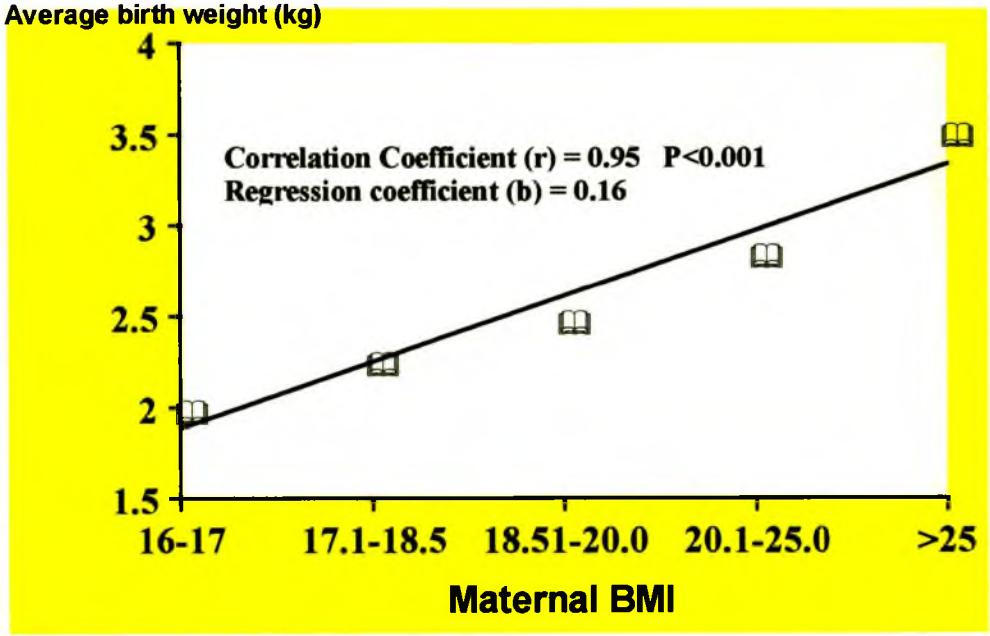

Table 15 Association Between Mother's Age and Birth Weight of Babies

Age of mother (year)	Number	Birth weight (kg)
<21	106	2.59±0.42
21-25	114	2.67±0.48
26-30	101	2.77±0.49
31-35	35	2.79±0.44
36 & above	10	2.89±0.51
Overall	366	2.74±0.45

Fig. 8: Curvilinear Relation Between Maternal Age and Birth Weight of Infants

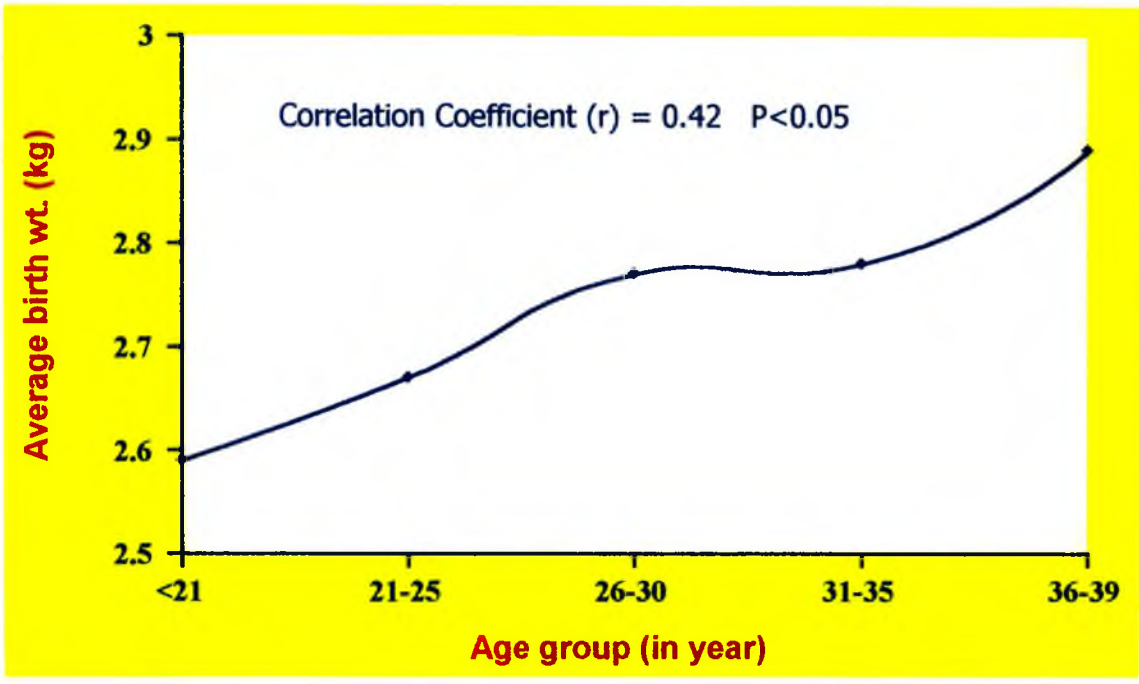

Table 16: Association Between Mother's Height and Birth Weight

Birth weight (kg)	Mother's height (cm)		Total
	< 141	≥ 141	
<2.5	76	5	81
	(20.76%)	(1.37%)	(22.13%)
≥2.5	19	266	285
	(5.19%)	(72.68%)	(77.87%)
Total	95	271	366
	(25.96%)	(74.04)	(100.0%)

Cut-off point 141 cm of mothers height

χ^2 = 244 P<0.001 OR = 212 (71<OR<683) RR = 14 (9.08<RR<21.81)

Sensitivity = 80 Specificity = 98

Fig. 9: Linear Relationship Between Maternal Height and Birth Weight

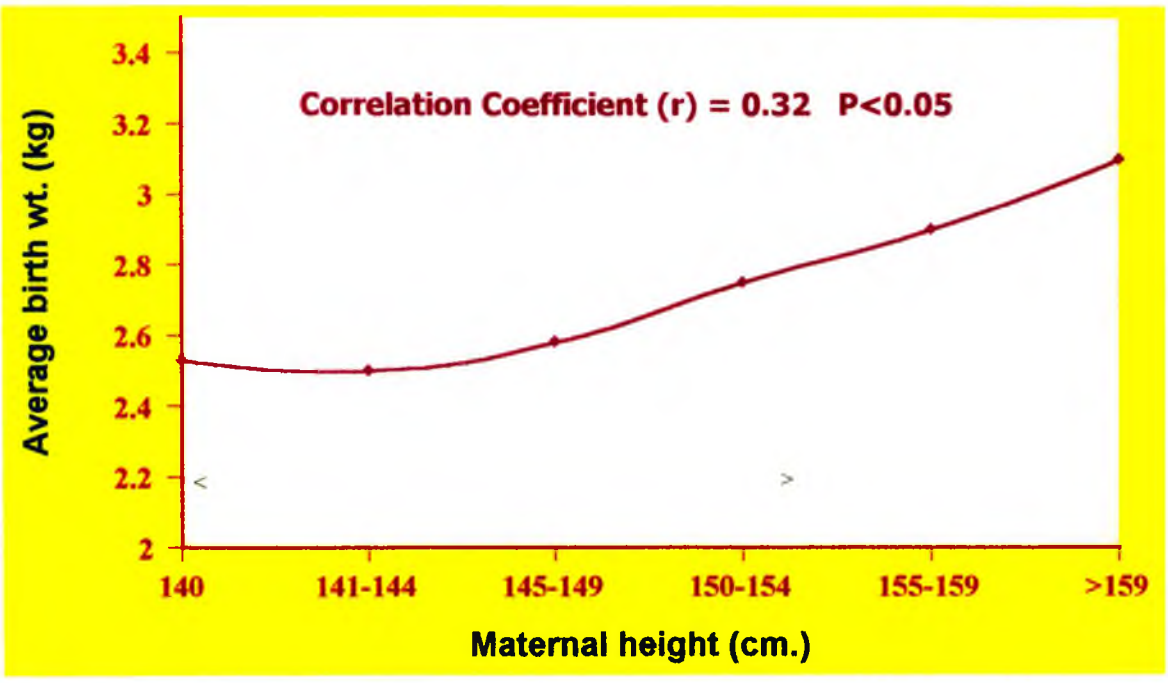

Table 17: Maternal Pregnancy Weight and Birth Weight

Birth weight	Mother's weight (kg)		Total
	< 45	≥ 45	
<2.5	71	10	81
	(19.40%)	(2.73%)	22.13%
≥ 2.5	20	265	285
	(5.45%)	(72.40%)	77.85%
Total	91	275	366
	24.86%	75.14%	100.0%

χ^2 = 215 P<0.001 OR = 94 (39<OR<229) RR = 12 (8.12<RR<19.4)

Sensitivity = 78 Specificity = 96

Fig. 10: Linearized Regression Relationship between maternal Pregnancy Weight and Birth Weight of Infants

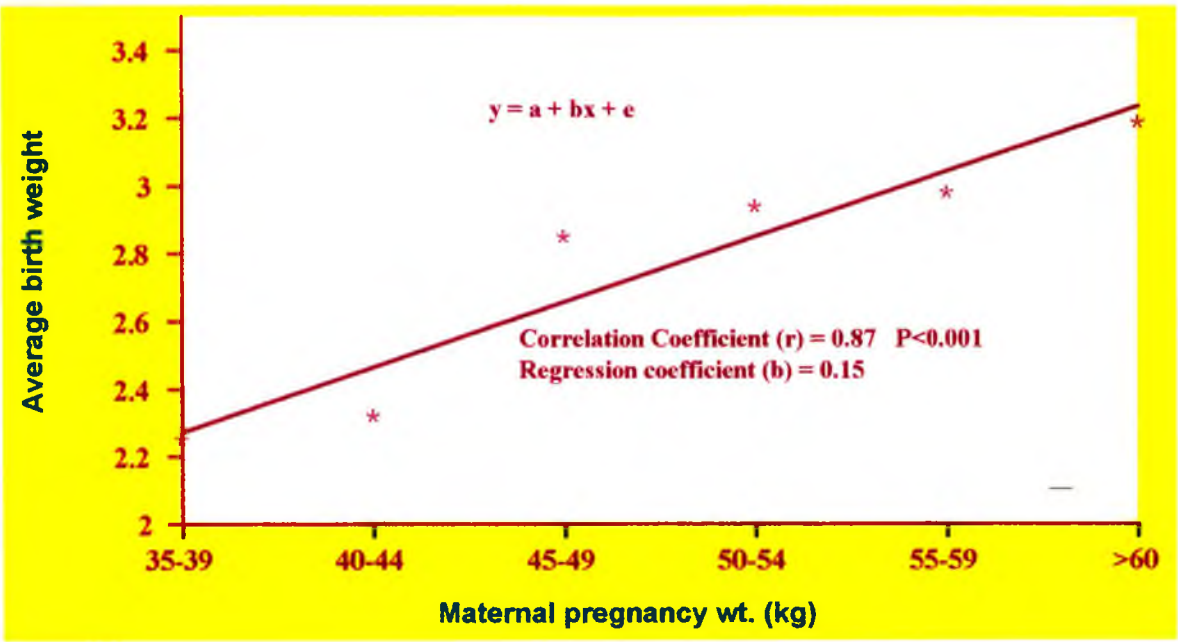

Table 18: Association Between Hemoglobin Level of Mothers and Birth Weight of Infants

Birth weight (kg)	Hemoglobin level (gm/dl)		Total
	< 11	≥ 11	
<2.5	71	10	81
	(19.40%)	(2.73%)	(22.13%)
≥ 2.5	251	34	285
	(68.58%)	(9.29%)	(77.87%)
Total	322 (87.98%)	44 (12.02%)	366 (100%)

χ^2 = 0.01 P>0.05 OR = 0.96 (0.43<OR<2.19) RR = 1 (0.9<RR<1.1)

Sensitivity = 22 Specificity = 77

Correlation coefficient = 0.04 P>0.05 Not significant

Table 19: Association Between Mother's MAC and Birth Weight of Infants

Birth weight (kg)	MAC (cm.)		Total
	< 23.5	≥ 23.5	
<2.5	72 (19.67%)	9 (2.46%)	81 (22.13%)
≥ 2.5	38 (10.38%)	247 (67.49%)	285 (77.87%)
Total	110 (30.05%)	256 (69.95%)	366 (100%)

χ^2 = 167 P<0.001 OR = 52 (22<OR<122) RR = 6.67 (4.91<RR<9.05)

Sensitivity = 65 Specificity = 96

Table 20: Association Between Skinfold Thickness and Birth Weight of Infants

Birth weight (kg)	skin fold thickness (mm)		Total
	< 16.5	≥ 16.5	
<2.5	44 (12.02%)	37 (10.11%)	81 (22.13%)
≥ 2.5	137 (37.43%)	148 (40.44%)	285 (77.87%)
Total	181 (49.45%)	185 (50.55%)	366 100%

χ^2 = 0.75 P>0.05 OR = 1.3 (0.76<OR<2.17) RR = 1.13 (0.89<RR<1.43)

Sensitivity = 24 Specificity = 80

Table 21. Low Birth Weight by MAC.

Birth weight (kg)	MAC		Total
	<92 mm	>92 mm	
<2.5	71 19.40%	10 2.73%	81 22.13%
≥ 2.5	16 4.37%	269 73.50%	285 77.87%
Total	87 23.77%	279 76.23%	366 100%

χ^2 = 229 P<0.001 OR = 119 (48<OR<303) RR = 15 (9.63<RR<25.31)

Sensitivity = 81 Specificity = 96

Fig. 11:Curvilinear Relation Between Mother's Arm Circumference and Infant's Arm Circumference

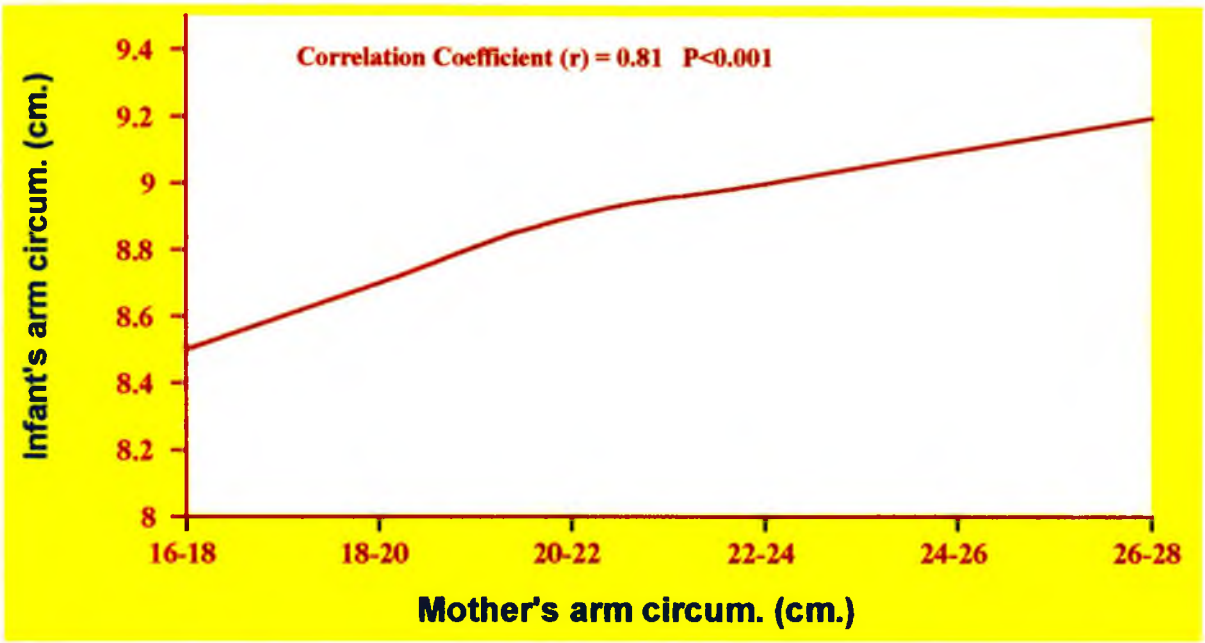

Table 22: Comparison of Anthropometric Variables
Of Babies with the Harvard Standard [48]

Measurements	***Average***	***% of Harvard standard***
Weight for age	2.74 kg	83 *
Height	48.54 cm.	91
Arm Circumference	9.01 cm.	93 **
Chest Circumference	31.17 cm	87.62
Head Circumference	33.61 cm.	95.12

Harvard Standard: Male = 3.40 kg Female = 3.18 kg Average = 3.29 kg.

Table 23: Correlation Matrix Between Anthropometric Variables of Infants

Correlation (r)	*Head circumference*	*MAC*	*Chest circumference*	*Height*
MAC (mm)	0.56			
Chest circu. (mm)	0.61	0.69		
Height (mm)	0.49	0.53	0.56	
Birth weight (gm)	0.66	0.76	0.75	0.62

Table 24 : Nutritional Status of the Newborn Infants by z-score (combined sex)

Nutritional level	***Nutritional indicators by Z-score***		
	WAZ (n=366)	HAZ (n=366)	WHZ (n=366)
below median – 2 SD	35.5%	45.36%	46.17%
	(130)	(166)	(169)
Above median – 2 SD	64.5%	54.64%	53.83%
	(236)	(200)	(197)

cut - off point – 2 SD.

WAZ = Weight for age Z-score HAZ = Height for age Z-score

WHZ = Weight for height Z-score

Fig.12: Nutritional Status by Z-Score

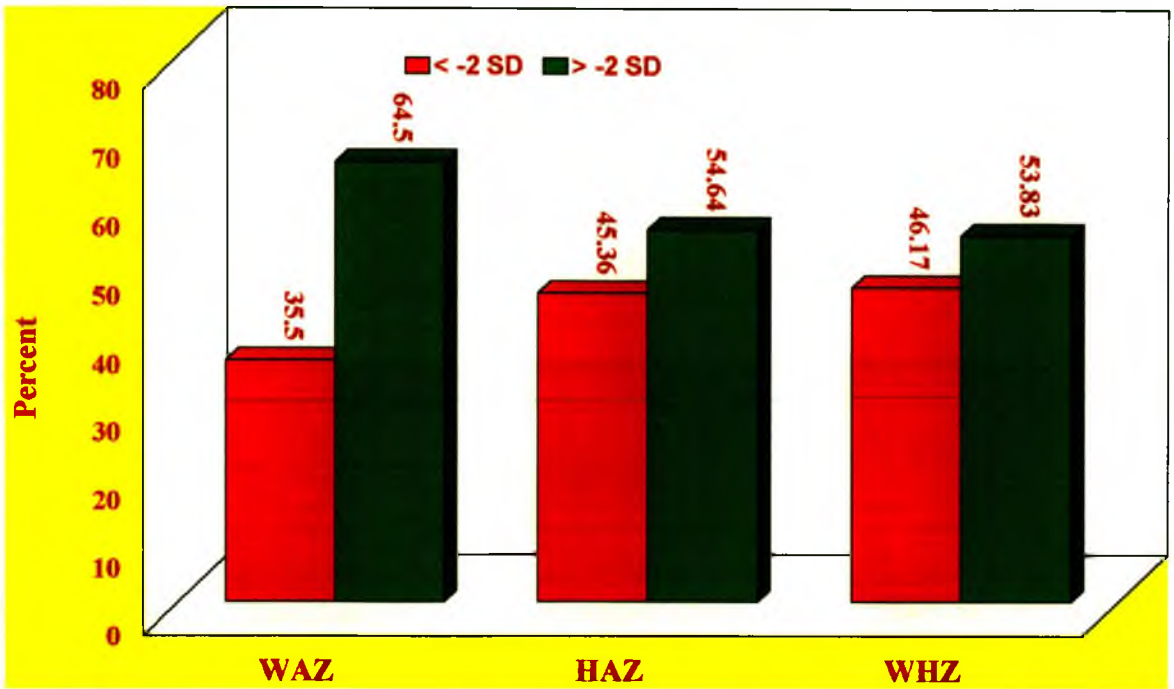

Table 25: Nutritional Status (weight for age) of the Newborn Infants by Z-score and by Sex

Nutritional level	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below median – 2 SD	68	38.86%	62	32.46%	130	35.52
Above median – 2 SD	107	61.14%	129	67.54%	236	64.48
Total	175	100%	191	100%	366	100%

Association between nutritional level of weight for age by sex

χ^2 = 1.36 P> 0.05 NS

OR = 1.32 (0.84<OR<2.08) RR = 1.15 (0.93<RR<1.43)

Nutritional level of weight for age is not associated with sex.

Table 26: Nutritional Status (height for age) of the Newborn Infants by Z-score and by Sex

Nutritional level	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below median – 2 SD	87	49.71	79	41.361	166	45.36
Above median – 2 SD	88	50.29	112	58.64	200	54.64
Total	175	100.0	191	100.0	366	100.0

Association between nutritional level of height for age by sex

χ^2 =2.25 P> 0.05 NS OD=1.40 (0.91<OR<2.16) RR = 1.19 (0.96<RR<1.47)

Nutritional level of height for age is not associated with sex.

Table 27 Nutritional Status (weight for height) of the Newborn Infants by Z-score and by Sex

Nutritional level	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Below median – 2 SD	87	49.71	82	42.93	169	46.17
Above median – 2 SD	88	50.29	109	57.07	197	53.83
Total	175	100.0	191	100.0	366	100.0

Association between nutritional level of weight for height by sex

χ^2 =1.43 P> 0.05 NS OR = 1.31 (0.85<OR<2.03) RR= 1.15 (0.93<RR<1.43)

Nutritional level of weight for height is not associated with sex.

Table 28. Logistic Regression Analysis Showing Effect of Independent Variables on Birth Weight.

Independent variables	*Regression Coefficient (b)*	*P*
Mothers age	0.95	P<0.05
Mothers education	0.85	P<0.05
Income	0.65	P<0.05
Maternal pregnancy weight	0.98	P<0.05
Maternal body index	0.17	P<0.05
MAC	0.59	P<0.05
Blood pressure	0.0	NS
Minor problems (Edema, sugar in urine and Albumin in urine)	0.0	NS
Mother's height	0.56	P<0.05
Mother's hemoglobin level	0.00	NS
Mothers Skin fold Thickness	0.00	NS
Husband's education	0.81	P<0.05

CHAPTER IV

RESULTS

RESULTS

A total of 400 pregnant mothers were studied and information on relevant parameters are presented in tables and graphs.

Age distribution of the study subject showed that 243 (60.75%) out of 400 were in the age group of less than 25 years. Of the total respondents, 118 (29.50%) belonged to the age of <21 years which followed by 110 (27.50%) of 26 - 30 years and then 37 (9.25%) of 31- 35 years. Only 10 (2.50%) respondents were in the age of 36 and above. (Table 1)

EDUCATIONAL STATUS OF MOTHER :

The literacy rate was 85% among the study subjects ranging from primary to postgraduate level. The highest number of mothers, that is 162 (40.50%) had SSC level education. Of the rest, 48 (12%), 47 (11.75%), and 46 (11.50) mothers had HSC, graduate, primary levels education respectively. The number of mothers who had post graduate level education was 37 (9.25%). Among all the mothers only 15% were illiterate.

EDUCATIONAL STATUS OF HUSBAND:

Among the Husbands 40.5% were University graduate while 15.75% had obtained post graduate degrees, 25.75% had passed HSC and 18% had

either completed School level education or attended School but has not completed SSC examination.

The highest number of mothers 280 (70%) lived in the building which was followed by 103 (25.75%) who resided in the tin-shed and the rest 17 (4.25%) lived in the thatched house.

INCOME :

More than two third (68.25%) of respondents were from the family with income higher than Tk. 4,000/= per month[49]. And for the rest respondents family income was below four thousand taka per month.

HUSBAND'S OCCUPATION :

Almost half of the respondents (49.50%) were wives of service holders followed by business which constituted 31.50%. Only 2% relied on agriculture farming, 4.50% on selling labor and 12.5% unclassified occupation.

Table 2 showed that mother's average age was 24.41±6.75 year and maternal pregnancy weight was 47.44 ± 6.49 kg. Maternal pregnancy weight was more when compared with predicted non pregnant weight. It was observed that higher the age higher the weight gain ($r=0.35$, $P<0.05$). The daily weight gain of mother is about 9.6g.

Table 3 Showed that calorie consumption was 2009, protein 56gm, fat 41gm carbohydrate 314g, calcium 750mg, iron 25mg, vit. A 690mg, vit. B 0.91mg, vit. B2 1.90 mg and vit C 38 mg. RDA of vit. A vit. B_1 of pregnant mother was above 90% and protein, fat, carbohydrate and vit. B_2 were above 80% and there were deficiency of iron and vit. C, by 75.76% and 76.0% respectively.

Table 4 Showed mean BMI by age as well as the prevalence of chronic energy deficiency (CED), using BMI < 18.5 as cut off point. Average BMI of pregnant mothers was 21.65 but Prevalence of CED was 27.0% Mean BMI in young mothers was lower than the BMI of older mothers . It was observed that BMI tended to increase with ages. The incidence of CED was also higher in very young mothers than in older ones .

Table 5 Showed the relationship between maternal pregnancy weight and arm circumference. Arm circumference had two cut off points ; 23 cm. which was often the level recommended for "under nutrition" and 20.7 cm. which was considered a "more severe" level. The corresponding cut off point for weight are 43.5kg and 37 kg respectively. It was observed that moderate level (43.5 kg cut off point of mother's weight) had the sensitivity of 88.4% and specifically of 65.2% in identifying the mothers with < 23 cm. arm circumference . For severe level it was calculated that the 37 kg cut-off point

of mother's weight had the sensitively of 70% and specificity of 81% in detecting mothers who were at higher risk of arm circumference < 20.7 cm.

Nutritional status of pregnant mothers by arm circumference for weight, 77.2% was normal, 21.0% moderate and 1.8% severely malnourished (Fig.2).

When Mid Arm Circumference (MAC) of Pregnant Mothers was Compared to a Standard of 28.5cm and 15% were Normal, 45% were Mildly Depleted, 39% were Moderately Depleted and 1% was Severely Depleted (Fig. 2a) .

The diastolic blood pressure of 81.0% was found Normal and 19.0% was Hypertensive (Fig. 3) .

The Hemoglobin level of the 88% pregnant mothers was found <11gm/dl and 12.0% mothers Hemoglobin level was >11gm/dl . This major portions (88%) of pregnant mothers blood anaemia indicated their iron deficiency or very low level of iron consumption (Fig. 4) .

As part of antenatal care it was observed that 65.0% of mother had done investigation of blood test, urine test, ultrasonogram, stool, x-ray (Fig. 5).

Table 6 Showed minor problem faced during pregnancy Period. The examination showed that 9% pregnant mothers had Edema, 3% and 8% pregnant mothers had sugar and albumin in Urine respectively.

Table 7 Showed that 91.5% babies had live birth and 8.5% had still birth.

Logistic regression analysis was done to see the effect of 8 factors on still birth (Table 8). The factors such as mother's age, height, weight, BMI, MAC, BP, Hb level and skin fold thickness which might influence the still birth were taken as independent variables and the still birth as dependent variable in the logistic regression analysis. There was no significant influence of independent variables on still birth.

Table 9 showed the Percent distribution of Pregnant Mothers by type of delivery. It was found that major portions (53.5%) of pregnant mothers experienced complicated delivery (Breech, Forceps, Cesarean) and 46.5% mother experienced normal delivery.

Logistic regression analysis was done to see the effect of 8 factors on complicated delivery (Table 10). The factors which might influence the complicated delivery were taken as independent variables and the complicated delivery as dependent variable in the logistic regression analysis. The variables mother's age, weight, CED, and MAC had significant (at 5% level) influence on complicated delivery.

It was found that 85.25% mothers accomplished full term delivery and only 14.75% mothers had delivered pre term (Table 11). Logistic regression analysis was done to see the effect of 8 factors on pre term of delivery

(Table12). The factors which might influence the pre term delivery were taken as independent variables and the pre term of delivery as dependent variable in the logistic regression analysis. The variables mother's age, weight, CED, and MAC had significant influence on pre term of delivery .

The distribution of birth weight of newborn babies was shown in Table 13. The mean birth weight was found to be 2.74 ± 0.56 kg. The prevalence of low birth weight (LBW) in this study was 22.13% (weight <2.5 kg).

Maximum birth weight range of 2.8-3.0 was observed on 31.97 % of babies (Fig. 6).

Table 14 showed the association between chronic energy deficiency (CED) and birth weight. Based on the chi-square test it was found that CED (BMI<18.5) was significantly associated with low birth weight (LBW). Odds ratio (OD=432) showed that exposure (low birth weight of babies, <2.5 kg[57]) was positively associated with CED of mothers (BMI<18.5). Relative Risk (RR=32) showed that the risk of exposure was 32 times higher than non exposure (birth weight $\geq$ 2.5 kg). It was calculated from Table 14 that at 18.5 cut off point of BMI had the sensitively of 90% and specificity of 98% in identifying the babies with <2.5 kg i.e. LBW babies. A 90% sensitivity means that 90% of chronic energy deficient mothers gave birth of <2.5 kg and the rest

10% give birth of ≥ 2.5 kg. There was a highly significant correlation (r = 0.95, P<0,001) between BMI and birth weight of infants (Fig. 7) .

Table 15 presented the age groups of mothers and its relation with the birth weight of babies. It was found (Fig. 8) that birth weight of babies increased progressively with increasing maternal age (r = 0.42, P<0.01)

Based on the chi-square test (χ^2 =244, P<0.001) it was found that birth weight was significantly associated with mothers height. Odds ratio (OD=212) showed that exposure (low birth weight of babies, <2.5 kg) was positively associated with mothers height <141 cm. Relative Risk (RR=14) showed that the risk of exposure was 14 times higher than non exposure (birth weight ≥ 2.5 kg). It was calculated from Table 16 the 141 cm. cut off of mothers height have the sensitively of 80% and specificity of 98% in identifying the babies with <2.5 kg i.e. LBW babies. A 80% sensitivity means that 80% of mothers who had height <141 cm. gave birth of <2.5 kg and the rest 20% gave birth of ≥ 2.5 kg.. A 98% specificity means that 98% of mothers whom had height ≥141 cm. gave birth of ≥2.5 kg and the rest 2% gave birth of <2.5 kg. There was a significant correlation (r=0.32, P<0.05) between maternal height and birth weight of babies (Fig. 9).

Table 17 presented values of maternal pregnancy weight and birth weight of babies. Based on the chi-square test (χ^2 =215, P<0.001) was is observed that

birth weight is significantly associated with mothers weight. Odds ratio (OD=94) showed that exposure (low birth weight of babies, <2.5 kg) was positively associated with mothers weight (< 45 kg). Relative risk (RR=12) showed that the risk of exposure was 12 times higher than non exposure (birth weight ≥ 2.5 kg). It was calculated from Table 17 the 45 kg. cut off of mothers weight had the sensitively of 78% and specificity of 96% in identifying the babies with <2.5 kg i.e. LBW babies. A 78% sensitivity means that 78% of mothers weighted < 45 kg. gave birth of <2.5 kg and the rest 22% gave birth of ≥ 2.5 kg. A 96% specificity means that 96% of mothers weighted ≥ 45 kg. gave birth of ≥2.5 kg and the rest 12% gave birth of < 2.5 kg.

The prevalence of low birth weight was more common in the mothers weighted up to 44 kg. The incidence gradually diminished as the weight of the mother increased. There was a highly significant degree of relationship (r=0.87, P<0.001) between maternal weight and birth weight of infants (Fig10). Of the 400 mothers studied, 88% of the pregnant mothers had hemoglobin level below 11 gm percent and were therefore anaemic.

Based on chi–square test, OR, RR correlation coefficient, it was found that birth weight of babies was not associated with the hemoglobin level of mothers (Table 18).

Table 19 presented the mothers arm circumference and birth weight. Based on the chi-square test (χ^2 =167, P<0.001) it was found that birth weight was significantly associated with mothers MAC. OD (OD=52) showed that exposure (low birth weight of babies, <2.5 kg) was positively associated with mothers MAC <23.5 cm. RR (RR=6.67) showed that the risk of exposure was 6.67 times higher than non exposure (birth weight $\geq$ 2.5 kg). It was observed from Table 19 that 23.5 cm cut off of mothers MAC had the sensitively of 65% and specificity of 96% in identifying the babies with <2.5 kg i.e. LBW babies .

In Table 20, the association between mothers skin fold thickness and birth weight of babies was shown. No significant association (χ^2 = 0.75, P>0.05) was found between them.

It was calculated from Table 21 that 92 mm. Cut off of MAC of babies had the sensitivity of 81% and specificity of 96% in identifying the infants with LBW (<2.5 kg) babies. Chi-square test (χ^2 = 229, P<0.001) showed that the birth weight of infants was significantly associated with MAC.

In Fig. 11, the correlation between mother's arm circumference and babies arm circumference was shown. And this indicated significant positive association between them (r=0.81, P<0.001).

Table 22 Compared to the Harvard standard the average weight of the new born babies of the study was 83% Harvard standard while weight was 91%, arm circumference 93% and chest circumference 95.12%.

Table 23 showed the degree of relationship among the anthropometric variables of infants. It was found that all the variables were significantly correlated with each other. It was found that MAC correlated significantly with head circumference (r = 0.56) with chest circumference (r = 0.69). Degree of correlation of MAC with height was (r = 0.53) and birth weight was (r = 0.76). Degree of correlation of height with Head Circumference, (r = 0.49), MAC (r =0.53) and with Chest Circumference (r = 0.56) showed a positive correlation.

A high degree of correlation was found between of chest circumference and head circumference (r = 0.61), birth weight and head circumference (r = 0.66), birth weight with chest circumference (r = 0.75) and birth weight and height was (r = 0.62) found positively correlated.

MAC had the highest correlation with birth weight (r=0.76, P<0.001). In identifying infants weight <2500 gm (<2.5kg), it was found that MAC had a cut-off value of 92 mm.

Nutritional status of the children were analyzed in respect of Weight for age z-score (WAZ), Height for age z score (HAZ) and Weight for height z-score (WHZ) using standard derivation score (z-score) .

Table 24 showed that 64.5% of the infants had normal weight for their age as they were above the cut-off point of –2 SD. On the other hand 35,5% of the infants were found under weight who were below the cut-off point indicating their low weight for their age. In respect of Height for age, 54.64 % were normal height for their age as against 45.36% were found stunted. Low HA (<–2 SD) was considered as an indicator of stunting (i.e. shortness). Regarding weight for height indicator, 46.17% of infants were below the cut off point and hence they were wasted. About 53.83% of infants were above the cut-off point having normal weights for the existing heights. However, Low WH (<–2 SD) was considered as an indicator of 'wasting' (Thinness) and was generally associated with current acute failure to gain weight or a loss of weight.

Based on chi-square test (chi-square = 1.36 P>0.05) it was found that nutritional status of weight for age was not associated with sex (Table 25) . According to chi-square test, OR and RR it was found that nutritional level of height for age and weight for height were not associated with sex respectively.

In assessing nutritional status of the new born by weight for height shows that 53.83% of the infants were above the medium by -2 SD while 46.17% were below the medium by -2 SD.

Logistic regression analysis was done to see the effect of 12 factors on birth weight of infants. (Table 28.) 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. The variables mother's age, mother's education, income, maternal pregnancy weight, maternal body mass index. MAC, mother's height, and husbands education had significant influence on birth weight of infants.

CHAPTER V

DISCUSSION AND RECOMMENDATION

DISCUSSION

The average age of pregnant mother was 24. 41 ± 6.75 years. According to the latest assessment done in 1994 by the Bangladesh Bureau of Statistics (BBS) the mean age of Urban pregnant women was 20 years. The findings of this study are inconfirmity with the findings of BBS[50].

According to the finding of this study 85% were found literate and 70% live in buildings. Human nutrition is the end result of multiple overlapping and interacting factors in the communities' ecology i. e. physical, biological, social and cultural environments including economic constraint. The housing condition, female's education, husband's occupation, and family income contribute to nutritional status through prevention or causation of infection.

Mean maternal pregnancy weight was 47.44 ± 6.49 kg in the third trimester of pregnancy which was much lower than expected weight gain in pregnancy. The mean height was 148.04 cm. Similar findings have been observed by Ali et al[51].

Widdowson in his research on "Demands of the Fetal and Maternal Tissues", found mean gain in weight before birth of the young of 19 species related to weight of the mother and showed that a mother of 56 kg gives birth to baby weighing 3.4 kg when the length of gestation is 280 days. The mean gain in

weight of the foetus per day is 12.1gm which was 0.021% of mother's weight gain during pregnancy[52]. While this study observed that daily weight gain of mother was about 9.6 g., Which satisfies 79.3% of daily weight gain in comparison to European standard. This difference of birth is (2.7 kg against 3.4 kg) may be due to cultural, social and economic factors exist between Europe and Bangladeshis women.

Study in India (Vencatechalum et at) has shown that under nutrition in pregnancy is a stress and for that reason women do not gain their normal weight and usually store very little reserve fat in their body[53]. The current study correlates with the study of Hussaini et al where they found that mean weight of pregnant women in age group 18 years was 46.7 kg and in age group of 29.7 years the mean weight was 48.7 kg[54]. Insufficient weight gain during pregnancy has been associated with small for gestational age (SGA). SGA infants are also at greater risk for neonatal death and various congenital defects and disabilities. In one study the neonatal mortality rate was lowest among the babies of women who gained 14 kg or more during pregnancy.

Improving the nutritional status of women before they become pregnant has a positive effect on subsequent birth outcome. Cann et a found in their study that the women who received food supplementation for 5 -7 month after the birth of the first child had a better pregnancy outcome with the second one

than the women who received supplementation for only ≤2 month [55]. Infants of women whose diets were supplemented for the longer period of time had a higher mean birth weight and birth length and a lower risk of being SGA.

The women of the present series received 85.49% of calorie, 84.85% of protein, 82% of fat, 85.10% of CHO, 68.18% calcium, and 75.76% iron of RDA. The total energy requirement for pregnant women covering the energy equivalent to protein and fat synthesis and increased metabolism - has been estimated to be ~ 85,000 kcal. About 36,000 kcal are needed for metabolism, 41,000 kcal are deposited as fat and lean tissue, and 8,000 kcal are used to convert dietary energy to matabolizable energy. Because of so many factors - prepregnancy weight and body composition and amount of weight gain, stage of pregnancy, and level of activity - affect energy needs, There is no single value for energy requirements that would apply to all pregnant women. On the basis of Hytten's figure of 85,000 kcal, divided by the 280 days of gestation, an additional energy intake of 300 kcal/day is suggested during pregnancy. The Food and Agriculture Organization (FAO) of the UN recommends an extra 285 kcal/day for those pregnant women who maintain their pre-pregnancy level of physical activity and 200 kcal/d for those who reduce their activity. The circulating concentrations of many vitamins are reduced during pregnancy, but it is difficult to evaluate how much of these reductions are due to normal

physiological adjustments of pregnancy and how much true increases are need. Vitamins of particular concern during pregnancy are vitamins A, D, and B-6 and folate.

The study reveals that average BMI of pregnant mothers is 21.65 with CED prevelence of 27%. The Baseline Survey for Bangladesh Integrated Nutrition Project showed that the prevalence of CED was 45 percent among ever married women in the project thanas and 40 percent among those in the non project thanas [56]. There is difference nutrition status among city dwellers and rural people, as reflected in the anthropometric indicators of rural and urban women of two separate studies. Bhuiya et al in their study showed that the average height, weight, and mid arm circumference of women in rural Bangladesh are 148.1 cm, 40.1 kg and 18.3 cm respectively[57]. While according to Baque et al the parametres in women in urban slums are 148.8 cm, 41.8 kg and 18.8 cm respectively. Mean BMI of young mothers is much lower than the BMI of older ones. Due to inadequate and inappropriate nutritent intake BMI remained low and prevalence of CED was high and this observation is supported by many authors[58]. The study also reveals highly significant correlation between maternal BMI and birth weight of infants. Mothers with BMI below 18.5 had given birth to babies below 2.5 kg. Information from National Institute of India revealed that 44% of women with

low BMI (<18.8) delivered 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.

While assessing nutritional status of pregnant mothers by mid arm circumference compared to standard (28.5 cm) 15% was found normal, 45% mildly depleted, 39% moderately depleted, and only 1% severely depleted. Huffman et al [59] found a high correlation ($r = 0.80$, $P<0.001$) between the mid arm circumference and mean weight in Bangladeshi women. Correlation between arm circumference and weight ($r = 0.68 - 0.79$) was high in all stages of pregnancy. Arm circumference measurements have been used extensively to identify malnutrition in children in developing countries[60]. Recent evidence indicates that maternal arm circumference can be used as an indicator of maternal nutritional status in non-pregnant women because of its high correlation with maternal weight or weight- for -height[61] and as a tool during pregnancy to screen for risk of LBW and late fetal and infant mortality[62]. Since maternal arm circumference is relatively stable during pregnancy[63], its measurements are independent of gestational age. An arm circumference during pregnancy of 23.5 cm had a sensitively of 77% and a specificity of 71% for predicting LBW in Brazil, where the prevalence of LBW is 9.0% [64]. An arm circumference measurement of 22.5 cm taken at any time during pregnancy was found to have a sensitivity of 73% and a specificity of 41% in predicting

risk of late fetal or infant mortality in rural Bangladesh, where the prevalence of LBW (approximately 30%) and low arm circumference was much higher than in Brazil, Chile, or Guatemala[65].

LBW is one of the most serious challenges in maternal and child health in both developed and developing countries. Its public health significance may be ascribed to numerous factors - its high incidence; its association with mental retardation and a high risk of prenatal and infant mortality and morbidity (half of all prenatal and one-third of all infant deaths are due to LBW); human wastage and suffering; the very high cost of special care and intensive care units and its association with socio-economic underdevelopment.

LBW is the single most important factor determining the child's survival chances. Many of them die during their first year. The infant mortality rate is about 20 times greater for all LBW babies than for others babies. The lower birth weight, the lower is the survival chance. Many of them become victims of protein - energy malnutrition and infection. LBW is thus an important guide to the level of care needed by individual babies. LBW also reflects inadequate nutrition and ill health of the mother. There is a strong and significant positive correlation among maternal nutritional status and the length of pregnancy and birth weight. A high percentage of LBW therefore points to deficient health status of pregnant women due to malnutrition, inadequate prenatal care and

the need for improved care of the newborn. Though this study is done in urban mother delivered in a tertiary level care yet this LBW prevalence was 22%.

Ahmed et al-explored association of maternal factor with birth weight of 2849 singleton live births. The mean birth weight was 2667 gm and 27% of babies were low birth weight (<2500 gm). Sixteen percent were teenagers, thirty percentage of teenage pregnancies resulted in low birth weight (LBW). The mean maternal weight gain during pregnancy was 54.8 kg with a range of minus 2 kg to 20 kg and 99% of mothers attained the expected weight gain of 10 -12 kg. The coefficient correlation between maternal weight gain during pregnancy and birth weight was found to be significant (r=0.1813.p<.002). More than sixty percent of mothers were found severely anemic and birth weight was found to be positively with mothers hemoglobin level [35].

Of the 400 mothers studied, 88% of had haemoglobin level below 11gm percent and one three for anaemic. As Pan America Health Organisation Scientific group on nutritional anaemics has considered that haemoglobin level below 11 gm/dl should be regarded as signifying anaemic during pregnancy. Significant association was found during the study between mother's height and birth weight of the new born. Eighty percent of mothers with height below

141 cm gave birth to babies weighting below 2.5 kg. There is a significant correlation ($r = 0.32$, $p<0.05$) between maternal height and birth weight of babies. Height has been shown in a number of studies in both industrialised and developing countries to be related to infants' birth weight. Studied in developing countries have found that the effect of maternal height on infant birth weight ranges from 10-22 gm/cm[66].

A brief review of selected Guatemalan studies permits a number of points to be raised about the value of maternal height as an indicator of risk. These data were obtained from maternity histories of about 600 Mayan Indian women. Review of the distribution of maternal height shows that Mayan Indian women are very short. The mean height for women in the shortest tertile is 137 cm, while the mean height for women in the tallest tertile is 148 cm. For infants of women in lowest tertile, the infant mortality rate (IMR) is 205 per 1,000 live births. For the middle group, the IMR is 150 per 1000 live births, and for the tallest group, it is 101 per 1000 live births. [65]

Height has also been related in the literature to difficulties during labor and to obstetric mortality. The linkage between height and these outcomes may be due to a relationship between height and dimensions of the pelvic inlet. It is important to determine whether there are other anthropometric indicators that are easier to measure and perhaps more useful than height as indicators of

delivery complications. Age an additional consideration here because pelvic measurements reach final dimensions late in adolescence. Height may also reflect socio-economic status. Associations between maternal height and various measures of socio-economic status, such as the quality of housing, education and income, and adult height, are often reported in the literature. Both neonatal and post neonatal mortality rates were higher for infants of Bangladesh mothers who had highly <147 cm compared to those who are taller.[67]

Other studies in Asia have also illustrated association of socio-economic status with maternal nutrition status similar to that reported in this study which revealed 88 % women to be anemic with hemoglobin level < 11gm/dl. Rajalakshmi [68] observed large discrepancies in weight and height of urban Boroda, India women by income groups, with low income women having weight of 40.3 kg and height of 150 cm compared to 51.5 kg and 156 cm for women with higher income. Prevalence of anaemia was also related to income group with low income group showing a higher incidence of anaemia. In another Indian study, Prema [69] observed difference in both weight and height by income. Women with low incomes had mean weights and heights of 45.7 kg and 151.5 cm compared to 49.9 kg and 154.2 cm for middle income group and 56.2 kg and 156.3 cm for high income women . A similar increase in

mean haemoglobin was observed by income class, (10.9, 11.1 and 12.4 g/dl). In addition, mean birth weight increased as income increased.

Maternal nutritional status was poor and positively correlated with socio demographic factors while more low birth weight of babies had born women with poor nutritional status. About one 3rd of mother had CED who delivered one 4th babies with LBW. The overall nutritional situation is poor among urban educated women who atilised maternal services from a tertiary care centre of Dhaka metropolis. The Maternal and Child Health service in urban area was extremely poor and needs immediate improvement to cut down morbidity and mortality of both mother and children.

RECOMMENDATIONS

Bangladesh bears a heavy burden of malnutrition, pregnant women and children are the first prey of under nutrition. Initiatives should be taken at various level to reduce malnutrition. Initiatives need to be taken through planning and policy making organisation of Government and Non-government agencies as well as those concerned with nutrition. The government needs to know the extent and distribution of malnutrition throughout the country to decide on the most efficient allocation of limited resources.

Measures to improve maternal nutritional status may be broadly divided into direct and indirect measures.

DIRECT INTERVENTIONS:

1. Community, family and individual nutrition education may be initiated. Education is the most important instrument in changing knowledge attitude and practice. Nutrition education needs to be incorporated in both formal and non formal education. Community can do a lot about malnutrition in their area . For this they need to be aware of malnutrition and more education on nutrition is needed which may be organized by using mass media and community health organiser/ groups.

2. Intrafamilial food distribution needs to be altered. Our society is a male dominant society, and majority malnuarished are female. So food collection to be changed keeping in view of the special nutrition requirement of pregnant women.
3. There could be Provision for additional food to pregnant women. Awareness and motivation programs may be taken at community level and national level highlighting the special need of pregnant women. Supplementary food distribution may be an integral part of antenatal care.
4. To mitigate Chronic energy deficiency ofmother and low birth weight, which is the central problem identified in this study. This may be part of antenatal care accomplished through home visit of community health workers. Folic acid may, also be distributed to pregnant women who come to Health Care Centers for antenatal care.
5. Certain foods may be fortified considering the essential nutritional need of pregnants. In Bangladesh salt is fortified with iodine, it may also be fortified with iron and folic acid. Staple food like flour may also be fortified with minerals and vitamins of critical requirement.
6. Pregnant women should reduce their work load and
7. At present there is no provision of Standardized Antenatal Care. Minimum national standard package for antenatal care may be developed and

meeting that standard may be mode as statutor requirement for institutions providing ANC.

8. Incorporation of individualized nutritional arrangement and counseling as part of prenatal care
9. Incorporation of nutritional individualized arrangement and counseling as part of prenatal care

INDIRECT INTERVENTIONS :

Indirect nutrition interventions have wider scope of actions because they are not directly related to nutrition.

These include:

1. Control of communicable disease through immunization. Improvement of environmental situation. Provision of safe drinking water and food hygiene.
2. Child spacing and limiting family size is need of time in our country. This contributes directly of enhance food availability of family, community and national level.
3. Primary health care approach may change nutritional status of the community as a whole. By meeting appropriate health need of mother and

community PHC may mitigate suffering and control factors contributing to malnutrition indirectly.

4. Nutritional surveillance for identifying sub clinical malnutrition may help in early detection of a nutrition problem and hence promote prompt action in preventing individual suffering and promote community actions.
5. Improving socioeconomic and environmental condition particularly education and employment generation
6. Enforcing law related to age at marriage may reduce chronic energy deficiency by reducing teen age pregnancy as the study shows that women who become pregnant at the early age suffers most from chronic energy deficiency.
7. Agricultural improvements including increased local production of the main nutritious food.

CHAPTER VI

SUMMARY

SUMMARY

The study was conducted to illustrate the nutritional status and pregnancy outcome of women living in Dhaka city.

Four hundred pregnant in third trimester from Dhaka Medical College Hospital, Holy Family Red Crescent Hospital, Maternal and Clinic Health Institute, Azimpur and a Private Clinic were studied. Assuming the pregnants availed tertiary level care in Dhaka city. Socio demographic data of these selected subjects have been collected through interview schedule and secondary sources from hospital and clinical records. Nutrition intake data have been collected through 24 hours food intake recall method. Anthropometric data of three mothers and their newborn babies have been taken by direct measurement.

The average age was 24.41± 6.75 years, literacy rate was 85% and 70% of the study subjects live in buildings. Monthly family income of 68% of the subjects are above 4,000.00 taka ranging between Tk. 3,000.00 and 30,000.00 per month.

Average maternal pregnancy weight was 47.44 ± 6.49 kg means on an average was 7.25 kg gained during pregnancy and daily weight gain was about 9.6 g. While in the developed countries the average pregnancy weight gain is 12 Kg and with weight gain of 12 g. This study met 79.3% of western standard. Average BMI was 21.65 and prevalence of CED was 27%. The study revealed that 80% RDA of protein, fat and carbohydrate was met. In comparison to standard mid arm circumference (28.5 cm), only15% of the study subject were normal.

Among the study subjects 19% were hypertensive, 88% were anemic. It was found that 8.5% had still birth and 14.75 experienced pre term delivery. Mothers age, weight, CED and MAC had significant influence on pre term delivery.

Mean birth weight of the newborn babies was 2.74 ±0.56 kg with 22.13% . prevalence of low birth weight at 2.5 kg cut off point. There was a highly significant correlation ($r = 0.95$, $P<0.001$) between BMI and birth weight of the new born.

Birth weight of the babies increase progressively with increasing maternal age $r=0.42$ $P<0.05$. There was a significant correlation ($r = 0.32$, $P<0.05$) between maternal height and birth weight and between maternal pregnancy weight and birth weight of their babies ($x^2 = 215$, $P<0.001$). However birth weight was not

found associated with anaemia of the mother. But birth weight was significantly associated with mothers MAC (x^2 = 167, P< 0.001). It was calculated that 23.5 cm cut off point of mothers MAC had a sensitively of 65% and specificity of 96% in identifying babies below 2.5 kg birth weight.

No significant association (x^2 = 0.75, P<0.05) was found between mothers skin fold thickness and LBW.

It was observed that birth weight of infants were significantly (x^2=229,P<0.001) associated with the MAC of infants. There was also positive correlation between MAC of the mother and their new borns (r = 0.81 P<0.001). The MAC, chest circumference, height and birth weight of the new born infants were significantly Correlated with MAC having heighest correlation with birth weight (r = 0.76, P<0.001).

More than sixty four percent of the newborn babies had normal weight for their age (above cut off point of -2SD) and 45.36% were found stunted while 46.17% are wasted.

It was found that weight of the newborn babies were not associated with sex (x^2 =1.36, P>0.05).

Logistic regression analysis showed that mother's age, education, income, weight in pregnancy, BMI, MAC, height, Husband's education had significant influence on birth weight of the infants.

Maternal nutritional status was poor and positively correlated with socio demographic factors while more low birth weight of babies had born women with poor nutritional status. Birth weight of baby was correlated with maternal nutritional status. About one 3rd of mother had CED who delivered one 4th babies with LBW. All this implies that Maternal and Child Health service in urban area was extremely poor and needs immediate improvement to cut down morbidity and mortality of both mother and children.

CHAPTER VII

CONCLUSION

CONCLUSSION

Maternal nutritional status was poor and positively correlated with socio demographic factors while more low birth weight of babies had born women with poor nutritional status. Birth weight of baby was correlated with maternal nutritional status. About one 3rd of mother had CED who delivered one 4th babies with LBW. So MCH service in urban area was poor. Nutrition education was not seriously considered as part of antenatal care. The health service needs improvement to cut down maternal and child morbidity and mortality.

CHAPTER VIII

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CHAPTER IX

ANNEXURES

Interview Schedule

Date of interview .....

Hospital/Clinic .....

IDENTIFICATION

1. Name of respondent : _____
2. Name of husband : _____
3. Holding No. : _____

   Lane : _____

   Road : _____

SOCIO DEMOGRAPHIC INFORMATION

4. Age of the respondent .....(in full years)

5. Educational qualification

Illiterate	_____	Literate	_____	Primary	_____
High School	_____	SSC	_____	HSC	_____
Graduate	_____	Masters	_____	Others	_____

6. Husband's Education

Illiterate	_____	Literate	_____	Primary	_____
High School	_____	SSC	_____	HSC	_____
Graduate	_____	Masters	_____	Others	_____

7. In what type of house do you live in?

Building	_____	Tinshed	_____
Thatch	_____	Others	_____

Your house is:

Rented	_____	Inherited	_____	Purchased	_____

8. Source (s) of family income

Service	_____	Business	_____
Skilled Labour	_____	Unskilled Labour	_____
Agriculture	_____	Others	_____

9. Monthly income of the family _____Taka

HISTORY OF PRESENT PREGNANCY

10. What investigation have you done as part of ANC

_____

_____

_____

_____

_____

11. PREGNANCY STATUS

❒ LMP _____

❒ Duration of pregnancy at the date of interview _____

12. On examination

a) B.P(mm of Hg) _____

b) Oedema _____

13. Biochemical Investigation

❒ Hb%

❒ Albumin in urine

❒ Sugar in urine

14. Anthropometric measurement

- Weight in kg _____
- Height in cm _____
- MAC _____
- Skin fold thickness _____

15. Type of delivery:

Normal _____

Breech _____

Cesarean _____

Others _____

16. Outcome of pregnancy:

Live birth _____

Still birth _____

17. Duration of pregnancy:

Full term _____

Pre term _____

18. ANTHROPOMETRIC MEASUREMENT OF NEW BORN:

Birth weight _____ kg

Length _____ cm

Chest Circumference _____ cm

Head " Circumference _____ cm

Food Intake Of The Pregnant Mother

Food intake During Last 24 Hours

Food Time	Menu	Quality of the Food	Cooked weight of the food	Items used in the food	Uncooked Food
Morning					
Noon					
Afternoon					
Night					
Others/ Food Taken in Between Meals					
Gram Equivalent of Household Measures					
H/H Measures					
Gram					