**CALORIE REQUIREMENT OF THE PREGNANT WOMEN BASED ON TOTAL ENERGY EXPENDITURE**

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**Department of Applied Food Science and Nutrition**

**Faculty of Food Science and Technology**

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**Chittagong-4225, Bangladesh**

**December, 2016**

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S.M. Nazmus Shakib

December, 2016

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**This is to certify that we have examined the above Master’s thesis and have found that is complete and average in all respects, and that all revisions required by the thesis examination committee have been made.**

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This thesis is not free from mistakes. There may have some mistakes such as spelling, writings, designing the thesis errors despite my utmost effort. I apologized for these.

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**LIST OF ABBBRIRIATIONS**

|  |  |  |
| --- | --- | --- |
| ANC | : | Ante Natal care. |
| BMI | : | Body Mass Index. |
| BMR | : | Basal Metabolic Rate. |
| DLW | : | Doubly Labeled Water.  |
| ER | : | Energy Requirement. |
| FP | : | Family Planning. |
| HRM | : | Heart Rate Monitoring. |
| IUGP | : | Intra Uterine Growth. |
| LBW | : | Low Birth Weight. |
| PAL | : | Physical Activity Level. |
| PAR | : | Physical Activity Ratio. |

**Abstract**

The study was to assess the socio economic condition and proper energy requirements of pregnant women of different groups. This study is entirely conducted in the Chittagong district. 100 respondents from three Upaziallas are taken who was followed in their whole gestational period and data was collected from them by exclusive questionary.

The collected data was later analyzed by MS-XL software. At first Total Energy Expenditure was calculated by the standard formula provided by World Health Organization (WHO). The result shows that the calorie requirement for the pregnant women varies between 2000-2700 kcal/day in the first trimester which increases 80-90kcal/day, 250-300kcal/day and 450-500kcal/day in 1st, 2nd and 3rd trimester respectively. This requirement increases with the increase of age and gestational period. Weight gain and energy requirement has a positive relation. It has also seen that order of pregnancy has a profound effect of the calorie requirement of the pregnant women. It also seen that carbohydrate is the major source of energy and it provides 72% of the total energy to the women of this region. Majority of the women does not take proper food and hence don’t get adequate energy which is worsening the health status of the overall situation of the health status of pregnant mother and her baby.

# CHAPTER-01

## 1.1 Introduction

Dietary intake during pregnancy must provide the energy that will ensure the full-term delivery of a healthy newborn baby. The ideal situation is for a woman to enter pregnancy at a normal weight and with good nutritional status. Therefore, the energy requirements of pregnancy are those needed for adequate maternal gain to ensure the growth of the fetus, placenta and associated maternal tissues, and to provide for the increased metabolic demands of pregnancy, in addition to the energy needed to maintain adequate maternal weight, body composition and physical activity throughout the gestational period, as well as for sufficient energy stores to assist in proper lactation after delivery. Special considerations must be made for women who are under- or overweight when they enter pregnancy.

This consultation reviewed recent information on the association of maternal weight gain and body composition with the newborn birth weight, on the influence of birth weight on infant mortality, and on the associated metabolic demands of pregnancy (WHO, 1995a; Kelly *et al.,*1996; Butte and King, 2002), in order to perform factorial calculations of the extra energy required during this period. It was acknowledged that estimates of energy requirements and recommendations for energy intake of pregnant women should be population-specific, because of differences in body size, lifestyle and underlying nutritional status. Well-nourished women raised in affluent or economically developed societies may have different energy needs in pregnancy than women from low-income developing societies; pregnancy energy requirements of stunted or undernourished women may differ from those of overweight and obese women; and physical activity patterns may change during pregnancy to an extent that is determined by socio-economic and cultural factors. Even within a particular society, high variability is seen in the rates of gestational weight gain and energy expenditure of pregnant women, and therefore in their energy requirements.

## 1.2 Objectives of the Study

This study was designed to estimate the energy requirements pregnant women with different nutritional status and to explore energetic adaptations to pregnancy. The health and nutritional status of both mother and her baby depends on the environmental condition, socio economic status of the family, health condition of the mother and degree of antenatal and post natal health services a woman receives.

Objectives of this study are:

* To assess of the Demographic condition of the study population.
* To calculate the energy requirements for all ages, based on measurements and estimates of total daily energy expenditure and energy needs during pregnancy. And segregating them according to age and order of pregnancy.
* To assess of the contribution of the three macronutrient in the diet of the pregnant women

# CHAPTER-2 (Literature Review)

Extra dietary energy is required during pregnancy to make up for the energy deposited in maternal and fetal tissues and the rise in energy expenditure attributable to increased basal metabolism and to changes in the energy cost of physical activity. Weight gain during pregnancy results from products of conception (fetus, placenta, and amniotic fluid), increases in various maternal tissues (uterus, breasts, blood, and extracellular extravascular fluid), and increases in maternal fat stores. Energy requirements during pregnancy remain controversial because of conflicting data on maternal fat deposition and putative reductions in the mother’s physical activity as pregnancy advances.(Am J ClinNutr)

## 2.7 Prenatal fetus development

Pregnancy is typically broken into three periods or trimesters, each of about three months. While there are no hard and fast rules, these distinctions are useful in describing the changes that take place over time.

### 2.7.1First trimester

Comparison of growth of the abdomen between 26 weeks and 40 weeks gestation. (SP Poterfield, CE Henrich, 1993)

Traditionally, doctors have measured pregnancy from a number of convenient points, including the day of last menstruation, ovulation, fertilization, implantation and chemical detection. In medicine, pregnancy is often defined as beginning when the developing embryo becomes implanted into the endometrial lining of a woman’s uterus. In some cases where complications may have arisen, the fertilized egg might implant itself in the fallopian tubes or the cervix, causing an ectopic pregnancy. Most pregnant women do not have any specific signs or symptoms of implantation, although it is not uncommon to experience light bleeding at implantation. Some women will also experience cramping during their first trimester. This is usually of no concern unless there is spotting or bleeding as well. The outer layers of the embryo grow and form a placenta, for the purpose of receiving essential nutrients through the uterine wall, or endometrium. The umbilical cord in a newborn child consists of the remnants of the connection to the placenta. The developing embryo undergoes tremendous growth and changes during the process of fetal development. (PH Wadhwa.2005)

* Morning sickness can occur in about seventy percent of all pregnant women and typically improves after the first trimester.
* In the first 12 weeks of pregnancy the nipples and areolas darken due to a temporary increase in melanin.
* Most miscarriages occur during this period.

### 2.7.2 Second trimester

Months 4 through 6 of the pregnancy are called the second trimester. Most women feel more energized in this period, and begin to put on weight as the symptoms of morning sickness subside and eventually fade away.

In the 20th week the uterus, the muscular organ that holds the developing baby, can expand up to 20 times its normal size during pregnancy.

Although the fetus begins moving and takes a recognizable human shape during the first trimester, it is not until the second trimester that movement of the fetus, often referred to as “quickening”, can be felt. This typically happens in the fourth month more specifically in the 20 to 21 week or by the 18th week if you’ve been pregnant before. However, it is not uncommon for some women to not feel the baby move until much later. The placenta is now fully functioning and the fetus is making insulin and urinating. The reproductive organs can be recognized, and can distinguish the fetus as male or female. (SP Poterfield , CE Henrich, 1993)

2.7.3 Third trimester

Final weight gain takes place, which is the most weight gain throughout the pregnancy. The fetus will be growing the most rapidly during this stage, gaining up to 28g per day. The woman’s belly will transform in shape as the belly drops due the fetus turning in a downward position ready for birth. During the second trimester, the woman’s belly would have been very upright, whereas in the third trimester it will drop down quite low, the woman will be able to lift her belly up and down. The fetus begins to move regularly, and is felt by the woman. Fetal movement can become quite strong and be disruptive to the woman. The woman’s navel will sometimes become convex, “popping” out, due to her expanding abdomen. This period of her pregnancy can be uncomfortable, causing symptoms like weak bladder control and back-ache. Movement of the fetus becomes stronger and more frequent and via improved brain, eye, and muscle function the fetus is prepared for ex-utero viability. The woman can feel the fetus “rolling” and it may cause pain or discomfort when it is near the woman’s ribs and spine.

It is during this time that a baby born prematurely may survive. The use of modern medical intensive care technology has greatly increased the probability of premature babies surviving, and has pushed back the boundary of viability to much earlier dates than would be possible without assistance. In spite of these developments, premature birth remains a major threat to the fetus, and may result in ill-health in later life, even if the baby survives.(SP Poterfield , CE Henrich,1993)

**Development of fetus from 1-8 weeks**



**Figure 01: Development of fetus (from 1-8 weeks)**



**Development of fetus from 9-20 weeks**

**Figure 02: Development of fetus (From 9-20 weeks)**

## 2.8 Gestational Weight Gain and Optimal Pregnancy Outcome

The WHO Collaborative Study on Maternal Anthropometry and Pregnancy Outcomes (WHO, 1995a; Kelly *et al.,*1996) reviewed information on 110 000 births from 20 countries to determine anthropometric indicators associated with poor foetal outcomes, such as low birth weight (LBW), intrauterine growth retardation (IUGR) and pre-term birth, and with poor maternal outcomes, such as pre-eclampsia, eclampsia, need for assisted delivery, and postpartum hemorrhage. Attained maternal weight (pre-pregnancy weight plus weight gain) was the most significant predictor of LBW and IUGR. Low pre-pregnancy weight and BMI, and weight gain between 20 and 28 weeks of gestation were moderate predictors of pre-term delivery and low maternal height (e.g. 146 compared with 160 cm) was a moderate predictor of caesarean delivery . (Merchant, Villar and Kestler, 2001).

Women with short stature, especially in developing countries with inadequate health care systems and high prevalence of impaired growth during childhood, are also at high risk of LBW and pre-term delivery, and of obstetric complications during labor and delivery (WHO, 1995a; Martorell *et al.,* 1981). A study of healthy women with uncomplicated pregnancies in the United States showed a positive association between maternal height and birth weight among white, black and Asian women, but not Hispanic women (Picket, Abrams and Selvin, 2000).

### 2.8.1 Desirable birth weight and gestational weight gain

Weight gain during pregnancy comprises the products of conception (fetus, placenta, amniotic fluid), the growth of various maternal tissues (uterus, breasts) and the increase in blood, extracellular fluid and maternal fat stores. The desirable amount of weight to be gained is that which is associated with optimal outcome for the mother, in terms of preventing maternal mortality and complications of pregnancy, labor and delivery, and allowing adequate postpartum body weight and lactation performance; and with optimal outcome for the infant, in terms of allowing adequate foetal growth and maturation, and in the prevention of gestational and prenatal morbidity and mortality. The WHO Collaborative Study on Maternal Anthropometry and Pregnancy Outcomes showed that birth weights between 3.1 and 3.6 kg, with a mean of 3.3 kg, were associated with the optimal ratio of good foetal and maternal outcomes (WHO, 1995a; Kelly *et al.,* 1996). The range of maternal gestational weight gains associated with such birth weights was between 10 and 14 kg, with a mean of 12 kg. This is in agreement with earlier estimates that healthy women in developing countries, who eat in accordance with appetite, gain 10 to 12 kg (Institute of Medicine, 1992). An analysis of gestational weight gains associated with optimal outcomes and full-term delivery of 3- to 4-kg infants in the United States gave a similar although somewhat higher range (11.5 to 16.0 kg) for women with pre-pregnancy BMI between 19.8 and 26.0 (Institute of Medicine/Food and Nutrition Board, 1990; Abrams, Altman and Pickett, 2000).

This consultation endorsed the WHO recommendation that healthy, well-nourished women should gain 10 to 14 kg during pregnancy, with an average of 12 kg, in order to increase the probability of delivering full-term infants with an average birth weight of 3.3 kg, and to reduce the risk of foetal and maternal complications.

## 2.9 Determinants of the Energy Cost of Pregnancy

The energy cost of pregnancy is determined by the energy needed for maternal gestational weight gain, which is associated with protein and fat accretion in maternal, foetal and placental tissues, and by the increase in energy expenditure associated with basal metabolism and physical activity. It was estimated by previous FAO/WHO/UNU expert committees and consultations (FAO/WHO, 1973; WHO, 1985) through factorial calculations based on a theoretical model that assumed an average gestational weight gain of 12.5 kg, an average infant birth weight of 3.4 kg, cumulative deposition of 925 g protein and 3 825 g fat, an efficiency of energy utilization of 90 percent, and a cumulative increment of 150 MJ in BMR (Hytten, 1980; Hytten and Chamberlain, 1991). Since then, several longitudinal studies in developed and developing countries have allowed for the revision of these theoretical estimates.

### 2.9.1 Protein and fat deposition during pregnancy

Protein is deposited predominantly in the foetus (42 percent), but also in the uterus (17 percent), blood (14 percent), placenta (10 percent) and breasts (8 percent) (Hytten, 1980; Hytten and Chamberlain, 1991). Total protein deposition has been estimated indirectly from calculations of total body potassium accretion, measured by whole body counting in a number of studies of pregnant women (Butte and King, 2002). Based on results of the most reliable longitudinal studies, which involved 93 women in Sweden (Forsum, Sadurskis and Wager, 1988), the United Kingdom (Pipe *et al.,* 1979) and the United States (King, Calloway and Margen, 1973; Butte *et al.,* 2003), and assuming a potassium to nitrogen (K:N) ratio of 2.15 meq K/g N in foetal tissues, protein deposition was estimated at 686 g, in association with a gestational weight gain of 13.8 kg (Butte and King, 2002). The corresponding protein gain associated with the mean weight gain of 12 kg (range 10 to 14 kg) observed in the WHO collaborative study would be 597 g (range 497 to 696 g).

Cumulative fat deposition in foetal and maternal tissues contributes substantially to the overall energy cost of pregnancy. Therefore, methodological errors in the estimation of fat accretion can affect significantly the calculation of energy requirements. Calculations based on skin-fold measurements lack the precision for an accurate estimate of changes in fat mass during pregnancy, because fat accumulation is not distributed evenly in all parts of the body. Two-component body composition models based on measurement of total body water, body density or total body potassium are acceptable only if they include appropriate corrections to account for pregnancy-related changes in the hydration, density and potassium content of fat-free mass (Butte and King, 2002). Three- and four-component models where the hydration or density of fat-free mass is measured are acceptable to calculate body fat at various stages of pregnancy.

Fat accretion was calculated from the results of 11 longitudinal studies that used three- and four-component body composition models, or two-component models with corrected constants, in 273 well-nourished pregnant women from the Netherlands (van Raaij *et al.,* 1988; Spaaij, 1993; de Groot *et al.,* 1994), Sweden (Forsum, Sadurskis and Wager, 1988; Sohlström and Forsum, 1997), the United Kingdom (Pipe *et al.,* 1979; Goldberg *et al.,* 1993) and the United States (Butte *et al.,* 2003; Lederman *et al.,* 1997; Lindsay *et al.,* 1997; Kopp-Hoolihan*et al.,* 1999a). Mean fat accretion measured up to 36 weeks of gestation was 3.7 kg, associated with a mean weight gain of 11.9 kg. Extrapolating the calculations to 40 weeks of gestation increased mean fat accretion to 4.3 kg, associated with a mean weight gain of 13.8 kg (Butte and King, 2002). The fat gain associated with the mean weight gain of 12 kg (range 10 to 14 kg) observed in the WHO collaborative study would be 3.7 kg (range 3.1 to 4.4 kg).

Rates of fat accretion during the first, second and third trimesters of pregnancy were available in a subset of the studies mentioned (Forsum, Sadurskis and Wager, 1988; Pipe *et al.,* 1979; Butte *et al.,* 2003).These were, on average, 8 g/day in the first trimester, and 26 g/day in the second trimester. Results varied markedly in the third trimester, from -7 to 23 g/day (average: 8 g/day), but if the three studies with very low mean values (-7.0, -1.4 and 4.8 g/day) are excluded from calculations, the average accretion rate would be 18 g fat/day in the third trimester.

### 2.9.2 Basal metabolism in pregnancy

Basal metabolism increases in pregnancy as a result of accelerated tissue synthesis, increased active tissue mass, and increased cardiovascular and respiratory work. Several studies have measured basal or resting metabolic rate at several stages of pregnancy. As energy requirements should be based on healthy populations with favorable pregnancy outcomes, this consultation only considered the results of studies that involved healthy, well-nourished groups of women with adequate weight gains during pregnancy, who gave birth to infants with adequate weights.(van Raaij *et al.,* 1987; Spaaij *et al.,* 1994; Piers *et al.*).

Several Studies conducted by WHO Shows that the cumulative increment in BMR calculated in relation to pre-pregnancy values, or to early pregnancy values when pre-pregnancy BMR was not available, ranged from 124 to 200 MJ, with an average increase of 154 MJ for the entire gestational period. The variation in BMR during pregnancy, which is further illustrated by a striking reduction well into the third trimester of pregnancy found among undernourished Gambian women (Lawrence *et al.,* 1987), a depression in BMR up to 24 weeks of gestation reported in groups of well-nourished United Kingdom (Prentice *et al.,* 1989) and Netherlands (Spaaij, 1993) women.Cumulative increases in BMR are significantly correlated with gestational weight gain (r = 0.79; p < 0.001) and pre-pregnancy percentage fat mass (r = 0.72; p < 0.001) (Prentice *et al.,* 1996). Hence, the cumulative increase of 154 MJ associated with an average gestational weight gain of 12.5 kg (Table 6.1) would correspond to 148 MJ for a weight gain of 12 kg. These values are remarkably close to the 150 MJ estimated from changes in oxygen consumption of individual organs (Hytten, 1980), which was used by previous expert consultations (FAO/WHO, 1973; WHO, 1985).

### 2.9.3 Total energy expenditure(TEE) during pregnancy

A review of 122 studies on practices related to work and pregnancy indicated that in most societies women were expected to continue with partial or full household and other duties throughout most of pregnancy (Institute of Medicine, 1992). Similarly, a review and summary of time-motion studies in Scotland, the Netherlands, Thailand, the Philippines, the Gambia and Nepal did not find conclusive evidence that women engaged in less activity during pregnancy and thus reduced their energy expenditure (Prentice *et al.,* 1996). But these studies did not give information about changes in the intensity of the effort associated with habitual tasks. However, there was a suggestion of increased efficiency in energy utilization for physical activity during pregnancy, as the energy cost of weight-bearing activities remained fairly constant during the first two trimesters of pregnancy, even though body weight had increased by 5 to 8 kg by the end of the second trimester (Prentice *et al.,* 1996).

Longitudinal measurements with DLW in free-living, well-nourished women in Sweden (Forsum *et al.,* 1992), the United Kingdom (Goldberg*et al.,* 1993 and 1991) and the United States (Butte *et al.,* 2003; Kopp-Hoolihan *et al.,* 1999b) showed a mean increase of 16.5 percent in TEE by the third trimester of pregnancy, compared with non-pregnant values Some of these studies provided information at each trimester of pregnancy and in the non-pregnant state, suggesting that TEE increased by about 1, 6 and 17 percent in the first, second and third trimesters of pregnancy, respectively. This was proportional to recorded increments in weight gain of 2, 8 and 18 percent during the same periods ((Butte and King, 2002). The relationship between TEE and weight gain is reflected in the lack of difference between non-pregnant and pregnant women when TEE is expressed per kilogram of body weight. The estimated increments in TEE were 100, 400 and 1500 kJ/day (25, 95 and 360 kcal/day) in the first, second and third trimesters of pregnancy, respectively, in association with an average weight gain of 13.8 kg (Butte and King, 2002). For an average gain of 12 kg, the corresponding values would be 85, 350 and 1 300 kJ/day (20, 85 and 310 kcal/day).

Cross-sectional studies with DLW, HRM or time-motion techniques in Colombia (Heini *et al.,* 1991)studies in the Gambia, showed a slight decrease in TEE, ranging from 1 to 7 percent, and larger reductions, from 10 to 38 percent, in AEE by the third trimester of pregnancy, relative to non-pregnant controls (Butte and King, 2002). This was consistent with observations that many women perform less arduous tasks as they approach at the end of pregnancy.

## 2.10 Special Considerations for Malnourished, Obese And Adolescent Pregnant Women

Under nutrition, whether manifested as underweight or as stunting and obesity increase the risk of poor maternal and fetal outcomes. Ideally, women should begin pregnancy at a healthy weight, defined as a BMI between 18.5 and 24.9 Adolescent girls who are pregnant must fulfill the dietary requirements imposed by growth associated with their age, in addition to the extra demands of pregnancy.(WHO, 1995a; March of Dimes, 2002).

### 2.10.1 Pregnancy and under nutrition

A large number of women in many parts of the world enter pregnancy at suboptimal weight and/or height. An analysis of studies in 20 countries (Kelly *et al.,* 1996) showed that in ten countries many women had pre-pregnancy weights of < 50 kg and heights of < 150 cm. These cut-off points were associated with increased risks of maternal complications. In addition, weight below 45 kg or height below 148 cm were associated with poor foetal outcomes. The linear relationship between gestational weight gain and birth weight is influenced by maternal pre-pregnancy BMI, such that women with a BMI < 18.5 must gain more weight than those with a normal BMI in order to have babies with adequate birth weight. It is then particularly important that underweight women increase their energy intake to gain the prescribed 10 to 14 kg during pregnancy, depending on their height (e.g. taller women should strive for a weight gain of 14 kg). Gestational weight gains as high as 18 kg have been suggested for undernourished women (Institute of Medicine/Food and Nutrition Board, 1992).

The association of short stature with increased risk of either delivering a low birth weight infant or requiring special assistance during delivery owing to cephalo-pelvic disproportion (Merchant, Villar and Kestler, 2001) indicates the importance for such women to have adequate prenatal attention and access to appropriate care during labour and delivery. This also reinforces the recommendations for good nutrition and measures to prevent repeated infections during childhood, which may result in stunting and in pregnancy-related problems at a later age.

### 2.10.2 Pregnancy and obesity

Maternal obesity is also associated with a higher risk of maternal and foetal complications. As for under nutrition, the relative risks of neural tube defects, congenital malformations and pre-term delivery are higher in overweight and obese women (March of Dimes, 2002). Incidences of hypertension, gestational diabetes and the need for caesarean section operations are also higher than in women with normal weight. Women with a pre-pregnancy BMI > 25 tend to have babies with high birth weights, even when the women have relatively low gestational weight gains (Institute of Medicine/Food and Nutrition Board, 1992; Shapiro, Sutija and Bush, 2000). As this may lead to problems during delivery, it is likely that such women will be better off gaining weight at, or somewhat below, the lower limit of the 10 to 14 kg range recommended for women with normal BMI. It has been suggested that weight gain should be as low as 7 kg for women who enter pregnancy with BMI > 26 (Institute of Medicine/Food and Nutrition Board, 1992).

# Chapter -3

## 3.1 Methodology

In this study the information about the pregnant women was collected through several stages. First, three upazilas were selected namely, Raozan, Baskhali, and Hathazari. From the list of Upazilas two unions (Lowest administrative unit) were selected based on random principle. This produced 6 unions from 3 upazillas. A house to house survey with house hold head with the respondent was then conducted in all 6 unions in order to locate pregnant women. These women were subsequently interviewed with a detail questionnaire and properly trained qualified women interviewer interviewed them in some privacy at home. All pregnancy related information presented in this study relates to their current pregnancy.

## 3.2 Research design

A cross sectional study was conducted to find out the rate of increase in the calorie requirement

## 3.3 Sampling method

It was a purposive sampling. Information was taken from the women who were available then.

## 3.4 Sampling instrument

To gather data a set of questionnaire had been used. In this research structured questionnaire method had been used like close end question. These include multiple choice question which offers respondent the ability to answer yes or no or choose from a list of several answer choices.

It is the most effective technique to collect data because of the following:

1. Respondents secrecy can be maintained.

2. In this study 100 respondents were conducted. It is not possible to take personal interview of all entire respondents. Therefore survey questionnaire is the most effective technique.

3. Internet service is not widespread in our country therefore only internet survey is inappropriate for collecting data in this research.

## 3.5 Data collection

There are two sources of data for conducting this research:

1.Primary source

2.Secondary source.

To collect data from primary source questionnaire and interview method had been used. As a secondary source of data internet, magazine or other marketing research materials had been used.

The proposed study is an analysis of different numerical data. As a result the collected data was analyzed by MS XL software as a statistical analysis tool as it offers greater flexibility of data  analysis and visualization.

Total Energy Expenditure (TEE) is calculated by using the following formula.

TEE=BMR\*PAL (FAO/WHO, 2004; James and Schofield, 1990)

Basal Metabolic Rate (BMR) is calculated by the

BMR=655+9.6(Wt) +1.8(Ht)-4.7(age) (FAO/WHO, 2004; James and Schofield,1990)

Wt= Weight in Kg

Ht=Height in cm

Age= age in years.

Classification of Physical Activity Level (PAL), (FAO 2004)

|  |  |
| --- | --- |
| Category | PAL value |
| Sedentary or light activity lifestyle | 1.40-1.69 |
| Active or moderately active lifestyle | 1.70-1.99 |
| Vigorous or vigorously active lifestyle | 2.00-2.40 |

\*PAL values< 1.40 indicate extremely inactive lifestyle.

\*PAL values >2.40 are difficult to maintain over a long period of time.

# CHAPTER-04

# RESULT

## 4.1 PROFILE OF SAMPLE PREGNANT WOMEN

Table 1 present background characteristics of the sample pregnant women. As shown by them, majority sample women are younger, 19 percent of them is aged below 20 years and those aged between 20-24 represent 34 percent of them is aged above 35 years including 2 percent of them aged 40+

For 35% of them, the current pregnancy is the first order one, it is second order pregnancy for 57% and for 8% the current pregnancy is the third or higher order.

These data indicate the fact that rural women complete most part of their reproduction by age 30-35 and substantial decline has occurred in recent years in the higher order births of women above distribution of pregnancy order may be realistic.

Nearly half of them (48%) is in the third trimester (pregnant for 4-6 months), and 14 percent is in the first trimester (pregnant for 3 months or less). Majority sample women are illiterate. Such women represent nearly two-third, 19 percent is educated up to primary level (grade 1-5), 12 percent up to secondary level (grade 6-10), and those with beyond secondary level education comprises of 4 percent. The matched figures for husband’s education are respectively 55, 21, 13 and 11 percent. Most of them (nearly two-third) belong to the poorer households with no or minimal landholding of less than half acre. Only 10 percent of them belong to households with more 2.50 acre of land and remaining 27 percent belongs to in-between land category (0.51 to 2.50 acres). The economically active women are few in numbers among them. Only 15 percent belong to this category and remaining 85 percent is housewife.

### 4.1.1Distribution of Sample Pregnant Women by Socio-economic and Demographic Characteristics

**Fig-03: Distribution of the women of Reproductive age according to age of the women**

Information was collected from married women of reproductive age. The distribution of women of reproductive age according to age is shown in the fig-.. Majority of the women of the study population was age between 20- 24 years which is suitable for pregnancy. Fewer cases were found where women are becoming pregnant above 30 years.

**Table 01: Distribution of women of reproductive age according by the level of education received by their husband**

|  |  |  |
| --- | --- | --- |
| **Husband’s education** | **Frequency** | **Percent** |
| No education  | 3 | 3.0 |
| Primary complete | 59 | 59.0 |
| SSC complete | 15 | 15.0 |
| HSC complete | 17 | 17.0 |
| Graduate and above | 6 | 6.0 |
| Total | 100 | 100.0 |

**Table 02: Distribution of women of reproductive age by the occupation of their husbands**

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| **Husband’s occupation** | **Frequency** | **Percent** |
| Farmer | 16 | 16.0 |
| Day Labor | 26 | 26.0 |
| Small Business | 17 | 17.0 |
| Service | 24 | 24.0 |
| School Teacher | 3 | 3.0 |
| Business | 4 | 4.0 |
| Foreign service | 5 | 5.0 |
| Driver | 5 | 5.0 |
| Total | 100 | 100.0 |

Though Husband’s occupation and their level of education do not have a direct effect on the calorie requirement of the pregnant women but it was seen in this study that women whose husband education level is SSC or higher are more aware about the health related problem and antenatal care and post natal care of the pregnant mother. In this study it was also seen that woman whose husband is either service holder or school teacher receives more pre-natal and post-natal care. In table-01 and table 02 the distribution of women of reproductive age according to their husband’s education level and their profession is shown In this study 38% respondents were found where women has husband whose education level is SSC or higher. Majority of the respondents are found that their husband’s had completed primary education.

**Table 03: Distribution of women of reproductive age by their economic status**.

|  |  |  |
| --- | --- | --- |
|  | **Frequency** | **Percent** |
| **Have own homestead** |  |  |
| Yes | 69 | 69.0 |
| No | 31 | 31.0 |
| Total | 100 | 100.0 |
| **Have any own land other than homestead** |  |  |
| Yes | 31 | 31.0 |
| No | 69 | 69.0 |
| Total | 100 | 100.0 |
| **Household food consumption all the year** |  |  |
| Deficit in whole year | 27 | 27.0 |
| Sometimes deficit | 28 | 28.0 |
| Neither deficit nor surplus | 37 | 37.0 |
| Surplus | 8 | 8.0 |
| Total | 100 | 100.0 |

Economic status of the respondents households are described in Table 03. Sixty nine percent of the respondents do stay in their own homestead and only 31% of the respondents have any cultivable land in their position. Respondents were asked whether they thought their household was a surplus or deficit household in terms of food consumption. Only 8% of the respondents indicated that they have a surplus of food, while 37% of the respondents mentioned that they have neither a deficit nor a surplus of food and 27% of the respondents always have sometimes deficit.

**Table 04: Distribution of women of reproductive age by visit to health center**

|  |  |  |
| --- | --- | --- |
|  | Frequency | Percent |
| **With whom go to health center** |  |  |
| Alone | 16 | 16.0 |
| With husband | 45 | 45.0 |
| With relatives/neighbor | 39 | 39.0 |
| **Total** | **100** | **100.0** |
| **Whom Need permission to go to health center** |  |  |
| Husband | 85 | 85.0 |
| Parents in Law | 15 | 15.0 |
| **Total** | **100** | **100.0** |

Education, exposure to media, and work participation are some of the means by which women gain status and autonomy, both important aspects of their empowerment. To measure women’s autonomy and freedom of movement respondents were asked whether they go alone to the health center which has presented in Table-05. Only 16% of women say that they go alone to the health center and rest of others either with their husband or with neighbors go to the health centers.

All the participants mentioned they need to take permission before go to the health center. 85% of the women need to take permission from their husbands’ and 15% from their parents in law. In case of final decision majority have mentioned that husband decide to go to health center.

**Table 05: Distribution of women of reproductive age by the number of child they have at present**

|  |  |  |
| --- | --- | --- |
|  | **Frequency** | **Percent** |
| **Order of pregnancy** |  |  |
| 1st | 35 | 35.0 |
| 2nd | 57 | 57.0 |
| 3rd or above | 8 | 8.0 |
| Total | 100 | 100.0 |
| **Given birth to a child who born alive but died later** |  |  |
| Yes | 34 | 34.0 |
| No | 66 | 66.0 |
| Total | 100 | 100.0 |

The distribution of all women by number of children they had is presented in Table 6. The table shows that more than half of the respondents are in the second order of pregnancy and only 8% have more than two children. Thirty four percent of the respondents have a history of child death.

**Table 06: Distribution of women of reproductive age by knowledge of FP methods**

|  |  |  |
| --- | --- | --- |
|  | Frequency | Percent |
| **Heard about FP methods** |  |  |
| Yes | 100 | 100.0 |
| Total | 100 | 100.0 |
| **Whom/where  first heard about FP methods** |  |  |
| Satellite clinic | 2 | 2.0 |
| Field workers | 4 | 4.0 |
| Relatives/Friends | 62 | 62.0 |
| Reading materials | 30 | 30.0 |
| Radio/TV | 2 | 2.0 |
| Total | 100 | 100.0 |
| **Use FP method to avoid pregnancy** |  |  |
| Yes | 69 | 69.0 |
| No | 31 | 31.0 |
| Total | 100 | 100.0 |
| **Method used to avoid pregnancy** |  |  |
| Oral pill | 45 | 65.2 |
| Injection | 15 | 21.7 |
| Norplant/Implant | 3 | 4.3 |
| Condom | 6 | 8.7 |
| Total | 69 | 100.0 |

Knowledge of family planning methods is presented in Table 06. Findings show that virtually all the respondents know about family planning methods. More than half (69%) of the respondents have ever used any family planning methods and among them majority (65.2%) has taken oral pill to avoid pregnancy.

The most commonly known family planning methods among women are the pill (82%) and injection (73%), followed by condom (56%) Norplant (16%), female sterilization (4%). Sixty two percent of the respondents mentioned they have heard about FP first from their relatives or friends.

**Fig-04: Distribution of the women of reproductive age according to their awareness of the health risk of pregnant women**

To assess the knowledge about the health risk of pregnant women respondents were asked whether they can identify the potential health risk of a pregnant woman.

One third of the women do not know any health risks of a pregnant mother. Forty six percent of the respondents mentioned prolonged labor as a major health risk followed by risk to life of mother (26%), eclampsia (19%), obstructed labor (13%), and risk to life of baby (8%).

**Table 07: Distribution of women of reproductive age by place of receiving of ANC**

|  |  |  |
| --- | --- | --- |
|   | Frequency | Percent |
| From where pregnant women can get ANC, PNC & delivery care\* |  |  |
| District hospital                             | **37** | **37.0** |
| Maternal and child welfare center             | **2** | **2.0** |
| Upazila health complex                        | **6** | **6.0** |
| Health and family welfare center              | **37** | **37.0** |
| Satellite clinic/EPI outreach                  | **8** | **8.0** |
| Doctors/service providers                     | **46** | **46.0** |
| Field workers                                 | **10** | **10.0** |
| NGO clinic                                    | **2** | **2.0** |
| Private clinic/hospital                       | **7** | **7.0** |
| **Total** | **100** | **100** |

Table-07 shows the health seeking behavior of women during pregnancy. Respondents were asked from where one can get pregnancy care and table shows that 45% of the respondents identified public hospitals and 37% health and family welfare centers for pregnancy care, 46% qualified doctors and 9% of the respondents mentioned abut NGO clinic or hospital.

Respondents were asked whom they have heard about pregnancy care and half of the respondents mentioned about field workers. One fourth of the respondents said they heard from qualified service providers and 28% mentioned about relatives. Ninety eight percent of the women think women should go for ANC and 54% think it should be in case of complications. Only 17% said women should go at one to three months of pregnancy duration.

**Table 08: Distribution of women of reproductive age by knowledge of ANC**

|  |  |  |
| --- | --- | --- |
|   | Frequency | Percent |
| **Whom you heard about ANC, PNC & delivery care.** |  |  |
| Upazila health complex | 2 | 2.0 |
| Health and family welfare center              | 6 | 6.0 |
| Doctors/Service providers                     | 25 | 25.0 |
| Field workers                                 | 50 | 50.0 |
| Relatives | 28 | 28.0 |
| Reading materials                             | 4 | 4.0 |
| Total | **100** |  |
| **Pregnant women should go for medical checkup** |  |  |
| Yes | 98 | 98.0 |
| Don’t know | 2 | 2.0 |
| Total | **100** | **100.0** |

 As the pregnant women responded to the question, whom you heard about ANC, PNC &  delivery care, the response were as followed Upazila health complex2%, Health and family welfare center 6%, Doctors/Service providers 25%, Field workers 50%, Relatives28%, Reading materials 4%.

Pregnant women should go for medical checkup, the answer were; Yes98%, Don’t know**–**2%.

The respondents described that in case of any complications the pregnant women usually go to seek health care (54%), other 17% told that during 1-3 months of pregnancy the women go to seek health care and 29% women said that they have no idea about it.

**Table 09: Distribution of women of reproductive age by ANC visit**

|  |  |  |
| --- | --- | --- |
|  | **Frequency** | **Percent** |
| **Take ANC during last pregnancy** |  |  |
| Yes | 94 | 94.0 |
| No | 6 | 6.0 |
| Total | 100 | 100.0 |
| Number of ANC visits |  |  |
| No antenatal care | 6 | 6.0 |
| One time | 8 | 8.0 |
| Two to three times | 60 | 60.0 |
| More than three times | 26 | 26.0 |
| Total | 100 | 100.0 |
| **Number of months pregnant at the time of first visit** |  |  |
| Less than six months | 66 | 70.2 |
| Six to seven months | 4 | 4.3 |
| More than seven months | 2 | 2.1 |
| Don’t know | 22 | 23.4 |
| Total | 94 | 100.0 |

Respondents were asked whether they went for ANC in their last pregnancy and it is found that 94% of the women had ANC. Among them 60% visit two or three times and 26% more than three times. Sixty six percent of the respondents said they visited when they were less than six months of pregnant. Those who did not take ANC they mentioned not perceived as necessary (16.7%), too far (33%), religious bindings (16.7%) and don’t know about the service (33.3%).

33% respondents do not know about the health services, 17% think that the health services are no a necessary things and the same percentage were not attend the health services due to religious bindings and 33% did not attend as the health centers are so far from their houses.

**Table 10: Distribution of women of reproductive age by service provider for ANC**

|  |  |  |
| --- | --- | --- |
|  | **Frequency** | **Percent** |
| **From whom seek  ANC during last pregnancy\*** |  |  |
| Qualified doctor                              | 28 | 29.8 |
| Nurse/Midwife/Paramedic                       | 17 | 18.1 |
| Family welfare visitor                        | 60 | 63.8 |
| HA/FWA                                        | 7 | 7.4 |
| Village doctor                                | 3 | 3.2 |
| **Total** | **94** |  |

Table-10 shows that, respondents were asked from whom they took the ANC. Sixty percent of the respondents sought treatment from Family Welfare Visitor (FWV) and 28% from a qualified doctor.

**Table-11: Distribution of women of reproductive age by ANC services**

|  |  |  |
| --- | --- | --- |
|   | Frequency | Percent |
| Services provided during ANC\* |  |  |
| Weight measured | 77 | 81.9 |
| Height measured                               | 55 | 58.5 |
| Check blood pressure                          | 88 | 93.6 |
| Test urine                                    | 42 | 44.7 |
| Test blood                                    | 26 | 27.7 |
| Exam eye for anemia                           | 10 | 10.6 |
| Ultrasonography | 26 | 27.7 |
| Total | **94** |  |
|  | **Frequency** | **Percent** |
| TT injection was given during ANC visit |  |  |
| Yes | 92 | 97.9 |
| Don’t know | 2 | 2.1 |
| Total | 94 | 100.0 |
| Number of TT injection given |  |  |
| One | 10 | 10.6 |
| Two | 68 | 72.3 |
| Three | 8 | 8.5 |
| More than three | 6 | **6.3** |
| Don’t know | 2 | **2.1** |
| Total | **94** | **100.0** |

**Table-12: Distribution of women of reproductive age by delivery care**

|  |  |  |
| --- | --- | --- |
|   | Frequency | Percent |
| Last delivery was assisted by |  |  |
| Qualified doctor | 20 | 20.0 |
| Nurse/Midwife/Paramedic | 3 | 3.0 |
| Family Welfare Visitor | 6 | 6.0 |
| TBA | 57 | 57.0 |
| Village doctor | 2 | 2.0 |
| Relatives/Neighbor/Friend | 12 | 12.0 |
| **Total** | **100** | **100.0** |

Table-12 presents the distribution of births by place of delivery and whom last delivery was assisted. Children delivered with the assistance from qualified doctors are 20%, and majority is delivered by TBA (57%). Seventy seven percent of the births occur at home. Twenty percent of the delivery occurs in public hospital and another 3% in private health care centers. Thirty two percent of the respondents mentioned they did not spend any money for delivery, 38% spend up to taka 1000 and another 13% spend about 15000 taka for delivery care.

As respondents responded about the birth place of their last child; District hospital 17%, Maternal and child welfare center 2%, Upazila health complex1%, Private clinic/hospital 3%, Home77%.

**Table 13: Distribution of women of reproductive age by knowledge of health centers**

|  |  |  |
| --- | --- | --- |
|  | Frequency | Percent |
| Know the nearest health facility center |  |  |
| Yes | 100 | 100.0 |
| Total | **100** | **100.0** |
| Know the service providers located in nearest health facility\* |  |  |
| Qualified service provider                              | 96 | 96.0 |
| Govt. of NGO field worker                     | 100 | 100.0 |
| Total | **100** |  |

Respondents were asked whether they know the nearest health center in her locality (Table 13). Findings suggest all the participants know the health center near by their home and all the participants know the field worker in her locality. Sixty two percent of the respondents mentioned health worker visited her home in the last six months.

**Table-14: Distribution of women of reproductive age by quality of health services**

|  |  |  |
| --- | --- | --- |
|  | **Frequency** | **Percent** |
| Visited any health center in the last 12 months |  |  |
| Yes | 25 | 25.0 |
| No | 75 | 75.0 |
| Total | **100** | **100.0** |
| Satisfaction level for the service |  |  |
| Satisfied | 25 | 100.0 |
| Total | **25** | **100.0** |

Respondents health seeking behavior was assess in the survey. Table-14 shows that only one fourth of the respondents visited any health center in the last one year for seeking any services. Fifty two percent of the respondents visited for general diseases treatment, 36% for FP service and 24% for ANC. All of them said they were satisfied with the service provided to them and 72% said they did not need to pay any money for the service.

## 4.2 Average calorie requirement of the sample population:

Pregnancy is a special physiological condition where 12kg weight gain throughout the pregnancy period is considered as standard to ensure the full term delivery of a healthy baby. This weight gain is the total growth of the foetus, placenta and associated maternal tissues. For these extra growths extra energy is needed from the beginning of the conception and the requirement increases with the increase of the gestational period

In the following tables the finding of this study is shown and the findings are segregated into two separate section. First one is the average increase of the Total Energy Expenditure of the women in the hilly Region and the Second one is the Average increase of the Total Energy Expenditure of the women of the plain land. In this study it is considered that the Physical Activity Level of all pregnant women is **“Moderate”.**

**Average calorie requirement of the women of plain land**

**TABLE 15: Average calorie requirement according to age**

|  |  |
| --- | --- |
| CATEGORY(According to age) | CALORIE REQUIREMENT(in Kcal/day) IN DIFFERENT STAGES OF GESTITIONAL PERIOD |
| 1st Trimester | 2nd trimester | 3rd trimester |
| Less than 20 years | 2096.641 | 2336.42 | 2816.16 |
| 20 – 24 years | 2196.31 | 2486.54 | 2945.481 |
| 25 – 29 years | 2458.24 | 2745.563 | 3204.59 |
| 30 years and above | 2586.915 | 2879.23 | 3352.75 |

Average energy requirements for the pregnant women who are studied in this study were calculated considering the TEE value of different trimester is stated above. After considering all the factors the Average calorie requirement for the pregnant women is found 2334.53 kcal/day in first trimester. This requirement increases 80-90 kcal/day in first trimester, 200-300 kcal/day in the second trimester and400-500 kcal/day in the third trimester.

Order of pregnancy has some profound effect of the calorie requirement of the pregnant women. It is obvious that the mother who is conceiving her second baby more likely to be older than the mother who is conceiving for the first time. But in this study it happened that women who are conceiving baby for the first time is more older than the women who is conceiving baby for the first time. The average calorie requirement for the women considering their order of pregnancy is given below.

**Table 16: Average calorie requirement according to order of pregnancy**

|  |  |
| --- | --- |
| CATEGORY(According to order of pregnancy) | CALORIE REQUIREMENT(in Kcal/day) IN DIFFERENT STAGES OF GESTITIONAL PERIOD |
| 1st Trimester | 2nd trimester | 3rd trimester |
| A | 1st | 2036 | 2306.5 | 2806 |
| B | 2nd | 2275.48 | 2495.85 | 3045.64 |
| C | 3rd | 2403.25 | 2675.21 | 3165.85 |

It is seen that the average calorie requirement of the women who is the category A is 2238.24 and that of category B and C is 2492.52 and 3205.83 kcal/day respectively. This increases 80-90 kcal/day in first trimester and 200-300 kcal/day in second trimester and 400-500 kcal/day in the third trimester. Rate of increase in the calorie requirement remains the same for the other two categories.

**Average calorie requirement of the women of hilly region:**

Unlike the plain land the health status of the pregnant women are not so good in the hilly region of the Upazillas considered for this study. The findings of this study in the hilly region are given bellow.

**TABLE 17: Average calorie requirement according to age**

|  |  |
| --- | --- |
| CATEGORY(According to age) | CALORIE REQUIREMENT(in Kcal/day) IN DIFFERENT STAGES OF GESTITIONAL PERIOD |
| 1st Trimester | 2nd trimester | 3rd trimester |
| Less than 20 years | 2054.65 | 2144.38 | 2554.13 |
| 20 – 24 years | 2174.3 | 2454.2 | 2874.32 |
| 25 – 29 years | 2405 | 2625.32 | 3045.32 |
| 30 years and above | 2575.58 | 2805.76 | 3255.25 |

Average energy requirements for the pregnant women of this region were calculated considering the TEE value of different trimester is stated above. After considering all the factors the Average calorie requirement for the pregnant women is found 2302.38 kcal/day in first trimester. This requirement increases 80-90 kcal/day in first trimester, 200-300 kcal/day in the second trimester and400-500 kcal/day in the third trimester. The following table shows the gradual increase of calorie requirement of the women who are conceiving pregnancy for the first, second or third time.

**Table 18: Average calorie requirement according to order of pregnancy**

|  |  |
| --- | --- |
| CATEGORY(According to order of pregnancy | CALORIE REQUIREMENT(in Kcal/day) IN DIFFERENT STAGES OF GESTITIONAL PERIOD |
| 1st Trimester | 2nd trimester | 3rd trimester |
| A | 1st | 2204.6 | 2504.6 | 2954.32 |
| B | 2nd | 2356.23 | 2626.23 | 3032.23 |
| C | 3rd | 2642.56 | 2990.7 | 3540.75 |

It is seen that the average calorie requirement of the women who is the category A is 2401.13 and that of category B and C is 2707.18 and 3175.77 respectively. This increases 80-90 kcal/day in first trimester and 250-300 kcal/day in second trimester and 400-500 kcal/day in the third trimester. Rate of increase in the calorie requirement remains the same for the other two categories.

# CHAPTER-05

# Discussion

This study was conducted in order to observe the increase of the calorie requirement of the pregnant women in their whole pregnancy period based on Total Energy Expenditure (TEE). In the original study the TEE was calculated using Dubley Labeled Water (DLW) method (J Josh Snodgrass, William R Leonard, Larissa ATrarskaia and Dale A Schoeller). In this study the energy requirements of the pregnant women were calculated using the FAO recommendation and methodology (FAO/WHO, 2004). The subjects in the current study were the representative of healthy moderately active pregnant women of the three upazillas namely Hathazari, Bashkhali and Raozan.

Along with other factor Age of the pregnant mother and order of her pregnancy has a very significant impact on her energy requirement. (Nancy F Butte, William W Wong,Margarita S Treuth, Kenneth J Ellis)*.* So in this study the energy requirement of the pregnant women was classified according to age of the pregnant mother and order of the pregnancy. The later one denotes how many children the mother already has. Again environment and lifestyle of the population has a profound impact on the energy requirement of the pregnant women, hence regarding thins fact the energy requirement of the subjects of the current study was further subdivided into “HILLY AREA” and “PLAIN LAND” as because women in the hilly region requires more energy for uphill and downhill climbing. The Physical Activity level (PAL) value has a huge impact on the calorie requirement of the pregnant women (WHO, 1985).In this study PAL values for specific lifestyle were noted from the FAO literature (FAO,1985; FAO,2004). The mean PAL value of the Current Subjects was found 1.85 which is within the moderate category. In the original study it between 1.88(Nancy F Butte, William W Wong,Margarita S Treuth, Kenneth J Ellis). The increase in the calorie requirement in the second trimester was calculated by subtracting the calorie requirement of the 1st trimester from the calorie requirement of the 2nd trimester and by doing so the increase of the calorie requirement of 3rd trimester was calculated. The average energy requirements of the pregnant women in their pregnancy period in both Hilly region and Plain land are summarized in Table15, Table 16, Table 17, and Table 18.

# Conclusion:

It is seen that the calorie requirement for the pregnant women for 1st trimester is 2401.13 kcal/day and that of for the 2nd and 3rd trimester is 2707.18 and 3175.77 kcal/day respectively.

The increase in the calorie requirement of the pregnant women in the 1st trimester is 80-90kcal/day, 250-300 kcal/day in the 2nd trimester and 400-500 kcal/day in the 3rd trimester

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