

Calorie Intake of Pregnant Women in Different Trimesters and Its Impact on Maternal Weight and Newborn Weight

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ABSTRACT

During pregnancy, increase energy demands for metabolism and intrauterine growth, these challenges for pregnant mothers to intake adequate calorie. A cross-sectional analytical study was conducted to evaluate the calorie intake of pregnant women in different trimesters and its impact on maternal weight and birth weight. This study period was three years duration from January 2019 to December 2021. A pretested, semi-structured, standard questionnaire and randomized sampling technique was used to collect the data, the number of calculated sample size was 407. Study found that average age of the pregnant mothers was 26.06 ± 3.08 years and average monthly income was 18527.40 ± 5801.44 BDT. Study revealed that average calorie intake of pregnant mothers of 1st, 2nd and 3rd trimester were 1779.65 ± 96.88 , 1986.60 ± 69.60 and 2179.65 ± 77.47 , whereas average weight gain of pregnant mothers of 1st trimester was 0.52 ± 0.60 Kg, 2nd trimester was 3.23 ± 1.29 Kg and 3rd trimester was 7.36 ± 2.50 Kg. It was observed that 0.50% of the pregnant mothers delivered low birth weight baby and 99.50% normal weight baby with their average birth weight was 3.04 ± 0.30 Kg. Calorie intake and body weight gain of different trimesters of pregnant mothers positively correlate with birth weight. Calorie intake influenced maternal weight and newborn weight.

Key Words: Calorie Intake, Trimester, Maternal Weight, and Birth Weight

BACKGROUND

Pregnancy is the period of maternal nutritional needs. Premature birth, negative fetal outcomes including structural abnormalities such as gestational age of 37 weeks, low birth weight, and neural tube defects were associated with dietary deficiency, whereas adequate maternal nutrition is important component of healthy pregnancy¹. Maternal preeclampsia and obesity in later in life were associated with dietary deficiency in pregnancy period². Nutrition is positive maternal and neonatal outcome, however in pregnancy period there were opportunity to nutritional assessment, healthy eating habit and adequate weight gain. Women were weight gaining or becoming obese during pregnancy³.

In pregnancy period energy intake, match the demands of resting metabolism, physical activity, and tissue growth and therefore energy balance by expenditure and energy storage. Resting metabolism rate increases during pregnancy because of increased body mass and pregnancy related physiological changes. The requirement of energy storage depends on maternal pregravid body size. In pregnancy outcome, women with low body weight required more energy require for healthy pregnancy than standard body weight and obese women. In contrast healthy nutritional management of weight gain in pregnancy better fetal outcome⁴. Adequate calorie requirements for fetal growth, good health of pregnant women and to avoid adverse effect of pregnancy. Women from under developed and developing countries with their limited resources, they have intake inadequate nutritional diet. Carbohydrate and energy intake in second and third trimester was different from first trimester.²⁷ Cereal intake was seen to be abundant in the diet of pregnancy followed by pulse, legumes, and other vegetable, whereas inadequate calorie intake of Nepalese pregnant women⁵.

Chinese National Health Survey was conducted among 1420 pregnant women and found that low calorie intake of protein, fat, iron and zinc. Among the participant 54% were risk of inadequate intake of energy. However, majority of pregnant women intake low amount of nutrient that impact on fetal outcome⁶. Chinese pregnant mother, average energy intake was 2008 ± 748 kcal. However, participant of third trimester maintain international guideline of physical activity compared to first trimester. Pregnant mothers, who have previous history of pregnancy, had higher dietary intake than younger participant⁷. Among obeys mother, 15% weight gain in second trimester when energy intake of 125 ± 52 Kcal/d, 67% weight gain when they consumed 186 ± 29 Kcal/d energy. However, excess energy intake not associated with fetal outcome⁸.

In 2014, study conducted at Shaheed Suhrawardy Medical College and Hospital and found that 36%, 28%, 24%, 8% and 4% of the pregnant women age group were 21-25 years, 20 years and below, 26-30 years, 31-35 years and 36-40 years respectively with their man age was 25 years. It was observed that average maternal weight gain was 10.72 ± 3.72 Kg and average birth weight was 2.77 ± 0.33 Kg. There was a statistically significant association between maternal weight gain with birth weight⁹. The prevalence of low birth weight was 24.3%, whereas mean calorie intake was 1696 ± 182.8 Kcal and mean protein intake was 50.8 ± 9.27 g. It was observed that low calorie intake of third trimester and maternal weight were significantly associated with birth weight of the baby¹⁰. Of the pregnant mother of Iran, average age of the pregnant women was 26 ± 5 years and average birth weight was 3.3 ± 0.4 kg. Protein, Calcium, Zinc and iron intake in the third semester were associated with birth weight of neonate, whereas maternal serum levels of calcium, Zinc and iron were associated with birth weight^{11 28}.

In south India, pregnant women suffered from calorie-protection deficiency, vitamin B complex deficiency, and anemia. However, nutritional status may reflect in the premature or termination of pregnancy, low birth weight and this baby become nutritional deficiency during early months of life¹². Higher maternal diet quality score was associated with reduced risk of low birth weight¹³. After calorie intake of more than 2000 kcal and 75g of protein intake and measure of weight, crown-heel length and heel circumference of newborn infants. It was revealed that fetal growth improves significantly with increasing maternal calorie and protein intakes¹⁴. Low-calorie sweetens increased in intervention groups, whereas further study need to determine the effect of parental exposure to low-calorie sweetens on maternal and child health outcome¹⁵.

In Northern Tanzania, one third of neonate classify as low birth weight and 40% of the neonatal head circumferences below WHO standard, whereas only 12% of infants exhibited low weight¹⁶. In Aligarh City Uttar Pradesh, India, dietary intake of all trimesters of pregnancy was significantly associated with the birth weight¹⁷. Average age of the respondents was 29 ± 5.7 years and average gestational age was 20.6 ± 8.8 weeks, whereas most of the participants were primigravida and it was 48.6%. Average calcium intake was 602.4 mg/day and it was inadequate intake, it was 82%, that was below standard of US Institute of Medicine¹⁸. In 2017, a study conducted by Nekemte Town, West Ethiopia and revealed that average birth weight of cases and controls were 2138.3 ± 206.87 g and 3145.95 ± 415.98 g, whereas no iron-folate supplementation, no nutrition counseling, maternal under nutrition, anemia, inadequate dietary diversity score of pregnant women were associated with low birth weight¹⁹. The Low birth weight was 14.6% and average birth weight was 3094 ± 587.6 grams. However, low birth weight associated with rural area, preterm birth, present and chronic medical illness, maternal weight and traditional feeding²⁰.

MATERIALS AND METHODS

A cross-sectional analytical study was conducted to evaluate the effect of calorie intake of pregnant women in different trimesters and its impact on maternal weight and birth weight. This study period were the three years duration from January 2019 to December 2021. Study area was the Mirpur, Dhaka city of Bangladesh. The study population were the pregnant women attending antenatal services in selected maternity centre of Dhaka city. A pretested, semi-structured questionnaire applied for collecting the data and randomized sampling technique applied for collecting sample from the selected maternity. After collection of data, it was checked and rechecked thoroughly with competently. Each questionnaire checked and to avoid possible mistake and data were analyzed using SPSS software version 20.

RESULTS

Table 01: Distribution of the study subjects by age (n=407)

Age in Years	Frequency	Percentage
≤ 20	2	0.50
21- 25	194	47.70
26-30	171	42.00
≥31	40	9.80
Total	407	100.0
Mean ± SD	26.06 ± 3.08	

Table 01 shows that 0.50%, 47.70%, 42.00% and 9.80% of the respondents belonged to their age group were ≤20 years, 21-25 years, 26-30 years and ≥31 years respectively with their mean age was 26.06 ± 3.08 years.

Table 02: Distribution of the study subjects by education (n=407)

Education	Frequency	Percentage
Primary	10	2.50
SSC	78	19.20
HSC	221	54.30
Degree	66	16.20
Postgraduate and above	32	7.90
Total	407	100.0

It is found from table 02 that 2.50%, 19.20%, 54.30%, 16.20% and 7.90% of the respondents educational qualification had primary, SSC, HSC, degree and post graduate and above respectively.

Table 03: Distribution of the study subjects by religion (n=407)

Religion	Frequency	Percentage
Muslim	377	92.60
Hindu	30	7.40
Total	407	100.0

Table 03 reveals that 92.60% of the respondents were Muslim and 7.40% of the respondents were Hindu.

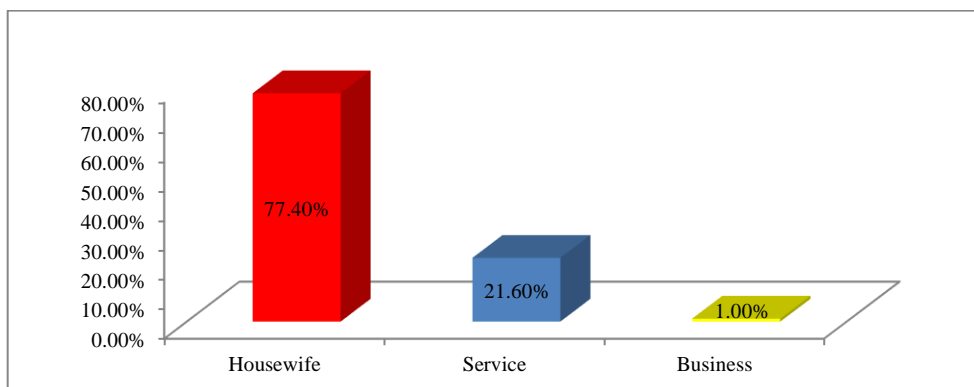


Figure 01: Distribution of the study subjects by occupation (n=407)

Figure 01 shows that 77.40%, 21.60% and 1.00% of the respondent's occupation were housewife, service and business respectively.

Table 04: Distribution of the study subjects by monthly family income (n=407)

Social Class	Frequency	Percentage
Lower socio-economic (BDT \leq 5360)	6	1.50
Lower middle socio-economic (BDT 5361-21270)	317	77.90
Upper middle socio-economic (BDT 21271-65761)	82	20.10
Upper socio-economic (BDT \geq 65762)	2	0.50
Total	407	100.0
Mean \pm SD	18527.40 \pm 5801.44	

Table 04 reveals that 1.50%, 77.90%, 20.10% and 0.50% of the respondents were lower socio-economic group, lower middle socio-economic group, upper middle socio-economic group and upper socio-economic group respectively with their mean monthly income was 18527.40 \pm 5801.44 BDT.

Table 05: Distribution of the study subjects by family types (n=407)

Family types	Frequency	Percentage
Join family	295	72.50
Nuclear family	112	27.50
Total	407	100.0

Table 05 reveals that 72.50% of the respondents were lived in join family and 27.50% of the respondents were lived in nuclear family.

Table 06: Distribution of the study subjects by calorie intake (n=407)

Trimester	Calorie Intake	Frequency	Percentage
First trimester	\leq 1800 calories per day (Inadequate)	399	98.00
	\geq 1801 calories per day (Adequate)	8	2.00
	Total	407	100.0
	Mean \pm SD	1779.65 \pm 96.88	
Second trimester	\leq 2200 calories per day (Inadequate)	403	99.00
	\geq 2201 calories per day (Adequate)	4	1.00
	Total	407	100.0
	Mean \pm SD	1986.60 \pm 69.60	
Third trimester	\leq 2400 calories per day (Inadequate)	403	99.00
	\geq 2401 calories per day (Adequate)	4	1.00
	Total	407	100.00
	Mean \pm SD	2179.65 \pm 77.47	

Table 06 reveals that 98.00% of the first trimester pregnant mothers' intake inadequate daily required calorie and 2.00% of the first trimesters pregnant mothers' intake adequate daily required calorie with their mean calorie was 1779.65 \pm 96.88. However, 99.00% of the 2nd trimester pregnant mothers' intake inadequate daily

required calorie and 1.00% of the 2nd trimesters pregnant mothers' intake adequate daily required calorie with their mean calorie was 1986.60 ± 69.60 . It is found that 99.00% of the 3rd trimester pregnant mothers' intake inadequate daily required calorie and 1.00% of the 3rd trimesters pregnant mothers' intake adequate daily required calorie with their mean calorie was 2179.65 ± 77.47 .

Table 7: Distribution of the study subjects by weight in 1st, 2nd and 3rd Trimesters (n=407)

Trimesters	Weight in Kilogram	Frequency	Percentage
First Trimester	(≤ 50)	16	3.90
	(51 -60)	333	81.80
	(≥ 61)	58	14.30
	Total	407	100.0
	Mean \pm SD	56.57 ± 4.48	
Second trimester	(≤ 50)	4	1.00
	(51 -60)	231	56.80
	(≥ 61)	172	42.30
	Total	407	100.0
	Mean \pm SD	59.68 ± 6.20	
Third trimester	(≤ 50)	4	1.00
	(51 -60)	88	21.60
	(≥ 61)	315	77.40
	Total	407	100.00
	Mean \pm SD	66.61 ± 5.05	

Table 07 that 3.90%, 81.80% and 14.80% of the pregnant mothers weight of the 1st trimester were ≤ 50 Kg, 51-60 Kg and ≥ 61 Kg respectively with their mean weight was 56.57 ± 4.48 Kg. However, 1.00%, 56.80% and 42.30% of the pregnant mothers weight of the 2nd trimester were ≤ 50 Kg, 51-60 Kg and ≥ 61 Kg respectively with their mean weight was 59.68 ± 6.20 Kg. It was shown that 1.00%, 21.60% and 77.40% of the pregnant mothers weight of the 3rd trimester were ≤ 50 Kg, 51-60 Kg and ≥ 61 Kg respectively with their mean weight was 66.61 ± 5.05 Kg.

Table 8: Distribution of the study subjects by weight gain in 1st, 2nd and 3rd Trimesters (n=407)

Trimesters	Weight in Kilogram	Frequency	Percentage
First Trimester	(≤ 1)	401	98.50
	1.1-4	4	1.00
	(≥ 4.1)	2	0.50
	Total	407	100.00
	Mean \pm SD	0.52 ± 0.60	
Second trimester	(≤ 5)	391	96.10
	5.1-8	14	3.40
	(≥ 8.1)	2	0.50
	Total	407	100.00

	Mean ± SD	3.23 ± 1.29	
Third trimester	(≤10)	389	95.60
	10.1-15	14	3.40
	(≥15.1)	4	1.00
	Total	407	100.00
	Mean ± SD	7.36 ± 2.50	

Table 08 shows that 98.50%, 1.00% and 0.50% of the pregnant mothers weight gain of the 1st trimester were ≤ 1 Kg, 1.1-4 Kg and ≥4.1 Kg respectively with their mean weight was 0.52 ± 0.60 Kg. However, 96.10%, 3.40% and 0.50% of the pregnant mothers weight gain of the 2nd trimester were ≤ 5 Kg, 5.1-8 Kg and ≥8.1 Kg respectively with their mean weight was 3.23 ± 1.29 Kg. It was shown that 95.60%, 3.40% and 1.00% of the pregnant mothers weight gain of the 3rd trimester were ≤ 10 Kg, 10.1-15 Kg and ≥15.1 Kg respectively with their mean weight was 7.36 ± 2.50 Kg.

Table 9: Distribution of the study subjects by birth weight (n=407)

Birth weight	Frequency	Percentage
Extremely low birth weight (<1000 gm)	00	00
Very low birth weight(<1001-1500 gm)	00	00
Low birth weight (<1501-2500 gm)	2	0.50
Normal weight (≥2501 gm)	405	99.50
Total	407	100.00
Mean ± SD	3000.04 ± 0.30	

Table 9 shows that 0.50% of the respondents’ delivered low birth weight baby and 99.50% of the respondents’ delivered normal weight baby with their mean birth weight was 3000.04 ± 0.30 gm.

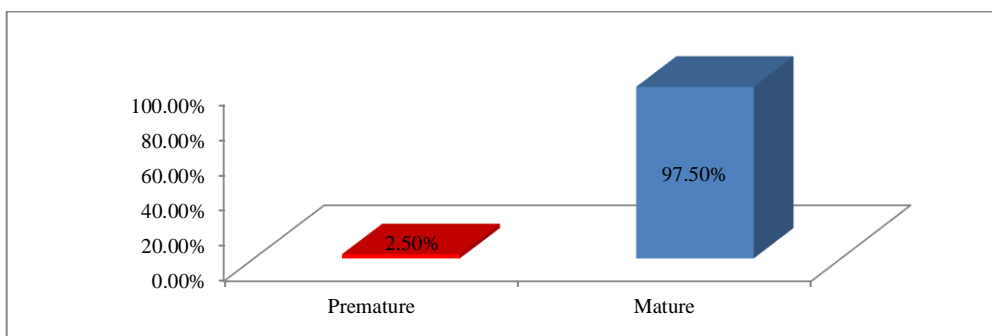


Figure 02: Distribution of the study subjects by types of baby (n=407)

Figure 02 shows that 2.50% of the respondents’ delivered premature baby and 97.50% of the respondents’ delivered mature baby.

Table 10: Distribution of the study subjects by Pearson correlation of calorie intake with maternal weight of different trimesters and maternal weight gain in different trimesters

Variables	Variables	r-value	p-value
Calorie intake in 1 st trimester	Body weight in 1 st trimester	0.195	0.000
	Body weight in 2 nd trimester	0.004	0.938
	Body weight in 2 nd trimester	0.016	0.754

Calorie intake in 2 nd trimester	Body weight in 2 nd trimester	0.079	0.115
	Body weight in 3 rd trimester	0.133	0.007
Calorie intake in 3 rd trimester	Body weight in 3 rd trimester	0.016	0.752
Calorie intake in 1 st trimester	Body weight gain in 1 st trimester	0.021	0.672
	Body weight gain in 2 nd trimester	0.213	0.000
	Body weight gain in 3 rd trimester	0.121	0.015
Calorie intake in 2 nd trimester	Body weight gain in 2 nd trimester	0.220	0.000
	Body weight gain in 3 rd trimester	0.195	0.000
Calorie intake in 3 rd trimester	Body weight gain in 3 rd trimester	0.223	0.000

Table 10 shows that there was a positive correlation of calorie intake of 1st trimester with body weight in 1st trimester ($p=0.000<0.05$), whereas was a correlations of calorie intake of 2nd trimester with body weight in 3rd trimester ($p=0.007<0.05$) and calorie intake of 3rd trimester with body weight in 3rd trimester ($p=0.752<0.05$). There were positive correlations of calorie intake of 1st trimester with body weight gain of 2nd ($p=0.000<0.05$), and 3rd ($p=0.015<0.05$), trimester and no correlation of calorie intake of 1st trimester with body weight gain of 1st trimester ($p=0.672<0.05$). There were positive correlations of calorie intake of 2nd trimester with body weight gain of 2nd ($p=0.000<0.05$), and 3rd ($p=0.000<0.05$) trimester and positive correlation of calorie intake of 3rd trimester with body weight gain of 3rd trimester ($p=0.000<0.05$). These findings were statistically significant. Study revealed that calorie intake of 1st trimester positively influenced the body weight in 1st trimester and calorie intake of 2nd trimester positively influenced on 3rd trimester, whereas calorie intake of 1st trimester positively influenced body weight gain of 2nd and 3rd trimester. However, calorie intake of 2nd trimester positively influenced body weight gain of 2nd and 3rd trimester and calorie intake of 3rd trimester positively influenced body weight gain of the 3rd trimester only.

Table 11: Distribution of the study subjects by Pearson correlation of birth weight with calorie intake in different trimesters, maternal body weight in different trimesters and maternal body weight gain in different trimesters

Variables	Variables	r-value	p-value
Birth weight	Calorie Intake in 1 st trimester	0.254	0.000
	Calorie Intake in 2 nd Trimester	0.264	0.000
	Calorie Intake in 3 rd Trimester	0.301	0.000
Birth weight	Body weight in 1 st trimester	0.038	0.449
	Body weight in 2 nd trimester	0.135	0.006
	Body weight in 3 rd trimester	0.022	0.652
Birth weight	Body weight gain in 1 st trimester	0.114	0.021
	Body weight gain in 2 nd trimester	0.371	0.000
	Body weight gain in 3 rd trimester	0.400	0.000

Table 11 shows that there were positive correlations of calorie intake of 1st, 2nd 3rd trimester with birth weight ($p=0.000<0.05$), ($p=0.000<0.05$) and ($p=0.000<0.05$). There was positive correlations of body weight of pregnant mothers in 2nd trimester with birth weight ($p=0.006<0.05$) and no correlation of 1st and 3rd trimester with birth weight ($p=0.449<0.05$) and ($p=0.652<0.05$). There were positive correlation of body weight gain of 1st, 2nd and 3rd trimester with birth weight ($p=0.021<0.05$), ($p=0.000<0.05$) and ($p=0.000<0.05$). These findings were statistically significant. Body weight of 2nd trimester and body weight gain of 1st, 2nd and 3rd trimester of pregnant mother positively influenced on birth weight, whereas calorie intake of 1st, 2nd and 3rd trimester negatively influenced on birth weight.

DISCUSSIONS

Study found that 89.70% of the pregnant mothers' ages were 21-30 years and 9.8% were ≥ 31 years and rest of the 0.50% were age ≤ 20 years with their average age was 26.06 ± 3.08 years. This findings were nearly similar findings to the study conducted by Mohammad et al in 2020²⁶. It was observed that most of the pregnant mothers were higher secondary school pass, then secondary school pass then degree pass and it was 54.30%, 19.20% and 16.20% and rest 7.9% were post graduate and above. These findings were opposite findings to the study carried out southwestern part of Bangladesh by Shamim et al in 2016²¹ and it was revealed that primary pass were 80% and 17.1% were illiterate. It was found that more than two third of the pregnant mothers occupations were house wife and one fifth of the pregnant mothers occupations were service holders and rest of them were business. These findings were nearly similar findings to the study carried out by Nessa et al in 2014²². These findings were similar findings to the study carried out by Naik et al in 2016²³. Study revealed that 72.50% of the respondents were lived in join family and 27.50% of the respondents were lived in nuclear family, among the respondents 59.50% of the respondents lived in urban area and 40.50% of the respondents lived in rural area. Similar type of study conducted in Netherlands by Baron et al in 2015²⁴.

Study revealed that average weight of the pregnant mothers of 56.57 ± 4.48 Kg in 1st trimester, 59.68 ± 6.20 Kg in 2nd trimester and 66.61 ± 5.05 Kg in 3rd trimester. Similar type of study conducted in the department of obstetrics and gynecology, Shaheed Suhrawardy Medical College and Hospital by Rijvi et al in 2018⁹. Study found that average gaining weight of the pregnant mothers of 0.52 ± 0.60 Kg in 1st trimester, 3.23 ± 1.29 Kg in 2nd trimester and 7.36 ± 2.50 Kg in 3rd trimester. These findings were nearly similar findings to the study carried out in the department of obstetrics and gynecology, Shaheed Suhrawardy Medical College and Hospital by Rijvi et al in 2018⁹. Calorie intakes of 1st, 2nd 3rd trimester positively correlate with birth weight. Similar type of study conducted in Aligarh city Uttar Pradesh by Durrani and Rani, 2011¹⁷. Body weight of pregnant mothers of 2nd trimester positively correlates with birth weight. These findings were similar findings to the study carried out in Private Clinic in Mekelle City, Northern Ethiopia by Tela et al, 2019²⁵. Body weight gain of pregnant mothers of 1st, 2nd and 3rd trimester positively correlates with birth weight. These findings were nearly similar findings to the study carried out in the department of obstetrics and gynecology, Shaheed Suhrawardy Medical College and Hospital by Rijvi et al in 2018¹⁷.

CONCLUSION

Study revealed that calorie intake of different trimesters effect on maternal weight and neonatal weight. However, outcome of healthy baby and reduce pregnancy complications, it is necessary to maintain proper nutritional guideline for gestational period.

RECOMMENDATIONS

1. Rising awareness among the pregnant mother about the calorie intake in different trimesters for healthy baby.
2. Government can arrange groups or individualized counseling for maternal nutrition by community health workers.

Disclosure

All the authors declared no competing interest

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