Patterns of Dietary Nutrient Consumption among Pregnant Mothers in Dhaka City, Bangladesh

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Abstract

Pregnancy is a condition of higher nutrient requirement but in developing country like Bangladesh most of the pregnant women can not meet their nutrient requirement and some time they are neglected in the family. The purpose of the study was to assess the nutritional status and dietary nutrient intake by the pregnant women, in Dhaka city, Bangladesh. Under a cross-sectional design, 30 healthy non-pregnant as well as 130 pregnant women, at 3 different trimesters of pregnancy were assessed. A questionnaire was developed to obtained demographic, socio-economic, anthropometric, drug and medical history. Using 24-hour food recall for three days in a row, their food intake was assessed and then converted to nutrients intake. The average BMI of the non-pregnant women was found 22.89 ± 3.4 kg/m^2 and for pregnant women was found 23.52 ± 3.71 kg/m^2. The mean dietary nutrients intake of dietary fiber, calorie, protein, fat, carbohydrate, calcium, iron, thiamine, riboflavin, vitamin C, Vitamin A, folate, vitamin B_6 and Vitamin B_{12} of the pregnant mothers was 4.38 g, 1619 kcal, 60.05 g, 30.38 g, 268.79 g, 537.21 mg, 21.53 mg, 1.15 mg, 0.94 mg, 97.36 mg, 647.6 μg, 153.93 μg, 1.41 mg and 4.09 μg respectively. Most of pregnant women (more than 90%) failed to meet their energy, calcium and folate requirement. Most of the pregnant mother in Bangladesh can not fulfill their dietary requirements during pregnancy.

Key word: Pregnancy, Dietary nutrient, Nutritional status, BMI

Introduction

Nutrient intake is important to the well being of pregnant women and the fetus. Inadequate nutrient intake can lead to maternal anemia, increasing the risk for other maternal morbidities and mortality, fetal growth retardation and low fetal birth weight [1, 2]. Maternal malnutrition during the prenatal period has been associated with spontaneous abortion, poor growth and development, learning impairment and behavior problems of the offspring [3, 4]. Inadequacy of macronutrient and micronutrient intake in pregnant women has been previously reported in developing countries such as Bangladesh [5], China [6], Sudan [7], Nigeria [8] and in developed countries such as the USA [9]. Women in Western Europe gain 10-12 kg in weight compared with their counterparts in the developing world where the average weight gain is 7-9 kg. Pregnancy weight gain among women in developing countries is about half or less compared with that of developed countries, and there are indications of even losing weight within them during the course of pregnancy [10, 11, 12].

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In Bangladesh, the first national food consumption survey was carried out in 1962 – 1964, followed by two more in 1975 – 1976 and 1981 – 1982 [13]. The latest large-scale food consumption survey in Bangladesh was undertaken in 1995 – 1996 [14]. Results from this survey suggested that nutritional status had improved from 1975 – 1976 to 1981 – 1982 but remained unchanged during the last two decades and intakes of energy and macronutrients in rural Bangladesh declined from 1962 – 1964 to 1981 – 1982 and 1995 – 1996. Intakes of iron, calcium and vitamin A declined between 1962 – 1964 and 1981 – 1982 but increased from 1981 – 1982 to 1995 – 1996 to a level similar to that in 1962 – 1964. Anemia and vitamin A deficiency have remained unchanged during the last three decades and are still public health problems in Bangladesh, anemia is 46% [15], and night blindness is 2.4% [16] among pregnant women.

In Bangladesh, a large segment of the population fails to consume food items with the required composition and at the required level to fulfill the nutritional requirements. The lack of capacity is mainly due to food poverty, which constrains the poor people to access the required quantity and quality of food and ensure food security. Moreover, there may also exist some people who fail to consume a balanced basket of food due to lack of nutritional knowledge and other reasons[17]. The average calorie intake was estimated at 2318.3 Kcal per capita per day in 2010, which was 2238.5 Kcal in 2005, 2240.3 Kcal in 2000 and 2254 Kcal in 1995-96. At the national level, per capita per day protein intake varied between 62.50 gram to 66.26 gram during the period 1995-96 to 2010, Per capita per day protein intake was recorded the lowest at 62.50 gram in 2000 and the highest of 66.26 gram in 2010 [17]. Very few studies in Bangladesh are about dietary intake of pregnant mother. The aim of this study is to assess the nutritional status and dietary nutrient intake during different trimester periods of pregnancy.

Materials and Methods

Subjects: The study population comprised of pregnant women from urban to semi-urban to rural areas that attended the antenatal checkup at Bangabandhu Sheikh Mujib Medical University (BSMMU) and OPD of Gynecology & Obstetrics department, Shuhrawardy Hospital, aged between 18 to 35 and free of pregnancy induced hypertension (PIH), preeclampsia (PE), diabetics and any other pregnancy related complication. Healthy pregnant women (n=43 in 1st trimester, n=44 in 2nd trimester and n=43 in 3rd trimester, 18 to 35 years old) and nonpregnant women (n=30, 18 to 35 years old) were sampled. Pregnant women attending antenatal clinics at the BSMMU and Shurawardy hospital were recruited in the study during antenatal visit at 6-12 week, 13-24 week and 25-36 week of gestation, and the study was conducted as cross-sectional design. Age matched nonpregnant women were recruited as control from the graduate students of Dhaka University. Trained interviewer collected information on socioeconomic data, previous obstetric history, vitamin supplementation (either folate or multivitamin), and height and weight.

Anthropometric Data:

Body weight was measured on a lever balance (Detecto-Medic, Detecto Scales, Inc, USA). The balance was calibrated every day before use. The body weight was measured bare footed to the nearest 0.1 kg with clothes on. The average weight (0.5 kg) of the clothes was later subtracted from the measured weight. Weight was measured after the bladder has been emptied and before a meal. Height of the subjects was measured barefooted in the standing position with a standard scale to the nearest 0.1 cm (Detecto-Medic, Detecto Scale Inc., USA).

Dietary Record:

The food consumption was assessed by 24-hours food recall method in three consecutive days. For the accurate measurement of the dietary record, serving plates, cups and spoons were displayed to get nearest possible approximation of serving size food consumed. Equivalent raw food was calculated using as the conversion factor. Bangladeshi Food Table by HKI [18] were used to estimate food consumption, but the value of folic acid, Vitamin B_{12} and B_6 of all regional foods were not available in the HKI food consumption table. So the composition of these nutrients of those foods was calculated from Indian Food composition table [19]. The rest of the value which were not available was calculated from East-Asian food composition table [20].

Statistical Analysis:

Data are expressed as mean ± SD for parametric values and median (range) for non-parametric values. Independent sampled t-test was used for normally distributed data. A p value of <0.05 was considered as significant. All the statistical analysis was performed with the SPSS data (SPSS Inc, Chicago, IL, USA).

Results

A major portion of the study subjects was from urban area. Regarding education level a highest percentage of pregnant women have completed secondary school certificate examination (27.9%, 36.4% and 27.9% in 1st, 2nd and 3rd trimester group respectively). Highest educational degree i.e. Masters Degree was completed by a few study subjects in contrast to other educational degrees and more than 70% of pregnant women were housewives (data not shown). Family history of hypertension was prominent in the non-pregnant group compared to pregnant group. Family history of diabetes was found among 20% of the pregnant women and 26.7% of non-pregnant subject. Only 4 (3.07%) pregnant women had hypertension and 2.3% woman from 3rd trimester of pregnancy had diabetes mellitus, but no thyroid disorder was found (Table 1).

Edema and anemia were more prevalent during 3rd trimester of pregnant women compared to 1st and 2nd trimester (table 2), and the significant difference in BMI was found only 3rd trimester pregnant women compared to non-pregnant women (table 3).

Table-4 depicts the daily nutrient intake in different group of study subjects. Although many of nutrient such as dietary fiber, energy, protein, carbohydrate and fat intake were slightly lower in 1st trimester of pregnancy than nonpregnant women, but intake of theses nutrients increased throughout pregnancy. Dietary folate intake was found higher in all groups of pregnant women compared to nonpregnant group. Dietary vitamin B_{12} intake was lower in early pregnancy compared to nonpregnant and higher in 3rd trimester group. Although dietary intake of all kinds of nutrients was found to be higher among pregnant women compared to the nonpregnant ones, but significant difference was found only in case of dietary fiber ($p = 0.037$) and dietary iron ($p = 0.017$) intake (table 4 and 5).

Table 5 illustrates the mean nutrient intake of the pregnant women which is compared to their RDA. About 96.4% of them can not meet their energy requirement as dietary energy provide only 64.76% of their RDA. In this study most of the pregnant women (about 80% and above) are deficient in the entire nutrient compared to their RDA, while 100% subject can not fulfill the folate requirement, dietary folate intake comprising only 25.65% of their RDA. Although mean protein intake is equal to RDA, more than half pregnant women can not meet their requirement. Mean dietary Vitamin C and Vitamin B_{12} intake were higher than the requirement but still about half of pregnant mother are deficient of those nutrients.

Table 1. Distribution of the study subjects by family history of hypertension, diabetes and medical history

Different Condition	Non Pregnant (n=30)	1st trimester (n=43)	2nd Trimester (n=44)	3rd Trimester (n=43)	Total pregnant mother
Family History of Hypertension	18 (60.0%)	12 (27.9%)	15 (34.1%)	16 (37.2%)	43 (33.07%)
Family History of DM	8 (26.7%)	7 (16.3%)	12 (27.3%)	7 (16.3%)	26 (20%)
Medical History of DM	-	-	-	1 (2.3%)	1 (0.76%)
Medical History of HTP	-	2 (4.7%)	1 (2.3%)	1 (2.3%)	4 (3.07%)
Thyroid Disorder	-	-	-	-	-

Data are presented as number (percentage); n=Number of subject; DM= Diabetes Mellitus

Table 2. Distribution of the study subjects by clinical history, previous obstetric history, parity and Vitamin supplementation

Different Condition	Non Pregnant (n=30)	1st trimester (n=43)	2nd Trimester (n=44)	3rd Trimester (n=43)	Total pregnant mother
Previous Obstetric History of PE	-	2 (4.7%)	-	2 (4.7%)	4 (3.07%)
Previous Obstetric History of GDM	-	-	-	-	-
Previous Obstetric History of Eclampsia	-	-	1 (2.3%)	-	1 (0.76%)
Anemia	-	11 (25.6%)	7 (15.9%)	18 (41.9%)	36 (27.7%)
Edema	-	-	1 (2.3%)	5 (11.6%)	6 (4.6%)
Urinary Protein (+)	-	1 (2.3%)	-	1 (2.3%)	2 (1.54%)
B Vitamin Supplement	8 (26.7%)	17 (39.5%)	21 (47.7%)	33 (76.7%)	71 (54.6%)
Parity					
Nulliparorus	-	23 (53.5%)	29 (65.9%)	20 (46.5%)	72 (55.38%)
Multiparorus	-	20 (46.5%)	15 (34.1%)	23 (53.5%)	58 (44.62%)

Data are presented as number (percentage); n= Number of subject; PE=Preeclampsia; GDM= Gestational Diabetes Mellitus

Table 3. Distribution of BMI of the study subjects

Status	BMI (mean ± SD)	BMI range
Non Pregnant	22.89 ± 3.4	17.37 – 33.21
1st Trimester	22.15 ± 3.55	16.59 – 31.57
2nd Trimester	22.81 ± 3.46	15.88 – 32.25
3rd Trimester	25.61 ± 3.23	18.73 – 33.33
Total pregnant mother	23.52 ± 3.71	15.88 – 33.33

Table 4. Daily nutrient intake among different groups of study subjects

Nutrient	Nonpregnant (n=30)	1st trimester (n=43)	2nd trimester (n=44)	3rd trimester (n=23)	*P* value with nonpregnant and pregnant mother
Fiber (gm)	2.62 (0.92-8.22)	3.2 (0.43-2.33)	3.94 (0.57-12.86)	3.12 (1.63-16.08)	0.037
Energy (kcal)	1446 (1107-2076)	1321.8 (1033-2038)	1544 (1138-2405)	1893 (1342-2969)	0.096
Protein (gm)	53.8 (33.8-93.6)	49.1 (25.67-110.38)	62.76 (33.0-118.16)	73.53 (42.77-109.66)	0.218
Fat (gm)	29.21 (16.25-47.22)	26.61 (13.77-54.47)	30.57 (11.6-52.36)	35.11 (20.77-53.23)	0.914
Carbohydrate (gm)	234.24 (179.97-356.54)	219.47 (133.18-350.6)	252.94 (164.3-405.68)	335.14 (212.66-519.9)	0.08
Calcium (mg)	424.6 (78.22-1216.03)	457.07 (71.33-1624.7)	437.89 (90.4-1081.43)	659.6 (246.6-1322.4)	0.128
Iron (mg)	17.51 (9.8-27.67)	17.78 (10.38-49.09)	19.73 (9.97-38.29)	25.36 (11.72-40.23)	0.017
Vitamin C (mg)	42.79 (6.5-290.64)	58.95 (4.72-490.7)	48.31 (5.46-365.76)	68.15 (10.66-504.06)	0.079
Vitamin B_1 (mg)	0.935 (0.66-1.57)	0.95 (0.6-2.36)	1.115 (0.49-2.14)	1.33 (0.76-2.49)	0.134
Vitamin B_2 (mg)	0.78 (0.35-1.46)	0.85 (0.35-1.9)	0.81 (0.21-2.13)	1.07 (0.43-2.35)	0.197
Retinol (μg)	160.97 (5.71-544.48)	98.9 (4.44-645.6)	156.7 (8.18-512.16)	169.76 (207.46-986.0)	0.66
Carotene (μg)	2479.46 (192.16-8765.5)	1683.3 (52.17-9895)	2284.5 (176.23-9399.3)	1352.27 (94.8-8549.5)	0.465
Folate (μg)	123.5 (46.3-264.2)	139.24 (41.11-523.13)	145.04 (44.07-311.32)	159.2 (59.8-280.21)	0.105
Vitamin B_6 (mg)	1.285 (0.84-2.51)	1.25 (0.390-2.31)	1.3 (0.65-2.71)	1.54 (0.99-2.72)	0.238
Vitamin B_{12} (μg)	3.06 (0.02-6.48)	1.95 (0.27-36.3)	2.695 (0.67-12.64)	4.04 (1.62-37.65)	0.322

Data are presented as median (range) for nonparametric value. n= Number of subjects.

Table 5: Nutrient Intake by Pregnant mother and comparison with RDA

Nutrient	RDA	Range	Mean (n=110)	Quartile levels			Mean intake as %RDA	Deficient Compare to RDA (%)
				25%	50%	75%		
Fiber (gm)		0.43-16.08	4.38	2.46	3.45	5.57		
Energy [a](kcal)	2500	1033-2969	1619	1333.31	1538.38	1867.38	64.76	96.4
Protein [a] (gm)	60	25.67-118.16	60.05	47.37	59.12	70.85	100.08	52.7
Fat (gm)		11.69-54.47	30.38	21.07	30.56	37.18		
Carbohydrate (gm)		133-520	268.79	218.96	253.68	318.04		
Calcium [c] (mg)	1000	71.33-1624.68	537.21	304.42	470.70	695.95	53.721	90.9
Iron [b](mg)	27	9.97-49.09	21.53	16.06	20.98	26.13	79.74	79.1
Vitamin B_1 [b] (mg)	1.4	0.49-2.49	1.15	0.85	1.08	1.36	82.14	78.2
Vitamin B_2 [b] (mg)	1.4	0.21-2.35	0.94	0.59	0.85	1.19	67.14	88.2
Vitamin C [b] (mg)	85	4.72-504.06	97.36	31.03	53.73	116.76	114.54	67.3
Retinol (μg)		4.44-989	172.18	47.55	153.19	248.3		
Carotene (μg)		52.17-9895	2852.43	471.52	1697	5017		
Vitamin A [b] (RE)	770	25.62-1844.77	647.6	236.41	644.13	1005.7	84.10	63.9
Folate [b](μg)	600	41.11-523.13	153.93	100.6	147.9	184.63	25.65	100
Vitamin B_6 [b] (mg)	1.9	0.59-2.72	1.41	1.06	1.3	1.63	74.21	86.4
Vitamin B_{12} [b](μg)	2.6	0.27-37.65	4.09	1.68	2.69	4.77	157.30	45.5

Source: Food and Nutrition Board [31, 32, 33, 34, 35]. RE, retinol equivalents. [a] Recommended Dietary Allowances (RDAs). [b] Dietary Reference Intakes (RDAs).[c] Dietary Reference Intakes (Adequate Intakes).

Discussion

In this study, total energy and macro nutrient consumption were higher in 1st trimester pregnant women compared to nonpregnant women. Protein, calcium and vitamin A intake of nonpregnant women in this study is similar to the Japan study by Hiroko Watanabe [21]. In this study it was found that energy, protein, fat, carbohydrate, iron, vitamin B_1, folate, vitamin B_6 and vitamin B_{12} intake were higher from 1st trimester to 3rd trimester. Hiroko Watanabe[21], also found similar trend in terms of protein, iron, folate, vitamin B_6 and B_{12} intake. They found the mean total energy intake for pregnant women to be 1723.0 ± 591.6, 1754.8 ± 442.3, and 1792.5 ± 442.9 kcal, in the first, second and third trimesters respectively, but in our study the intakes were 1321.9, 1544 and 1893 kcal in the first, second and third trimesters, respectively. In another study in Bangladesh by DS Alam [22], the BMI was found 20.2 ± 2.9 during 5-7 month of pregnancy (252 subjects) but in our study it was found to be 23.52 ± 3.71 (n=130) , which is significantly higher (p = <0.05). Studies have shown that energy intake during pregnancy either remain unchanged or increased slightly in late pregnancy [23, 24]. This finding is supported by our study and is also consistent with the intake pattern reported previously [25, 22] and DS Alam *et al* [22] who observed low energy intake considered it as the usual intake among pregnant women in rural Bangladesh. Although the energy intake (1619 ± 415 kcal/day) in our study was significantly higher (p = <0.05) than another study in Bangladesh by DS Alam *et al* [22] (energy intake at 5 – 7 months of gestation was 1464 ± 416 kcal/day) but still low compared to RDA.

A Hospital based Narathiwat, southern Thailand study by Sukchan *et al* [26] at 12-20 weeks of gestation, reported the mean intake of carbohydrate, protein, fat, calories, calcium, iron, thiamine, riboflavin, retinol, niacin and vitamin C to be 177.6g , 37.1 g, 38.9g, 1204.5 kcal, 493.2 mg, 17.6 mg, 0.7 mg, 1.3 mg, 2366.5 RE, 9.8 mg, and 251.7 mg respectively. Most of these values are lower compared to the intakes of pregnant mothers in our study, at second trimester and also during whole pregnancy. A community based study in southern Thailand by Plammongkol *et al* [27] among pregnant women at 32-40 weeks of gestation, the mean dietary nutrient intake are observed to be lower for most nutrients compared to our pregnant mother at 3rd trimester and during whole pregnancy. A similar type of hospital based study in songkhla, southern Thailand by Jaruratanasirkul *et al* [28] among women at 12-16 weeks of gestation, demonstrated the mean intake energy, protein, fat, calcium, riboflavin and vitamin C to be higher but lower in case of carbohydrate, iron and thiamine, compared to our study.

A study by Cheng *et al* [6] in western China among women at <24 weeks of gestation, recorded the mean intake of carbohydrate, protein, fat, calories, calcium, iron, thiamine, riboflavin, retinol, niacin, vitamin C and folate, and showed the energy and fat intake higher than our study. Oguntona & Aklnyele [8] at Ogun state, Nigeria at <24 weeks of gestation found the mean intake of carbohydrate, protein, fat, calories,

calcium, iron, retinol and folate. Nutrient values of energy and macronutrient in our study are higher than Oguntona & Aklnyele [8] but lower than the study non smoker pregnant women by Mathews *et al* [29] and of study carried out by Belgnaoui [30] in agricultural region of Morocco (3110.9 kcal in urban; 2707.5 kcal in rural)

Conclusion

About 96.4% of pregnant women cannot meet their energy requirement. Most pregnant women (about 80% and above) are deficient in the entire nutrient compared to their RDA. 100% of the subjects can not fulfill their folate requirement, dietary folate intake providing only about 25% of their RDA.

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