ORIGINAL ARTICLE

Frequency and Nutrient Content of Meals of the Mothers and the Birth Weight and Gestational Age of the Baby

Avinash H. Salunkhe[1], Asha Pratinidhi[2], Jyoti A. Salunkhe[1], S. V. Kakade[2], Vaishali R. Mohite[1], Prabhu Hiremath[1]*

[1]Krishna Institute of Nursing Sciences, Karad-415110 (Maharashtra) India, [2]Department of Preventive and Social Medicine, Krishna Institute of Medical Sciences, Karad-415110 (Maharashtra) India

Abstract:

Background: Maternal nutrition during pregnancy is one of the most important factors for the health and the wellbeing of both mother and the baby. In spite of Reproductive Child Health (RCH) programme, the proportion of Low Birth Weight (LBW) babies continues to be at around 28% and preterm birth around 12 % with associated high mortality and morbidity. *Aim and Objectives*: To study the association between frequency of meals of the mother, their nutrient content and the birth weight and the gestational age of the baby. *Material and Methods*: A cohort of 1876 apparently healthy pregnant women registered and attending Antenatal Care (ANC) clinic of Krishna Hospital was studied to find out the maternal risk factors associated with the LBW and preterm births. Mothers with twin pregnancy were excluded. A sub sample of 380 women was taken for the in-depth study of frequency of meals and nutrient content of food of pregnant women. They were followed till delivery and the birth weight was noted on standard electronic weighing machine and the gestational age of the baby was calculated from the Last Menstrual Period (LMP). A dietary history was asked during second trimester and nutrient content of their daily diet was found out by 24-hours' recall method. If the diet was not representative of their usual food intake next eligible woman was included instead of earlier randomly chosen woman. The analysis of the data was done using SPSS version 16. *Results:* The change in meal pattern from 2 to 3 meals a day meant average of 291 calories, 7.4 g of protein, 27.6 mg of calcium and 0.4 mg of iron more and from 3 meals to 4 meals a day meant on an average of 374 calories, 11.3 g of protein, 181 mg of calcium and 3.7 mg of iron more. The mean birth weight increased by 443 g and the mean gestational age increased by 18 days and the proportion of LBW reduced from 100 to 57.8 % and the proportion of preterm reduced from 66.7% to 17.8 % when the frequency of meals changed from 2 to 3. There was further increase in birth weight by average of 496 g and increase in gestational age by 4.3 days and reduction in proportion of LBW from 57.8 % to 5.2% and proportion of preterm from 17 .8 to 7.4 % when number of meals increased from 3 to 4. *Conclusion*: There was a strong association between the frequency of meals and the daily intake of calories, proteins, calcium and iron. Significant increase in the mean birth weight and mean gestational age was associated with increasing frequency of meals from two to four. There was also a significant reduction in the proportion of LBW and preterm births.

Keywords: Frequency of Meals, Recall Method, Dietary History, Pregnant Women

Introduction:

Diet of mother during pregnancy is of paramount importance for the health of the mother as well as her baby. There are studies showing direct relationship of calorie intake of mother during pregnancy and the birth weight of the baby [1]. Adequate intake of protein up to 70 g per day has direct relationship but further increase in protein

intake may result in the reduction of the birth weight [2, 3]. The food consumed in India is based mainly on cereals and pulses. Even those who consume non- vegetarian diet, majority of them have it intermittently and the quantity consumed is small due to economical and religious considerations. To meet the daily requirements of nutrients of by a vegetarian diet, the quantity of food required to be consumed is large due to presence of fiber, thalates and phylates. One may not be able to consume such a bulky food to fulfill daily requirements with two meals a day pattern. A study was therefore undertaken to find out frequency of daily meals and its relation to selected nutrient intake of calories, protein, calcium and iron among pregnant mothers and its effect on the birth weight and the gestational age of the baby.

Material and Methods:

All apparently healthy consecutive mothers planning their delivery in Krishna Hospital, Karad, Maharashtra, India, who registered for the antenatal care were enrolled. Out of these 1876 eligible mothers included in the cohort of pregnant women to study the effect of selected maternal risk factors on the birth weight and gestational age of the baby, a sub sample of 380 randomly selected pregnant women was taken for in-depth study. A dietary history was asked and nutrient content of their daily diet was found out by 24-hours' recall method on first visit during second trimester. If the food intakes during the recall period did not pertain to their usual food pattern due to fast, fist, illness etc. then the next eligible woman was included instead of this woman to ensure representative day of her food intake. Each woman was asked about her meal pattern and dietary intake (24 h) by recall method. The woman recalled what and how much food was consumed and when it was consumed. The mothers were asked to express the consumption of all food items in terms of exact Katori/ wati/ glass size, *chapati* or *bhakari* size and number, spoon size (large, medium, small). This information was used to compute the daily intake of foods by converting the household measures into grams. The nutrient content of the cooked food was determined by conversion tables [3].

The pregnant women were followed till their delivery. The birth weights of the babies were taken with the help of digital weighing scale. The care was taken to minimize the error. The pretesting of the machine was done and it was periodically checked for accuracy by weighing a standard 2500 g weight. The sample size of 380 was calculated for the study of nutritional factors based on the assumption of proportion of LBW of around 20%, preterm births around 4%, the confidence level at 95% and permissible error of 10% using the formula-

$$n = \frac{Z^2(1-p)}{E^2 p}$$

Where, Z = the standard normal variate at 5% significance level (value of Z is 1.96 = 2)

p = 4% Preterm deliveries, 20% of Low Birth Weight (LBW)

E = Relative precision = 50%

For LBW it was 62 and for preterm births it was 369. So highest of the two namely 369 was selected and rounded off to 380.

Informed consent of the mothers and ethical approval from the institutional Ethics Committee was obtained before commencement of the study.

Data was analyzed by SPSS version 16 using descriptive and inferential statistics.

1. **Descriptive statistics**- Frequency, percentage Mean and SD where ever applicable.

Table 1: Profile of Women According to Type of Work Frequency of Meals

Type of work	Number	Percentage	2-meals	3-meals	4 and above	χ^2-value p-value
Sedentary work	109	28.7	5 (4.6)	26 (23.9)	78 (71.6)	χ^2= 26.665 p <0.001
Moderate work	248	65.3	6 (2.4)	96 (38.7)	146 (58.9)	
Heavy work	23	6	4 (17.4)	13 (56.5)	6 (26.1)	
Total	380	100	15 (4.0)	135 (35.5)	230 (60.5)	

2. **Inferential statistics**- Chi-square (χ^2) test was used to see the association with respect to maternal risk factors for qualitative data and ANOVA (Boneferoni multiple comparison test) and 't' test for the quantitative data.

Results:

Out of 380 women studied for daily frequency of meals, none had one meal a day pattern. The frequency varied from two meals a day to five meals a day (Table 1).

The age of the mother, her educational status, monthly family income and type of family were not associated with the frequency of the meals. Only one socio demographic variable associated with the frequency of the meals was the type of the work. Highest number of women i.e. 71.6% were consuming four meals a day or more in the sedentary work category, followed by moderate work category of 58.9% while only 26.1% pregnant women doing hard work were consuming four meals or more. Out of 109 sedentary workers 86.2% were housewives, 11.9% teachers and 1 woman had a beauty parlor and 1 was a tailor. All moderate workers were working in the farms (92.7% on their own farms and 7.3% on others farms). All 23 heavy workers were working on road construction and stone cutting work. There was an increase in all nutrients with the increasing frequency of meals. The statistical significance varied for different nutrients as seen from Bonferroni multiple comparison tests as follows. (Table 2)

Table 2: Correlation between Number of Meals and Average Calorie, Protein, Calcium and Iron intake of Mothers: [N=380]

Number of meals	Average Caloric intake ± SD in (kcals)	Difference in Caloric intake ± SD in (kcals)	Average Protein Intake ± SD in (gm)	Difference in Protein intake ± SD in (gm)	Average Calcium Intake ± SD in (mg)	Difference in Calcium intake ± SD in (mg)	Average Iron Intake ± SD in (mg)	Difference in Iron intake ± SD in (mg)
2	1838.0±323.4	---	56.5± 12.9	---	645.6± 223.3	---	22.2± 6.2	---
3	2129.0±388.9	+ 291.0	63.9± 14.9	+ 7.4	673.2± 224.4	+ 27.6	22.6± 7.0	+ 0.4
4	2503.2± 332.0	+ 374.2	75.2± 14.2	+ 11.3	854.7± 285.7	+181.5	25.9± 5.9	+ 3.7
5	2678.2± 295.2	+175.0	82.2± 18.4	+ 7.0	939.7± 285.6	+ 85.0	27.0± 4.9	+ 1.1
Total	**2350.5± 410.2**	**+ 840.2**	**70.7± 15.9**	**+ 25.7**	**785.1± 278.6**	**+294.1**	**24.7± 6.5**	**+ 5.2**

Calorie intake: ANOVA F=45.915, p<0.001
Bonferroni multiple comparison test: All comparisons p<0.001except 4 times vs 5 times

Protein intake: ANOVA F=24.289, p<0.001
Bonferroni multiple comparison test: All comparisons p<0.001except 2 times vs 3 times and 4 times vs 5 times

Calcium intake: ANOVA F=16.177, p<0.001
Bonferroni multiple comparison test: All comparisons p<0.05 except 2 times vs 3 times and 4 times vs 5 times.

Iron intake: ANOVA F=9.114, p<0.001
Bonferroni multiple comparison test: All comparisons p<0.001except 3 times vs 4 times.
All the nutrients except iron intake were not significantly different when the frequency changed from four to five meals per day. The changes in calorie intake were persistent for frequency of meals up to 4 meals a day, hence the mean birth weight and mean gestational age, proportion of LBW and preterm births were correlated with the caloric intake.

Average Calorie intake: ANOVA F=45.915, p<0.001

Average birth weight: ANOVA F=100.7; p<0.001; χ^2=158.6
Bonferroni multiple comparison test: All comparisons p<0.001except 4 times vs 5 times.
There were 15 (4.0%) women having 2 meal a day pattern and 135 (35.5%) 3 meal a day pattern, rest all 4 meal or more per day. Average calorie intake and difference in calorie intake with increasing frequency of meals is given in (Table 2 and 3).
The difference in the calories of 549.2 calories as well as the birth weight of 722.9 g were not statistically significant when the pattern of meals changed from 4 - meals a day to 5 meals a day. All other differences were statistically highly significant.
The change in meal pattern from 2 to 3 meant on an average 291 calories more. The change from 3 meals to 4 meals a day meant on an average of 374 calories more. The mean birth weight increased by mean of 443 g and gestational age increased by 18 days when the frequency of meals changed from 2 to 3. The proportion of LBW reduced from 100 % to 57.8 % and the proportion of preterm births reduced from 66.7% to 17.8 %. There was further increase in birth weight by average of 496 g and

Table 3: Correlation between Number of Meals, Average Calorie Intake, Average Birth Weight, and Percentage of LBW [N =380]

Meal pattern	Number (%)	Average Caloric intake ± SD in (kcal)	Difference in Caloric intake ± SD in (kcal)	Average Birth weight ± SD in (gm)	Difference in Birth weight ± SD in (gm)	Number of LBW
2	15(4.0)	1838±323.4	---	1661.7±388.5	.....	15 (100.0)
3	13(35.5)	2129.0± 388.9	+ 291.0	2430.3±382.5	+ 443.0	78 (57.8)
4	216(56.8)	2503.2± 332.0	+ 374.2	2926.3±342.8	+ 496.0	12 (5.6)
5	14(3.7)	2678.2± 295.2	+175.0	3153.2±453.8	+ 226.9	00 (0.0)
Total	**380 (100.0)**	**2350.5± 410.2**	**+ 840.2**	**2708.5±486.1**	**+ 1165.9**	**105 (27.6)**

increase in gestational age average 4.3 days and reduction in proportion of LBW from 57.8 % to 5.2% and proportion of preterm from 17.8 to 7.4 % when number of meals increased from 3 to 4 (Table 3 and 4) Each additional meal by the mother from 2 to 5 meals yielded 291, 374.2 and 175 mean calories more which was associated with an increase in the mean birth weight by 443, 496, 226.9 g respectively (Table 3).

Average Calorie intake: ANOVA F= 16.789, $p<0.001; \chi^2 = 16.789$

Average GA by LMP: ANOVA F=9.120; $p<0.001; \chi^2 = 33.122$

The Bonferroni multiple comparison test: All comparisons p<0.001 except 4 times vs 5 times. The gestational age increased and preterm births decreased with increasing frequency of meals, however the changes were statistically significant from 2 meals to 4 meals a day and not significant from four meals to five meals a day. (Table 4)

The relative risks for LBW with two meals and three meals a day were 14.2 and 2.2 respectively. Both were significant at 95 % CI. The relative risks for preterm births for two meals and three meals a day were close to 4.9 and 3.1 respectively. Both were statistically significant at 95 % CI. (Table 5)

Table 4: Number of Meals, Average Calorie Intake, the Mean Gestational Age and Percentage of Preterm Births. [N =380]

Meal pattern	Average Caloric intake ± SD (kcals)	Difference in Caloric intake ± SD (kcals)	Average GA ± SD (days)	Difference in GA ± SD (days)	No of Preterm (%)
2	1927.8± 298.5	.....	254.0± 30.1	.....	08 (66.7)
3	2142.0± 391.6	+291	272.0± 13.4	+18.0	24 (17.8)
4	2501.0± 334.0	+374.2	276.3± 11.2	+4.3	16 (7.4)
5	2714.8± 272.2	+175	278.7± 8.1	+2.4	0.0 (0.0)
Total	**2362.9± 403.0**	**+840.2**	**274.1± 13.6**	**+24.7**	**48(12.6)**

Table 5: Relative Risk (RR) Related to Number of meals and Birth Weight and Gestational Age [N=380]

No. of meals	Number	Percentage	Number (%) LBW	RR	95%CI	Number (%) Preterm	RR	95%CI
2	15	3.9	15(100)	4.1	3.390-4.652	08 (53.3)	4.9	2.789- 8.491
3	135	35.5	78 (57.8)	11.9	6.754-20.909	24 (17.8)	3.1	1.745- 5.390
4 and above	230	60.5	12(5.2)	(1)	.....	16 (7.0)	(1)	.....

Discussion:

In the present study there was a strong correlation between number of meals per day and intake of nutrients by the mother during pregnancy, with increasing number of meals there was a significant increase in almost all nutrients up to four meals per day. There are many studies correlating either frequency or calorie intake of food with LBW [3-6].

Most researchers have found positive correlation our findings indicate strong correlation with the frequency of food intake and birth weight of baby. There are few studies who failed to find correlation with maternal food intake [7, 8]. As frequency of diet increased, the nutrient content i.e. calories, protein, calcium and iron increased from 2 to 4 meals a day.

Maternal energy intake and birth weight

In the present study it is seen that calorie intake is directly related to the birth weight of the baby. As per the RDA, the energy consumption for pregnant woman should 2175 Kcal/d for Indian women [3]. The average energy consumption of pregnant women was lesser by 58.01%, 48.69%, and 44.86% than RDA in the first, second, and third trimesters, respectively in a study carried out by Gopalan *et al*. [3]. Anisa [4] also noted that there was a significant correlation between the nutrient intake of the mothers and the weight of the newborn in all trimesters of pregnancy (P=0.01). Calorie intake during pregnancy was found to be positively correlated with birth weight in all trimesters. (r =0.343, 0.370, 0.426). Gopalan *et al*. [3] have shown that the mean birth weight of newborns increased with proportionate increase in the consumption of calories by the mothers during the last trimester (P<0.05). Mothers who consumed calories <1500 kcal/d during the last trimester delivered low birth weight (LBW) (2242.63±324.49 g) newborns [3] and similar results with regard to energy intake were reported by other researchers also [5, 6].

Maternal protein intake and birth weight

In the present study majority of mothers i.e. 286 (75.3%) had protein intake of lesser than 78 g per day and their babies weighed significantly less and had a very high proportion of LBW. The study conducted by Anisa [4] noted that the mean protein intake was lesser by 54.06%, 43.64%, and 40.21% than RDA in the all trimesters respectively. During pregnancy, a protein-rich diet promotes optimum fetal growth. RDA for protein in pregnancy is 65 g/day. In general, protein intake in all trimesters was found to be positively correlated with birth weight [3-6]. However some researchers did not find correlation of birth weight with the protein intake [7-10].

Maternal Calcium intake and birth weight

In the present study those mothers consuming less than RDA of calcium (i.e. 90.3%) gave birth to the babies weighing significantly lesser and proportion of LBW being significantly higher than the babies born to mothers consuming calcium equal to or above 1200 mg/day. The study conducted by Anisa [4] noted that the recommended calcium intake during pregnancy is 1000 mg/day. But the mean calcium intake of the mothers was lesser by 59.0%, 43.49%, and 35.55% than RDA in all trimesters respectively. Calcium consumption was found to be positively correlated with birth weight in all trimesters (r=0.276), (r=0.355) (r=0.421) respectively there was significant correlations found between adequate maternal calcium intake with birth

weight [4]. Gopalan *et al.* [3] have found that the highest mean birth weight was observed among mothers consuming ⩾ 1000 mg/day of calcium [3]. In contrast there was no associations with birth weight were found for the dietary intake of calcium [9, 10].

Maternal iron intake and birth weight

In the present study majority of the mothers (i.e. 91.3%) with lesser than RDA of 35 mg or more of iron intake every day gave birth to babies weighing significantly lesser and proportion of LBW babies being significantly higher. Daily iron intake was associated with longer gestational period **(p=0.031)**. There were no preterm births among 33 women **(p =0.022)** consuming 35 mg or more iron. It means intake of iron supplements during pregnancy was found to have a protective effect with respect to LBW. The study conducted by Anisa [4] also noted that the percentage of iron deficit was higher (78.73%, 75.76%, 71.47% during all the trimester respectively) when compared to the RDA. The low intake of calcium and iron noted among pregnant women might have been due to the inadequate intake of green leafy vegetables. Iron intake was also found to be positively correlated with birth weight in all the trimester (r=0.424), (r=0.288), (r=0.303) respectively. In general, iron intake in all trimesters was found to be positively correlated with birth weight [3-6]. However some researchers did not find correlation of birth weight with the iron intake [7-10]. There are very few studies animal [11, 12] human [1-4] but all of them have found a good correlation of food. Our findings also showed a strong positive co-relation of frequency and nutrient content and gestational period.

Frequency of food intake and preterm births

In the present study the gestational age increased and preterm births decreased with increasing frequency of meals, however the changes were statistically significant from 2 meals to 4 meals a day ($p<0.001$). The study conducted by Siega-Riz *et al.* [13] to identify meal patterns and preterm delivery (n = 2,065). Noted that those women had a lower total energy intake, these women had a higher risk of delivering preterm (adjusted odds ratio = 1.30, 95 percent confidence interval: 0.96, 1.76).

Meal patterns and preterm birth

The study conducted by Siega-Riz *et al*. [13] reported that those women who consumed only three meals without snacks or one meal with or without snacks per day had the highest (19%) rates of preterm birth. Women who consumed food at a less optimal frequency were at a slightly higher risk for delivering preterm. The study conducted by Linda Englund-Ögge [14] found that an overall dietary pattern was associated with a reduced risk of preterm delivery. Meal patterning during pregnancy may be important because pregnant women who sustain prolonged periods of time without food by skipping meals and/or snacks may be inducing a physiologic stress upon their pregnancy. Experimental evidence from animal studies suggests that as little as 24 hours without food may decrease the length of gestation [11-12]. In humans, spontaneous term delivery rates increased dramatically after 24 hours of fasting noted by Kaplan [15]. Prolonged periods of time without food can cause hypoglycemia, which stimulates a cascade of neuroendocrine events that may ultimately affect the health of the fetus

[16]. Thus, meal patterns may have important implications on pregnancy outcomes.

Maternal energy and protein intake and preterm births

The study conducted by Awasthi *et al*. [17] noted that there was a statistically significant lower mean (SD) energy intake [cases 1624 (249) Kcal vs. controls 1911 (341) Kcal; P<0.001] and protein intake [cases 32.1 (6.1) vs. controls 37.2 (7.0); P<0.001] among women who delivered preterm neonates. Maternal energy and protein intake had significant positive correlation with neonatal weight and concluded that lower energy and protein intake during pregnancy is possibly associated with preterm birth. In contrast, in other studies there was no association between diet during pregnancy and the risk of preterm birth [18-19].

Maternal Calcium intake and preterm births

The study conducted by Imdad [20], calcium supplementation during pregnancy leads to a reduction in risk of preterm birth in developing countries. Calcium should be supplemented to all women during pregnancy in developing countries. Another researcher Villar *et al*. [21] also noted that calcium supplementation could also prevent preterm labor and delivery by reducing uterine smooth muscle contractility [21]. Various studies have shown consistency of nutrient intake over period of one year studied by the researchers [22-23]. It could be considered as representative food intake like during illness, fast, festival, party is excluded from the study and the diet is considered during 2nd trimester of pregnancy after getting over the morning sickness associated with pregnancy.

Limitation of study:

It is a hospital based study of a tertiary care hospital attached to a medical college hence registration of women with bad obstetric history and complication during previous pregnancies could be more for obtaining better outcome in current pregnancy.

Conclusions:

1. Increase in frequency of meals is associated with increased consumption of nutrients namely calories, proteins, calcium and iron. Increased calories were consistent with frequency, up to 4 meals a day.
2. There was a significant increase in birth weight and gestational period from 2 meals a day pattern to 3 and 4 meals a day.
3. The proportion of LBW and preterm births decreased with increasing frequency of meals from 2 to 4 per day.

Recommendations:

1. Advice of consuming four meals a day is simple to give and simple to follow.
2. Ensuring dietary intake as per RDA for each type of work during ANC can result in favorable birth weight and gestational age.
3. Improved antenatal care coverage will be of paramount importance in prevention of LBW and preterm births.

References

1. Raman L. Influence of maternal nutritional factors affecting birth-weight. *Am J Clin Nutr* 1981; 34 (Suppl 4):775-83.
2. Verma S, Shrivastava R. Effect of Maternal Nutritional Status on Birth Weight of Baby. IJCMR 2016; 3 (4): 943-45.
3. Gopalan C, Ramasastri BV, Balasubramanian SC. Nutritive Value of Indian Food. Hyderabad: National Institute of Nutrition, ICMR; 2002.
4. Durrani AM, Rani A. Effect of maternal dietary intake on the weight of the newborn in Aligarh city, India. *Niger Med J* 2011; 52(3): 177-81.
5. Mridula D, Mishra CP, Chakraverty A. Effect of mother's dietary intake on birth weight of newborn. *Indian J Nutr Diet* 2002; 39:327-32.
6. Khoushaabi F, Saraswathi G. Association between maternal nutrition status and birth weight of neonates in selected hospitals in Mysore city, India. *Pakistan J Nutr* 2010; 9:1124-30.
7. Mathews F, Yudkin P, Neil A. Influence of maternal nutrition on outcome of pregnancy: prospective cohort study. *BMJ* 1999; 319(7206): 339-43.
8. Andreasyan K, Ponsonby AL, Dwyer T, *et al*. Higher maternal dietary protein intake in late pregnancy is associated with a lower infant ponderal index at birth. *Eur J Clin Nutr* 2007; 61(4): 498-508.
9. Neggers YH, Goldenberg RL, Tamura T, Cliver SP, Hoffman HJ. The relationship between maternal dietary intake and infant birthweight. *Acta Obstet Gynecol Scand Suppl* 1997; 165:71-5.
10. Johnson AA, Knight EM, Edwards CH *et al*. Dietary intakes, anthropometric measurements and pregnancy outcomes. *J Nutr* 1994; 124(6 Suppl): 936S-42S.
11. Silver M, Fowden AL. Uterine prostaglandin F metabolite production in relation to glucose availability in late pregnancy and a possible influence of diet on time of delivery in the mare. *J Reprod Fertil Suppl* 1982; 32:511-19.
12. Fowden AL, Silver M. The effect of the nutritional state on uterine prostaglandin F metabolite concentrations in the pregnant ewe during late gestation. *Q J Exp Physiol* 1983; 68:337-49.
13. Siega-Riz AM, Herrmann TS, Savitz DA, Thorp JM. Frequency of eating during pregnancy and its effect on preterm delivery. *Am J Epidemiol* 2001; 153(7):647-52.
14. Ögge LE, Brantsæter AL, Sengpie V, Haugen M, Birgisdottir BE, Myhre R, *et al*. Maternal dietary patterns and preterm delivery: results from large prospective cohort study. *BMJ* 2014; 348:1446.
15. Kaplan M, Eidelman AI, Aboulafia Y. Fasting and the precipitation of labor. *JAMA* 1983; 250(10): 1317-18.
16. Knopp RH. Hormone-mediated changes in nutrient metabolism in pregnancy: a physiological basis for normal fetal development. *Ann N Y Acad Sci* 1997; 817(1): 251-71.
17. Awasthi S, Chauhan M, Pandey M, Singh S, Singh U. Energy and protein intake during pregnancy in relation to preterm birth: a case control study. *Indian Pediatr* 2015; 52(6):489-92.
18. Haugen M, Meltzer HM, Brantsaeter AL, Mikkelsen T, Osterdal ML, Alexander J, *et al*. Mediterranean-type diet and risk of preterm birth among women in the norwegian mother and child cohort study (Moba): A prospective cohort study. *Acta Obstet Gynecol Scand* 2008; 87(3):319-24.
19. Saunders L, Guldner L, Costet N, Kadhel P, Rouget F, Monfort C, *et al*. Effect of a Mediterranean diet during pregnancy on fetal growth and preterm delivery: results from a French Caribbean Mother-Child Cohort Study (TIMOUN). *Paediatr Perinat Epidemiol* 2014; 28(3):235-44.
20. Imdad A, Jabeen A, Bhutta ZA. Role of calcium supplementation during pregnancy in reducing risk of developing gestational hypertensive disorders: a meta-analysis of studies from developing countries. *BMC Public Health* 2011; 11(Suppl 3): S18.
21. Villar J, Repke JT. Calcium supplementation during pregnancy may reduce preterm delivery in high-risk populations. *Am J Obstet Gynecol* 1990; 163(4 Pt 1):1124-31.
22. Bernstein S, Zambell K, Amar MJ, Arango C, Kelley RC, Miszewski SG, *et al*. Dietary intake patterns are consistent across seasons in a cohort of healthy adults in a metropolitan population. *J Acad Nutr Diet* 2016; 116(1): 38-45.
23. Willett WC, Sampson L, Stampfer MJ, Rosner B, Bain C, Witschi J, *et al*. Reproducibility and validity of a semiquantitative food frequency questionnaire. *Am J Epidemiol* 1985; 122(1):51-65.

[*] ***Author for Correspondence:*** *Mr. Avinash. H. Salunkhe, Krishna Institute of Nursing Sciences, Krishna Institute of Medical Sciences Deemed to be University Karad, Maharashtra, India. Email: salunkheah@gmail.com Cell: 9881451168*