International Journal of Nursing & Clinical Practices

Research Article Open Access

A Pilot Study of Total Energy, Three Major Nutrients and Food Intakes among Pregnant Women: A Comparison with Nulliparous and Multiparous Women in Miyagi, Japan

Megumi Fujita[1*], Megumi Tsubota[2] and Motoko Ishida[3]

[1]*Faculty of Medicine, School of Nursing, Yamagata University, 2-2-2, Iida-Nishi, Yamagata-shi, Yamagata 990-9585, Japan*
[2]*National Institute of Health and Nutrition, 1-23-1 Toyama, Shinjuku-ku, 162-8636 Tokyo, Japan*
[3]*Tohoku Medical Megabank Organization, 2-1 Seiryo-machi, Aoba-ku, Sendai, 980-8573, Japan*

Abstract

In Japan, almost one-quarter of young women in their 20s are lean, with a body mass index less than 18.5 kg/m^2, and the number of thin pregnant women has also increased. Although the effects of several nutrients and foods have been well examined, little is known regarding the current status of foods and nutrients intake during pregnancy. The purpose of our pilot study was to investigate the current status among nutrients and foods intake during pregnancy, and parity.

Study subjects who were recruited 3-4 days after delivery were admitted to three maternity hospitals in Miyagi Prefecture in 2009. We analyzed 113 postpartum women. The subjects were divided into two groups according to the parity: 52 nulliparas and 61 multiparas. The questionnaire contained the following information: age, body mass index, gestational weight gain, parity, occupation, smoking habits, infant status (gestational weeks and birth weight) and a semi-quantitative food frequency questionnaire (FFQ) inquiring about foods. We examined categorical data using the chi-square test, and compared continuous variables using Student's t-test.

Among the major macronutrients(carbohydrate, protein and fat), the multiparas group showed significantly higher fat intake than the nulliparas group. The nulliparas group showed significantly higher carbohydrate intake than the multiparas group.

Among food intakes, the multiparas group showed a higher intake of fish and a lower intake of fruits compared with the nulliparas group. Among the proportion of frequency of fish intake in both group, less than the nulliparas group had frequency of fish intake than did the multiparas group.

Our pilot study shows that the diet of Japanese pregnant women is insufficient and far below the recommended levels. Although fish intake is also insufficient, the proportion of fish intake increases with increasing parity. Pregnancy can be an opportune time to improve nutrition and presents an ideal time for promotion of health activities.

Publication History:

Received: December 25, 2014
Accepted: February 11, 2015
Published: February 13, 2015

Keywords:

Nutrients intakes, Food intakes, Pregnancy, Parity

Introduction

The trend in Japanese women's body size of being underweight is increasing, especially in young women. Almost one-quarter of young women in their 20s are lean, with a body mass index less than 18.5 kg/m^2 , and the number of thin pregnant women has also increased [1,2]. For this reason, weight gain during pregnancy was classified into three categories of recommended levels of the Maternal and Child Health Division, the MHLW [3]. Moreover, a diet food guide for pregnant women was produced by the MHLW and the Ministry of Agriculture in Japan. Nevertheless, several studies have reported that dietary intake is insufficient among Japanese women during pregnancy [4,5]. Although the effects of several nutrients and foods have been well examined, little is known regarding the current status of foods and nutrients intake during pregnancy with reproductive factors, particularly parity.

The purpose of our pilot study was to investigate the current status among nutrients and foods intake during pregnancy, and the number of children previously borne (parity).

Materials and Methods

Subjects

Study subjects were admitted to three maternity hospitals in Miyagi Prefecture from March to October in 2009. These three maternity hospitals are located in Sendai, which is the prefectural capital of Miyagi Prefecture, and on the Pacific coast of Honshu (the largest of Japan's four major islands).

Subjects were 124 postpartum women recruited 3-4 days after delivery. Those who had extreme levels of energy intake (in the upper or lower 2.5% of the range for all subjects; n = 8) were excluded in the present study. The subjects was divided into two groups according to the parity: nulliparas and multiparas. We excluded subjects for reasons, such as an incomplete answer (n = 3) or an implausible total energy intake (n = 8). Finally, 113 postpartum women were included as subjects in the present study.

Self-report assessments

We distributed self-administered questionnaires to subjects and collected them from the subjects during the hospital stay. The questionnaire contained the following information: age, body mass index, gestational weight gain, parity, occupation, smoking habits, and infant status (gestational weeks and birth weight). The questionnaire also contained a semi-quantitative food frequency questionnaire (FFQ) inquiring about foods.

***Corresponding Author:** Dr. Megumi Fujita, Faculty of Medicine, School of Nursing, Yamagata University, 2-2-2, Iida-Nishi, Yamagata-shi, Yamagata 990-9585, Japan; E-mail: f.megumi@med.id.yamagata-u.ac.jp

Citation: Fujita M, Tsubota M, Ishida M (2015) A Pilot Study of Total Energy, Three Major Nutrients and Food Intakes among Pregnant Women: A Comparison with Nulliparous and Multiparous Women in Miyagi, Japan. Int J Nurs Clin Pract 2: 115. doi: http://dx.doi.org/10.15344/2394-4978/2015/115

In this FFQ, we asked the subjects to recall the frequency of averageconsumption of 141 food items during pregnancy to the inquiry. There were six categories of responses to the question on food consumption: "almost never (<1 time/month)," "1-3 times/month," "1-2 times/week," "3-4 times/week," "5-6 times/week," and "every day." The reliability and validity of this FFQ have already been assessed [6]. The nutrients and fish intake were analyzed by the National Institute of Health and Nutrition.

Statistical analysis

Normality of distribution was assessed through the use of the Shapiro-Wilk test, and equal variances. We examined categorical data using the chi-square test, and compared continuous variables using Student's t-test. A sample size of 124 participants was chosen for conventional methodology [7] to have 80% power at α =0.05 (two tailed) to detect an effect size of 0.5. All statistical analyses were performed with JMP version 11.0 for Windows (SAS Institute Inc., Tokyo, Japan). All reported p values were two-sided and were considered statistically significant if <0.05.

Ethics

The study was approved by the Ethics Committees of the University of Tohoku Fukushi. Written consent was obtained from all participants, after a researcher explained the purpose.

Results

Maternal characteristics

The characteristics of the subjects are shown in Table 1. The mean age (± SD) of the participants was 29.8 ±4.8 years for the nulliparas group and 32.0 ±3.7 years for the multiparas group. There was significant difference in age among the groups (p = 0.006). The body mass index was a normal body size for both groups. For infant, gestational weeks was significant difference in both groups (p = 0.01). There were no preterm births and no low birth weights. None of the other variables were significantly different in both groups.

	Nulliparas	Multiparas	
	(n = 52)	(n = 61)	$P^{\dagger}$
Mother			
Age(Years)	29.8±4.8	32.0±3.7	0.006
Prepregnancy Body Mass Index(kg/m^2)	21.3±3.1	21.0±3.7	0.61
Gastational weight gain(kg)	10.2±4.3	9.5±3.5	0.35
Occupation (%)			
Outside work	4602	2935	0.06
Housewife	53.9	70.5	
Smoking (%)			
Never	57.7	70.5	
Former	40.4	29.5	0.24
Current	1.9	0.0	
Infant			
Gestational weeks(w)	39.5±1.0	38.9±1.3	0.01
Birth weight	3047.1±334.0	3080.8±348.3	0.60

Table 1: Characteristics of subjects in the parity.
$^{\dagger}P$ value was calculated by student's t-test for continious variable and the chi-squre test for categorical variables to test differences between the groups. Stastical significance was defined as p

Selected nutrients and foods

Table 2 shows the intake of selected nutrients and foods, according to the parity. In the total energy intake, multiparas groups was significantly higher than the nulliparas group (p =0.02). Among the major macronutrients (carbohydrate, protein, and fat), the multiparas group showed significantly higher fat intake (44.7 ±10.9 g) than the nulliparas group (p =0.02). The nulliparas group showed significantly higher carbohydrate intake (240.8 ±15.1 g) than the multiparas group (p = 0.01).

Among food intakes, the multiparas group showed a higher intake of fish (31.5 ±16.0 g, p=0.03) and a lower intake of fruits (57.8 ±41.7 g, p=0.03) compared with the nulliparas group. No significant differences in other food intake were observed between subjects in both groups.

	Total Fish intake			
	All	nulliparas	multiparas	P[a]
	(n=113)	(n=52)	(n=61)	
Nutrient intake				
Toatal Energy (kcal)	1544±536.7	1416.0±378.7	1653.2±624.1	0.02
Protein(g)[b]	54.1±7.4	53.3±6.5	54.7±8.1	0.31
Fat(g)[b]	42.7±9.5	40.4±6.9	44.7±10.9	0.02
Carbohydrates(g)[b]	235.2±22.5	240.8±15.1	230.4±26.5	0.01
Food intake				
Fish(g)	28.8±14.2	25.7±11.2	31.5±16.0	0.03
Rice(g)	333.7±93.4	334.6±83.4	332.9±101.8	0.92
Potatoes(g)	37.9±22.5	34.5±17.6	40.7±25.8	0.15
Sugar(g)	5.5±1.9	5.6±1.7	5.3±2.0	0.47
Legumes(g)	69.7±45.3	62.4±33.2	75.9±53.0	0.11
Nuts (g)	1.6±2.0	1.4±1.8	1.7±2.2	0.49
Vegetables(g)	159.7±94.0	167.6±108.2	153.0±80.5	0.41
Fruits(g)	69.4±63.0	83.1±79.5	57.8±41.7	0.03
Mushrooms(g)	5.1±3.4	4.6±2.9	5.5±3.7	0.20
Seaweeds(g)	18.4±9.5	19.4±7.1	17.5±11.2	0.28
Meats (g)	24.5±13.2	22.3±12.9	26.3±13.3	0.11
Eggs(g)	24.9±14.3	23.3±10.8	26.4±16.7	0.25
Dairy(g)	322.8±172.3	345.8±184.6	303.3±160.1	0.19

Table 2: The intake of selected nutrients and food groups during pregnancy in the parity.
[a]P value was calculated by Student's t-test for continious variable to test differences between the group. Stastical significance was defined as P<0.05.
[b]Nutrient intakea are energy-adjusted.

Figure 1 shows the proportion of frequency of fish intake in both groups. Frequencies of fish intake were further classified into 3 groups as follows: a few times a month, a few times a week and most days. In the nulliparas group, the proportion of fish intake was 19.0% for a few times a month, 46.0% for a few times a week and 35.0% for most days. Less than the nulliparas group had frequency of fish intake than did the multiparas group (χ^2 =8.8, 2 df, p =0.01).

Discussion

The present pilot study investigates the current status among and foods intake during pregnancy, and parity. The analyzed sample size

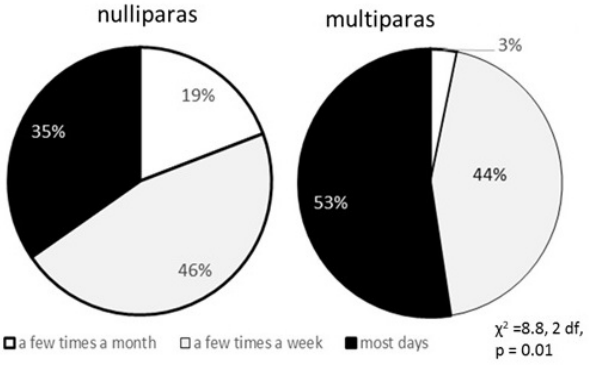

Figure1: The proportions of frequency of fish intake in the parity *P* value was calculated by the chi-square test for categorical variables to test differences between the groups.

was 52 in the nulliparas group and 61 in the multiparas group, and the study had slightly lower statistical power (1-β = 0.75) to investigate the associations among food in both groups. Consequently, we consider that error type II cannot be excluded.

The MHLW's 2010 edition of 'Dietary Reference Intakes for Japanese recommends a total calorie intake of 1950 and 2000 kcal/day for 18- to 29-year-old and 30- to 49-year-old non-pregnant women with ordinary levels of physical activity [8]. In the current study, mean total caloric intake for both groups was between 1416.0 ± 378.7 kcal/day and 1653.2 ± 624.1 kcal/day, which is far below the recommended levels (Table 2).

Subjects in the present study were admitted to three maternity hospitals in Miyagi Prefecture. In people living in Miyagi Prefecture, fish intake during a 1-year period showed a medium ranking regarding overall food intake in Japan [9]. Therefore, we expected that pregnant women would have sufficient intake of fish. However, the mean fish intake in study subjects was 28.8 ±14.2 g/day, which is far below the recommended levels. Intake of fish was significantly higher in the multiparas group compared with the nulliparas group, but the mean fish intake in study subjects was 25.7 ±11.2 g/day for the nulliparas and 31.5 ±16.0 g/day for the multiparas which is far below the recommended levels (Table 2). These results suggest that dietary intake is insufficient, and the tendency to eat less fish is increasing among Japanese women during pregnancy. For Japanese people, fish has traditionally been a major source of protein. Japan has a high rate of fish intake in the global market [1]. However, the National Health and Nutrition Survey (2011) conducted by the Japanese government indicated that fish intake varied between 102.9 g and 78.6 g per day from 2001 to 2011. In addition, meat intake has been higher than fish intake since 2008 [10], indicating that Japanese food styles have changed. The trend of eating less fish is apparent in the young generation [10], and less fish intake in pregnant women is concerning.

The reasons for eating less fish include difficulty in cooking the fish, and anxiety regarding hazardous chemicals, such as polychlorinated biphenyls, dioxins, and methylmercury (MeHg), in fish [11]. MeHg is an environmental neurotoxin, and the fetus is highly susceptible to the adverse effect of MeHg on brain development [12]. Fish intake during pregnancy might be insufficient because almost 80% of Japanese pregnant women are aware of the relation between fish intake and MeHg [13]. A previous study found that large predatory fish, such as tuna, swordfish, and marlin, are the main source of exposure to MeHg in Japan [14]. We consider that it is important to give advice for selecting the type of fish to eat for pregnant women, especially among nulliparas.

The present study showed an increase in the proportion of fish intake with increasing parity (Figure 1). In Japan, healthcare professionals include midwives who advise pregnant women to have a well-balanced diet throughout routine prenatal care. We determined that parous women may have knowledge regarding diet during pregnancy because of multiple opportunities for education on diet. Bastian et al. reported that women with three or more children had 2.5 times the odds of high motivation of a change in their diet compared with primigravid women [15]. As noted above, multiparous women who change their diet behavior may result in action because of having the opportunity for education on diet, such as preparation of action many times. We consider that advice on diet education should be given continuously during pregnancy, as well as breastfeeding. In particular, we consider that it is important to provide the opportunity for education on diet for nulliparas women.

Our study has several methodological limitations. First, the FFQ was self-reported, and participants may have underreported their food consumption and frequency. Although the validity of the information collected by the FFQ has been shown by a validation study [6], this information is not as detailed as that collected by dietary records because it involves recall bias [16]. Several studies have reported that the prevalence of underweight in young Japanese women is increasing, mainly owing to a strong desire to be thin, and low pregnancy weight is also increasing [2,17,18]. Low nutrition intake during pregnancy may lead to restricted maternal weight gain.

Second, we lacked data on socioeconomic and educational status. However, for the Japanese population, higher education is easily accessible, and there is less diversity in socioeconomic levels than in other countries.

Third, there might have been issues in selection of subjects. We selected subjects who were residing at the same geographical region. To eliminate selection bias, we surveyed three maternity hospitals located in the same region in the present study. However, the diets of Japanese vary according to geography, culture, and socioeconomic status. Therefore, dietary during pregnancy needs to be studied in other areas of Japan.

In conclusion, our pilot study shows that the diet of Japanese pregnant women is insufficient and far below the recommended levels. Fish intake is also insufficient, and a lack of fish from the diet is becoming more common among Japanese women during pregnancy. The proportion of fish intake increases with increasing parity. Pregnancy can be an opportune time to improve nutrition and presents an ideal time for promotion of health activities.

Acknowledgments

We would like to sincerely thank the mothers who took part in this study. We also thank all the hospital which participated in the study.

Funding

This study was supported by a Grant-in-Aid for Scientific Research (C) from the Japan Society for the Promotion of Science (grant number 20592601).

Competing Interests

The author(s) declare that they have no competing interests.

Author Contributions

All of authors were involved in designing the research. Megumi Fujita formulated and organized the project, analyzed the data and wrote the majority of the manuscripts. Megumi Tsubota provided a nutritional requirements in the analysis. Megumi Tsubota and Motoko Ishida assisted in the interpretation of results. All the co-authors contributed to the preparation and review of the content of manuscript.

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