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Diversity of Nutrient Intake in Pregnant Women with Different Nutritional Behaviors

Mitra Mirsanjari[1+], Wan Abdul Manan Wan Muda[1], Affizal Ahmad[1], Mohd Shukri Othman[2] and Mir Mehrdad Mirsanjari [3]

[1]School of Health Sciences, Universiti Sains Malaysia,16150, Kubang Kerian,Kelantan
[2]School of Medical Sciences, Universiti Sains Malaysia,16150, Kubang Kerian, Kelantan
[3]Department of Environmental Sciences, Malayer University, Iran

Abstract. A healthy and varied diet during pregnancy is important as it provides improvement of maternal health and birth outcomes. The aim of this study is to investigate pregnant women nutritional intake and comparison with recommended dietary allowances (RDA), and also to understand whether healthy and unhealthy food practices influence on nutrient intake of pregnant women. A cross-sectional study was carried out among pregnant women attended Obstetrics and Gynaecology clinic during their antenatal care visits. Questionnaire KAP and 24 diet recall were used for obtaining data. The findings of this study showed that mean differences of some essential vitamins and minerals was significantly different between two groups of healthy and unhealthy food practices. This study showed that protein, carbohydrate, vit B_1, vit B_2, Niacin, folate, vit B_{12}, phosphorous and zinc, were higher than RDA. Whereas, intake of some other nutrients e.g. fiber, magnesium, potassium were lower than RDA. Pregnant women in this study had higher percentage of positive attitude on food and nutrition (65.1%) versus (27.4% and 7.5%) for moderate and poor attitude respectively. Also, the participants with moderate food practices had highest percentage (77.3%) among 21.7% and 1% for poor and good practices respectively. Knowledge score for poor, moderate and good categories were 18%, 45.6% and 36.4% respectively. It is concluded that pregnant women need to increase their food intakes with rich sources of fibre, magnesium and potassium. The findings recommend that pregnant women need continuous guidance to choose nutrient dense food items. Additionally, the results of this study highlight the importance of healthy nutritional practices of pregnant women with respect to nutritional knowledge. Therefore appropriate nutrition counselling and education could be performed in different stages of women's childbearing age to be reflected on adequate dietary intake before and during the pregnancy.

Keywords: Nutrient intake, Pregnancy, Nutritional practices, Health

1. Introduction

Adequate intake of nutrition during gestation has been accredited as an important determinant for a healthy and successful pregnancy as well as life-long health of future generation [1]. Healthy nutrition intake during gestation becomes decisive prerequisite considering its important role as the most important intrauterine environmental factor that affects on fetal genome expression which may lead to lifelong consequences [2]. It has been proposed that inadequate intake of nutrients during pregnancy induces the fetus to develop adaptations to a limited supply of nutrients, results in permanent alteration on its structure, physiology, function, and metabolism. Such changes in "fetal programming" may activate a number of diseases later in life when individual exposed to dietary intakes and lifestyles diverse significantly from the scarcity experienced in utero, cause the emerging the theory of "fetal origins of adult disease" (the 'Barker hypothesis) [2, 3]. Given the detrimental impacts of imbalanced maternal nutrition on both gestational and neonatal outcomes, mothers could benefit from consultations on the impact of diet and physical activity on

+ Corresponding author. Tel.: + 60913446671; fax: +6097677515.
E-mail address: mitra.mirsanjari@hotmail.com.

reproductive health prior to gestation as well as during pregnancy in order to improve these adverse outcomes through elevating of knowledge level [4]. Women with higher knowledge of nutrition displayed better dietary behavior [5]. However, individual nutritional intake was shown to be influenced by various factors such as lifestyle and health issues, demographic characteristics, social and physiological factors rather than nutrition knowledge [6]. Increasing nutrition knowledge (NK) base, with disclosing an individual to new information, may emerge changes in attitude and consequently resulting in improvements in dietary habits [7]. The aim of this study is to investigate pregnant women nutritional intake and comparison to recommended dietary allowances (RDA) and also to understand whether healthy and unhealthy food practices influence on nutrient intake.

2. Materials and Methods

A total of four hundred and one pregnant women attending for routine antenatal check up at Obstetrics and Gynecology antenatal clinic, participated in this cross-sectional study. Sampling was conducted according to the numbers of registered pregnant women on that day. Women were eligible for this study if they had low risk pregnancy or pregnancy free from complications, single fetus, gestational age between 20^{th} and 34^{th} weeks from the time of initiation of last menstrual period, of Malay ethnicity, and ages between 18 and 44 years old. Exclusion criteria included inability to reasonably communicate with research staff (e.g., language or mental state), gestational age below 20 weeks or above 34 weeks, diagnosing high risk pregnancy at the time of enrollment including conditions such as; cervical incompetence, history of diabetes mellitus, a thyroid condition hyper/ hypothyroidism, any gastric disorders, chronic hypertension, pre-eclampsia, placenta previa, bronchial asthma, advised from primary care members not to contribute in the study, medical or physical condition that prohibits daily regular activity, multiple pregnancies, and infected with blood borne diseases; i.e. HIV or syphilis. Prior to involving in the study, the research purpose was explained to the subjects. Only pregnant women who gave their written consent participated in the study. Demographic information, nutritional knowledge, attitude and practices were obtained by a standardized self-administered questionnaire of Knowledge, Attitude and Practice on food and nutrition (KAP) questionnaire. Data on nutrient and dietary group intake were obtained with single 24-hour dietary recall interview as a proper method to measure current nutrient intake in dietary cross sectional studies [10, 11]. Data entry and analysis conducted using SPSS version 18.0. Mean and Standard deviation for categorical variables and frequencies for continuous variables were obtained through descriptive analysis. Comparisons of means of each nutrient score between healthy/unhealthy dietary practices for normally distributed variables were performed using independent *t*-tests with a significant level of $\alpha < 0.05$.

3. Results

Four hundred and one pregnant women completed the study. The mean (standard deviation) of women's age was 29.68(5.02) years with a range of 18 to 42 years. Table 2 shows that the majority of women were married (n = 397, 99%). Pregnant women with 28.3% were in their first, 20.4% in their second, and 21.4% in their third pregnancy. Monthly income of family was grouped into four categories in Ringgit Malaysia (RM): less than or equal to RM 1000 (20%); RM 1001-3000 (43.9%); RM 3001-5000 (23.2%); and more than RM 5000 (12.5%). The nutritional knowledge score had a mean of 13.8 (3.4), which represented 65.7% correct responses. Pregnant women in this study had higher percentage of positive attitude on food and nutrition (65.1%) versus (27.4% and 7.5%) for moderate and poor attitude respectively. Also, the participants with moderate food practices had highest percentage (77.3%) among 21.7% and 1% for poor and good practices respectively. Knowledge score for poor, moderate and good categories were 18%, 45.6% and 36.4% respectively. Mean of vitamin B_1, B_2, B_{12}, C, B_3, K, Folate and iron scores in healthy consumption of fish and sea foods were significantly higher than unhealthy group (Table 1). Our study showed no significant mean differences of vitamins and minerals between healthy/unhealthy consumption of chicken. However, there was significant difference between means of fat quantity between two groups (45.8 vs. 40.1). The group with healthy consumption of meat, beef and mutton had higher mean score in Energy, Fat, CHO, Fiber and Sodium compared to unhealthy group (Table 1). Means of vit E scores between two groups of egg consumers were (4.9 vs. 4.1), but mean of magnesium was higher in unhealthy group (149 vs. 164; p= 0.028).

Among healthy/unhealthy consumers of bean and products only vit B_5 mean scores showed significant difference between two groups (4.9 vs. 4.1). Mean scores between two groups of vegetable users were significant in Fiber, Ca, Potassium, vit B_1, vit B_2, Niacin, vit C, Folate (Table 1). Fruit consumers showed significant different in mean scores of Fiber, Ca, Potassium, vit E, Zn. This study showed means of Ca, potassium, vit B_1, B_2, B_6, E and Zn scores were significantly different in healthy/ unhealthy groups of milk consumers. Findings also showed that 56.7% of pregnant women exceeded the RDA in their intakes of protein, CHO (75.6%). Conversely, intakes of fibre (93.9%), magnesium (82.5%), and potassium (98.2%) were below the RDA.

Table 1: Comparison of mean of nutrients between healthy and unhealthy food practices of pregnant women

Consumption of food groups	nutrient	Mean(SD)		t statistic (df)	P value*
		Healthy behavior	Unhealthy behavior		
	Vit B1	2.5 (2.5)	1.5(1.1)	-4.162(57)	<0.001
	Vit B2	2.9 (2.6)	1.9(1.2)	-3.899(50)	<0.001
	Fe	49.8(23.7)	23.31(15.6)	-2.187(136)	<0.001
	potassium	1397.9(677.4)	1146.4(573.8)	-1.945(399)	0.052
Fish and other sea food	Niacin	20.1(13.7)	13.43(6.2)	-4.942(53)	<0.001
	Vit C	241.6(73.6)	104.9(69.2)	-7.138(123)	<0.001
	Folate	733.3(282.5)	492.1(163.2)	-2.583(30)	0.014
	Vit B12	5.9(2.7)	4.1(2.8)	-2.393(43)	0.021
	Vit K	84.9(32.1)	48.7(28.8)	-4.527(91)	<0.001
Chicken/ duck	Fat	45.8(25.6)	40.1(22.1)	-2.022(399)	0.044
	Energy	1767.8(667.3)	1594.3(554.5)	-2.736(399)	0.006
	Fat	49.9(28.7)	41.7(22.4)	-2.849(204)	0.005
Meat, beef, mutton	CHO	256.4(94.2)	236.9(84)	-2.092(399)	0.037
	Fiber	17.6(4.9)	14.3(3.2)	-2.429(319)	0.016
	Na	2132.8(1434.4)	1787.5(1141.6)	-2.397(208)	0.017
	Vit E	8.7(3.3)	6.5(2.7)	-1.777(391)	0.079
Egg	Mg	149.9(64.4)	164.3(65.5)	2.212(399)	0.028
	B5	4.9(1.4)	4.1(2.1)	-2.012(399)	0.045
Bean and products	Mg	180(47.5)	155.4(66)	-1.893(399)	0.059
	Fiber	5.3(2.9)	2.7(4.1)	-2.929(269)	0.004
	Ca	585.2(341.6)	507(357)	-1.954(399)	0.051
	Potassium	1422.6(687.7)	1250.6(611.8)	-2.225(399)	0.027
	B1	2.6(2.5)	2.2(1.8)	-2.964(191)	0.003
Vegetables	B2	3.1(2.5)	2.2(1.8)	-2.961(194)	0.003
	Niacin	20.5(13.7)	16.7(11.9)	-2.703(194)	0.007
	Vit C	251.8(82.9)	171.2(55.3)	-2.772(184)	0.006
	folate	757.1(74.2)	591.4(64.6)	-2.195(176)	0.029
	Fiber	7.5(3.1)	3.7(2.4)	-2.855(397)	0.005
	Ca	597.6(353.6)	512.6(329.2)	-2.388(399)	0.017
	Potassium	1454.6(697.9)	1254.4(610.9)	-2.910(399)	0.004
Fruits	Vit E	8.7(2.4)	5.8(3.1)	-2.357(366)	0.019
	Zn	8.9(4.7)	7.4(3.5)	-2.136(359)	0.033
	Ca	677(327.8)	476.1(336.1)	-6.017(399)	<0.001
	Potassium	1473.1(637.7)	1304.3(692.3)	-2.514(399)	0.012
	B1	2.6(2.3)	2.1(1.8)	-1.998(399)	0.046
Milk	B2	3.1(2.5)	2.5(1.3)	-2.565(399)	0.014
	B6	3.2(1.7)	2.2(0.92)	-2.130(399)	0.034
	Vit E	9.3(3.6)	6.3(2.7)	-2.353(356)	0.019
	Mg	163.5(62.6)	151.8(67.1)	-1.786(399)	0.075
	Zn	9.8(6.4)	7.2(3.2)	-3.618(357)	<0.00

*Independent *t* test

4. Discussion

Maternal nutrition during pregnancy is of prime importance in maternity care as it provides improvement of maternal health and birth outcomes [12]. During pregnancy demand for energy and nutrients is increased

[13]. However, many women in developing countries limit their nutrient intake to have smaller infants, and consequently lower risk of delivery complications [14]. Therefore, behavioral change programs established to promote positive health and nutritional practices for females in childbearing ages [15]. This study was set up with the aim of estimation of difference in nutrient intake between pregnant women who followed healthy dietary habits. The findings of this study revealed existence of significant difference between some nutritional behaviors and nutrient intake quantity. Findings of this study showed that pregnant women who consumed sea foods and fish every day or 2-3 days per week had higher intake of some vitamins and minerals in comparison to other group. The most common types of sea foods used by pregnant women in our study were mackerel, salmon, sardine, shellfish, prone, catfish, crab and lobster. It was recently recognized that sea foods are the best dietary sources of both converted forms of omega-3 fatty acids, docosahexaenoic acid (DHA) and ecosapentaenoic acid (EPA). Different types of omega-3 fatty acids have been shown to be beneficial in treatment or prevention of some disease conditions [16]. Among diversity of disease, depression was highly reported to be associated with omega-3 categories. Delion *et al*. found that the densities of dopamine and serotonin receptors as two main neurotransmitters, are dependent on brain DHA levels [17]. Given that dopamine and serotonin have lower prenatal level in pregnant women with depression, and considering that antenatal depression negatively affects the fetus and newborn, the importance of sea foods on antenatal mental health is becoming noteworthy [18]. While sea foods are good source of both DHA and EPA, their probable contamination with methyl mercury, a neurotoxin to which the fetal brain is particularly sensitive, put their intake into concern [19, 20]. Since 92.8% of pregnant women in this study consumed fish and seafood everyday or 2-3 days per week, they needed to be advised about the quantity of seafood consumption to 12 ounces per week and from low-mercury species such as anchovies, catfish, mackerel, oyster, lobster, salmon, sardine, trout, and tuna according to recommendation of the American College of Obstetricians and Gynaecologists and Environmental Protection Agency [20]. In this study, no significant mean differences were shown in vitamins and minerals between healthy/unhealthy consumption of chicken. Only the mean difference of fat between two groups was significant. This finding may be explained by this fact that intake of chicken is usually together with oily and starchy foods in these participants. In addition, cultural habits in preparing of foods and type of cooking, mostly frying the chicken affects its fat content. This study showed that intake of vegetables and fruits among pregnant women were 75.1% and 62.6% respectively. The health benefits of vegetables and fruits as the valuable sources of vitamins and minerals have been acknowledged by researchers. Brantaeter et al. in their study found that pregnant women with dietary pattern high in vegetables, plant foods, and vegetable oils had reduced risk of preeclampsia compared to dietary pattern with high amount of processed meat, salty snacks, and sweet drink [21]. Effect of fruits and vegetables on risk of preeclampsia can be contributed to amount of vitamin C as shown by Cuilin Zhang et al. who disclosed that women with intake of vitamin C below the RDA had lower plasma ascorbic acid and higher risk of preeclampsia [22]. Another study in United State indicated that dietary fibers had negative association with concentration of maternal lipoprotein and plasma lipid [23]. Furthermore, higher intake of fruits and vegetables by women has resulted in reduced risk of upper respiratory tract infection during pregnancy [24]. Although the results of current study shows that 81.5% of participants consumed bean and products in their meals every day, the mean intake of magnesium was 44% of RDA. It is possible that, the portion size of bean, dhal and its products are small while they are consumed with combination with other foods. Consequently the amount of bean in food serving will be inadequate to provide optimum amount of nutrients. Our study described some specific nutrient of dietary intake with respect to nutritional practices in sample of pregnant women. The finding of low intake of some micronutrient and energy suggests that these women were using low energy and nutrient dense foods. However, intake of some other micronutrients exceeded the RDA.

5. Conclusion

It is concluded from this study that pregnant women need to increase their knowledge in food intakes with rich sources of fibre; magnesium and potassium. The findings recommend that pregnant women need continuous guidance in choosing nutrient dense food items. Additionally, the results of this study highlight the importance of healthy nutritional practices of pregnant women with respect to nutritional knowledge.

Therefore appropriate nutrition counselling and education could be performed in different stages of women's childbearing age to be reflected on adequate dietary intake before and during their pregnancy.

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Table 2: Participants' Descriptive Statistics

Variables		**(n=401)** †	**(%)**
Marital Status	Single	1	0.2
	Married	397	99
	Divorced	2	0.5
Housing tenure	Owner	172	42.9
	Rented	111	27.7
	With parents	117	29.2
Occupation	Housewife	93	23.2
	Government	265	66.1
	Non government	41	10.2
Monthly income	≤1000 RM		20
	1001-3000 RM	80	43.9
	3001-5000 RM	176	23.2
	>5000RM	93	12.5
		50	
Food expenses	≤500 RM	197	49.1
	501-1500RM	180	44.9
	>1500RM	22	5.5
Educational level	No/ primary school	6	1.5
	Secondary school	152	37.9
	Higher education	243	60.6

† Number may not be total 401 in each item because of missing data

Table 3: Nutrient intake of pregnant women

Nutrient	**Mean (SD)**	**RDA (%)**
Energy(Kcal)	1650.14 (597.85)	2743-2855* (60.15)
Protein(g/d)	68.97 (28.51)	60* (114.95)
Carbohydrate(g/d)	243.19 (87.78)	175† (138.97)
Fat(g/d)	44.34 (24.90)	47* (94.34)
Fiber(g/d)	5.23 (4.91)	28* (17.10)
Vit B1(mg)	2.41 (2.47)	1.4† (172.14)
Vit B2(mg)	2.82 (2.53)	1.4† (201.42)
Vit B6(mg)	2.73 (0.71)	1.9* (143.68)
Niacin(mgNE)	19.61 (13.42)	18† (108.94)
Folate(µg)	715.82 (271.64)	600† (119.3)
Vitamin B12(µg)	3.84 (3.72)	2.6* (147.6)
Vit B5 (mg)	4.19 (2.05)	6* (69.8)
Vit K(µg)	81.1 (23.2)	90* (90.1)
Calcium (mg)	565.79 (346.76)	1000† (56.57)
Phosphorus (mg)	906.14 (390.60)	700† (129.44)
Magnesium (mg)	157.08 (65.33)	350* (44.88)
Zinc (mg)	8.41 (7.10)	7-10† (120-84.1)
Selenium (µg)	24.32 (4.18)	29† (83.86)
Potassium (mg)	1379.70 (672.95)	4700*(29.3)
Sodium(mg)	1898.58 (1251.97)	2300*(82.54)

*Recommended dietary allowance (RDAs)/National Research Council (NRC) †Recommended Nutrient Intakes for Malaysia