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Kertas Asli/*Original Articles*

Nutritional Status and Nutritional Knowledge of Malay Pregnant Women in Selected Private Hospitals in Klang Valley

(Status Pemakanan dan Pengetahuan Pemakanan dalam Kalangan Wanita Hamil Melayu dari Hospital Swasta Terpilih di Lembah Klang)

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ABSTRACT

Adequate nutrition is important for mothers and their offspring during and after birth. This cross sectional study was conducted to determine nutritional status and nutritional knowledge of pregnant women from two selected private hospitals in Klang Valley, Malaysia. A total of 236 Malay pregnant women aged between 20 to 45 years old (mean age 31±5 years) were recruited through convenient sampling method. Socio-demographic data, nutritional knowledge and a 24-hours diet recall were obtained through a self-administered questionnaire. Anthropometric and haemoglobin data were obtained from the antenatal records in the respective hospitals. The percentages of participants who were underweight, normal, overweight and obese before pregnancy were 12.7%, 55.1%, 25.0% and 7.2% respectively. Among those who were obese before pregnancy, a total of 59.7% had inadequate weight gain, 24.6% gained adequate weight and 15.7% gained excessive gestational weight. About 33.5% of subjects were anaemic (Hb < 11.0g/dL). The mean daily energy intake of the participants was 1748 ± 526 kcal which was 76% of RNI. Calcium (73% of RNI), folic acid (36% of RNI), niacin (89% of RNI) and vitamin D (40% of RNI). The nutritional knowledge level of subjects was moderate (51.9 ± 13.8%). Lower monthly household income (p < 0.001), educational level (p < 0.001) and gestational stage (p < 0.05) of participants were associated with a lower nutritional knowledge level. Nutritional knowledge score was positively correlated with gestational weight gain (r = 0.166, p < 0.05) and haemoglobin level (r = 0.200, p < 0.05). Subjects who claimed practising food taboos had higher nutritional knowledge score (54.9 ± 12.5%) than those who did not (49.9 ± 14.4%)(p < 0.05). A comprehensive nutrition education should be integrated in the antenatal classes to improve nutritional status of pregnant women.

Keywords: Nutritional knowledge; gestational weight gain; haemoglobin; nutrient intake; food taboo

ABSTRAK

Pemakanan yang mencukupi adalah penting bagi ibu dan bayi mereka semasa dan selepas kelahiran. Kajian hirisan lintang telah dijalankan untuk menentukan status pemakanan dan pengetahuan pemakanan wanita hamil dari dua buah hospital swasta terpilih di Lembah Klang, Malaysia. Seramai 236 wanita hamil Melayu berusia antara 20 hingga 45 tahun (min umur 31 +5 tahun) telah diambil melalui kaedah persampelan mudah. Data sosio-demografi, pengetahuan tentang pemakanan dan 24 jam ingatan diet diperoleh melalui soal selidik laporan sendiri. Data antropometri dan hemoglobin diperoleh daripada rekod antenatal di hospital tersebut. Peratusan peserta yang mengalami kekurangan berat badan, berat badan normal, berat badan berlebihan dan obes sebelum kehamilan adalah masing-masing 12.7%, 55.1%, 25.0% dan 7.2%. Dalam kalangan wanita yang obes sebelum mengandung, sebanyak 59.7% peningkatan berat badan mereka adalah tidak mencukupi, 24.6% normal dan 15.7% mengalami peningkatan berat badan yang berlebihan. Prevalens anemia (Hb < 11.0g/dL) subjek adalah 33.5%. Pengambilan tenaga harian min peserta ialah 1748 ± 526 kcal, iaitu 76% dari saranan RNI. Kalsium (73% dari saranan RNI), asid folik (36% dari saranan RNI), niasin (89% dari saranan RNI) dan vitamin D (40% dari saranan RNI). Tahap pengetahuan pemakanan subjek adalah sederhana (51.9 ± 13.8%). Pendapatan isi rumah bulanan yang lebih rendah (p < 0.001), tahap pendidikan (p < 0.001) dan fasa gestasi (p < 0.05) subjek dikaitkan dengan tahap pengetahuan pemakanan yang lebih rendah. Tahap pengetahuan pemakanan berkorelasi positif dengan peningkatan berat badan semasa mengandung (r = 0.166, p < 0.05) dan tahap hemoglobin (r = 0,200, p < 0.05). Subjek yang mendakwa mengamalkan pantang larang makanan mempunyai skor pengetahuan pemakanan yang lebih tinggi (54.9 ± 12.5%) berbanding wanita yang tidak mengamalkan pantang larang makanan (49.9 ± 14.4%) (p < 0.05). Pendidikan pemakanan yang komprehensif adalah perlu semasa kelas antenatal untuk meningkatkan status pemakanan wanita hamil.

Kata kunci: Pengetahuan pemakanan; berat badan semasa mengandung; hemoglobin; pengambilan nutrien; pantang larang makanan

INTRODUCTION

The diet of a woman before and during pregnancy has immense influence on the course of pregnancy and health of a child after birth. Lack of dietary knowledge and the knowledge about consequences of malnutrition among pregnant women may result in a lot of dietary indiscretion, which in turn can cause deficiency or excess of energy and particular nutrients, as well as abnormal course of pregnancy (Kozlowska-Wojciechowska & Wujec 2002).

Anaemia during pregnancy is a common problem among pregnant women. Maternal mortality is strongly associated with severe anaemia (Brabin et al. 2001). In addition, anaemia during pregnancy is a risk factor for preterm delivery, low birth weight, and possibly for inferior neonatal health (Allen 2000). Studies in China (Cheng et al. 2009), Thailand (Suchan et al. 2010) and Brazil (Sato et al. 2010) showed that many pregnant women experienced inadequate nutrition intake especially iron and folic acid. Research by Hadipour et al. (2010) found that maternal haemoglobin level is associated with neonatal birth weight, length and head circumference. In Malaysia, the prevalence of anaemia among pregnant women is still prevalent. In 2005, Jamaiyah and her colleagues reported anaemia prevalence among pregnant women in rural and urban areas at 14 states in Malaysia was 35% (Jamaiyah et al. 2007). A more recent study by Thirukanesh and Zahara (2010) in rural area in Johor and urban area in Selangor showed that 42.3% of pregnant women were anaemic. Low intake of iron and folic acid among pregnant women were frequently reported (Nora 2007; World Health Organization 2001). Awareness of diet–disease relationships, favourable attitudes about healthy eating and better nutritional knowledge contribute to healthier food choices (Frazao & Allshouse 2003). Besides, nutritional knowledge is also integral to the achievement of healthful dietary behaviours and consequently in the improvement of diet quality (Zalihah et al. 2008).

A proper diet and adequate weight gain during pregnancy are essential for good health of the mother and optimum development of the baby (Institute of Medicine 2009). Inadequate gestational weight gain may cause fetal growth restriction such as low birth weight and increased prenatal mortality rates (Institute of Medicine 1990; Johnson & Yancey 1996). In addition, preterm birth is more common among mothers with low gestational weight gain (Oken et al. 2007). In 2009, the Institute of Medicine (IOM) recommended the gestational weight gain ranges during the entire pregnancy based on pre-pregnancy Body Mass Index (BMI). Women with a normal weight for their height before pregnancy (BMI of 18.5 to 24.9 kg/m^2) should gain 11.3 to 15.9 kg, underweight women (BMI less than 18.5 kg/m^2) should gain 12.7 to 18.1 kg, overweight women (BMI of 25 to 29.9 kg/m^2) should gain, 6.8 to 11.3 kg and those who are obese (BMI greater than 30 kg/m^2) should limit their weight gain to 5 to 9 kg (Institute of Medicine 2009).

The joint of Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO) and United Nations University (UNU) (2004) recommended that, no additional energy is required in the first trimester for pregnant women with normal pre-pregnancy BMI. However, an additional of 360 kcal/day and 475 kcal/day are required during the second and the third trimester respectively (FAO/WHO/UNU 2001). Butte et al. (2004) has outlined the additional energy needs during pregnancy by trimester based on the mother's pre-pregnancy BMI. The underweight woman should increase her usual energy intake by an additional of 150 kcal/day in the first trimester, 200 kcal/day in the second trimester and 300 kcal/day in the third trimester. The normal-weight woman should add 350 kcal/day in the second trimester and 500 kcal/day in the third trimester. The overweight/obese woman should add 350 kcal/day in the second trimester and 450 kcal/day in the third trimester. Earlier, Snyder et al. (1994) recommended that 23-25 kcal/kg should be prescribed for obese women before pregnancy and 30-34 kcal/kg to normal-weight women before pregnancy.

In Malaysia, the Third National Health and Morbidity Survey (NHMS III) in 2006 reported that 29.1% of the adults were overweight (BMI 25.0-29.9 kg/m^2) and 14.0% were obese (BMI >30.0 kg/m^2) (Noor Safiza et al. 2008) . According to the Institute of Medicine (2009), an increasing percentage of women who are entering pregnancy are overweight or obese, and many are gaining too much weight during pregnancy which put them at higher risk for chronic diseases that affects both mother's and baby's health. Excessive gestational weight gain is an established independent risk factor for high postpartum weight retention and future weight gain, cardiovascular disease and Type 2 diabetes mellitus in women (Hedderson et al. 2006; Little & Weinberg 1993; Sebire et al. 2001; Shaw & Carmichael 2008; Stephansson et al. 2001; Waller et al. 2007). It is also related to several more immediate adverse obstetrical outcomes, including gestational diabetes, pre-eclampsia, caesarean deliveries and stillbirths (Hedderson et al. 2006; Institute of Medicine 2009; Little & Weinberg 1993; Sebire et al. 2001; Shaw & Carmichael 2008; Stephansson et al. 2001; Waller et al. 2007). Babies born by women with excessive gestational weight gain are at high risk of macrosomia, childhood obesity and development of obesity-related comorbidities (Frazao & Allshouse 2003; Oken et al. 2007; Stotland et al. 2006).

To the best of our knowledge, studies on the level of nutritional knowledge among Malay pregnant women are limited. Majority of Malay pregnant women have a moderate educational level (Nora 2007; Norsaadah 2002) and also did not consume sufficient energy and nutrient during pregnancy (Nora 2007). In addition, according to Thirukkanesh and Zahara (2010), a half of their Malay pregnant women subjects did not comply with supplementations (50.8%) which has been linked to the ineffectiveness of supplementation programme among pregnant women. Most of previous local studies were

conducted in the public hospitals (Nora 2007) and clinics (Jamaiyah et al. 2007; Thirukkanesh & Zahara 2010). Studies conducted among pregnant women attending private clinics or hospitals is scarce. Thus, this study was conducted to determine the nutritional status and nutritional knowledge of Malay pregnant women at selected private hospitals in Kuala Lumpur and Selangor. It is hypothesized that higher nutritional knowledge is associated with better nutritional status of pregnant women. The results of this study are important for health professionals to develop strategies in nutrition education targeted on pregnant women to optimize their nutritional status during and after pregnancy.

MATERIALS AND METHODS

STUDY DESIGN AND SAMPLING METHOD

This cross-sectional study was carried out from March 2011 until June 2011 in two private hospitals in Kuala Lumpur and Selangor. Hospitals and participants were selected using convenient sampling method where all the hospitals and clinics within Selangor and Kuala Lumpur were selected online based on high attendances by Malay pregnant women. The researchers have sent written permission to over 15 hospitals and clinics in Selangor and Kuala Lumpur and only 2 private hospitals in Klang Valley approved for this study to be conducted in their premises. The inclusion criteria included: Pregnant women who were healthy, Malays, Malaysian citizen and agreed to participate in this study. Pregnant women with chronic diseases such as gestational diabetes, hypertension and multiple pregnancies were excluded. A total of 236 pregnant women aged 20 to 45 who met the inclusion criteria were recruited. Based on the sample size calculation using the formula by Daniel (1999) with 80% power, 0.05 of significant level and 10% drop out, 214 participants were required to be recruited. An ethical approval for the study protocol was obtained from Universiti Kebangsaan Malaysia Research Ethical Committee. Approval from the respective hospitals and informed consents from all participants were obtained.

ASSESSMENT OF NUTRITIONAL STATUS AND NUTRITIONAL KNOWLEDGE

The antenatal data such as gestational week, pre-pregnancy and current body weight, height and haemoglobin level were obtained from participants' antenatal records in the respective hospitals. Pre-pregnancy Body Mass Index (BMI) was classified according to World Health Organization (2004) categorization. Participant's gestational weight gain was compared with the recommendation of weight gains from Institute of Medicine (2009). Haemoglobin levels were classified according to the cut-off points for pregnant women by World Health Organization (2001) of which < 110 g/L was classified as anaemic. Energy and nutrient intake was assessed by a 24 hours diet recall which was conducted during the interview with the participants in the antenatal clinics and the data was analysed using NutritionistPro software, fourth edition of Nutrient Composition of Malaysian Foods (Tee et al. 1997) and Atlas of Food Exchanges & Portion Sizes (Suzana et al. 2009).

Participants' nutritional knowledge was assessed using a 68-items self-administered questionnaire of the nutritional knowledge, attitude and practice questionnaire for adults which was developed by a modification of National Network of Child Care (1999a, 1999b) nutrition of pregnancy questionnaire. Participants were also asked about whether they practiced any food taboo. The questionnaire was face validated among dietitians then tested for reliability (Cronbach's alpha = 0.78) in 28 pregnant women attending antenatal clinic in the same private hospital in Kuala Lumpur.

STATISTICAL ANALYSIS

All data obtained were analyzed using the Statistical Package for Social Science (SPSS) version 16.0. Data were summarized using means, standard deviations and percentages. Kolmogorov-Smirnov test was used to test the data normality. Comparisons of nutritional knowledge score with pregnancy order and food taboo practices were performed using the Mann-Whitney U test. Kruskal-Wallis test was used to compare mean gestational weight gain between pre-pregnancy BMI categories, factors affecting nutritional knowledge and haemoglobin level. Spearman correlation test was used to determine the relationship between nutritional knowledge score with haemoglobin level and pregnancy weight gain while Pearson correlation test was used to determine the relationship between nutritional knowledge score and nutrients intake. Chi-square test was used to determine the relationship between gestational weight gain with educational levels, food taboo practices and status of nutritional advice during pregnancy. Significant level was set at $p < 0.05$.

RESULTS

SOCIO DEMOGRAPHIC PROFILES OF PARTICIPANTS

A total of 236 participants participated in this study with more than half of them aged between 20 to 30 years old (58.9%), followed by 31 to 40 year old (39.4%) (Table 1). About half of participants (53%) had monthly household income in between RM1500 – RM3500 and only 37.7% of participants had monthly household income more than RM3500. More than a half (72.0%) of participants received tertiary education and a quarter (25.5%) of them received secondary school education. A total of 72.8% of participants were in their first or second pregnancy while the rests (27.2%) were in their third or more pregnancy. More than half of participants (57.2%) were in the third trimester, while the rest were in the first (17.8%) and the second trimester (25.0%). The mean of haemoglobin level

TABLE 1. Nutritional knowledge score by demographic and antenatal characteristics of participants (n = 236)

	n	%	Nutritional knowledge score	p-value
Age (Year)				
20-30	139	58.9	52.0 ± 13.6	
31-40	93	39.4	51.4 ± 14.1	0.463[a]
41-45	4	1.7	59.8 ± 15.3	
Monthly household income (RM)				
< 1500	22	9.3	37.0 ± 13.9	
1500-3500	125	53.0	50.9 ± 12.6	< 0.001[a]
>3500	89	37.7	57.1 ± 12.5	
Educational level				
Secondary	60	25.5	43.9 ± 14.1	
Tertiary	170	72.0	55.3 ± 12.2	<0.001[a]
Others[#]	6	2.5	37.5 ± 14.8	
Pregnancy Order				
1-2	172	72.8	52.4 ± 12.6	0.830[b]
≥ 3	64	27.2	51.1 ± 16.6	
Gestational week				
First trimester (week 1-14)	42	17.8	46.3 ± 13.8	
Second trimester (week 15-28)	59	25.0	52.1 ± 13.2	0.017[a]
Third trimester (week 29-40)	135	57.2	53.6 ± 13.7	
Haemoglobin level				
Anemic (< 11 g/dL)	79	33.5	58.4 ± 1.07	0.101[b]
Non anemic (≥ 11 g/dL)	179	66.5	62.9 ± 0.57	

[a]Kruskal-Wallis test
[b]Mann-Whitney test
[#]Others = diploma and certificates

was 11.4 ± 1.0 g/dL. About two-thirds of participants were non-anaemic (66.5%) with mean haemoglobin level of 11.9 ± 0.7 g/dL while 33.5% of participants were anaemic with mean haemoglobin level of 10.4 ± 0.5 g/dL.

NUTRITIONAL KNOWLEDGE SCORE ACCORDING TO CHARACTERISTICS OF PARTICIPANTS

The Kruskal-Wallis test showed that only monthly household income ($p < 0.001$), educational level ($p < 0.001$) and gestational stage ($p < 0.05$) were significantly associated with nutritional knowledge scores. When participants were categorized by pre-pregnancy BMI status, 12.7% were underweight, 55.1% were normal, 25.0% were overweight and 7.2% were obese (Table 2). The difference of nutritional knowledge score was not statistically significant between participants who had normal pre-pregnancy BMI and those who were obese. However, participants who had normal pre-pregnancy BMI had highest nutritional knowledge score (52.8%) while those who were obese had the lowest score (45.0%) (Table 2). In terms of gestational weight gain, more than half of participants (59.7%) had inadequate gestational weight gain, 24.6% had normal gestational weight gain and 15.7% had excessive gestational weight gain (Table 2). Spearman correlation test showed a significant positive correlation between nutritional knowledge score with the mean of gestational weight gain ($r = 0.166$; $p < 0.05$).

GESTATIONAL WEIGHT GAIN ACCORDING TO GESTATIONAL WEEK

The mean of gestational weight gain in the first, second and third trimester were 3.26 ± 4.42 kg, 6.38 ± 4.28 kg and 11.72 ± 4.87 kg respectively (Table 3). The majority of participants in the first trimester (90.5%) had inadequate gestational weight gain compared with their counterparts in the second (86.4%) and the third trimester (37.8%). There were 5.1% of participants in their second trimester and 25.2% in the third trimester had excessive gestational weight gain. However, this discrepency was not seen among participants in the third trimester.

There was a significant positive correlation between nutritional knowledge score with the mean of haemoglobin level ($r = 0.203$; $p < 0.05$) (Table 4). There was no significant relationship between haemoglobin level with educational level, monthly household income and food taboo practice. However, participants who claimed practiced food taboo (41.4%) had a higher nutritional knowledge score (54.9 ± 12.5%) than participants who did not (49.9 ± 14.4%) ($p < 0.05$) (Table 5). There are no significant gestational weight gain between subjects who claimed practiced food taboo compared with those who did not ($p > 0.05$).

TABLE 2. Nutritional knowledge score by pre-pregnancy BMI categories and gestational weight gain

Pre-pregnancy BMI categories (kg/m^2)	n%	Nutritional knowledge score, %	r value	p value[a]
Underweight (< 18.5)	30 (12.7)	50.6		
Normal weight (18.5-24.9)	130 (55.1)	52.8	-0.038	0.056
Overweight (≥ 25.0)	59 (25.0)	52.7		
Obese (≥ 30.0)	17 (7.2)	45.0		
Gestational weight gain	n%	Nutritional knowledge score, %	r value	p value
Inadequate	141 (59.7)	51.3		
Normal	58 (24.6)	52.4	0.166	0.010
Excessive	37 (15.7)	53.8		

[a]Pearson correlation test
[†]Spearman correlation test

TABLE 3. Gestational weight gain by gestational week

Gestational week	n (%)	Mean gestational weight gain ± SD (kg)	Gestational weight gain		
			Inadequate weight gain	Normal weight gain	Excessive weight gain
			n (%)	n (%)	n (%)
First trimester	42 (17.8)	3.26 ± 4.42	38 (90.5)	4 (9.5)	-
Second trimester	59 (25.0)	6.38 ± 4.28	51 (86.4)	5 (8.5)	3 (5.1)
Third trimester	135 (57.2)	11.72 ± 4.87	51 (37.8)	50 (37.0)	34 (25.2)

TABLE 4. Haemoglobin level by sociodemoghrapic characteristics and food taboo practices

Pre-pregnancy BMI categories (kg/m^2)	n%	Mean haemoglobin level (g/dL)	r value	p value[#]
Nutritional knowledge score (%)				
< 50	23 (1.3)	11.2 ± 0.92		
50 - 75	203 (86.4)	11.5 ± 0.99	0.203	0.002
> 75	9 (3.8)	11.7 ± 1.17		
Education level				
Secondary	60 (25.5)	11.3 ± 1.03		
Tertiary	170 (72.0)	11.4 ± 0.96	0.061	0.642
Others	6 (2.5)	11.5 ± 1.01		
Monthly household income (RM)				
< 1500	22 (9.3)	11.2 ± 0.98		
1500 – 3500	125 (53.0)	11.3 ± 1.02	0.127	0.148
>3500	89 (37.7)	11.5 ± 0.91		
Food taboo practises				
Yes	97 (41.1)	11.4 ± 0.90	-0.076	0.245
No	139 (58.9)	11.3 ± 1.00		
Stage of pregnancy				
Trimester 1	42 (17.8)	11.0 ± 0.12		
Trimester 2	59 (25.0)	11.5 ± 0.12	0.096	0.142
Trimester 3	135 (57.2)	11.4 ± 0.09		

[#]Spearman correlation test

TABLE 5. Nutritional knowledge score and gestational weight gain by food taboo practices

	Food taboo practices		p-value[#]
	Yes	No	
Nutritional knowledge score, Mean ± SD (%)	54.9 ± 12.5	49.9 ± 14.4	0.009
Gestational weight gain, n (%)			
Insufficient	59 (60.7)	82 (59.0)	
Normal	21 (21.6)	37 (26.6)	0.514
Excessive	17 (17.5)	20 (14.4)	

[#]Mann-Whitney test

TABLE 6. Energy and nutrient intake by participants

Nutrient		Mean ± SD	RNI	% RNI	< RNI		≥ RNI	
					n	%	n	%
Energy (kcal)	Trimester 1 (n = 42)	1580 ± 530	2000	79	33	78.5	9	21.4
	Trimester 2 (n = 59)	1794 ± 552	2360	76	54	91.5	5	8.5
	Trimester 3 (n = 135)	1780 ± 506	2470	72	122	90.4	13	9.6
Carbohydrate (g)		224 ± 76	#	#	NA	NA	NA	NA
Protein (g)		68 ± 22.0	62.5	109	99	41.9	137	58.1
Fat (g)		64 ± 27	#	#	NA	NA	NA	NA
Calcium (mg)		734 ± 0	1000	73	183	77.5	53	22.5
Ferum (mg)		20 ± 12	20	100	150	63.6	86	36.4
Thiamin (mg)		1.4 ± 0.8	1.4	100	144	61.0	92	39.0
Riboflavin (mg)		2.0 ± 1.2	1.4	143	77	32.6	159	67.4
Niacin (mg)		16 ± 9	18	89	168	71.2	68	28.8
Folate (ug)		213 ± 0	600	36	228	96.6	8	3.4
Vitamin A (ug)		1398 ± 950	800	175	75	31.8	161	68.2
Vitamin C (mg)		151 ± 0	80	189	76	32.2	160	67.8
Vitamin D (ug)		2 ± 4	5	40	189	80.1	47	19.9

[#]Depends on energy intake; NA = not applicable

ENERGY AND NUTRIENT INTAKE

The mean of daily energy intake for all participants was 1748 ± 526 kcal which achieved about 76% of Malaysian RNI (National Coordinating Committee on Food and Nutrition 2005) (Table 6). Only 58.1% of participants achieved the RNI of protein intake while 41.9% of participants did not. Most of the participants did not achieve RNI for calcium (77.5%), folic acid (96.6%), niacin (71.2%) and vitamin D (80.1%). Less than a quarter of participants (22.5%) achieved RNI for calcium, and almost all participants (96.6%) did not achieve RNI for folic acid. There were no significant correlation between nutritional knowledge score with the percentage of RNI achieved for all nutrient intakes.

DISCUSSION

This study aimed to determine the nutritional status and nutritional knowledge of Malay pregnant women in selected private hospitals and also specifically aimed to identify the relationship between nutritional knowledge with gestational weight gain, haemoglobin level and dietary intake. We found that monthly household income and educational level are associated with nutritional knowledge score. These findings are consistent with a study in China which reported that both educational level and monthly household income are associated with nutritional knowledge of pregnant women (Zhang et al. 2009). Another study in China reported that the level of knowledge, attitudes and dietary practices increased with educational level (Liu et al. 2007). Pregnant women with higher education level in this study may have learned more and have better understanding when exposed to

nutrition education. A study in Egypt reported that women with a higher education level was found to be a predictor of toddler dietary intake as they understand more about nutrition and able to provide a more nutritionally adequate diet for their child (Wachs & Mccabe 2001). A study among mothers in Mozambique reported that good education was associated with higher nutritional knowledge and enhanced their understanding of information disseminated by various media (Burchi 2010).

In this study, we found that nutritional knowledge score increased as the gestational week increased. This may be due to pregnant women had collected information and knowledge on health and nutrition during their visits to antenatal clinics, from media or friends as their pregnancy progressed. Participants of this study received education on antenatal care which includes dietary aspect during antenatal class. However, this finding is inconsistent with a recent study in Western Kenya which reported that gestational age was negatively associated with health knowledge score suggesting that a delay in seeking antenatal clinic may contribute to less health knowledge as the opportunities to receive advice and education are reduced (Perumal et al. 2013).

A study in the USA reported that many pregnant women were lacked of general nutritional knowledge and their dietary intake did not achieve nutrient requirements during pregnancy. Hence, their weight gain was not desirable (Fowles 2002). A study in Korea showed that nutritional knowledge during pregnancy was strongly associated with nutritional practices (Kim 2009). Prevalence of anaemia in Pakistan was lower among pregnant women who attended antenatal care centre and had high level of nutritional knowledge (Alam et al. 2005). However, a study among Mexican American adolescents reported that diet adequacy during pregnancy was not influenced by their nutritional knowledge; their diet was based on traditional foods thought most nutritious by parents and family (Gutierrez 1999).

This study showed that 24.6% of pregnant women gained weight within recommended gestational weight gain, 15.7% gained more than recommended, and 59.7% gained less than recommended. This finding is comparable with an earlier study conducted in Indonesia which reported that only 21% of pregnant women achieved the recommended gestational weight gain (Winkvist et al. 2002). In our study, 91.9% of pregnant women who gained excessive gestational weight gain were in their third trimester. During pregnancy, the largest daily deposition of fat occurs from 10 to 30 weeks of gestation (Institute of Medicine 2009) which explains a higher additional calorie recommendation during this stage. Based on the dietary assessment, we found that energy intake of the participants in the third trimester only achieved 72% of RNI. This may due to the limitation of the method used in this study i.e. one day diet recall which may not represent the usual intake of the participants. It is also possible that the participants under-estimated or underreported their intake.

This study showed that up to 90% of pregnant women in the first trimester experienced inadequate gestational weight gain. A study in Indonesia also reported that mean gestational weight gain for pregnant women in the first trimester was less than 50% of the recommendation (Winkvist et al. 2002). A low weight gain during the first trimester may be explained by a low energy intake (less than 80% of RNI for energy) which may be due to morning sickness. A systematic review reported that more than half of pregnant women suffered from nausea and vomiting, which typically begins by the 4th week and disappear by the 16th week of pregnancy (Festin 2009). Moreover, daily deposition of protein and fat and plasma volume expansion is lower during the first 10 weeks of gestation (Institute of Medicine 1990).

About a half (55.1%) of our participants had normal pre-pregnancy BMI status. This finding is similar to a previous study conducted in Selangor of which reported that 54.8% of pregnant women had normal pre-pregnancy BMI (Low et al. 2009). Women with a low pre-pregnant Body Mass Index (BMI) gained less weight, and women with high BMI tended to gain more weight than recommended (Fowles 2002). Our study found a significant positive correlation between nutritional knowledge score and gestational weight gain. According to Palmer et al. (1985), knowledge about recommended gestational weight gain provides a significant influence on gestational weight gain while another study in Australia among pregnant women at antenatal clinics shows strong relationship between knowledge on gestational weight gain and the actual gestational weight gain (Copper et al. 1995).

The prevalence of anaemia among participants of this study was 33.5%. This finding is similar with a study among 1072 pregnant women attending the Ministry of Health (MOH) antenatal clinics, at primary care settings across 14 states of Malaysia which reported the prevalence of anaemia at 35% (Jamaiyah et al. 2007). In Malaysia, anaemia during pregnancy is still prevalent despite supplementation of vitamin and mineral programme for all pregnant women. This may be linked to the low compliance to the supplementation as has been studied in other local study (Thirukkanesh & Zahara 2010). However, this has shown an improvement compared to during the 80's which 55.1% of 378 pregnant women who attended the antenatal clinics in the district of Kuala Selangor were anaemic (Hb < 11 g/dL) (Fatimah 1984).

We found a significant positive correlation between nutritional knowledge score and haemoglobin level. Result of this study is concurrent the finding of an intervention study targeted pregnant women with iron deficiency anaemia in Jordan (Elmasri & Yonus 1998). After the nutrition programme, the nutritional knowledge and better iron status was significantly increased in the treatment group (haemoglobin level 12.2 ± 0.6 g/dL) compared with the control group (haemoglobin level 10.0 ± 0.6 g/dL) which indicates that better nutritional knowledge is linked with a higher haemoglobin level.

In this study, 41.1% of participants claimed that they practiced food taboo. Similar results was found in a study by Noor Aini et al. (1994) among Malay, Chinese and Indian pregnant women. A study by Poh et al. (2005) also reported that food taboos practices are also common among postpartum Chinese women in Kuala Lumpur. The result of this study shows that nutritional knowledge score is higher in participants who claimed that they practiced food taboo compared with their counterparts who did not. We also did not find any significant difference in gestational weight gain between participants who practiced food taboo and who did not. Several false beliefs and food taboos were reported causing low weight gain during pregnancy (Bamji 2003) but not all food taboos lead to deprivation in essential nutrients or limited caloric intake (Zobairi et al. 1998). In this study we only asked the participants whether they practiced any food taboo and did not investigate types of food taboo being practiced. This aspect would require further research for better understanding of food taboo practices among pregnant women in the urban area.

We found that women who were obese before pregnancy have the lowest nutritional knowledge score. This result is similar to a study in the United Kingdom which reported that obese women had lower scores in general nutrition knowledge than the lean group (Mohd-Shukri et al. 2011). In the USA, a study showed that misperceived pre-pregnancy body weight status was directly associated with excessive gestational weight gain in normal, overweight or obese women (Herring et al. 2008). Misperception of body weight status may signify a lack of awareness and knowledge about the clinical thresholds of normal and overweight or obese. By failing to recognize their overweight/obese status, these women may be less likely to stay within the Institute of Medicine (IOM) guidelines for weight gain in pregnancy.

The results showed that most of the participants did not meet nutrient requirements especially calcium, folic acid, niacin and vitamin D. This finding is consistent with a study among 40 pregnant women in Hospital Kuala Lumpur which showed that calcium and niacin intake below requirement by achieving 74% and 61% of RNI respectively. However, the study did not report on folic acid and vitamin D intake (Nora 2007). In Thailand, 55% and 42% of pregnant women who attended antenatal clinic were deficient in folic acid and vitamin D respectively (Suchan et al. 2010). Other studies in Nepal and China also reported a high percentage of pregnant women were deficient in vitamin D, folate, iron and calcium that are essential for pregnancy (Cheng et al. 2009; Jiang et al. 2005).

In this study, we did not identify the sources of nutritional information obtained by participants. It will be useful for future studies to be carried out to provide important information for formulating nutritional education strategies targeting pregnant women. We reported the nutrients intake based on dietary intake from diet recall which we did not include the supplementation. The actual minerals and vitamin intake might be higher as the majority of pregnant women were prescribed with folic acid, iron and vitamin B complex supplement. Despite these limitations, this study has highlighted that the nutritional knowledge was related with weight gain, educational level, monthly household income, haemoglobin level and food taboos. Therefore, nutrition education on adequate food intake and recommended gestational weight gain should be emphasized during antenatal classes in private hospitals.

CONCLUSIONS

In conclusion, even though 55.1% Malay pregnant women in this study reported to have normal pre-pregnancy BMI, most of the participant did not achieve recommended weight gain as recommended by Institute of Medicine (IOM) and 33.5% of them were anaemic. This study shows inadequate calcium, folic acid, niacin, and vitamin D intake among participants. More than half of the participants in this study had a moderate nutritional knowledge score where the nutritional knowledge score was associated with gestational weight gains and haemoglobin level but did not correlate with nutrient intake. The results of this study highlight the need for nutritional intervention programmes during pregnancy to be included in present antenatal classes in clinics or hospitals.

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REFERENCES

Alam, A.Y., Qureshi, A.A., Adil, M.M. & Ali, H. 2005. Comparative study of knowledge, attitude and practices among antenatal care facilities utilizing and non-utilizing women. *J. Pak. Med. Assoc.* 55(2): 53-56.

Allen, L.H. 2000. Anemia and iron deficiency: effects on pregnancy outcome. *Am. J. Clin. Nutr.* 71(5 Suppl): 1280S-1284S.

Anon. 2001. Report of a Joint Fao/Who/Unu Expert Consultation: Human Energy Requirements.

Bamji, M.S. 2003. Early nutrition and health-indian perspective. *Current science* 85(8): 1137-1142.

Brabin, B.J., Hakimi, M. & Pelletier, D. 2001. An analysis of anemia and pregnancy-related maternal mortality. *J. Nutr.* 131(2S-2): 604S-615S.

Burchi, F. 2010. Child nutrition in mozambique in 2003: The role of mother's schooling and nutrition knowledge. *Economics & Human Biology* 8(3): 331-345.

Butte, N.F., Wong, W.W., Treuth, M.S., Ellis, K.J. & O'brian Smith, E. 2004. Energy requirements during pregnancy based on total energy expenditure and energy deposition. *Am. J. Clin. Nutr.* 79(6): 1078-1087.

Cheng, Y., Dibley, M.J., Zhang, X., Zeng, L. & Yan, H. 2009. Assessment of dietary intake among pregnant women in a rural area of western China. *BMC Public Health* 9(222).

Copper, R.L., Dubard, M.B., Goldenberg, R.L. & Oweis, A.I. 1995. The relationship of maternal attitude toward weight gain to weight gain during pregnancy and low birth weight. *Obstet. Gynecol.* 85(4): 590-595.

Daniel, W.W. 1999. *Biostatistics: A Foundation for Analysis in the Health Sciences*. New York: John Wiley & Sons.

Elmasri, K. & Yonus, O. 1998. Nutrition intervention program for the management of iron-deficiency anemia in a group of pregnant women in Jordan. *Ecology of Food and Nutrition* 36(6): 427-442.

Fatimah, A. 1984. *The Etiology of Iron Deficiency Anemia During Pregnancy among Rural Mothers in Malaysia*. Canada: University of British Columbia.

Festin, M. 2009. Clinical evidence: Nausea and vomiting in early pregnancy. *BMJ* 6(1405): 1-45.

Fowles, E.R. 2002. Comparing pregnant women's nutritional knowledge to their actual dietary intake. *MCN: The American Journal of Maternal/Child Nursing* 27(3): 171-177.

Frazao, E. & Allshouse, J. 2003. Strategies for intervention: commentary and debate. *J. Nutr.* 133(3): 844S-847S.

Gutierrez, Y.M. 1999. Cultural factors affecting diet and pregnancy outcome of Mexican American adolescents. *J. Adolesc. Health.* 25(3): 227-237.

Hadipour, R., Norimah, A., Poh, B., Firoozehchian, F., Hadipour, R. & Akaberi, A. 2010. Haemoglobin and serum ferritin levels in newborn babies born to anaemic iranian women: A cross-sectional study in an Iranian Hospital. *Pakistan Journal of Nutrition* 9(6): 562-566.

Hedderson, M.M., Weiss, N.S., Sacks, D.A., Pettitt, D.J., Selby, J.V., Quesenberry, C.P. & Ferrara, A. 2006. Pregnancy weight gain and risk of neonatal complications: macrosomia, hypoglycemia, and hyperbilirubinemia. *Obstet. Gynecol*. 108(5): 1153-1161.

Herring, S.J., Oken, E., Haines, J., Rich-Edwards, J.W., Rifas-Shiman, S.L. & Gillman, M. W. 2008. Misperceived pre-pregnancy body weight status predicts excessive gestational weight gain: Findings from a us cohort study. *BMC Pregnancy Childbirth* 8(1): 54.

Institute of Medicine. 1990. *Nutrition During Pregnancy:Part I: Weight Gain, Part Ii: Nutrient Supplements*. The National Academies Press.

Institute of Medicine. 2009. *Weight Gain During Pregnancy: Re-Examined the Guidelines*. Washington.

Jamaiyah, H., Das, A., Onn, L.T., Sun, C.W., Nordin, N.M., Rampal, S., Bahrin, S., Ganeslingam, M., Kularatnam, K.I.K. & Zaher, Z.M. M. 2007. Anemia in pregnancy in Malaysia: A Cross-Sectional Survey. *Asia Pac. J. Clin. Nutr.* 16(3): 527-536.

Jiang, T., Christian, P., Khatry, S.K., Wu, L. & West, K.P. 2005. Micronutrient deficiencies in early pregnancy are common, concurrent, and vary by season among rural nepali pregnant women. *J. Nutr.* 135(5): 1106-1112.

Johnson, J.W. & Yancey, M.K. 1996. A critique of the new recommendations for weight gain in pregnancy. *Am. J. Obstet. Gynecol.* 174(1 Pt 1): 254-258.

Kim, H.W. 2009. Development of the pregnancy nutrition knowledge scale and its relationship with eating habits in pregnant women visiting community health center. *Journal of Korean Academy of Nursing* 39(1): 33-43.

Kozlowska-Wojciechowska, M. & Wujec, M.M. 2002. Dietary knowledge and practice in pregnant women. *Rocz. Panstw. Zakl. Hig.* 53(2): 167-175.

Little, R.E. & Weinberg, C.R. 1993. Risk factors for antepartum and intrapartum stillbirth. *Am. J. Epidemiol.* 137(11): 1177-1189.

Liu, D.-Y., Wang, L.-J. & Wang, X.-X. 2007. Survey and analysis on nutritional knowledge, attitude and practice of pregnant women in Guangzhou [J]. *Modern Preventive Medicine* 14(36).

Low, C., Tohit, E., Chong, P. & Idris, F. 2009. Adiponectin and hemoglobin levels in overweight and obese pregnant mothers in early pregnancy. *The Internet Journal of Gynecology and Obstetrics* 11(2): pg?

Mohd-Shukri, N., Forbes, S., Denison, F., Norman, J., Walker, B. & Reynolds, R. 2011. Food intake and nutrition knowledge in severely obese pregnant women in Scotland. *Proceedings of the Nutrition Society* 70(OCE1): pg?

National Coordinating Committee on Food and Nutrition. 2005. *Recommended Nutrient Intakes for Malaysian (RNI)*. A Report of the Technical Working Group on Nutritional Guidelines. Ministry of Health Malaysia, P.

National Network for Child Care. 1999a. *Nutrition Assessment: Pregnancy Nutrition Questionnaire*. http://www.org/Evaluation/nutrition3.html [28 December 2010].

National Network for Child Care. 1999b. *Nutrition Assessment: Belief About Food and Pregnancy*.

Noor Aini, M.Y., Hanafiah, M.S., Md Idris, M.N. & Fatimah, A. 1994. Food taboos and its relationship to anaemia among pregnant women. *J. Mal. Soc. Health* 12(1): 41-49.

Noor Safiza, M.N., Khor, G.L., Shahar, S., Kee, C.C., Haniff, J., Appannah, G., Rasat, R., Wong, N.F., Zainuddin, A.A., Rahman, J.A., Talib, R.A. & Yusoff, A.F. 2008. The third national health and morbidity survey (Nhms Iii) 2006: nutritional status of adults aged 18 years and above. *Malaysian Journal of Nutrition* 14(2): 1-87.

Nora, N. 2007. Kajian Pengambilan Makanan di Kalangan Wanita Hamil di Hospital Kuala Lumpur. Tesis Ijazah Sarjana Muda, Universiti Kebangsaan Malaysia, Malaysia.

Norsaadah, R. 2002. Corak Pengambilan Makanan di Kalangan Wanita Hamil yang Mengalami Gangguan Toleransi Glukosa (Igt) Tesis Ijazah Sarjana Muda, Jabatan Pemakanan dan Dietetik, Universiti Kebangsaan Malaysia.

Oken, E., Taveras, E.M., Kleinman, K.P., Rich-Edwards, J.W. & Gillman, M.W. 2007. Gestational weight gain and child adiposity at age 3 years. *Am. J. Obstet. Gynecol.* 196(4): 322.e321-322.e328.

Palmer, J., Jennings, G. & Massey, L. 1985. Development of an assessment form: attitude toward weight gain during pregnancy. *J. Am. Diet. Assoc.* 85(8): 946.

Perumal, N., Cole, D.C., Ouedraogo, H.Z., Sindi, K., Loechl, C., Low, J., Levin, C., Kiria, C., Kurji, J. & Oyunga, M. 2013. Health and nutrition knowledge, attitudes and practices of pregnant women attending and not-attending anc clinics in western Kenya: A cross-sectional analysis. *BMC Pregnancy Childbirth* 13(146).

Poh, B.K., Wong, Y.P. & Norimah, A.K. 2005. Postpartum dietary intakes and food taboos among Chinese women attending maternal and child health clinics and maternity hospital, Kuala Lumpur. *Mal. J. Nutr.* 11(1): 1-21.

Sato, A.P., Fujimori, E., Szarfarc, S.C., Borges, A.L. & Tsunechiro, M.A. 2010. Food consumption and iron intake of pregnant and reproductive aged women. *Rev. Lat. Am. Enfermagem* 18(2): 247-254.

Sebire, N.J., Jolly, M., Harris, J.P., Wadsworth, J., Joffe, M., Beard, R.W., Regan, L. & Robinson, S. 2001. Maternal obesity and pregnancy outcome: A study of 287,213 pregnancies in London. *Int. J. Obes. Relat. Metab. Disord.* 25(8): 1175-1182.

Shaw, G.M. & Carmichael, S.L. 2008. Prepregnant obesity and risks of selected birth defects in offspring. *Epidemiology (Cambridge, Mass.)* 19(4): 616-620.

Snyder, J., Gray-Donald, K. & Koski, K.G. 1994. Predictors of infant birth weight in gestational diabetes. *Am. J. Clin. Nutr.* 59(6): 1409-1414.

Stephansson, O., Dickman, P.W., Johansson, A. & Cnattingius, S. 2001. Maternal weight, pregnancy weight gain, and the risk of antepartum stillbirth. *Am. J. Obstet. Gynecol*. 184(3): 463-469.

Stotland, N.E., Caughey, A.B., Lahiff, M. & Abrams, B. 2006. Weight gain and spontaneous preterm birth: the role of race or ethnicity and previous preterm birth. *Obstet. Gynecol.* 108(6): 1448-1455.

Suchan, P., Liabsuetrakul, T., Chongsuvivatwong, V., Songwathana, P., Somsrivichai, V. & Kuning, M. 2010. Inadequacy of nutrients intake among pregnant women in the deep south of Thailand. *BMC Public Health* 10(572).

Suzana, S., Noor Aini, M.Y., Nik Shanita, S., Rafidah, G. & Roslina, A. (pnyt.). 2009. *Atlas of Food Exchanges and Portion Sizes (2nd Edition)*. MDC Publishers Sdn. Bhd. (91168-A).

Tee, E.S., Noor, M.I., Idris, K. & Azudin, M.N. 1997. *Nutrient Composition of Malaysian Foods*. Kuala Lumpur: Institute of Medical Research.

Thirukkanesh, S. & Zahara, A.M. 2010. Compliance to vitamin and mineral supplementation among pregnant women in urban and rural areas in Malaysia. *Pakistan Journal of Nutrition* 9(8): 744-750.

Wachs, T.D. & Mccabe, G. 2001. Relation of maternal intelligence and schooling to offspring nutritional intake. *International Journal of Behavioral Development* 25(5): 444-449.

Waller, D.K., Shaw, G.M., Rasmussen, S.A., Hobbs, C.A., Canfield, M.A., Siega-Riz, A.M., Gallaway, M.S. & Correa, A. 2007. Pre-pregnancy obesity as a risk factor for structural birth defects. *Arch. Pediatr. Adolesc. Med.* 161(8): 745-750.

Winkvist, A., Stenlund, H., Hakimi, M., Nurdiati, D.S. & Dibley, M.J. 2002. Weight-gain patterns from pre-pregnancy until delivery among women in Central Java, Indonesia. *Am. J. Clin. Nutr.* 75(6): 1072-1077.

World Health Organization 2001. *Iron deficiency anaemia assessment, prevention and control. A guide for programme managers*. Geneva, WHO.

World Health Organization. 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet* 363(9403): 157-163.

Zalihah, M., Sb, S. & O, N. 2008. Nutrition education intervention improves nutrition knowledge, attitude and practices of primary school children: A pilot study. *International Electronic Journal of Health Education* 11(119-132).

Zhang, F., Cai, Q.-X. & Yi, C. 2009. Investigation of pregnant women's nutritional knowledge in li nationality rural area of hainan and analysis of its influence factors [J]. *Modern Preventive Medicine* 10(37).

Zobairi, S.E., Freitas, M.L. & Wasti, S.A. 1998. Diet and nutrition: A knowledge, attitude and practice study of pregnant women in Karachi. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 38(2): 188-193.

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