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Maternal nutrition associated with nausea and vomiting during pregnancy: A prospective cohort China study.

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Abstract

Objective: To compare dietary intake and demographics characteristic in Chinese women who experienced nausea and vomiting, nausea only, and women who had no symptom of nausea and vomiting during pregnancy.

Materials and methods: In this prospective cohort study, Chinese pregnant women attending to Shenzhen Longgang District Maternity and Child Healthcare Hospital during 2010-2015 were enrolled. All enrolled women were instructed to answer validated food frequency questionnaire to assess dietary intake during the first trimester of pregnancy. Data related to demographic characteristic, nausea and vomiting were also recorded using validated questionnaire. Data were analysed using univariate analysis (Chi-square test/fisher exact test) to investigate role of dietary intake and demographics characteristic on incidences of nausea and vomiting during pregnancy.

Result: A total of 150 pregnant women were participated in this study, of these a total of 100 patients (67%) experienced either nausea or vomiting. Women of NVP group had highest energy intake, mainly from carbohydrates sources including added sugars as compared with the other groups (P<0.001). Moreover, women of NVP group were heavier at the time of pregnancy as compared to other groups (P<0.001). Women of NSG group had highest intake of protein and lowest intake of carbohydrates and fatty foods as compared to other groups (P<0.001).

Conclusion: Our preliminary finding suggests that higher consumption of carbohydrates and added sugar leading to greater prevalence of nausea and vomiting among Chinese pregnant women.

Keywords: Nausea and vomiting, Maternal nutrition, Pregnant women.

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Introduction

Nausea and Vomiting in Pregnancy (NVP) also known as morning sickness is experienced by 70%-80% women [1]. These symptoms begin in the first trimester around gestational week 5-8 and subside by week 12 where the maximal symptoms occur at gestational week 9 [2], yet some women continue to experience the symptoms after 20th week of gestation [3]. NVP is classified into mild, moderate and severe forms characterized by nausea alone, nausea and vomiting and extensive vomiting respectively. Although there is no exact mechanism of NVP, but it is influenced by dietary intake, demographic profile and lifestyle factors [4]. The dietary factors affecting NVP includes the intake of carbohydrates, sugars, macronutrients, micronutrients, proteins, fats and fiber. The demographics also suggest the variation occurs in NVP in different regions of the world, more often in Western countries and urban populations and is rare among Africans, Native Americans, Eskimos, and most Asian populations [5]. The influence of nutrition has a major role on the health of mother and fetus both. The previous studies suggested that the women develop craving for sweet food, milk and aversion for caffeinated drinks and spicy foods. One study suggested that high incidence rates of NVP occur with aversive foods (caffeinated drinks, spicy and high protein foods) [6] and another study mentions that women having high carbohydrate intake, lower protein and energy intake have it more [7]. Associations between NVP and pregnancy outcome have also been reported where increased incidence of NVP was associated with positive pregnancy. The explanation for this finding may be that NVP lowers maternal energy intake thereby decreasing levels of insulin and IGF-1, and hence directing the nutrients towards developing fetus [8]. Another reason is that NVP protects the embryo against harmful ingested substances [9]. The gestational diet and the lifestyle factors play a crucial role and so can be modified to prevent the adverse effects in the offspring.

The main objective of this study to assess dietary intake and demographics characteristic in Chinese pregnant women by dividing into three groups: those experiencing nausea and vomiting, those experiencing nausea only and women with no symptom of nausea and vomiting or nausea. Dietary intake and demographics characteristic were compared in three groups: 1) Women with no symptoms of Nausea and vomiting (SFG group), 2) Women with symptoms of Nausea (NG group), 3) Women with symptoms of Nausea and Vomiting (NVG group).

Materials and Methods

In this prospective cohort study, Chinese pregnant women attending to Shenzhen Longgang Distract Maternity and Child Healthcare Hospital during 2010-2015 were enrolled. Study procedure was explained to each pregnant woman during screening visit. Blood sample of each pregnant woman was taken and instructed to provide answer of 2 questionnaires designed to record demography characteristic and food habits/ frequency. All the pregnant woman were followed up after delivery, and were instructed to provide answer of questionnaires administered during follow-up. Approval of ethics committee was obtained from Shenzhen Longgang Distract Maternity and Child Healthcare Hospital. Informed consent was obtained from each woman. After obtaining informed consent from each pregnant woman, a well-designed questionnaire was given to each participant to collect data related to dietary intake, demographic characteristic, and occurrence of nausea and vomiting.

Both the questionnaires were validated by testing this questionnaire on 50 randomly selected pregnant women who attended our clinic. Before testing, questionnaire was reviewed by experts from researchers of obstetrics and gynecology department of obstetrics, Shenzhen Longgang Distract Maternity and Child Healthcare Hospital. Moreover, the developed questionnaire were tested statistically using Pearson test, the correlation coefficient was found statistically significant. Both the questionnaires were answered in gestational weeks 15 to 22 (questionnaires 1: Up to Week 15, and questionnaires: Week 18 to Week 22). Questionnaires 1 (Q1) contain questions related to health, life style, demographic, and clinical characteristic including question about the nausea and vomiting.

Questionnaires 2 is a semi-quantitative Food Frequency Questionnaire (FFQ) contain questions related nausea and vomiting in addition to frequency of dietary intake, this questionnaires designed with the objective to record dietary habits and use of dietary supplements during the first 4-5 months of pregnancy. Total nutrient consumed by each pregnant woman was calculated by FoodCalc and using nutrition composition table. A questionnaire 2 was thoroughly validated with regard to nutrients, foods, and use of dietary supplements. Questions concerning nausea were addressed separately from vomiting. Women answering 'yes' to nausea were asked whether this had created any increase or decrease in their consumption of food items (more/less), as compared with pre-pregnancy. They were also asked whether they had begun to eat or drink any specific foods as a consequence of the pregnancy (yes/no). Based on frequency of nausea and vomiting, we have divided patients of three groups: 1) Women with no Symptoms of Nausea and Vomiting (SFG group), 2) Women with symptoms of Nausea only (NG group), 3) Women with symptoms of nausea and vomiting (NVG group). Total daily intake (calories, protein, fat, fiber, carbohydrates etc.) in each of group was assessed. Also level of nutrients (macro and micro) was also assessed in each group, and compared between all groups. We also compared the consumption of specific food items (milk, chocolate, probiotics foods, vegetables, meat/fish, fruits, juice, water and soft drinks) among all three groups.

Since, this was a pilot randomized study. Therefore, no formal sample size calculation was performed. However, we have planned to include at least 100 patients in this study. Data from each patient was coded and analysed using Graph Pad Prism statistical analysis software (version 6.0). Quantitative variable was presented as mean ± standard deviation, and data were compared using ANOVA. Categorical variables were presented as absolute number and/or percentage of subjects in each category, and compared using Chi-square test. All statistical tests were 2 sided.

Results

A total of 150 pregnant women were participated in this study, of these a total of 100 patients (67%) experienced either nausea or vomiting. A total of 33.3% (50/150 patients) had no symptoms of nausea or vomiting (SFG group), 33.3% of women had symptoms of nausea (NG group), and 33.3% of women had symptoms of both nausea and vomiting (NVG group). In NVG group, women had higher BMI at the time of pregnancy as compared to NG and SFG group. The women who had history of nausea and vomiting in their previous pregnancy were experienced higher incidences of nausea and vomiting. Gestational weight gain (kg) was numerically higher among patients of NG and NVG group as compared to SFG group; however the difference was not statistically significant (Table 1).

Duration of nausea was significantly longer in NVG group as compared to NG groups (mean (SD)) 9.2 (1.9) weeks versus 7.1 (1.2) weeks, $P<0.001$). There was higher proportion of women in NG groups had shorter duration of nausea (≤ 8 weeks) than women of NVG group. We observed that the women who had nausea ate less than the women who had no symptoms of nausea. Similarly, a significantly higher proportion in the NVG group ate less (74%) than in the SFG group (53%, $P<0.001$). In NVG group, 70% of the women had incidences of vomiting for eight weeks or less, with a highest incidence of vomiting occurs between six to eight week (39%), while 40% of the women had highest vomiting between weeks 9 to 17 weeks.

The women of NVG group had the highest total mean energy intake (8374 kJ), and the SF group had the lowest (7912 kJ; Table 2). Mean intakes of all macronutrients were highest in the NVP group. Significant differences in energy percentage (E

(%)) were found between the three groups for all macronutrients (P<0.001). In pairwise comparisons using one way ANOVA suggested that all three groups were significantly different from each other for all macronutrients (P<0.001). Mean intakes of the all the micronutrients were higher in the SFG group as compared to NG and NVG group (Table 3). There were statistical significant differences in the levels of micronutrient intake per 10 MJ energy intake were found between the three groups for all micronutrients (P<0.001).

For the frequency of consumption of specific food items from the FFQ, significant differences between the three groups were found for all food items (P ≤ 0.02; Table 3). NVP had the highest proportion reporting no consumption of specific food items, except for sugar-containing soft drinks. In the most frequent consumption level, the NSG group had the highest proportion for milk, probiotic- containing dairy food, salty snacks, fresh meat and fish, vegetables, fruits and fruits juice. The NVP and NP group had the highest number of women with more frequent consumption levels of chocolate and sugar-containing soft drinks The NSG group had more frequent consumption of almost all specific foods except sugar-containing soft drinks.

Table 1. *Demography and clinical characteristic.*

Variables	NG group (N=50)	NVG group (N=50)	SFG group (N=50)	P value
Age (year) at delivery, Mean (SD)	29 (5.2)	28 (4.3)	27 (3.4)	>0.05*
Maternal weight at pregnancy start (kg) Mean (SD)	71 (3.6)	83 (3.7)	62 (2.3)	<0.001*
Gestational weight gain (kg)	15.1 (5.7)	15.1 (5.8)	14.4 (6.4)	>0.05*
Pre-pregnancy BMI, n (%)				
Overweight (25-29 kg/m^2)	30 (60)	38 (76)	12 (24)	<.0001**
Non-overweight	20 (40)	12 (24)	38 (76)	
Smoking status prior to pregnancy, n (%)				
Smoker	27 (54)	33 (66)	8 (16)	<0.0001**
Non-smoker	23 (46)	17 (34)	42 (84)	
Smoking during pregnancy, n (%)				
No	27 (54)	17 (34)	42 (84)	<0.0001**
Occasionally	10 (20)	10 (20)	7 (14)	
Daily	17 (34)	23 (46)	1 (2)	
Number of years of schooling/education (year), n (%)				
≤ 8 year	1 (2)	2 (4)	0 (0)	0.0427**
Between 9-15 year	9 (18)	13 (26)	3 (6)	
≥ 16 year	40 (80)	35 (70)	47 (94)	
Having previously experienced nausea and vomiting during pregnancy				
Yes	27 (54)	28 (56)	16 (32)	0.028**
No	23 (46)	22 (44)	34 (68)	
Annual maternal income, n (%)				
No income	0	0	0	0.088**
<35,000 USD	31 (62)	33 (66)	43 (86)	
≥ 35,000 USD	19 (38)	17 (34)	7 (14)	

Values are expressed as absolute number (%) of subjects in each category except age and weight. N=Total number of subject in each group. *P value calculated by One-way ANOVA for quantitative data, **P value calculated by Chi-square test for qualitative data.

Table 2. *Total daily intake as energy percentage (E (%)) for consumed macro and micronutrients using food frequency questionnaire.*

Variables	NG group (N=50)	NVG group (N=50)	SFG group (N=50)	E% P*

	Intake	E%	Intake	E%	Intake	E%	
Energy (kJ)	8234.4 (1235.1)		8374.2 (1035.1)		7912.3 (1012.1)		-
Carbohydrates (g)	278.5 (17.3)	52.5 (4.7)	384.5 (14.4)	73.5 (4.7)	259.3 (14.2)	32.5 (2.7)	<0.001[ABC]
Added Sugar (g)	56.3 (14.1)	13.3 (2.3)	69.3 (12.1)	27.3 (2.3)	48.5 (12.2)	7.3 (1.3)	<0.001[ABC]
Protein (g)	81.3 (12.3)	14.4 (1.3)	80.3 (10.3)	13.4 (1.3)	88.3 (11.1)	15.4 (1.3)	<0.001[ABC]
Fibers (g)	28.2 (8.3)	12.1 (0.2)	26.5 (6.3)	8.1 (0.4)	29.2 (3.7)	13.1 (0.4)	<0.001[ABC]
Fat (g)	71.0 (13.2)	28.7 (1.6)	72.0 (11.2)	29.2 (1.6)	69.0 (7.2)	27.1 (1.6)	<0.001[ABC]
Saturated fat (g)	28.3 (4.1)	14.1 (0.6)	29.3 (3.21)	12.1 (1.1)	27.2 (3.3)	13.1 (0.6)	<0.001[ABC]
Monounsaturated fat (g)	24.3 (8.0)	7.9 (1.4)	25.3 (8.0)	8.5 (1.4)	23.4 (4.4)	6.3 (1.1)	<0.001[ABC]
Polyunsaturated fat (g)	18.4 (2.2)	5.3 (1.3)	19.8 (1.7)	4.6 (1.3)	17.2 (3.1)	3.3 (1.2)	<0.001[ABC]
Vitamins and micronutrients/10 MJ/10 MJ/10 MJ							/10 MJ P[*]
Retinol (µg)	821 (317)	842 (569)	811 (227)	812 (529)	842(303)	862 (569)	<0.001[ABC]
Beta- Carotene (µg)	2132 (1231)	2615 (1612)	2031 (1211)	2315 (1414)	2333 (1221)	2715 (1612)	<0.001[ABC]
Folic acid (µg)	222 (91)	282 (63)	212 (84)	242 (62)	242 (81)	289 (63)	<0.001[ABC]
Niacin (mg)	15.1 (4.5)	18.2 (2.4)	13.1 (3.4)	16.2 (2.4)	19.1 (2.2)	24.2 (2.4)	<0.001[ABC]
Riboflavin (mg)	1.9 (0.3)	1.2 (0.3)	1.6 (0.2)	1.2 (0.2)	2.9 (1.8)	2.2 (0.3)	<0.001[ABC]
Thiamine (mg)	1.3 (0.3)	1.6 (0.2)	1.1 (0.8)	1.4 (0.1)	2.3 (0.6)	2.6 (0.2)	<0.001[ABC]
Vitamin B6 (mg)	1.2 (0.7)	1.6 (0.3)	1.1 (0.4)	1.3 (0.3)	2.2 (0.3)	2.6 (0.3)	<0.001[ABC]
Vitamin B12 (µg)	4.9 (2.7)	4.3 (2.4)	4.2 (1.7)	2.3 (1.7)	6.9 (2.2)	6.3 (2.4)	<0.001[ABC]
Vitamin C (mg)	145 (81)	151 (80)	135 (61)	142 (62)	162 (53)	171 (80)	<0.001[ABC]
Vitamin D (µg)	3.2 (1.2)	2.6 (2.1)	2.2 (1.4)	1.6 (1.1)	6.4 (1.1)	3.1 (2.1)	<0.001[ABC]
Iron (mg)	13.1 (2.6)	16.0 (2.4)	11.1 (2.2)	13.0 (1.3)	18.1 (2.1)	19.0 (1.4)	<0.001[ABC]
Vitamin E (mg)	8.5 (1.9)	10.3 (2.1)	7.1 (1.3)	09.3 (1.1)	13.3 (1.2)	9.3 (1.1)	<0.001[ABC]
Calcium (mg)	1012 (316)	411 (54)	1001 (216)	375 (47)	1212 (326)	423 (52)	<0.001[ABC]
Magnesium (mg)	364 (112)	1062 (249)	334 (122)	1010 (232)	364 (112)	1068 (112)	<0.001[ABC]

Values are expressed as Means (SDs). [*]By One-way ANOVA. [A]Pairwise comparison: NSG *vs.* NG significant. [B]Pairwise comparison: NSG *vs.* NVG significant. [C]Pairwise comparison: NG *vs.* NVG significant.

Table 3. *Frequency of intake of specific food using questionnaire.*

Variables	NG group (N=50)	NVG group (N=50)	SFG group (N=50)	P value
Milk products				
None	9 (0.2)	20 (40)	0 (0)	<0.001
≤ 12 times/week	31 (62)	27 (54)	34 (68)	
≥ 13 times/week	10 (20)	13 (26)	16 (32)	
Products rich with probiotic				
None	18 (0.4)	20 (40)	1 (2)	<0.001
Once/week	28 (56)	22 (44)	3 (6)	
≥ Twice/week	4 (0.08)	8 (16)	43 (86)	
Chocolate				

None	9 (0.2)	10 (20)	12 (24)	<0.001
Once/week	11 (22)	5 (10)	23 (46)	
2-3 times/week	30 (60)	35 (70)	15 (30)	
Food rich with salt content				
None	8 (0.2)	18 (36)	4 (0.08)	<0.001
Once/week	23 (46)	27 (54)	22 (44)	
≥ 2 times/week	21 (42)	20 (40)	24 (48))	
Meat				
None	2 (0.04)	14 (28)	5 (0.01)	<0.001
Once/week	30 (60)	32 (64)	24 (48)	
≥ 2 times/week	18 (36)	16 (32)	21 (38)	
Fish				
None	8 (0.2)	10 (20)	8 (16)	<0.001
Once/week	30 (60)	32 (64)	21 (42)	
≥ 2 times/week	12 (24)	18 (36)	21 (38)	
Vegetables				
None	21 (0.4)	27 (54)	1 (2)	<0.001
1-7 times/week	19 (0.4)	13 (26)	22 (44)	
8-14 times/week	7 (14)	6 (12)	24 (48)	
≥ 15 times/week	3 (6)	4 (8)	4 (8)	
Fruit				
None	13 (0.3)	15 (30)	0 (0)	<0.001
1-7 times/week	17 (0.4)	15 (30)	10 (20)	
8-14 times/week	4 (8)	6 (12)	14 (28)	
≥ 15 times/week	16 (32)	14 (28)	26 (52)	
Fresh Juice				
None	9 (0.2)	11 (22)	0 (0)	<0.001
1-7 times/week	19 (0.4)	19 (38)	18 (36)	
8-14 times/week	7 (14)	6 (12)	12 (24)	
≥ 15 times/week	4 (8)	4 (8)	20 (40)	
Sugar-containing soft drinks				
None	3 (0.06)	2 (4)	28 (56)	<0.001
1-7 times/week	17 (0.34)	14 (28)	12 (24)	
8-14 times/week	15 (30)	24 (48)	10 (20)	
≥ 15 times/week	15 (30)	10 (20)	0 (0)	

Values are expressed as number of subject (% of subjects) in each category. N=Total number of subject in each group. *by chi-square test

Discussion

In the present study, the women of NVG group had the highest total mean energy intake (8374 kJ), and the SF group had the lowest (7912 kJ). It has been observed that the women with more prevalence of NVP had least Gestational Weight Gain (GWG) in spite of having highest energy intake being highest from carbohydrate and sugar. This occurs because gastric

dysrhythmias are aggravated by high carbohydrate meals leading to nausea. Vomiting therefore reduces the appetite of pregnant women which causes aversion to foods. Dehydration and energy lost in regurgitation may also be responsible for lowest GWG. The cohort studies performed in Norway [10] with 17,070 women reports young, heavy and less educated women to be associated more with NVP. The woman with no symptoms of NVP consumed highest protein along with highest consumption of probiotic containing foods and chocolate. The intake of macronutrients obtained from animal origin indicates a positive correlation with NVP (more pronounced with fat). The consumption of total mean energy intake was also highest in NVP groups compared with symptom free groups. Significant difference is reported in the consumption of riboflavin, thiamine, iron and magnesium between NVP and women with nausea groups. Our preliminary findings in Chinese pregnant women are consistent with results of cohort study conducted in Norway. The prevalence of severity of NVP in 318 Chinese women was 90.9% with one, two or three symptoms of NVP, but the severity in Chinese women was less in contrast to other ethnic groups. It also has a significant impact on the mental and health status of Chinese women [11]. The NVP rates are also high in women with previous history of pregnancy, previous miscarriages and cigarette smokers [12]. The effect of alcohol on NVP is observed more in East Asian populations (Korea, Japan) compared to Asian population (India, Sri Lanka, Nepal). The various observational executed so far explains the effect of nutrition and lifestyle factors on NVP. These studies have also explored the relation between NVP and pregnancy outcomes [13].

Conclusion

Our study results offer preliminary finding that higher consumption of carbohydrates and sugar leading to greater prevalence of nausea and vomiting among Chinese pregnant women. This needs to be confirmed in large multi-centric randomized clinical study. Our study will serve the basis for conducting large multi-centric randomized clinical study to confirm the relationship between maternal nutrition and nausea and vomiting in Chinese pregnant women.

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Statement of Competing Interests

Authors' declare no conflict of interest.

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