Original Article

Food and nutrient consumption patterns in third trimester Thai-Muslim pregnant women in rural Southern Thailand

Sumalika Piammongkol MCN[1], Geoffrey C Marks PhD[2], Gail Williams PhD[2] and Virasakdi Chongsuvivatwong MD, PhD[3]

[1]*Food Science and Nutrition Department, Faculty of Science and Technology, Prince of Songkla University, Pattani, Thailand*
[2]*Australian Centre for International & Tropical Health & Nutrition, School of Population Health, University of Queensland, Australia*
[3]*Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, Thailand*

The aims of this study were to determine food and nutrient intakes and the socio-economic factors influencing food and nutrient intakes of rural Thai-Muslim women in the third trimester of pregnancy. The study was conducted in Pattani province, Thailand, where 166 women were interviewed between 32 and 40 weeks gestation. A questionnaire, including a Food Frequency Questionnaire was used. Data on food items were compiled into the five basic Thai food groups, and food intakes were computed into macro and micro- nutrients. Mean weight intake of each of the five groups was below the recommended level for pregnant Thai women. Mean intake of niacin, vitamin A (RE) and vitamin C were above the recommended Thai level. Thiamin, calcium, phosphorus and iron intakes were lower than 50% of recommended levels. Intakes of the five food groups were not associated with socio-economic status, although total non-haem iron intake was associated with level of education. Under-consumption of food and nutrients among pregnant women in the study area was due to poor education, poverty and food availability. Integrated strategies should be considered to promote increased intakes to meet nutrient recommendations.

Key Words: Muslim, food consumption, diet, pregnancy, iron, calcium, rural, socio-economic factors, Thailand

Introduction

Diet is an important issue in maternal health, since optimal fetal development requires adequate nutrients. Maternal malnutrition during the prenatal period has been associated with spontaneous abortion, poor growth and development, learning impairment and behaviour problems of the offspring.[1,2] Some nutrient deficiencies can be dealt with by strengthening the training and practice of antenatal care providers, enabling them to dispense supplementation, such as iron, calcium and vitamin tablets. Understanding the dietary patterns of pregnant women and the associated factors leads to proper planning of nutrition education programs.

A previous study on food consumption patterns in Southern Thailand by Pratoomsindh *et al.,* 1986[3] found that Thai-Muslim women consumed less vegetables than Thai-Buddhist women, but more fruit and fat, although it did not examine food intake patterns in pregnant women specifically. Women from southern Thailand, especially the rural provinces bordering Malaysia where the Muslim religion predominates, are well known to have low economic development and formal education, poor health status and a high prevalence of poor pregnancy outcomes. Their pregnancy related maternal mortality rate of 25.5 per 100,000 live births[4] is considered to be high. While religious teachings emphasise good health and proper nutrition, religious practices lead to diets that are somewhat different from those of the Thai-Buddhist population (eg. avoidance of *haram* foods, including pork). This is exacerbated by poverty and relatively low levels of education. Since prenatal maternal nutritional status is a risk factor for unwanted outcomes, understanding of this status may assist interventions to reduce their risk. Very few studies have looked at the dietary habits during pregnancy in Thai-Muslim pregnant women. Information on the dietary pattern of this population is essential to the planning of intervention programs.

The study was undertaken to examine community factors impacting on food habits, and to describe food and nutrient

Correspondence address: Assistant Professor Sumalika Piammongkol, Food Science and Nutrition Department, Faculty of Science and Technology, Prince of Songkla University, Pattani, Thailand. 94000
Tel: + 66-73-312160; Fax: + 66-73-335130
Email: Psumalik@bunga.pn.psu.ac.th
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intakes and their socio-economic determinants among pregnant Thai-Muslim women living in lower Southern Thailand. We focussed on women in their third trimester of pregnancy because of the logistical constraints of identifying and following women for the duration of their pregnancies.

Subjects and methods

The study was carried out in rural villages in Pattani province, southern Thailand. This province is well known for its poverty, low levels of education and the presence of socio-cultural barriers that affect relationships with the central government.

A cross-sectional survey of pregnant women was conducted from March to October 1997 in five Amphurs (Amphur Panalae, Yarang, Mayor, Mung and Nongjig) randomly selected from nine Amphurs. A sample of 30 from 57 health centres (HC) within these five Amphurs was randomly chosen and 60 villages served by these HCs randomly selected. In each study village all pregnant women between 32 and 40 weeks gestation at the time of the study were included. We estimated the "design effect" to be close to unity due to the relatively small cluster size (3 women per village) and relatively large number of clusters (60). The target sample size was 160. Assuming the estimated prevalence to be around 50%, this result in a 95% confidence interval width of approximately seven percent.

The qualitative component of the research included a documentary review of routine local health statistics. In-depth interviews were undertaken with key informants, such as village leaders, and HC staff. The principal investigator participated in the daily life of all 166 pregnant women at their home, visited local markets, village food shops and mobile food markets in order to obtain in-depth information on their food consumption.

Two local female Thai-Muslim research assistants, who were Bachelor of Food Science and Nutrition graduates, were trained as interviewers. A structured questionnaire was used to collect information on socio-economic variables including age, family income, education, occupation (unemployed vs part time employed), housing status (physically unstable vs stable) and food expenditure. Family income was estimated by combining incomes reported for husband, son or daughter and the participants each month, with the overall range of incomes divided into three approximately equal categories.

Dietary data were collected with a modified food frequency questionnaire (FFQ). It was adapted and tested to obtain qualitative and quantitative information on usual food consumption during the last four months. The structure of the FFQ was modified from Willett[5] to fit the local situation. A list of 92 items of traditional food covering the summer season, commonly eaten by the local population and available for purchase in the market was used to estimate the frequency of dietary intake (assessed as daily, weekly, or monthly). All food items were standardised into three to four commonly eaten portion sizes and photographed by the investigator, to facilitate the interview and recall process. Consistency between the amount of food in the picture and actual consumption was confirmed in the pilot study, with one FFQ interview completed on same four persons one month apart. This showed high intra-subject reproducibility. The questionnaire was completed in face-to-face interviews in local Malay dialect.

Data from the FFQ were used to calculate individual consumption of foods based on the five Thai food groups and of nutrients. The five Thai food groups are a simple classification of foods promoted by the Thai Ministry of Public Health.[6] These are: Group 1 - meat, liver, fish, chicken, cockles, crab, squid, milk, eggs, beans, peanuts; Group 2 - rice, flour, sugar and tubers; Group 3 – vegetables; Group 4 – fruit; Group five - fat from animals and vegetables. Calculation of nutrient intakes used a conversion table derived from the Thai food composition table.[6] Food intake was converted to average daily intake of macro-nutrients and micro-nutrients (thiamin, riboflavin, niacin, vitamin C, vitamin A (RE), calcium, phosphorus and iron) over the last four months. These were compared with the Recommended Dietary Allowance (RDA) for Thai pregnant women. Descriptive statistics of food and nutrient intake were tabulated.

Multivariate regression (using "svyreg" in Stata with village as the primary sampling unit) was used to examine the association between these outcomes and socio-demographic factors. Qualitative data were analysed from the field notes and summarised in narrative text to provide context and assist with interpretation of results of the survey.

Results

The study area consisted of coastal and inland villages, of similar culture. The occupations of the study families varied by geography with fishing being the main occupation in coastal areas and orchard, rice farming and rubber-tapping in inland areas. The study population comprised a mixture of extended and nuclear families. In both, husbands control resource allocation, whereas wives are responsible for buying and cooking food and doing housework. In each village, at least one shop sells raw food (chicken, seafood, beef, vegetables, flour, and seasoning).

Food availability

In the village, sources of food are the central market in town, the local market in the village, convenience shops in the village, and the mobile market. Approximately a half of the study families have paddy rice fields. Some families buy rice or exchange rice for other food with their neighbour. One third of the households have vegetable and fruit gardens and keep poultry. Every one to three months, the villagers kill a cow and beef is sold, usually at lower prices than those in the market. Sometimes, women's husbands obtain seasonal fruit such as mangoes, oranges, or watermelons from the market in town, or seafood (if fishermen).

Storage of foods is problematic, however. Food is not always fresh when prepared for consumption. Food preparation is usually based on simple local methods, and food is usually cooked once a day and then kept for various meals on that day. Husbands and pregnant women are concerned about health during pregnancy and pregnant women have priority for access to food in the family.

However, the choice of food is limited if family income is low.

Although, men usually have the role of head of household, some help women in household tasks. Women also supplement family income with part-time work, such as collecting fish or crabs from nets, shelling crabs and prawns, selling crab meat at the market, making dried fish, working on rubber plantations, or religious teaching. Typically, a merchant may bring cooked small prawns or fish to the village and women find employment preparing these for factory processing. Women and family members may spend three to six hours at this activity: This earns 20-40 Baht per day depending on time spent. Although this is a modest payment, it also provides opportunity for social interaction as well as additional money to buy food or snacks.

Table 1 shows the characteristics of the pregnant women: 10.2% were teenager mothers whereas 13.9% were 35 years or older; they generally had low income, low levels of education and lived in an extended family situation with poor housing; 76% of women had part-time jobs; expenditure on food was 2,000-3,000 Baht per month. The mean height of women (154.03 cm ± 5.7) was close to the average height of Thai women (155 cm). Thus the Thai RDA would be appropriate for our subjects.

Food consumption pattern of pregnant women

There was wide variation in the weight of various food groups consumed by the women. Table 2 describes food consumption in terms of the five Thai food groups. All five food groups were under-consumed, compared to Thai Ministry of Public Health recommendations.[7] Mean intakes of non-dairy protein foods and food group 2 were 80-90% of the recommended levels, whereas those for fruits, vegetables and fats were around 40-50%. The greatest under-consumption was for milk – mean intake only 5% of the recommended level. This appeared to be because of insufficient money to buy milk, rather than a food preference. The recommended 780ml of milk per day would cost 24 Baht, about half a woman's daily wage. Many pregnant women said *"We want to drink milk everyday and we like it, because it is delicious and useful for our health, but we have no money to buy it*." The situation was similar for fruit consumption. In contrast, the low consumption of readily available vegetables was due to dislike of them. A typical meal of a pregnant woman contained relatively low fat, and included kao-yam (rice topped with sliced vegetables, herb, fish powder, dry grated coconut, and fermented fish sauce), boiled egg and vegetables, soup and Thai curry.

Drinking coffee

Forty-two percent of women drank coffee during pregnancy. Drinking coffee was significantly associated with good housing status (OR= 2.02; 95% CI= 1.08-3.80). Women rarely consumed alcohol or used tobacco.

Nutrient consumption pattern

The energy intakes of this group of women was estimated to be very low with the group average at 56.1% of the RDA for Thai pregnant women (Table 3). The nutrients with mean consumption greater than the Thai RDA were vitamins A (RE) and C. Nutrients with mean consumption below the RDAs were thiamin, riboflavin, calcium, phosphorus, iron, total calories and protein. The RDAs for thiamin, calcium, iron and total calorie intake were in the fifth quintile category of the sample indicating severe deficits. The RDA for protein was in the third quintile indicating a high proportion with inadequate intake. The RDA for vitamins A (RE) and C in the first quintile, indicate sufficient intake of these nutrients.

The association between food consumption and socio-demographic factors

Table 4 shows the results from multiple linear regression analysis, taking the village as the primary sampling unit, predicting various nutrient intakes with socio-demographic variables. There was no serious collinearity among independent variables. The dependent variables were nutrient intakes as continuous variables. The independent variables were women's age, family income, housing status (physically unstable vs stable), types of families (extended, nuclear) and working status (unemployed, employed part time). Increasing age was associated with decreasing consumption of vitamin A (RE) and non-haem iron. Increasing education was significantly associated with increasing consumption of non-haem iron intake.

Table 1. Characteristics of pregnant women (*N*= 166)

Characteristics	*N*	%
Age		
15-19 yrs	17	10.2
20-24 yrs	53	31.9
25-29 yrs	43	25.9
30-34 yrs	30	18.1
≥35 yrs	23	13.9
Family income (Baht)		
<5,000	90	54.2
5,000-8,000	50	30.1
>8,000	26	15.7
Family income spent on food (Baht)		
<1,000	29	17.5
1,000-2,000	88	53.0
2,000-3,000	28	16.9
>3,000	21	12.7
Education (years)		
0	30	18.1
1-3	29	17.5
4-6	70	42.2
7-9	19	11.6
≥10	18	10.8
Occupation		
Full time work	40	24.1
Part time working	60	75.9
Family type		
Extended family	95	57.2
Nuclear family	71	42.8
Housing status		
Physically unstable	97	58.4
Physically stable	69	41.6
Height (cm) mean + SD	*154.03±5.71*	

Table 2. Daily consumption the five Thai food groups in grams (*N*= 166)

Food group (gm)	Mean	SD	Min	Max	% eating by weight	% of total weight	Recommended (gm) *	% of intake
Meat	9.3	10.6	1	72.5	4.8			
Poulty	9.6	13.9	0.3	138	4.9			
Seafood	85.7	77.8	3.9	513.4	44.5		250	
Egg	39.3	49.6	2.4	248	20.4			
Dry bean	9.5	9.3	1	58.6	4.9			80.4
Milk	39.1	69.7	0	600	20.3		780	5.0
Sub total	192.5	123.7	26.4	749.34	100	18.9	1030	
Rice	476.6	224.8	200	1638	90.9			
Noodle	16.9	14.9	1	102	3.2			
Sugar	27.8	21.9	3	113	5.3			
Tuber	3.3	6.8	0	60	0.6			
Sub total	524.5				100	51.4	540	89.9
Vegetables	92.9	64.1	12.8	350.4	100	9.1	225[1]	42.2
Fruits	201.1	194.4	12.8	1138.4	100	19.7	450	44.4
Fat	10.2	5.4	1.3	29.1	100	1	20	50.0
Total weight	1021					100		

* = For Thai pregnant women in handbook by Ministry of Health.
** = Total weight of recommended consumption for cucumber, string bean, hogplum young leave, lead tree tender tip, Indian penny wort leave, djenkol beans, purkia speciosa and goabean young pod.

Table 3. Distribution of daily total nutrient intake (*N*= 166)

Nutrients	Quintile cut-offs				Range (g)	Mean intake	Mean intake as %RDA*	Percentage <80% RDA
	1	2	3	4				
Thiamin (mg)	0.25	0.34	0.44	0.61	0.1 – 1.9	0.45	32.14	98.8
Riboflavin (mg)	0.52	0.73	0.96	1.31	0.2-3.9	0.94	62.67	75.3
Niacin (mg)	11.41	13.96	16.95	20.13	3.7 – 48.7	16.23	101.44	29.5
Vitamin A (μg RE)	1,287	1,751	2,322	3,468	518-14,112	2,628	329	3.6
Vitamin C(mg)	56.39	77.09	115.64	159.75	15.8-960.1	119.91	149.89	14.5
Calcium(mg)	148.10	205.75	286.39	411.69	43-3022	281.74	23.48	99.4
Phophorus(mg)	252.12	342.54	414.83	587.62	119-2214	431.34	35.95	97.6
Iron (mg)	15.59	19.48	21.80	25.51	5-146	22.06	49.02	98.8
Total calories	1025	1196	1341	1544	345-3540	1285	56.1	96.4
Total protein (g)	33.25	40.42	51.04	62.69	12-151	48.91	95.90	46.4
% total calories						15.22		
Total CHO (gm)	177.39	206.75	236.91	275.89	56-605	227.10		
% total calories						70.65		
Total fat (gm)	13.03	16.76	19.82	26.94	8-71	20.19		
% total calories						14.13		

* For Thai pregnant women

Discussion

As might be expected from their relatively deprived socio-economic background, pregnant women in this population under- consumed all food groups. The most serious food deficiency was milk. Consequently, intakes of thiamin, calcium, iron, calories and protein were all well below recommended levels. Vitamin C and vitamin A (RE) were above the recommended daily allowances. Socio-economic factors, especially level of education was associated with various nutrient intakes, but did not correlate with intake based on food groups.

The study area was a combination of coastal and inland areas with good road system, which allowed transportation of food between city and villages. However, access to good foods was still limited. Women can easily find protein foods such as eggs, meat, seafood and milk in the village but choices of vegetables are limited. In addition, income was low, and family's ability to purchase food was very limited. The qualitative data showed that pregnant women obtained an equal share of family food. The causes of food deficiencies do not arise from family food distribution, but rather from general poverty in the family together with limited transportation of food from outside the village. These outcomes of the qualitative components of the project support the pattern of quantitative findings described above.

The findings differ from that in China[8] and in Guatemala[9] where household leaders obtain a greater share of energy and nutrients than other members. As reported elsewhere by Ene-Obong *et a*l.,[10] in Nigeria, the main

Table 4. Regression coefficients (β) and their standard errors (SE) for the association between nutrient intakes and socio-demographic factors

Nutrients	Pregnant women age (yrs)	Family Income/ 1,000 (Baht)	Education (years)	Housing condition[1]	Type of family[2]	Working status[3]
	β/ SE					
Thiamin (mg)	-0.006/0.003	0.005/0.007	0.008/0.007	-0.01/0.04	0.05/0.04	-0.02/0.05
Riboflavin (mg)	-0.009/0.005	0.012/0.015	-0.0009/0.016	-0.10/0.09	0.10/0.09	-0.08/0.09
Niacin (mg)	-0.12/0.10	0.13/0.20	0.09/0.27	-1.71/1.46	0.76/1.39	-1.19/1.07
Retinol (μg)	-59.78/24.60*	25.76/56.2	33.22/50.08	241.39/367.21	174.64/315.29	459.99/351.13
Vitamin C (mg)	-0.77/ 1.15	2.33/ 2.34	1.82/ 2.10	0.58/ 15.03	1.38/ 15.33	17.57/ 15.21
Calcium (mg)	-2.36/2.13	5.69/ 5.07	2.04/ 5.26	-33.72/28.01	35.52/ 28.21	-32.14/31.01
Total calories	-0.06/ 0.06	0.15/ 0.14	0.26/ 0.17	-0.62/ 0.95	0.11/ 0.85	-0.50/ 0.69
Total protein	-0.18/ 0.28	0.68/ 0.62	0.51/ 0.82	-4.85/ 4.36	2.13/ 3.87	-3.74/ 3.39
Total carbohydrate	-1.10/ 1.07	1.12/ 2.31	5.65/ 2.97	-3.14/ 16.88	-1.64/ 15.4	-5.89/ 12.77
Haem iron	-0.03/ 0.07	0.07/ 0.13	-0.29/ 0.15	-1.79/ 0.85	0.97/ 1.01	-1.30/ 0.89
Non-haem iron	-0.27/ 0.11*	0.17/ 0.28	0.75/ 0.33*	0.31/ 2.37	-1.21/ 1.82	1.53/ 1.22

1= Not stable vs stable; 2= Nuclear vs extended family; 3= Part-time vs unemployed; * $P<0.05$

determinants of health and nutritional status of women are socio-economic and culture. Similarly, in the eastern part of Thailand, Maneethorn *et al*.,[11] reported that pregnant women with higher family income and higher level of formal education tended to consume a nutritious diet with greater frequency than poorer group.

As with any study the results will be limited by the survey instruments used and the relative homogeneity of the population for some characteristics. The format of the FFQ used here has been shown to have good validity and reliability in a range of populations[5], though these have not been quantitatively assessed in this population group. Typically the FFQ under-reports total intakes but the validity varies by food/nutrient. The very low energy and other intakes reported here may be influenced by under-reporting, but they are also consistent with the intensive qualitative observations and the short stature and low body weights of the population. Unfortunately it was not possible to assess pre-pregnancy weight of the study participants and investigate this further through assessing pre-pregnancy body mass index and weight gains during pregnancy. However, the failure of socio-economic factors to predict food intake in the five Thai food groups, may indicate that crude categorisation of food intake is not sensitive to these factors. In contrast, measurement of nutrient intake was predicted by some socio-economic factors. Intake of some water-soluble vitamins such as vitamin C (available in leafy green vegetables) is sufficient in this study group, even though intake of vegetables was only 42% of the recommended level. Other simple methods of monitoring nutritional status of pregnant women include weight gain[12] and body mass index.[13] However, although underweight indicates under nourishment, normal weight gain does not rule this out.

Weight gain should take into account the possible effects of pregnancy complications such as toxaemia of pregnancy, pre-eclampsia or high blood pressure.[14] In addition, it cannot detect non-protein energy malnutrition such as vitamin deficiency. Hence, measures, which combine the dietary habits with weight gain of pregnant women, may be useful to use in future studies.

During pregnancy extra nutrients are required for fetal and placental growth, adequate development of the fetus, and support for immune function. This study showed that these pregnant women had low intakes of thiamin, riboflavin, calcium, iron, calorie and protein. This is of great public health concern. There is increasing evidence that nutrient deficiencies or malnutrition in the fetus is associated with chronic disease in later life.[15]

Our subjects had lower calorie intake but higher protein intake than in pregnant women in Madura East Java, Indonesia (1,500 kcal and 41 grams of protein intake).[16] In our study, 96.4% of pregnant women had caloric intake and 46.4% of pregnant women had protein intake less than 80% of Thai RDA. Chronic energy deficiency is directly associated with low BMI.[17] Pregnant women with chronic energy deficiency and low BMI are more likely to have low birth weight babies. This effect is preventable. Kramer,[2] concluded in a systematic review that balanced protein/energy supplementation in pregnant women was associated with an increase in maternal weight gain, fetal growth and reduced neonatal deaths.

Vitamin A intake among the subjects exceeded Thai RDA by more than three-fold. Vitamin A is abundant in green vegetables, but is fat-soluble. Low fat intake among our subjects could have reduced its absorption. Excess vitamin A in pregnancy has been considered as not harm-ful

Low intake of thiamin, riboflavin, calcium and iron can be solved by supplementation with vitamin B complex, calcium and iron tablets. In low income, urban women, use of prenatal multivitamin/mineral supple-ments may have the potential to diminish infant morbidity and mortality.[18] Improved knowledge of food and nutrition may improve dietary habits, being a more sus-tainable way of reducing seriously low intake of calories, protein and other nutrients.

Education is the most important predictor of nutrient intake in pregnant women in this study. It is more important than other economic variables such as family income, housing-condition, and types of family and working status. By this statistical evidence, investing in education would be prime importance. However, overall

the population has poor dietary practices and a range of factors appears to contribute to these. International programs have shown that improvement in nutrition must be incorporate various facets, including education and economic development.

In the short term, nutrition education programs, should be designed to provide knowledge of food and nutrition, and encouragement of appropriate food choices and techniques of food preparation together with information about how to adapt traditional diets. This program could increase the awareness of health in order to prepare women for better or appropriate health status during pre-pregnancy, pregnancy and lactation. In addition, a food production program would increase access to appropriate foods, and enable them to meet the required standards. This may require an income-generating project. In the long term, the level of education of women should be raised, so that nutrition and health understanding can be properly instilled.

Strength and limitations of the study

This study has focussed on determining food patterns in pregnant women. The assessment was based on a FFQ, an accepted method for measuring dietary intakes in epidemiological studies.[5] Results from a FFQ can detect changes in dietary intakes associated with pregnancy, particularly total calories, protein, carbohydrate, total fat, calcium, iron, and vitamin C[19] and can be used to rank individuals.[20] Under reporting of food intake is a possible but unlikely bias. The questionnaire had been qualitatively validated against direct observation and there was no detectable motivation of the women to under report. Limitations of the study are a lack of pre-pregnancy weights to assess pre-pregnant status and weight gains during pregnancy, and the lack of pregnancy outcomes, to correlate with dietary patterns.

Recommendation

Under-consumption of food and nutrients among pregnant women in the study area was due to poor education, poverty and food availability. Integrated strategies should be considered to promote increased intake to meet nutrient recommendations.

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