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ORIGINAL ARTICLE

Estimation of Nutrient Intake in Thailand: Influence of Differences in Food Composition Tables on Estimated Intake

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Abstract

Objectives: Food composition tables are essential to estimating nutrient intake. For the Thai diet, food composition tables have been established in Thailand and also by the Food and Agriculture Organization of the United Nations. However, nutritional evaluations to date have been limited because the number of food items and nutritional components in the tables is restricted. The aim of the present study was to calculate the nutrient intake of young Thais using different food composition tables from Thailand, Japan, and the US and to clarify the influence of these differences on calculated nutrient intake.

Methods: The study was conducted by the Chiang Mai Rajabhat University in Chiang Mai, Thailand in August of 2013, 2014 and 2015. A total of 297 female students were asked to complete a Self-Administered Food Frequency Questionnaire (SFFQ) asking about the habitual consumption of 80 kinds of listed foods and eight frequency categories within the past one year. Intakes of energy and nutrients were quantified using Japanese Food Composition Tables (J-FCT), USDA Food Composition Tables (U-FCT), and Thai or ASEAN Food Composition Tables (T-FCT). Mean estimated intakes of energy and nutrients were compared and Spearman's correlation coefficients between the intakes of each nutrient using the different FCTs were calculated.

Results: Means of almost all nutrients, excluding energy and protein, significantly differed with use of the different FCTs. Fat, vitamin E, and dietary fiber intake were lower when calculated using T-FCT than the other FCTs. Moreover, calcium and iron intake were lower and total energy and carbohydrate intake were higher when calculated using J-FCT than the other FCTs. Never the less, correlation coefficients between nutrients using the different FCTs were significant and more than 0.8 for all nutrients except vitamin E.

Conclusion: Ranking of participants by estimated nutrient intake did not change no matter which FCT was used. This finding suggests that nutrient composition values from other food composition tables can be substituted for missing values in the primary table.

Keywords

Food composition table, Estimation of nutrient intake, Thailand, Japan, USDA

Introduction

The reported prevalence of overweight and obesity in Thailand has dramatically increased over the last 30 years, among not only middle aged and older but also young Thais [1,2]. The leading causes are rapid changes in food intake and lifestyle pattern [3]. Thailand's public health authorities have used dietary guidelines to inform and assist consumers in making healthy nutrition choices and in following healthy lifestyles [4]. Although the Thai Ministry of Public Health conducts a national nutritional survey [5], the intake of some generic food items, such as non-alcoholic beverages, prepared or semi-prepared foods, and snacks is not included [6,7], and the two Food Composition Tables (FCTs) used each list fewer than 800 kinds of food and less than 15 kinds of nutrient.

The Food and Agriculture Organization of the United Nations (FAO) has been working towards improving food composition data quality and availability, including

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the development and updating of FCTs [8]. However, because nutrient ingredients listed in FCTs are affected by climate and soil, it is inevitable that food ingredient values are different. Similarly, because measurement methods differ among countries, the measured values of a particular nutrient in a particular food are unlikely to have the same degree of accuracy when evaluated in different countries.

However, research in to the relationship between dietary intake and the morbidity or mortality of disease in epidemiological studies using food frequency questionnaires and dietary surveys is frequently done not to estimate absolute values, but rather to rank the correlations of nutrient intake in subjects [9,10]. Therefore, when nutrient intakes are estimated in epidemiological study, FCTs developed by the FAO may not be necessary - rather, if target foods are not listed in the FCT of the study country, it may be possible to use FCTs of other developed countries, such as Japan or the US, by replacing the foods with similar foods. If it is indeed possible to calculate nutrient intake using the composition table of a developed country, it would then be possible to epidemiologically study the association between life style-related chronic diseases and nutrient intake in Thailand.

The aim of this study was to calculate the nutrient intake of young Thais using food composition tables developed in Thailand, Japan, and the US, and to clarify differences in nutrient intakes calculated from them. If correlations of estimated nutrient intakes from these FCTs were high, it would be possible to calculate nutrient intakes for nutrients not listed in the Thailand or ASEAN FCT (T-FCT) [6,7] using the Japan [11] or USDA [12] FCT.

Methods

Participants

The study was conducted by Chiang Mai Rajabhat University in Thailand in the three respective Augusts of 2013, 2014 and 2015. The survey was conducted using a Self-Administered Food Frequency Questionnaire (Thai_SFFQ) in 334 female students. After excluding 37 participants who failed to answer all questions, 297 participants were included in the analysis. Written informed consent was obtained from all participants before distribution of the Thai_SFFQ and the study protocol was approved by the Institutional Review Board of Otsuma Women's University, Tokyo (26-001).

Dietary survey

The Thai_SFFQ asks about the habitual consumption of listed foods within the past one year. Details of the development of this SFFQ have been reported elsewhere [13]. In brief, 80 food items were included, in the 8 frequency categories of none, less than 1 day per month, 2-3 days per month, 1 day per week, 2-3 days per week, 4-6 days per week, almost daily, and more than twice per day. Portion sizes were described for every food item based on standard or typically presented portion sizes, namely less than half the standard portion size, 20% to 30% less than the standard portion size, same as the standard portion size, 20% to 30% more than the standard portion size, and more than 1.5 times the standard portion size. This Thai_SFFQ was developed in reference to a Japanese SFFQ (JP_SFFQ) which was designed to estimate nutrient intake in young Japanese, and has been validated [14]. The Thai_SFFQ was modified by removing or adding some food items according to data from a dietary record of 56 young Thai [13]. The food items listed in the Thai_SFFQ are described in the Appendix.

Food composition tables

Nutrient components listed in either the Thai or ASEAN Food Composition Tables (T-FCT) were selected [6,7]. Weighted average composition tables were developed using T-FCT [7], the Japan standard Food Composition Table (J-FCT) [11], and the USDA Food Composition Table (U-FCT) [12]. Nutrient components listed in the developed composition tables were energy and 14 kinds of nutrients, namely protein, fat, carbohydrate, calcium, phosphorus, iron, vitamin A, niacin, vitamin B1, vitamin B2, vitamin E, vitamin C, total dietary fiber, and salt.

Statistical analysis

The different FCTs express energy and nutrient intake as the mean, standard deviation, minimum value, and maximum value. Analysis of variance with Tukey - Kramer post-hoc comparison of means was performed to test for differences between the FCTs. Spearman correlation coefficients were calculated between each nutrient intake from the different FCTs. Statistical analyses were performed using SAS statistical software version 9.4 (SAS Institute Inc, Cary, NC, USA).

Results

The mean age of participants was 20.3 ± 1.3 years (range 18-24 years) and the average BMI was 22.6 ± 5.2 kg/m^2. The prevalence of overweight classified by the WHO criteria for Asians [15] (BMI > 25) was 23.9%. This prevalence of overweight participants was higher than the 20.6% for age 15-29 years in The Fourth National Health Examination Survey (NHES4) [16] (Table 1).

Table 1: Characteristics of Participants (n = 297).

	Mean	SD	Min	Max
Age (y)	20.3	1.3	18.0	24.0
Height (cm)	159.0	5.8	140.0	170.1
Weight (kg)	57.3	14.2	35.1	111.6
BMI (kg/m^2)	22.6	5.2	14.6	48.2
	n	**(%)**		
BMI < 18.5	61	(20.5)		
25 > BMI ≧ 18.5	165	(55.6)		
BMI ≧ 25.0	71	(23.9)		

Nutrient intakes calculated using the different FCTs were significantly different for all nutrients except protein. In particular, mean intakes of total fat, vitamin E and dietary fiber intakes were lower, and mean intakes of iron and retinol were higher when calculated by T-FCT. Sodium intake was more than 20 g when calculated by any FCT. Meanwhile, all nutrients were significantly correlated between each FCT and Spearman correlation coefficients were more than 0.8, except for vitamin E (Table 2).

Discussion

In this study, we calculated the mean intakes of young Thais using a FFQ and different food composition tables from Thailand, Japan and the US. Results showed that the intake of the 13 kinds of nutrients listed in the T-FCT significantly differed by FCT. Nevertheless, intake levels of all nutrients were highly correlated among the different FCTs, and the J-FCT or U-FCT may accordingly be used to calculate nutrient intakes and to classify subjects on the basis of their intake ranking, which is generally assigned by quartile rank in dietary studies in Thailand.

When dietary surveys are conducted in developed countries, it is natural that nutritional calculations should use their own FCT. This is because the FCT is developed using values analyzed from the country's own foods. In international comparisons of nutrient intake between developed and developing countries, however, when the degree of completion of the FCT of one country is low, it seems preferable to use the FCT of a developed country. Because, it is unnecessary to compare in consideration of the difference of the ingredient in FCT.

A recent study estimated nutrient intake in Thais [17-19]. However, dietary assessment in that study was limited to a single 24-hour dietary recall or non-weighed dietary record, and nutrient intakes and subjects were restricted to certain nutrients and preschool children or sedentary workers in Bangkok. The development and validation of an SFFQ in Thailand has not been reported, and we are therefore unable to compare our estimated nutrient intakes in young Thais with other those of studies. Moreover, nutrient intake was estimated using the SFFQ, which aims to rank subjects by nutrient intake rather than to estimate absolute values in subjects. It is therefore difficult to compare our estimated nutrient intakes with the dietary reference intake in Thailand [4].

Because fatty meat was not listed in the T-FCT, meat intake was calculated using the value for lean meat. Estimated fat intake is accordingly lower using the T-FCT than when using the other FCTs. On the other hand, the T-FCT includes vitamin E only in cooking oil and coffee milk, and estimated intake levels using T-FCT were lower than those using other FCTs. Because the amount of dietary fiber in rice and noodles, which are staple foods

Table 2: Energy and nutrient intake of young Thais (n = 297) estimated from food composition tables developed in Japan, Thai and the USDA.

	Food composition table in Japan				Food composition table in Thai				Food composition table in USDA				*p* value[1]	*p* value[2]	Correlation coefficient[3]		
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max			(Japan-Thai)	(Japan-USDA)	(Thai-USDA)
Energy (kcal)	1681	875	431	4871	1539	835	452	4897	1518	804	412	4973	0.0361	US-JP	0.95	0.97	0.97
Protein (g)	62.4	30.4	13.6	183.6	64.8	31.9	13.8	189.2	68.4	34	13.8	211.5	0.0693		0.98	0.98	0.97
Fat (g)	45.2	24.2	8	145.7	40.1	21.2	8	125.9	45.4	25.2	8	161.2	0.0088	JP-TH, TH-US	0.94	0.91	0.92
Carbohydrate (g)	247.9	148.2	58	871.8	223.1	139.3	51.3	871.2	205.3	120.1	45.1	794	0.0007	US-JP	0.91	0.96	0.95
Calcium (mg)	537	297	75	1750	672	365	88	2109	719	392	94	2926	< 0.0001	JP-TH, US-JP	0.96	0.97	0.93
Phosphorus (mg)	917	435	191	2444	1032	511	200	2917	1120	544	230	3542	< 0.0001	JP-TH, JP-US	0.98	0.98	0.96
Iron (mg)	6.7	3.5	1.3	18.9	12.9	7.1	2.3	36.8	11.2	5.6	1.7	30.8	< 0.0001	JP-TH, JP-US, TH-US	0.89	0.9	0.87
Retinol (ugRE)	1298	1161	72	6999	1783	1247	181	7114	1677	1388	140	8119	< 0.0001	JP-TH, US-JP	0.91	0.98	0.96
Niacin (mgNE)	12.3	6.8	2	39.2	14.3	8.2	2.9	53.2	20.7	11.1	3.2	61.2	< 0.0001	JP-TH, JP-US, TH-US	0.92	0.92	0.86
Vitamin B_1 (mg)	1.05	0.63	0.13	4.42	1.1	0.67	0.12	4.3	1.71	0.97	0.27	6.37	< 0.0001	JP-US, TH-US	0.88	0.91	0.88
Vitamin B_1 (mg)	1.5	0.76	0.26	4.35	1.98	0.96	0.33	5.57	2.03	1	0.4	6.24	< 0.0001	JP-TH, JP-US	0.95	0.93	0.9
Vitamin E (mg)	7.4	4.5	1	25.8	4.5	2.3	0.5	14.5	6	3.4	0.9	22	< 0.0001	JP-TH, JP-US, TH-US	0.86	0.87	0.76
Vitamin C (mg)	78	48	6	241	95	67	4	432	112	113	7	1078	< 0.0001	JP-TH, JP-US, TH-US	0.87	0.84	0.88
Total Dietary Fiber (g)	10.6	6.3	1.3	37.9	5.1	3.3	0.6	22.1	11.6	6.4	1.8	37.9	< 0.0001	JP-TH, TH-US	0.9	0.97	0.91
Salt (g)	24.2	12.3	5.6	76.2	25.1	12.7	3.8	80.8	27.4	13.7	4	86.4	0.0078	US-JP	1	0.98	0.99

[1]ANOVA; [2]Tukey-Kramer, TH: food composition table in Thai; JP: food composition table in Japan; US: food composition table in USDA; [3]Spearman rank-correlation coefficient, all p values of correlation coefficients are < 0.001.

in Thailand, is low in the T-FCT, the dietary fiber intake estimated using the T-FCT appears low. Because the amount of carbohydrate in staple rice noodles is high in JP_FCT, the estimated carbohydrate and energy intake using the J-FCT appears to be high. Meanwhile, because the amount of calcium and iron in vegetables is low in the J-FCT, the estimated calcium and iron intake using the J-FCT appears to be low. Salt intake was high no matter which FCT was used, likely because salt is an important ingredient in Nam Pla, a fish sauce which is the most commonly used seasoning in Thailand.

The FFQ we used in this study was developed from the findings of two-day dietary records of young Thais (n = 56). Its validity has been examined by comparing it with other FFQs developed using the Fourth National Health Examination Survey (NHES4) in Thailand. It was modified to incorporate a setting for the portion size of each food, and included photographs of the food examined [13]. However, it appears likely that this FFQ did not allow adequate quantification of the intake of any nutrients. Because this study was conducted in young women, verification in men and in people of other ages is necessary.

Conclusion

Our data indicate that FCTs developed by different countries may be used to calculate nutrient intake and to classify subjects on the basis of their relative ranking, as assigned by quartile rank in Thailand. This finding suggests that nutrient composition values from other food composition tables can be substituted for missing values in the primary table.

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References

1. Kosulwat V (2002) The nutrition and health transition in Thailand. Public Health Nutr 5: 183-189.
2. Aekplakorn W, Inthawong R, Kessomboon P, Sangthong R, Chariyalertsak S, et al. (2014) Prevalence and trends of obesity and association with socioeconomic status in Thai adults: National Health Examination Surveys, 1991-2009. J Obes 2014: 410259.
3. Popkin BM (2009) Global changes in diet and activity patterns as drivers of the nutrition transition. Nestle Nutr Workshop Ser Paediatr Program 63: 1-10.
4. Ministry of Public Health (2003) Dietary Reference Intake for Thais. (4th edn), Ministry of Public Health, Bangkok, Thailand.
5. Ministry of Public Health (2006) The Fifth National Food and Nutrition Survey in Thailand, 2003. Nutrition Division, Ministry of Public Health, Bangkok, Thailand.
6. Institute of Nutrition Mahidol University (2014) ASEAN Food Composition Database.
7. Institute of Nutrition Mahidol University (2016) Thai Food Composition Tables 2015.
8. Charrondiere UR, Rittenschober D, Nowak V, Stadlmayr B, Wijesinha-Bettoni R, et al. (2016) Improving food composition data quality: Three new FAO/INFOODS guidelines on conversions, data evaluation and food matching. Food Chem 193: 75-81.
9. Riboli E, Elmstahl S, Saracci R, Gullberg B, Lindgarde F (1997) The Malmo Food Study: validity of two dietary assessment methods for measuring nutrient intake. Int J Epidemiol 26: S161-S173.
10. Willett WC, Hu FB (2006) Not the time to abandon the food frequency questionnaire: point. Cancer Epidemiol Biomarkers Prev 15: 1757-1758.
11. Ministry of Education Culture, Sports, Science and Technology (MEXT) (2016) Standard Tables of Food Composition in Japan-2015.
12. USDA (2012) USDA National Nutrient Database for Standard Reference.
13. Kobayashi M, Takada Y, Utsunomiya Y, Sakkayaphan S (2016) Estimation of the nutrient intake in Thailand -Evaluation of semi-quantitative food frequency questionnaires to assess habitual dietary intake in young Thai. Int J Hum Cult Stud 26: 451-460.
14. Takada Y, Kobayashi M (2017) Development and validity of the food intake frequency questionnaire for dietary assessment of the young woman. Bulletin of Otsuma Univ.
15. World Health Organization (2000) Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 894: 1-253.
16. Department of Health Ministry of Public Health (1997) The Fourth National Nutirtional Survey of Thailand 1995.
17. Ivanovitch K, Klaewkla J, Chongsuwat R, Viwatwongkasem C, Kitvorapat W (2014) The intake of energy and selected nutrients by thai urban sedentary workers: an evaluation of adherence to dietary recommendations. J Nutr Metab 2014: 145-182.
18. Satheannoppakao W, Kasemsup R, Inthawong R, Chariyalertsak S, Sangthong R, et al. (2013) Sodium intake and socio-demographic determinants of the non-compliance with daily sodium intake recommendations: Thai NHES IV. J Med Assoc Thai 96: S161-S170.
19. Satheannoppakao W, Kasemsup R, Nontarak J, Kessomboon P, Putwatana P, et al. (2015) Energy and Macronutrient Intakes and Food Sources in Preschool Children: Thai NHES IV. J Med Assoc Thai 98: 957-967.

Appendix: Food items listed in FFQ.

Alcohl	Distilled liquor	Meat	Fatty beef	Cereal	Bread
	Beer		Lean beef		Pastries
	Whiskey		Fatty pork		Oridinary rice
	Wine		Lean pork		Unpolished rice
	Cocktail		Fatty chicken		Black rice
			Lean chicken		Glutinous rice
Beverage	Tea without sugar		Liver		Rice noodle
	Tea with sugar		Processed meat		Wheat noodle, Instant noodle
	Coffee				Rice cake
	Milk-containing coffee	Seafood	Dried fish		Corn
	Cocoa		Raw fish		
	Vegetable juice		Shellfish	Corm	Corm
	100% fruit juice		Prawn		
	Carbonated drink		Deep-fried minced fish	Seeds	Sesame
	Sport drink				Peanut
	No-calorie drink	Egg	Egg		
	Soy milk			Fruit	Fresh fruit
	Lactobacillus beverage	Dairy	Low fat milk		Processed fruit
	Commercially water		Milk		Preserved fruit in syrup
			Cheese		
Seasoning	Butter		Yoghurt	Vegetable	Green vegetable
	Jam, marmalade		Creamer for coffee		Red vegetable
	Sugar for coffee		Creamer for black tea		Yellow vegetable
	Sugar for black tea				Other vegetable
	Dressing	Bean	Bean curd		Pickled vegetable
	Mayonnaise		Fermented food		
	Sauce			Seaweed	Seaweed
	Ketchup	Confectionery	Cake		Laver
	Nam pla (fish sauce)		Biscuit, cookie		
	Cooking salt		Pudding, jelly		
	Soup with noodle		Chocolate		
	Cooking oil		Ice cream		
			Snack		
			Traditional cake with egg		
			Traditional cake with rice		