

Regional and Seasonal Variations of Food Consumption in Cambodia

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ABSTRACT

Introduction: This study aimed to assess the regional and seasonal variations of food consumption in Cambodia. **Methods:** A cross-sectional food consumption survey was conducted in four different regions in Cambodia involving purposive sampling of 441 and 500 adult subjects aged 25-65 years, respectively. Dietary intake was assessed using 24-hour recall and a food frequency questionnaire. **Results:** The Cambodian diet typically consists of rice, fish, meat, fruits and vegetables. All subjects consumed rice at least twice a day. Mean daily consumption of cooked rice was 823 g/person, with the men consuming 1022 g/day compared to 712 g/day for women. In the wet season all subjects consumed 881 g/day compared to 772 g/day in the dry season. The mean consumption of vegetables (250 g/day) and fruits (145 g/day) approximately reached international recommendations (400 g/day). The highest meat consumption and the lowest fish consumption rates were found in the capital region. The difference in fish and egg consumption between men and women was statistically significant. The Cambodian diet is still not sufficient in milk. The average consumption of alcohol was about 25 g/day. **Conclusion:** High consumption of rice observed in this study confirms that rice is a staple food in Cambodia as in the other Asian countries. Relatively high meat consumption in the capital could be related to income growth and could indicate the beginning of a nutritional transition from the traditional dietary pattern. Overall, the dietary habits of the Cambodian population have not changed (yet) to adapt to the western style diet.

Key words: Cambodia, food consumption, regional and seasonal variations

INTRODUCTION

The nutritional transition currently occurring in Asia is a sign of a more general demographic and epidemiological transition that accompanies development and urbanisation. This transition is

marked by a shift away from relatively monotonous diets of varying nutritional quality towards an industrialised diet that is usually more varied and which includes more pre-processed food, more food of animal origin, more added sugar and fat,

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and often more alcohol (Amuna & Zotor, 2008). In South Asia, malnutrition and under nutrition are closely associated with poverty, with 21% of people suffering from severe energy deficiency (Tuyen, 2009). Diet-related chronic diseases are projected to increase, and dietary factors will account for an increased share of chronic diseases (principally obesity). The experience of Thailand which has seen a rapid increase in fat consumption and changing lifestyle patterns, clearly demonstrates a significant impact on the shifting pattern of the burden of diseases on the population (Winichagoon, 2013).

Cambodia is a developing country located in the south-western part of Indochina. It has a land area of 181, 035 square kilometers and population of around 14.7 million in 2013, of which 48.5% are males; the population is growing at an estimated rate of 1.5% per annum, with a life expectancy at birth of 61 years for men and 66 years for women (NSDP, 2014). The geography of Cambodia is dominated by the Mekong River and the Tonlé Sap (Great Lake) as important sources of fish. There is no statistical data on nutrition, nor food consumption and behaviour of the general population in Cambodia. The most recent information concerning the diet of the Cambodian population has come from studies of the several international organisations like the World Health Organisation, Food and Agricultural Organisation and United Nations International Children's Emergency Fund (UNICEF) and the other studies on micronutrient deficiency and poor nutrition related to children under five years and lactating pregnant women (Anderson *et al.*, 2008; Skau *et al.*, 2014). The assessment of food consumption in such studies was based on the calculation of expenditure and income of non-food items with most consumption surveys being rather qualitative. The Cambodia socio-economic survey as well as the food insecurity assessment of the magnitude of

hunger (as measured by the prevalence of food limitation) in 2003/2004 approximated that one person out of five suffers from malnutrition in Cambodia. Higher levels of nutrient deficiency were observed in people with low incomes and in rural areas with women being mostly affected.

There is a lack of data on the dietary intake and nutritional status of the Cambodian population. Our study is likely the first study to assess the food consumption of Cambodian adults in both rural and urban areas, and to describe the food groups contributing to overall consumption. Our second objective was to assess the differences in dietary intake between the wet and dry seasons in four different regions of the country. It will provide the first database of food consumption of the Cambodian population, which is useful for scientists working in the fields of nutrition, food security and food safety.

METHODS

Selection of subjects

In order to incorporate the effects of seasonality, food consumption was conducted during two seasons based on a convenient sampling of subjects. The study population consisted of a total of 941 adult participants (603 females and 338 males) with age ranging from 25 to 65 years. For the dry season, the survey took place in March 2010 and involved 500 (53.1%) individuals; and for the wet season, it took place in September 2010 with 441 (46.9%) participants.

Participants were purposively selected from the four main regions of the country (Figure 1), namely the capital Phnom Penh (R1), the region around Mekong River and/or near the border of Vietnam (R2), the geographical region around Tonlé Sab Lake and near the border of Thailand (R3), and the region near the sea (R4). The study covered at least one urban and several rural areas in each region in order

consumption frequency of meat and fish products, portion sizes, cooking techniques and doneness levels. To do so, we first evaluated the consumption of meat, poultry, fish, sausage and offal products using frequency and portion size. Then the consumption of these products (expressed in g/person/day) was computed by summing across items that contributed to each food group, and characterised by mean value and standard deviation.

Statistical analysis

All food groups and food items were coded and the descriptive statistics were calculated (i.e. mean value, standard deviation, median and 95th percentile) for both individual and total consumption (expressed in g/person/day). Non-consumers of food group were excluded from the estimation and the percentage of consumers was also calculated. Gender, seasonal and regional differences were calculated using Independent-Sample T-test in order to consider a significant difference for the data following normal distribution, and Kruskal-Wallis test for non-parametric data. The mean difference (difference observed) was recorded and a p-value < 0.05 was considered significant. All data analysis was performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Socio-demographic characteristics

The number of subjects was almost similar in the four regions: around 25% in R1, 25% in R2, 31% in R3 and 19% in R4 (Table 1). Overall, there were 36% men and 64% women. The average age was 39.6 ± 12.2 years for men and 40.5 ± 11.6 years for women. The predominant age group was between 25 and 34 years (40%) followed by 23% for those aged 45-54 years. A high proportion of participants had a low education level, with almost 45% having completed primary school

only. Differences were observed between men and women in terms of occupational status and educational level. Notably, the proportion of men and women with university education was 20% and 7.8%, respectively, with 37% of the men and 11% women holding professional jobs.

About 14% of the subjects were smokers and these were mostly men (87%). The majority (85%) smoked around one pack a day. Most of the physical activity of the subjects was related to their daily activities with almost none of them going to sports centres.

The average BMI was 20 ± 3.5 kg/m² with 14% overweight (BMI: 25-29.9 kg/m²) and 2.4% obese (BMI \geq 30 kg/m²). Malnutrition (BMI < 18.5 kg/m²) was also found in 12% of the subjects, mainly among the women (82%).

Food consumption

The results of daily food consumptions are presented in Table 2. All the participants consumed rice at least twice a day, which is typical of the Cambodian population. The daily consumption of cooked rice was 823 g/person/day, with the value increasing to 1425 g/person/day for the "high rice eating" consumers. The other food groups consumed by more than 95% of the adults were vegetables, fish and meat. On average, they consumed 250 g/person/day of vegetables and 145 g/person/day of fruit, with 'high consuming' participants ingesting 421 and 400 g/person/day respectively of vegetables and fruits. On average, the subjects consumed about 75 g/person/day of meat and the same quantity of fish, with 'high consuming' participants ingesting 144 and 141 g/person/day of meat and fish respectively. The mean consumption for eggs was 35 g/person/day, with duck eggs being the most popular.

Nuts and seeds, starchy roots, tuber and products were consumed in small amounts. Soybean was widely consumed

Table 1. Demographic and socio-economic background of the study population

	<i>Number of participants</i>	<i>Percentage (%)</i>
Region 1:	238	25.3
Region 2:	233	24.8
Region 3:	289	30.7
Region 4:	181	19.2
Women	603	64.1
Men	338	35.9
Age groups		
25-34 years	378	40
35-44 years	207	22
45-54 years	216	23
55-65 years	140	15
Education attainment		
University	115	12.2
High school	161	17.1
Secondary school	238	25.3
Primary school	318	33.8
No formal schooling	109	11.6
Occupation		
Student	42	4.5
Employee and official (civil servant)	175	18.6
Own account worker & employed unpaid	299	31.8
Housewife	200	21.2
Farmer	207	22.0
Not working	18	1.9
Smoking		
Not smoking	810	86.1
Smoking	131	13.9
Alcohol consumption		
Regularly	63	15.1
Often	116	27.8
Occasionally	160	38.4
Rarely	78	18.7
Never	524	55.7
Body Mass Index (kg/m ²)		
<18.5	115	12.2
18.5-24.9	672	71.4
25-29.9	131	13.9
≥ 30	23	2.4
Physical activity		
Walking	858	91.2
Bicycle	226	24.0
Working in field/garden	231	24.5
Household tasks	752	79.9
Work out at sports centre	4	0.4

Table 2. Food consumption (g/person/day)#

Food groups	Consumers (%) [*]	Food consumption (g/person/day)	
		(Mean \pm SD)	(95th percentile)
Rice##	100	823 \pm 334	1425
Other cereals and products	72.2	110 \pm 77	250
Starchy roots, tubers	23.7	32 \pm 53	109
Legumes, nuts, seeds	31.5	38.5 \pm 42	114
Vegetables and products	98.5	250 \pm 101	421
Fruits and products	55.8	145 \pm 125	400
Meat and products	96.8	75 \pm 40	144
Fish, shellfish and products	96.8	75 \pm 37	141
Eggs and products	36.7	35 \pm 25	85
Milk and milk products	21	67 \pm 49	170
Fats, oil and products	89.8	23 \pm 18	55
Sugar and confectionary	90.8	22.7 \pm 20	62
Condiments and spices	95.4	42 \pm 22	82
Beverage, alcoholic	5.6	255 \pm 164	548
Amount of alcohol (g)	5.6	26 \pm 16	60
Beverage, non-alcoholic	54	261 \pm 201	683

#: Total consumption for both seasons and sexes combined

##: Cooked rice

as fermented soybean, soybean curd, soy noodle, and soy milk.

Milk and dairy products were not widely consumed in Cambodia. In this study, the average consumption of milk was 67 g/person/day (61 ml/person/day).

The common cooking methods widely used were boiling, stewing, grilling, baking and frying. Cambodian cooking tends to be salty and/or with a sweet taste. Historically, herbs and spices are used for flavour enhancement and for their medical properties. Fresh spices and herbs are common basic ingredients in most traditional Cambodian cooking. Overall, the subjects consumed on average about 23 g of fats and oils, 21 g of sugars and 42 g of condiments and spices per person per day.

Non-alcoholic beverages including tea, coffee, and soft drinks were consumed by 54% of the subjects. In contrast, soft drinks were not frequently consumed in the rural areas due to their high price. The percentage of consumers who drank alcoholic beverages was 5.6%. On average,

the adults consumed 255 g/person/day of alcoholic beverages, corresponding to around 26 g of alcohol per person per day. The amount increased to about 548 g/person/day corresponding to 60 g of alcohol among the "high alcohol consumption" subjects.

The mean consumption of all food groups, except condiments and spices, was significantly higher for men compared to women (Table 3). While a significantly higher percentage of the men consumed alcoholic beverages, the amount of alcohol consumed (in g per day) was not significantly different between the sexes.

The consumption of rice, vegetables, starchy roots and tubers, as well as condiments and spices was significantly higher in the wet season (Table 4). In contrast, the consumption of alcoholic and non-alcoholic beverages was higher during the dry season, but without significant seasonal differences for the mean quantity of alcohol consumed.

The mean dietary consumption of the four different regions is presented in

Table 3. Differences in food consumption between men and women (g/ person/ day)

Food groups	Consumers (%)		Mean \pm SD		Mean-difference
	Men	Women	Men	Women	
Rice#	100	100	1021.8 \pm 345.2	711.7 \pm 271	310.1**
Other cereals and products	66.6	75.3	116.8 \pm 85	106.1 \pm 73	10.7
Starchy roots, tubers	21.6	24.9	33.3 \pm 50.5	31.7 \pm 54.1	1.6
Legumes, nuts, seeds	27.5	33.7	38.7 \pm 43.1	38.4 \pm 41.8	0.3
Vegetables and products	98.5	98.5	257.3 \pm 106.9	245.7 \pm 97.7	11.6
Fruits and products	48.5	59.9	138.4 \pm 137.9	147.8 \pm 119	-9.4
Meat and products	95.9	97.3	80.3 \pm 42.8	71.7 \pm 38.5	8.6*
Fish, shellfish and products	97.3	96.5	79.8 \pm 39.6	72 \pm 35.2	7.8*
Eggs and products	32.2	39.1	39.1 \pm 29	32.8 \pm 23.1	6.3*
Milk and milk products	22.2	20.4	73.8 \pm 45.9	63 \pm 51	10.8
Fats, oil and products	82.5	93.9	20.8 \pm 18	23.5 \pm 17.2	-2.7*
Sugar and confectionary	79.9	96.8	20.8 \pm 18	23.6 \pm 20.8	-2.8
Condiments and spices	90.2	98.3	37.2 \pm 23.7	44.5 \pm 20.4	-7.3*
Beverages, alcoholic	10.4	3	294 \pm 180	178.6 \pm 92.1	115.4*
Quantity, alcohol	10.4	3	25.4 \pm 13.6	27.9 \pm 20	-2.5
Beverages, non-alcoholic	63	48.9	301 \pm 222	231.7 \pm 178	69.3**

Notes: Consumption values are mean \pm standard deviation (95% confidence interval).

Independent-Sample T-test performed at p -value < 0.05, between men and women (* p < 0.05; ** p < 0.01).

cooked rice.

Table 4. Seasonal variations of food consumption

Food groups	Consumers (%)		Mean \pm SD		Mean-difference
	Wet S	Dry S	Wet S	Dry S	
Rice#	100	100	880.8 \pm 349.5	772.3 \pm 312.2	108.6**
Other cereals and products	75.3	69.4	109.6 \pm 75.2	109.7 \pm 78.8	-0.1
Starchy roots, tubers	23.1	24.2	40.7 \pm 70.8	25.1 \pm 28.8	15.6*
Legumes, nuts, seeds	31.7	31.2	37.8 \pm 48.6	39.2 \pm 35.5	-1.4
Vegetables and products	99.3	97.8	262.6 \pm 106.7	238.4 \pm 94.7	24.1**
Fruits and products	55.1	56.4	146.3 \pm 138.1	143.5 \pm 113.2	2.8
Meat and products	98	95.8	77.2 \pm 39.5	72.68 \pm 40.9	4.5
Fish, shellfish and products	96.8	96.8	72.4 \pm 37.4	76.96 \pm 36.6	-4.5
Eggs and products	17.7	35.6	36.8 \pm 24.9	33 \pm 25.4	3.8
Milk and milk products	16.8	24.8	59.4 \pm 46.9	71.6 \pm 50	-12.2
Fats, oil and products	93.4	86.6	22.4 \pm 15.8	22.8 \pm 19	0.4
Sugar and confectionary	93	88.8	23.8 \pm 21.4	21.8 \pm 18.1	2
Condiments and spices	98	93.2	44 \pm 21.3	40.3 \pm 22.1	3.7*
Beverages, alcoholic	3.4	7.6	189.5 \pm 121.6	280.7 \pm 173.1	-91.2*
Quantity, alcohol	3.4	7.6	21.6 \pm 15.3	28.1 \pm 15.9	-6.5
Beverages, non-alcoholic	47.8	59.4	221.8 \pm 180.3	288.4 \pm 210	-66.6**

Note: Independent-Sample T-test performed at p -value < 0.05 between wet season (Wet S) and dry season (Dry S)
* p < 0.05; ** p < 0.01)

Table 5. Regional variations in food consumption (g/ person/day)

Food groups	Region 1	Region 2	Region 3	Region 4
		(mean±SD)		
Rice#	817.5±315.8	880.4±326.5	831.8±333	743±356
Other cereals and products	98.5±66.5	122.2±79.5	147.9±84.7	114.2±74.1
Starchy roots, tuber and products	23.1±29.7	45.2±73	28.5±35.8	30.9±68
Legumes, nuts, seeds	37.9±39.7	38.4±34.1	33.9±41.4	48.4±53.9
Vegetables and products	259.9±107.7	251.5±92.1	257.9±105.6	221.6±90.4
Fruits and products	169.4±141.4	131.8±104.4	140.6±126.1	125.4±110.9
Meat and products	93.1±38.6	62.6±37.5	69±41.9	74.8±36.5
Fish, shellfish and products	65.4±37.8	76.2±34.2	76.9±36.4	82.1±38.5
Eggs and products	39.7±30.2	28.5±17.7	36.5±27.5	33.5±19.5
Milk and milk products	70±48.5	61.1±34.8	72.6±56.9	63.5±57.1
Fats, oil and products	22.5±15.8	26.1±21	21.8±15	19.2±18.9
Sugar and confectionary	21.3±14.8	28±27	21.1±19.4	20.8±16.5
Condiments and spices	46.6±20.8	44.7±27.6	38.8±18.4	37.6±18.2
Beverage, alcoholic	247.2±192.3	262.2±192.6	261±153.7	246±163.5
Quantity, alcohol	15.4±10.9	29.9±19.9	27.1±18	28.6±10.3
Beverage, non-alcoholic	253.3±200.2	289.4±234.8	205.1±149.5	294.9±195

#: cooked rice

Table 5. The daily consumption of rice differed significantly between regions. The lowest rice consumption was in R4 (region near the sea) with a mean consumption of 743 g/person/day. The highest rice consumption was observed in R2 (region around Mekong River and/or near the border of Vietnam) with a mean amount of 880 g/person/day. Daily consumption of vegetables was similar in R1 (Phnom Penh), R2 and R3 (region around Tonlé Sab Lake and near the border of Thailand) with about 260 g/person/day, but it was significantly lower in R4 near the sea (222 g/person/day). The daily consumption of fruits also differed significantly between regions.

Mean consumption of meat, fish and their products were significantly different among the regions. Whilst significantly more meat was consumed in the capital region, fish and seafood were consumed more in the coastal region (R4).

Our results show that pan-frying and deep-frying were the main cooking methods used (Table 6).

DISCUSSION

The prevalence of undernourishment or food deprivation measured by Cambodia Socio-Economic Survey showed that the highest prevalence of food deprivation occurred in the lowest income population group, especially in women. However, the proportion of the population that is undernourished in Cambodia is known to have declined from 43% to 26% between 1990 and 2005, in parallel with economic improvements (Tuyen, 2009). This study found 12% of the subjects to be malnourished. The prevalence of overweight and obesity has emerged among adults, and found to be 14% and 2.4% respectively.

Overall, food consumption of the Cambodian population was quite similar during the wet and dry seasons. Rice is a staple food of the Cambodian population, as in other Asia countries such as Lao People's Democratic Republic, Vietnam, and Thailand (Norimah *et al.*, 2008; Phan *et al.*, 2012; Nguyen *et al.*, 2013).

Table 6. Consumption of specific foods (g/ day) according to cooking methods

	Men	Women	Wet season	Dry Season
	Mean±SD			
Grilled				
Pork	13±18	12±13	12±14	12±17
Beef	11±14	10±15	11±16	9±12
Poultry	8±13	6±10	7±13	6±9
Fish	28±27	23±22*	21±19	28±28*
Sausage	6±8	5±8	7±10	4±6**
Offal products	12±22	6±8*	10±18	4±3
Pan-fried				
Pork	14±18	13±15	14±15	14±17
Beef	8±11	11±16	11±13	9±15
Poultry	9±23	6±9	8±12	7±18
Fish	23±22	21±21	21±19	22±23
Sausage	4±5	5±7	5±8	4±4*
Offal products	7±10	9±8	10±12	6±6
Deep-fried				
Poultry	10±18	7±9	10±16	6±9
Fish	12±13	11±16	9±11	13±17
Baked				
Poultry	6±14	7±11	8±15	5±9
Fish	5±7	8±12	8±12	4±5

Notes: Consumption values are mean ± standard deviation (95% confidence interval)

Kruskal-Wallis test for non-parametric data performed at p-value<0.05 between men and women; and wet season and dry season (* p< 0.05; ** p<0.01).

Vegetables represented the second highest quantity of foodstuff consumed after rice. Vegetables constitute a major component of Cambodian cooking, making up to 70-80% in a dish. This could be due to the availability and accessibility of vegetables in all seasons and regions, high national production and relative low cost (Peltzer & Pengpid, 2012; Kanungsukkasem *et al.*, 2009).

Subjects in the capital city (R1) consumed significantly more fruits than in other regions. Fruit consumption seemed to increase in the capital due to household income and education (Satheannoppakao, Aekplakorn & Pradipasen, 2009). But in contrast, in the southern coast (R4) where fruits and vegetables are not grown and mostly imported, fruit and vegetable consumption was lowest among all the regions. Low fruit and

vegetable consumption is among the top 10 risk factors contributing to mortality worldwide (WHO, 2003). Public education and campaigns on adequate consumption of fruits and vegetables should be targeted more towards low socio-economic groups (Kanungsukkasem *et al.*, 2009).

Both meat and fish were consumed daily by almost 100% of the subjects. The production and consumption of beef, pork and poultry have increased substantially in Cambodia since the 1980s (Knips, 2004). The highest consumption of meat was observed in the capital (R1). Traditionally, per person consumption of non-ruminant meat in Cambodia, as well as in Southeast Asia, is higher than that of ruminant meat owing to availability and relatively lower prices. Processed meats such as ham, smoked bacon, meat sausage hamburger, hotdogs and varieties of canned meat are

rarely found, other than in the fast food restaurants in the capital. An increase in processed meat and meat consumption in the capital of Cambodia is likely to be due to rapid economic development, as in other Asia Countries such as in Korea (Son, 2003).

The highest consumption of fish and seafood observed in the area of the southern coast (R4) was likely to be related to aquaculture which is well developed in that region; fresh water fish from the Mekong River and Tonle Sab Lake contribute to the relatively high fish consumption in the other regions. Fish is the main source of protein as well as a number of vitamins and minerals (Roos *et al.*, 2007(a,b)) for the Cambodian population. Fish is a major component of Cambodian cuisine, and its consumption is an alternative to meat consumption. Cambodia, with its productive inland fisheries, ranks among the top 25 countries in terms of aquaculture volume with the average per capita consumption of fish being higher than the world average of 27.1 kg a year according to the latest FAO statistics (Hishamunda *et al.* 2009). The present study shows that the average consumption of fish meets with the international recommendation that calls for cooked fish consumption of at least 150 g (5 ounces) or 2 servings per week as part of a healthy pattern of eating (WHO, 2003). The majority of the Cambodian population (97% of consumers in this study) consumed fish at least once a day. Epidemiological studies have shown that fish consumption is associated with a reduced risk of coronary heart disease (Reddy & Katan, 2004). Additionally, indicators of modernisation, particularly economic development, have influenced the consumption of both meat and fish (York & Gossard, 2004). On the other hand, the high price of meat in Cambodia and the availability of fish are partly responsible for the relatively high consumption of fish, particularly in the rural areas (Roos *et al.*, 2007c).

Cambodian men tend to consume more eggs than women and a similar finding has been reported for Singapore and Malaysia (Yeo, 1998; Norimah *et al.*, 2008). Overall, egg consumption in Cambodia was similar to that in Lao but less than that in Thailand and Vietnam (Thieme, 2008).

Milk and dairy products are not part of the traditional diet in Cambodia, and are imported. However, in urban centres, the demand for dairy products is increasing (Steinfeld, Wassenaar & Jutzi, 2006). No difference was observed in milk consumption among the subjects in terms of sex, seasons and regions. Concentrated sweet milk was most widely used in Cambodia for coffee/milk preparation. Imported pasteurised and sterilised milk is not very popular due to the high price. Yogurt is found in the supermarkets, but is not widely consumed by the sampled population.

The estimated daily average consumption of starchy roots and tubers, of legumes, nuts and seeds, was lower than the WHO estimates, whereas the mean consumption levels of fats and oil, and condiments and spices were above the WHO values (WHO, 2007). However, subjects in this study consumed less fats and oils (22.7g/person/day) compared to other South and South East Asia countries (less than 50 g/capita/day) and China (79 g/capita/day) (WHO, 2003).

Sugar is usually added to beverages such as coffee and tea and also in a meal. Cambodian cooking is salty and/or with a sweet taste. Fats and oils are used for stewing, pan-frying and deep-frying, which are the main forms of cooking methods for Cambodians. Consumption of condiments and spices was higher in women than in men. Soy sauce, fish sauce, monosodium glutamate and oyster oil are also commonly used in Cambodian cooking.

While the consumption of alcoholic beverages was higher in men than in women, during the dry season, the average

quantity of alcohol consumed showed no significant differences between seasons and the sexes. In rural areas, rice wine and palm wine are the most common types of alcoholic beverage consumed. Beer is more commonly consumed in the capital and central areas due to its high price.

Limitations of the study

Several limitations of our study should be addressed. Owing to limited resources, the questionnaires were repeated only once in September during the wet season, and again in March during the dry season. This might not have been sufficient to capture the seasonal variations in food consumption, and could lead to an overestimation or underestimation of consumption of certain food items. The number of male participants was limited because interviews were conducted at home where women are more frequently encountered than men.

CONCLUSION

Rice remains the staple food in Cambodia, as in other ASEAN countries. Dietary patterns in the capital appear to be more diversified than in the rural areas, with a higher consumption of meat products, fruits and vegetables. The consumption of fish in Cambodia is notably high compared with other countries. Overall, dietary habits of the Cambodian population have not dramatically changed towards a more western style diet.

Inadequate dietary intake in rural areas leading to nutrient deficiencies is still of concern in Cambodia especially among the women. Effective policies, programs and initiatives to increase household income and promote adequate diversification of food consumption in rural areas are needed. .

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