

Food Consumption Frequency and Eating Habit among Taiwanese – NAHSIT 1993-1996

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Abstract

Besides using twenty four-hour dietary recall combined with household recipes interviewing method to evaluate nutrient intakes, a food frequency questionnaire was used to evaluate the usual food consumption frequency of Taiwanese. The age of studied subjects was 13 years old and above. The average daily vegetable, fruit, protein food group and milk consumption frequencies were about 2.5 times, less than once, 2.4 to 3.7 times and less than once, respectively. The consumption frequency of above mentioned foods increased with the degree of urbanization. Males had higher tea drinking frequency than females. The same phenomenon was found for betel nut consumption. People living in mountainous and east coast area had the highest consumption frequency of betel nut. Teenagers had higher fried food and sweetened beverage consumption frequency compared with other age groups. Variations in staple food for breakfast were found from the results of the survey. The percentage of consuming cakes and breads for breakfast decreased with age. The percentage of vegetarians was higher in females than in males. Most male vegetarians were lacto-ovo vegetarians. The results showed that eating habits might be affected by food availability. Although teenagers had the highest milk consumption frequency, it did not meet the recommendation of national Daily Food Guide. The high consumption frequency of high fat food and sweetened beverage among teenagers requires close attention. The adequacy of being vegetarian during growing period needs further evaluation.

Key words: consumption frequency, eating habit, high fat food, sweetened beverage, vegetarian, Taiwan

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Introduction

Nutritional status can be evaluated by anthropometric, biochemical, clinical, and dietary methods (1). Twenty four-hour dietary recall, food record, food frequency questionnaire, and household inventory method are usually used to assess dietary intakes among humans (2). These methods can assess individual's nutritional status through the estimation of one's food intakes. Twenty four-hour dietary recall combined with household recipe recall measuring method was used in Nutrition and Health Survey in Taiwan conducted through 1993-1996 (3). The average energy and nutrient intakes of Taiwanese can be assessed by the previous recall method. However, in order to compensate for the weakness of being unable to reveal the usual eating habits of individuals, food frequency questionnaires were designed for different age groups in the survey to understand the consumption of different food groups and some special eating habits among Taiwanese population.

Methods

I. Studied subjects

Studied subjects were sampled from Taiwanese population by a multistage, stratified sampling method. Seven strata named Hakka, mountainous, east coast, Penghu, metropolitan cities, provincial cities and urbanization class I townships, and urbanization class II townships were stratified according to the eating habits of residents and the degree of urbanization. Three towns or cities were sampled from each stratum by using the method of Probabilities Proportional to Sizes (PPS). Following by the sampling of the town or city, 3 villages were selected from each town or city, 63 villages were sampled totally in the survey. Ages were stratified to 4-6, 7-12, 13-15, 16-18, 19-44, 45-64, 65 and above. Sex was also stratified for subject sampling. Eight or 16 subjects were sampled from each sex, age and residential stratum. In the present paper, studied subjects were limited to those who were 13 years old or above. Food consumption frequencies among 4-12 year old children were reported in a separate paper (4).

II. Materials

A. Food frequency questionnaire

Two sets of food frequency questionnaires were developed for those aged 13-64 and 65 and above respectively. Each questionnaire included general food consumption frequency, eating habits, staple food eating pattern for main meals, vegetarian eating, and dietary supplementation. The major differences between the two questionnaires were that the food items in the general food consumption questionnaire were far less in the questionnaire for aged 65 or above than that for 13-64 year old. The reason for

the difference was consideration of recall difficulty for the aged.

B. Data analysis

Food consumption frequencies were based on foods consumed by the surveyed subjects in the most recent one month. Three criteria of eating habits were analyzed according to subjects' sexes, ages, and living areas:

a. Consumption frequencies of general food items:

1. Vegetable, fruit, protein foods (including fish, meat, bean and legume (except soybean and soy products), egg), and milk
2. Soybean and soy product
3. Sweetened beverage (including soda, coke, root beer, soft drinks etc.)
4. Tea
5. Fermented food (including soybean cheese, fermented soybean curd, fermented and seasoned soybean etc.)
6. Betel nut

b. Eating habits — such as eating meat and poultry with skin/fat, cooking method using oil, and fried food consumption. A scoring system was designed for different eating habits: 100% was assigned to always, 80% as mostly, 50% as half of the time, 20% as seldom, 0% as never. The frequency of a eating habit was obtained by multiplying the per cent score with the consumption frequency of the corresponding foods.

c. Staple foods consumed at three main meals

d. Vegetarian eating habits — the data of vegetarian eating habits were collected only in the last year of the survey. The results shown here were the analysis of the data collected during the last year of survey.

Data was weighted to be representative to Taiwanese population. For weighting method details please see 'Nutrition and health survey in Taiwan (NAHSIT) 1993-1996: Design, contents, and operations' (5) in this issue of the journal. Data were analyzed by using Window SAS 6.01 software.

Results

I. General food consumption frequencies

A. Vegetable, fruit, milk and milk products, and protein food group consumption frequencies

Vegetable The average vegetable consumption frequencies among Taiwanese were about 2.2 to 2.6 times per day (Table 1). Teenagers (13-18 year old group) had the lowest consumption frequencies (2.2-2.3 times/day) among different age groups. Penghu islands had the lowest and metropolitan cities had the second lowest frequency among all strata.

Table 1 Daily consumption frequency of vegetable, fruit, protein food group and milk among different age groups of Taiwanese

Gender	Age (yr)	Vegetable	Fruit	Protein food group	Milk
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Male	13-18 (n=956)	2.3 \pm 1.6	0.8 \pm 0.8	3.7 \pm 2.2	0.8 \pm 0.9
	19-44 (n=981)	2.5 \pm 1.6	0.8 \pm 0.7	3.5 \pm 2.5	0.5 \pm 1.3
	45-64 (n=937)	2.6 \pm 1.5	0.8 \pm 0.8	3.1 \pm 1.9	0.5 \pm 0.7
	65+ (n=504)	2.4 \pm 1.5	0.7 \pm 0.7	3.2 \pm 2.0	0.4 \pm 0.5
Female	13-18 (n=956)	2.2 \pm 1.5	0.9 \pm 0.8	3.2 \pm 2.0	0.7 \pm 1.0
	19-44 (n=981)	2.6 \pm 1.7	1.1 \pm 0.8	3.1 \pm 1.6	0.5 \pm 0.6
	45-64 (n=937)	2.6 \pm 1.5	0.9 \pm 0.8	2.9 \pm 1.7	0.5 \pm 0.8
	65+ (n=504)	2.4 \pm 1.3	0.7 \pm 0.9	2.4 \pm 1.7	0.5 \pm 0.6

Milk The average milk intake was about 0.4-0.8 times/day (Table 1). The trend for milk consumption decreased with age for both sexes. Both female and male teenagers had the highest milk consumption frequency. Comparing the milk intake frequency in various sampling areas, the metropolitan area had the highest and the Penghu area had the lowest consumption frequency (Table 2).

Table 2 Daily consumption frequency of vegetable, fruit, protein food group and milk among Taiwanese in different strata

Gender	Strata	Vegetable	Fruit	Protein food group	Milk
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Male	Hakka area (n=353)	2.6 \pm 1.3	0.9 \pm 0.9	3.4 \pm 1.9	0.5 \pm 0.7
	Mountainous area (n=351)	2.5 \pm 1.8	0.6 \pm 0.7	3.1 \pm 2.7	0.4 \pm 1.2
	East coast area (n=360)	2.8 \pm 1.7	0.7 \pm 0.8	3.3 \pm 2.3	0.3 \pm 0.5
	Penghu islands (n=339)	2.1 \pm 2.2	0.8 \pm 0.7	3.4 \pm 1.8	0.3 \pm 0.6
	Metropolitan cities (n=337)	2.4 \pm 1.4	0.9 \pm 0.9	4.0 \pm 3.5	0.7 \pm 2.3
	Provincial cities and urbanization class I townships (n=333)	2.5 \pm 1.6	0.7 \pm 0.7	3.2 \pm 1.8	0.5 \pm 0.7
	Urbanization class II townships (n=350)	2.7 \pm 1.5	0.7 \pm 0.7	3.3 \pm 1.9	0.4 \pm 0.5
Female	Hakka area (n=348)	2.8 \pm 1.4	1.2 \pm 0.9	3.2 \pm 1.8	0.5 \pm 0.5
	Mountainous area (n=354)	2.6 \pm 1.7	0.9 \pm 1.1	2.8 \pm 1.7	0.4 \pm 0.6
	East coast area (n=352)	2.9 \pm 1.6	0.8 \pm 0.8	3.0 \pm 1.9	0.4 \pm 0.7
	Penghu islands (n=353)	2.0 \pm 1.3	0.9 \pm 1.1	3.1 \pm 2.3	0.4 \pm 0.7
	Metropolitan cities (n=338)	2.3 \pm 1.5	1.1 \pm 0.8	3.4 \pm 1.9	0.7 \pm 0.8
	Provincial cities and urbanization class I townships (n=337)	2.5 \pm 1.7	1.0 \pm 0.8	2.9 \pm 1.4	0.5 \pm 0.5
	Urbanization class II townships (n=352)	2.7 \pm 1.5	0.8 \pm 0.7	2.8 \pm 1.6	0.5 \pm 0.7

Protein food group The protein food intake frequency had higher variation compared to other food groups. The average intake frequency for men was about 3.1-3.7 times per day, whereas that for the female was about 2.4-3.2 times/day (Table 1). Both sexes in the 13-18 age group had the highest protein food consumption frequency per day. The lowest consumption frequencies were at 45-64 and 65+ age group for males and females respectively (Table 1). Comparing different sources of protein food consumption frequency, the meat and egg consumption frequency for 45-64 year-old males was lower than for other age groups (Table 3), while the average weekly meat, bean and legume, and egg food group consumption frequency were lower than other age groups for females 65+ years. Both males and females living in metropolitan areas had highest protein food consumption frequencies.

Table 3 Weekly consumption frequency of fish, meat, bean and legume, and egg among different age groups of Taiwanese

Gender	Age (yr)	Fish	Meat	Bean and legume	Egg
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Male	13-18 (n=956)	2.5 \pm 3.6	9.6 \pm 8.2	3.9 \pm 3.7	4.6 \pm 3.6
	19-44 (n=982)	3.6 \pm 3.9	9.0 \pm 7.4	4.5 \pm 7.2	4.1 \pm 3.2
	45-64 (n=936)	4.4 \pm 4.3	8.0 \pm 9.4	3.5 \pm 4.3	2.6 \pm 2.4
	65+ (n=504)	4.7 \pm 5.2	9.0 \pm 8.6	3.1 \pm 4.1	2.9 \pm 4.8
Female	13-18 (n=954)	2.6 \pm 3.3	7.6 \pm 6.9	3.1 \pm 3.6	3.9 \pm 3.2
	19-44 (n=1003)	3.8 \pm 5.2	7.4 \pm 6.1	3.8 \pm 3.8	3.3 \pm 2.4
	45-64 (n=927)	4.2 \pm 4.7	6.6 \pm 6.5	2.9 \pm 3.8	2.5 \pm 2.7
	65+ (n=505)	3.8 \pm 4.8	5.4 \pm 6.5	2.5 \pm 5.5	1.6 \pm 2.2

Fish The consumption frequencies were increasing from 2.5 times/week for 13-18 age group to 4.7 times/week at 65+ age group for males. For females, the fish consumption frequency increased from 2.6 times/week for 13-18 age group to 4.2 times/week for 45-64 age group then decreased to 3.8 times/week for 65+ age group.

Before age 45, the average fish consumption frequency of females was higher than that of males. People who lived in Penghu area consumed fish more than twice as frequent as those who lived in other areas; however, both sexes in mountainous area had the lowest fish consumption frequency (Table 4).

Meat (including poultry) The average meat consumption frequencies were all higher for males than that for females among different age groups. For females, the average meat consumption frequency decreased from 7.6 times/week for 13-18 age group to 5.4 times/week for 65+ age group. The meat consumption frequency was lower in Penghu area, while Hakka area had the highest consumption frequency.

Bean and legume Males' average bean and legume consumption frequency was higher than females'. The age group of 19-44 had the highest bean and legume consumption frequency, and the age group of 65+ had the lowest bean and legume consumption frequency for both sexes (Table 3). People living in metropolitan area had

the highest consumption frequency, while people living in Penghu had the lowest consumption frequency (Table 4).

Egg The average egg consumption frequency of males was higher than of females for every age group. Males in 13-18 age group had the highest egg consumption frequency (about 5 times/week); the consumption frequency decreased as age increased in general. The egg consumption frequency also decreased with age (Table 3).

Similar to the bean and legume consumption frequency pattern, metropolitan residents had the highest, and Penghu residents had the lowest egg consumption frequency (Table 4).

Table 4 Weekly consumption frequency of fish, meat, bean and legume and egg among Taiwanese in different strata

Gender	Strata	Fish	Meat	Bean and legume	Egg
		Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Male	Hakka area (n=353)	3.8 \pm 4.2	9.5 \pm 7.7	3.7 \pm 3.8	3.6 \pm 3.3
	Mountainous area (n=351)	2.8 \pm 3.1	9.1 \pm 8.2	3.6 \pm 3.7	3.3 \pm 5.3
	East coast area (n=360)	3.3 \pm 5.8	9.6 \pm 9.6	4.1 \pm 4.2	3.5 \pm 3.2
	Penghu islands (n=339)	10.2 \pm 6.6	5.8 \pm 6.4	2.6 \pm 2.9	2.8 \pm 3.1
	Metropolitan cities (n=337)	4.4 \pm 4.6	8.7 \pm 9.5	5.7 \pm 12.5	4.2 \pm 3.2
	Provincial cities and urbanization class I townships (n=333)	3.9 \pm 4.2	8.1 \pm 7.0	3.9 \pm 3.9	3.5 \pm 2.8
	Urbanization class II townships (n=349)	3.7 \pm 3.7	9.5 \pm 8.1	3.6 \pm 3.3	3.4 \pm 3.8
Female	Hakka area (n=349)	3.9 \pm 4.2	8.7 \pm 7.7	3.5 \pm 3.9	3.2 \pm 2.6
	Mountainous area (n=354)	2.7 \pm 2.8	7.4 \pm 7.8	3.3 \pm 3.6	3.0 \pm 3.5
	East coast area (n=352)	3.2 \pm 4.6	7.3 \pm 7.1	4.1 \pm 4.4	3.2 \pm 3.5
	Penghu islands (n=353)	9.8 \pm 10.9	4.1 \pm 5.2	2.9 \pm 6.5	2.1 \pm 2.4
	Metropolitan cities (n=338)	4.6 \pm 7.9	6.5 \pm 6.0	4.2 \pm 4.8	3.2 \pm 2.6
	Provincial cities and urbanization class I townships (n=337)	3.8 \pm 3.8	7.1 \pm 6.1	3.2 \pm 3.2	3.1 \pm 2.6
	Urbanization class II townships (n=352)	3.7 \pm 4.0	7.1 \pm 6.5	3.2 \pm 4.4	2.5 \pm 2.3

B. Soybean and soy products

The soybean and soy products consumption frequency among males were higher than that of female in any age groups. Both males and females in 19-44 and 65+ age groups had the highest soybean and soy product consumption frequency. The consumption frequencies were 3.1 times/week and 2.5 times/week at 65+ age group for males and females respectively. The average consumption frequency of soybean milk decreased with age from 0.8 times/week for 13-18 age group to 0.4 times/week for 65+ years females (Table 5).

Table 5 Weekly consumption frequency of soybean, soybean product and soybean milk among different age groups of Taiwanese

Gender	Age (yr)	Soybean and soybean product	Soybean milk
		Mean \pm SD	Mean \pm SD
Male	13-18 (n=958)	2.6 \pm 2.8	1.1 \pm 1.9
	19-44 (n=982)	3.1 \pm 6.2	1.5 \pm 5.6
	45-64 (n=936)	2.4 \pm 3.5	0.9 \pm 2.2
	65+ (n=504)	3.1 \pm 4.1	0.9 \pm 1.9
Female	13-18 (n=954)	2.0 \pm 2.8	0.8 \pm 2.3
	19-44 (n=1003)	2.3 \pm 2.6	0.7 \pm 1.4
	45-64 (n=928)	1.9 \pm 3.2	0.5 \pm 1.6
	65+ (n=505)	2.5 \pm 5.5	0.4 \pm 1.3

Table 6 shows that males had the highest soybean consumption frequency (4 times/week) in metropolitan area, and the lowest in Penghu area (1.8 times/week). For females, the highest consumption frequency areas were metropolitan and east coast areas, while the lowest was the mountainous area. Males' soybean milk consumption frequency pattern was similar to soybean products, the highest in metropolitan area (1.9 times/week), and the lowest in Penghu area (0.9 times/week). The average consumption frequency of soybean milk for males was higher than that of females.

Table 6 Weekly consumption frequency of soybean, soybean product and soybean milk among Taiwanese in different strata

Gender	Strata	Soybean and soybean product	Soybean milk
		Mean \pm SD	Mean \pm SD
Male	Hakka area (n=353)	2.6 \pm 3.2	1.0 \pm 1.7
	Mountainous area (n=350)	2.3 \pm 2.9	1.4 \pm 2.6
	East coast area (n=360)	2.8 \pm 3.2	1.3 \pm 2.3
	Penghu islands (n=339)	1.8 \pm 2.3	0.9 \pm 1.7
	Metropolitan cities (n=337)	4.0 \pm 10.9	1.9 \pm 9.9
	Provincial cities and urbanization class I townships (n=333)	2.8 \pm 3.3	1.1 \pm 2.2
	Urbanization class II townships (n=350)	2.5 \pm 2.8	1.1 \pm 2.0
Female	Hakka area (n=348)	2.3 \pm 2.9	0.9 \pm 1.9
	Mountainous area (n=355)	1.9 \pm 2.4	1.1 \pm 1.9
	East coast area (n=352)	2.7 \pm 3.4	1.2 \pm 2.6
	Penghu islands (n=354)	2.1 \pm 6.3	0.8 \pm 1.7
	Metropolitan cities (n=338)	2.7 \pm 3.6	0.8 \pm 1.5
	Provincial cities and urbanization class I townships (n=337)	2.1 \pm 2.2	0.6 \pm 1.2
	Urbanization class II townships (n=352)	2.0 \pm 3.8	0.6 \pm 1.4

C. Sweetened beverages

The average consumption frequency of sweetened beverage decreased with age for both sexes; males had higher consumption frequency than that of females (Table 7). The average sweetened beverage consumption frequency of 13-18 age group was 4.9 times/week for males, and 2.4 times/week for females. Males had higher sweetened beverage consumption frequency than that of females in all different areas. The highest average sweetened beverage consumption frequency was in Penghu for males (2.7 times/week), and in mountainous area for females (1.5 times/week) (Table 8).

Table 7 Weekly consumption frequency of sweetened beverage among different age groups of Taiwanese

Gender	Age (yr)	Sweetened beverage
		Mean \pm SD
Male	13-18 (n=957)	4.9 \pm 8.0
	19-44 (n=982)	2.7 \pm 6.1
	45-64 (n=937)	1.1 \pm 3.6
Female	13-18 (n=954)	2.4 \pm 4.1
	19-44 (n=1003)	1.0 \pm 2.3
	45-64 (n=928)	0.6 \pm 1.7

Table 8 Weekly consumption frequency of sweetened beverage among Taiwanese in different strata

Gender	Strata	Sweetened beverage
		Mean \pm SD
Male	Hakka area (n=278)	2.0 \pm 3.7
	Mountainous area (n=280)	2.0 \pm 2.9
	East coast area (n=284)	2.0 \pm 3.7
	Penghu islands (n=267)	2.7 \pm 6.3
	Metropolitan cities (n=267)	2.4 \pm 4.5
	Provincial cities and urbanization class I townships (n=265)	2.0 \pm 3.9
	Urbanization class II townships (n=278)	2.6 \pm 7.5
Female	Hakka area (n=276)	0.8 \pm 1.9
	Mountainous area (n=284)	1.5 \pm 4.9
	East coast area (n=279)	0.8 \pm 2.4
	Penghu islands (n=281)	1.1 \pm 2.2
	Metropolitan cities (n=266)	0.8 \pm 1.8
	Provincial cities and urbanization class I townships (n=265)	1.0 \pm 2.4
	Urbanization class II townships (n=280)	0.9 \pm 1.9

D. Drinking frequency of tea

Table 9 showed the average drinking frequency of tea for different age and sex groups. Males had higher tea drinking frequency than that of females in every age group. Males, age 45-64 had the highest tea drinking frequency (9.7 times/week), while for females, it was the 19-44 age group (5.6 times/week). The urbanization class II township residents had the highest tea drinking frequency (11 times/week for males, 6.1 times/week for females); the mountainous area residents had the lowest tea drinking frequency (3.6 times/week for males, 2.3 times/week for females).

Table 9 Weekly tea drinking frequency among different age groups of Taiwanese

Gender	Age (yr)	Tea drinking
		Mean \pm SD
Male	13-18 (n=957)	5.7 \pm 10.0
	19-44 (n=980)	8.8 \pm 22.3
	45-64 (n=935)	9.7 \pm 18.4
	65+(n=503)	7.2 \pm 15.7
Female	13-18 (n=954)	4.1 \pm 6.3
	19-44 (n=1003)	5.6 \pm 11.9
	45-64 (n=922)	4.9 \pm 10.0
	65+(n=504)	2.7 \pm 10.5

Table 10 Weekly tea drinking frequency among Taiwanese in different strata

Gender	Strata	Tea drinking
		Mean \pm SD
Male	Hakka area (n=353)	7.3 \pm 13.6
	Mountainous area (n=351)	3.6 \pm 4.9
	East coast area (n=360)	7.1 \pm 13.9
	Penghu islands (n=338)	6.0 \pm 11.4
	Metropolitan cities (n=337)	8.6 \pm 30.7
	Provincial cities and urbanization class I townships (n=333)	7.4 \pm 15.7
	Urbanization class II townships (n=346)	11.0 \pm 20.1
Female	Hakka area (n=348)	4.6 \pm 11.2
	Mountainous area (n=353)	2.3 \pm 3.8
	East coast area (n=352)	4.2 \pm 8.2
	Penghu islands (n=353)	2.4 \pm 4.4
	Metropolitan cities (n=338)	4.1 \pm 7.1
	Provincial cities and urbanization class I townships (n=337)	4.9 \pm 12.0
	Urbanization class II townships (n=348)	6.1 \pm 12.7

Table 11 Weekly consumption frequency of fermented foods among different age groups of Taiwanese

Gender	Age (yr)	Fermented foods
		Mean \pm SD
Male	13-18 (n=958)	1.9 \pm 3.7
	19-44 (n=982)	2.5 \pm 4.5
	45-64 (n=936)	2.0 \pm 4.7
	65+ (n=504)	3.3 \pm 8.5
Female	13-18 (n=954)	1.5 \pm 3.5
	19-44 (n=1004)	2.6 \pm 15.5
	45-64 (n=928)	2.3 \pm 7.7
	65+ (n=505)	3.0 \pm 15.8

E. Fermented food consumption frequency

For both sexes, 65+ age group had the highest fermented food consumption frequency (3.3 times/week for males and 3.0 times/week for females); 13-18 age group had the lowest consumption frequency (1.9 times/week for males and 1.5 times/week for females). Males living in mountainous area had the highest consumption frequency of fermented food (3.5 times/week), while, it was the east coast females who had the highest consumption frequency of fermented food (4.4 times/week) (Table 12). The area where the lowest frequency of fermented food was consumed was metropolitan area for males, and provincial cities and class I township for females.

Table 12 Weekly consumption frequency of fermented foods among Taiwanese in different strata

Gender	Strata	Fermented foods
		Mean \pm SD
Male	Hakka area (n=353)	2.5 \pm 6.9
	Mountainous area (n=351)	3.5 \pm 7.6
	East coast area (n=360)	3.0 \pm 9.6
	Penghu islands (n=339)	2.6 \pm 7.3
	Metropolitan cities (n=337)	2.3 \pm 5.6
	Provincial cities and urbanization class I townships (n=333)	2.5 \pm 4.0
	Urbanization class II townships (n=349)	2.5 \pm 5.5
Female	Hakka area (n=349)	2.2 \pm 6.9
	Mountainous area (n=355)	2.7 \pm 6.0
	East coast area (n=352)	4.4 \pm 35.5
	Penghu islands (n=354)	2.4 \pm 6.3
	Metropolitan cities (n=338)	2.1 \pm 5.9
	Provincial cities and urbanization class I townships (n=337)	1.8 \pm 5.1
	Urbanization class II townships (n=352)	3.6 \pm 21.5

F. Betel nut consumption frequency

There was great variation among different male age groups betel nut consumption frequency. Table 13 showed that 19-44 age group had the highest betel nut consumption frequency (31.6 times/week), 65+ age group had the lowest consumption frequency (3.6 times/week). Females had very low betel nut consumption. The average betel nut consumption frequency for females was below once per week. For both sexes, mountainous residents had the highest betel nut consumption frequency (75.3 times/week for males, 38.5 times/week for females). East coast area came in with the next highest betel nut consumption area (Table 14). The lowest betel nut consumption area were Penghu for males, and metropolitan area for females.

Table 13 Weekly consumption frequency of betel nut among different age groups of Taiwanese

Gender	Age (yr)	Betel nut
		Mean \pm SD
Male	13-18 (n=956)	8.0 \pm 58.3
	19-44 (n=981)	31.6 \pm 85.9
	45-64 (n=937)	17.0 \pm 58.4
	65+ (n=503)	3.6 \pm 27.2
Female	13-18 (n=954)	0.1 \pm 2.1
	19-44 (n=1002)	0.9 \pm 16.4
	45-64 (n=928)	0.8 \pm 14.7
	65+ (n=505)	0.6 \pm 11.4

Table 14 Weekly consumption frequency of betel nut among Taiwanese in different strata

Gender	Strata	Betel nut
		Mean \pm SD
Male	Hakka area (n=352)	13.1 \pm 43.1
	Mountainous area (n=351)	75.3 \pm 150
	East coast area (n=360)	58.2 \pm 132
	Penghu islands (n=339)	10.9 \pm 42.6
	Metropolitan cities (n=336)	13.0 \pm 51.0
	Provincial cities and urbanization class I townships (n=333)	21.8 \pm 65.0
	Urbanization class II townships (n=350)	32.1 \pm 89.7
Female	Hakka area (n=348)	0.3 \pm 2.7
	Mountainous area (n=354)	38.5 \pm 127
	East coast area (n=352)	18.9 \pm 70.3
	Penghu islands (n=354)	0.1 \pm 1.2
	Metropolitan cities (n=338)	0 \pm 0
	Provincial cities and urbanization class I townships (n=337)	0.1 \pm 0.9
	Urbanization class II townships (n=352)	0.5 \pm 5.2

II. Eating habits

Table 15 showed the frequency of getting meat/poultry with skin/fat, cooking with oil, fried food consumption, and eating rice mixed with stewed sauce, lard, and soups for different age groups. The mean weekly frequency of getting meat/poultry with skin/fat for males was higher than for females of the same age group. The highest consumption frequency was found in age group of 19-44, and lowest in the age group of 13-18 for both sexes. The frequency of using oil for cooking was approximately 20 times per week for both sexes, with the highest frequency was found at the age group of 19-44 and the lowest was at the age group of 65 and above. The consumption frequency of fried food decreased with age. The average consumption frequency of fried food was more than once per week for both sexes, also, the mean consumption frequency was higher for males than females of any age groups. The age group of 13-18 had the highest consumption frequency for mixing lard, stewed sauces or oily soup with rice, the rates for this kind of eating behavior were about 25%-40% and 16%-30% for male and female respectively.

Table 15 Weekly frequency of getting meat/poultry with skin/fat, cooking with oil, fried food consumption and eating rice with oily sauce among different age groups of Taiwanese

Gender	Age (yr)	High fat food ¹	Cooking with oil ²	Fried food	Percentage of eating rice with oily sauce ³ (%)
		Mean \pm SD	Mean \pm SD	Mean \pm SD	
Male	13-18 (n=955)	2.8 \pm 4.5	21.8 \pm 13.0	1.4 \pm 2.1	38.9
	19-44 (n=981)	3.5 \pm 4.1	22.7 \pm 11.8	0.8 \pm 1.4	28.3
	45-64 (n=936)	3.1 \pm 4.4	21.6 \pm 11.4	0.5 \pm 2.1	25.1
	65+ (n=503)	3.1 \pm 4.7	18.5 \pm 11.7	0.5 \pm 1.4	30.4
Female	13-18 (n=953)	1.2 \pm 2.3	19.7 \pm 11.7	1.2 \pm 1.9	28.8
	19-44 (n=1003)	1.7 \pm 2.8	22.5 \pm 12.5	0.6 \pm 1.0	16.4
	45-64 (n=927)	1.6 \pm 3.0	20.8 \pm 11.3	0.2 \pm 0.7	19.4
	65+ (n=503)	1.4 \pm 2.8	16.9 \pm 10.6	0.3 \pm 1.0	22.9

¹ meat and poultry with skin/fat

² frequency of cooking meat, fish, vegetable, soy product with oil

³ eating rice mixed with lard, stew sauce, or oily soup

Table 16 showed the frequency of getting meat/poultry with skin/fat, cooking with oil, fried food consumption, and eating rice mixed with stewed sauce, lard, and oily soups for Taiwanese living in different areas. People living in mountainous area had the highest consumption frequency of getting meat/poultry with skin/fat, while people living at Penghu island and metropolitan cities had the lowest consumption frequency. For both sexes, people living in Hakka area and urbanization class II townships had the highest frequency of cooking with oil, whereas people living in mountainous area had the lowest frequency. Males living in metropolitan cities and females living in metropolitan cities and urbanization class I area had the highest consumption frequency of fried foods. Both males and females living in mountainous area ate rice with stewed sauces, lard, or soups most frequently, while people living at Penghu islands had that kind of eating habit least frequently.

Table 16 Weekly frequency of getting meat/poultry with skin/fat, cooking with oil, fried food consumption and eating rice with oily sauce among Taiwanese in different strata

Gender	Strata	High fat food ¹	Cooking with oil ²	Fried food	Percentage of eating rice with oily sauce ³ (%)
		Mean \pm SD	Mean \pm SD	Mean \pm SD	
Male	Hakka area (n=353)	3.6 \pm 4.5	22.3 \pm 11.1	0.6 \pm 2.1	21.6
	Mountainous area (n=351)	5.0 \pm 5.3	19.9 \pm 13.4	0.4 \pm 1.2	31.8
	East coast area (n=360)	4.0 \pm 5.4	22.0 \pm 14.0	0.6 \pm 1.4	29.1
	Penghu islands (n=338)	2.3 \pm 3.8	21.4 \pm 15.5	0.5 \pm 1.0	13.4
	Metropolitan cities (n=337)	2.7 \pm 3.6	21.8 \pm 11.8	1.0 \pm 2.7	20.9
	Provincial cities and urbanization class I townships (n=333)	3.2 \pm 4.1	21.2 \pm 12.0	0.6 \pm 1.1	30.5
	Urbanization class II townships (n=348)	3.8 \pm 4.5	22.9 \pm 11.3	0.6 \pm 1.2	28.9
Female	Hakka area (n=348)	1.8 \pm 3.5	22.7 \pm 12.0	0.5 \pm 1.7	12.4
	Mountainous area (n=355)	2.6 \pm 4.3	18.3 \pm 13.1	0.4 \pm 1.5	24.4
	East coast area (n=352)	1.9 \pm 3.8	22.2 \pm 12.0	0.3 \pm 0.8	18.2
	Penghu islands (n=354)	1.1 \pm 2.3	21.1 \pm 13.1	0.4 \pm 0.9	11.2
	Metropolitan cities (n=336)	1.1 \pm 2.0	20.5 \pm 12.9	0.6 \pm 1.2	18.8
	Provincial cities and urbanization class I townships (n=336)	1.8 \pm 3.1	21.6 \pm 12.0	0.6 \pm 1.0	14.4
	Urbanization class II townships (n=352)	1.8 \pm 2.8	22.0 \pm 12.0	0.4 \pm 0.8	21.6

¹ meat and poultry with skin/fat

² frequency of cooking meat, fish, vegetable, soy product with oil

³ eating rice mixed with lard, stew sauce, or oily sou

III. Staple food groups for the three main meals

Breakfast Figures 1 and 2 show the intake of breakfast staple food types of different age groups for both sexes. The main breakfast staple foods were cooked rice, porridge, western style cake, bread, toast and sandwiches, noodles, Chinese baked bread and fried sticks, and steamed and stuffed bread. About 40% of teenagers (age 13-18) had western style breakfast mainly including cake, toast, bread, and sandwiches. The percentage of this kind of eating habit decreased with age. However, the percentage of eating porridge as breakfast increased with age; about half of the females age 65 or above had this kind of eating habit. The highest percentage of eating rice as breakfast was for age 45-64 (around 25%), while teenagers had the lowest consumption rate (around 10%). Chinese-style wheat flour products for breakfast included noodles, steamed bread, steamed stuffed bread, Chinese baked bread, fried bread sticks, and egg breads, etc. The percentage of Taiwanese eating Chinese style wheat flour products for breakfast was about 10 to 30%, the age group which had the highest percentage of this kind of eating habit was age 19-44 year-old for both sexes.

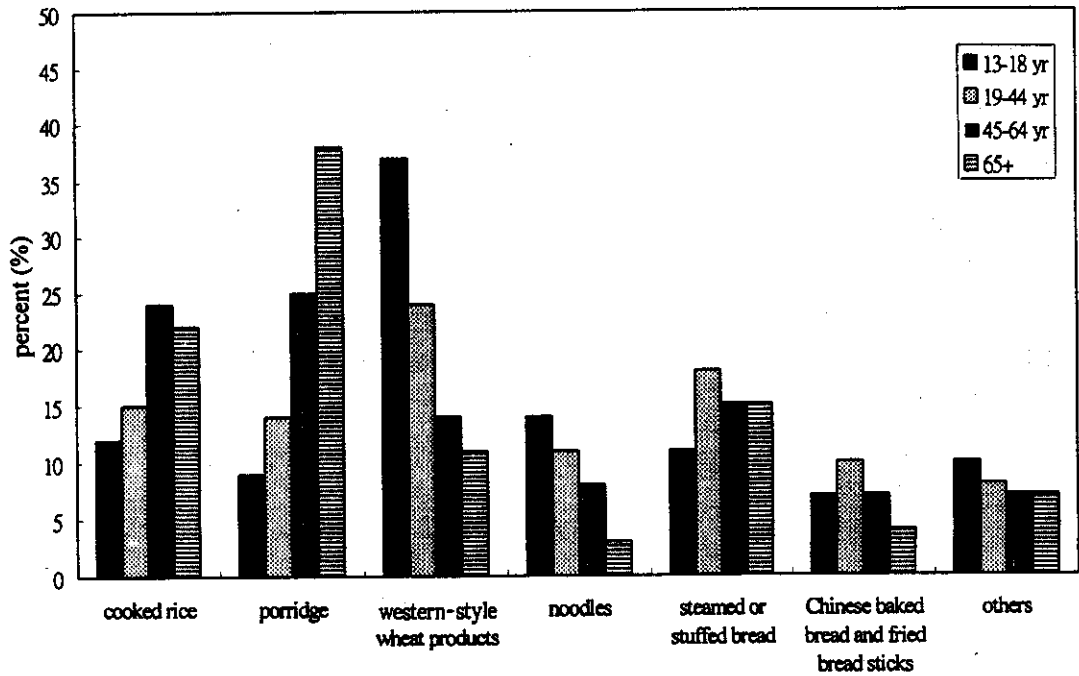


Figure 1 Types of staple food consumed at breakfast by males

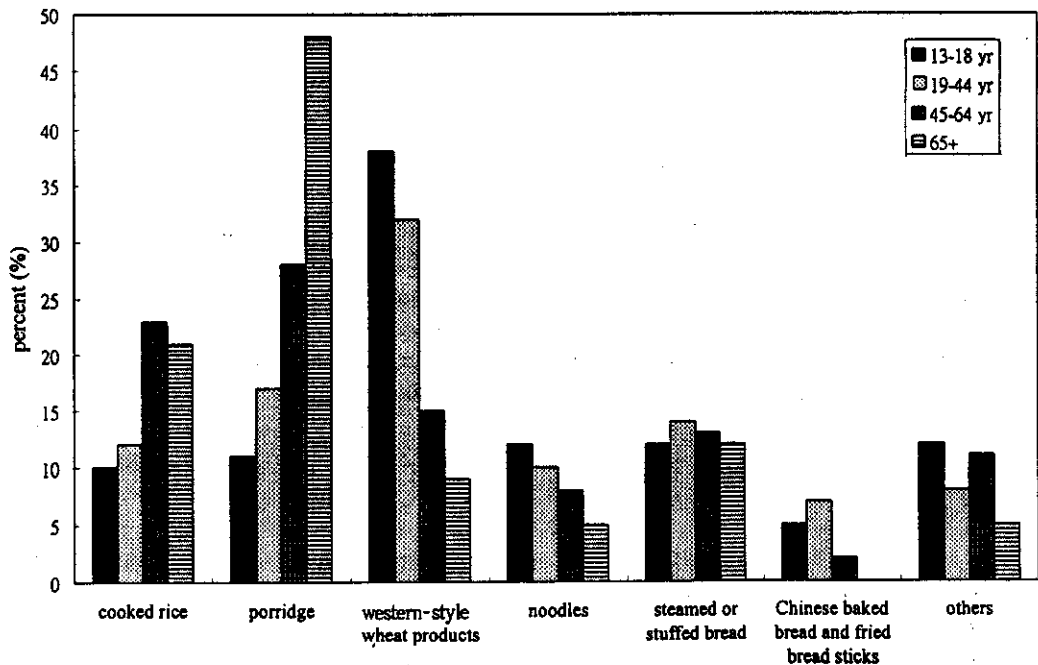


Figure 2 Types of staple food consumed at breakfast by females

Lunch Figure 3 and figure 4 showed the intake of lunch staple food types of different age groups for both sexes. The main staple food for lunch was cooked rice for Taiwanese. Eighty percent of Taiwanese males had rice for their lunch for all age groups except for 65+ years, wherein 70% had rice for their lunch. About 70% of Taiwanese females had rice for their lunch. Next to rice, noodles were the second most popular staple foods for Taiwanese. The percentages of those eating noodles for lunch were 10-20% and 15-25% for males and females respectively. Twelve percent of Taiwanese males aged 65 and above ate porridge for lunch and it was 17% for females. Almost none of Taiwanese males had western staple baked products for lunch, however around 4% of teenage girls ate western pastry for lunch.

Dinner Figure 5 and 6 showed the intake of dinner staple food types of different age groups for both sexes. Cooked rice also was the main staple food for dinner among Taiwanese, 75 to 90% of Taiwanese ate rice for dinner. The age group of 45-64 year-old for both sexes had the highest percentage of eating rice as staple food for dinner, while female teenagers had the lowest percentage. Next to rice, noodles were the second most popular staple food for dinner among males aged less than 45 and females aged less than 65. For males, the consumption rate was highest for the age group of 13-18 (14%), and lowest for the age group of 45-64 (6%). The percentage of noodle consumption increased as age decreased; around 20% of teenage girls had noodles for their dinner. The percentage of porridge intake increased with age.

IV. Vegetarian

Table 17 showed the percentage of vegetarians among different age groups of Taiwanese and the mean duration of being vegetarian. The percentage of vegetarians was 2.5 to 4.3% for males above 13 years, and it was 1-20% for females. The percentages of preschool and school children vegetarians were between 3.3% and 6.3%. Compared to their age, the duration of being vegetarian was rather long for these age groups. The percentage of consistent vegetarians (being vegetarian everyday) was around 1.2-2.5%. Females aged over 65 had the highest percentage vegetarians (around 10%). Among vegetarians, about 40% were consistent vegetarians, however, about 50% of vegetarians were vegetarians only on the first and fifteenth day of the lunar month (table 18). All those children who were vegetarian at the age of 4-6 were ovo-lacto vegetarians (table 19). The percentage of ovo-lacto vegetarians was 86 % for children aged 7-12, and the percentage of ovo-lacto vegetarians decreased with age.

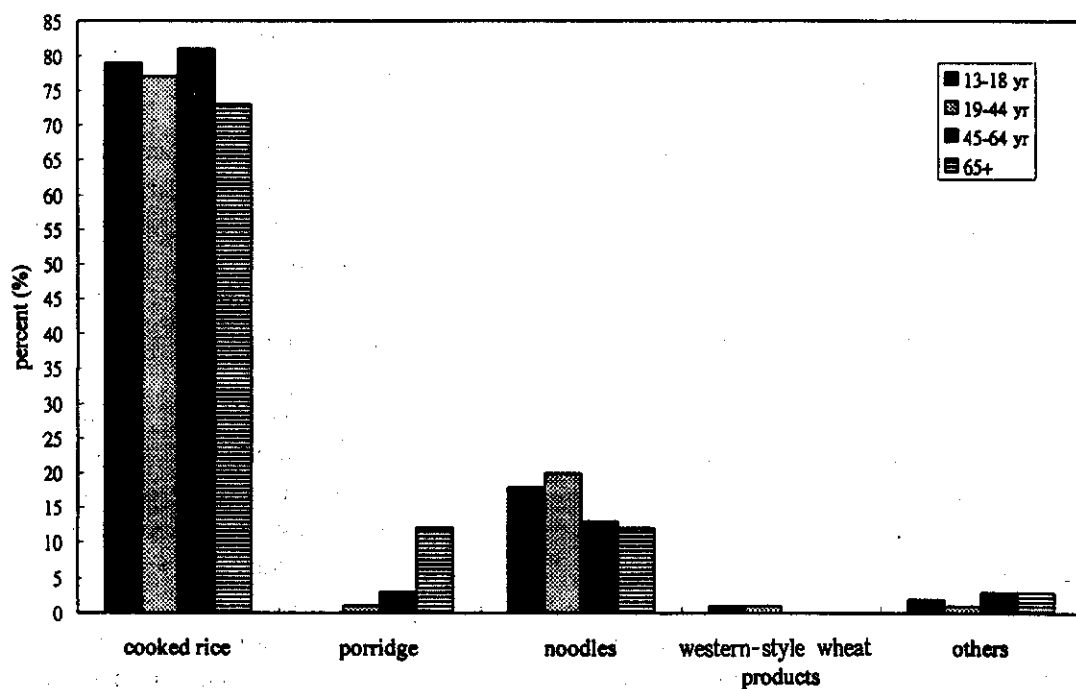


Figure 3 Types of staple food consumed for lunch by males

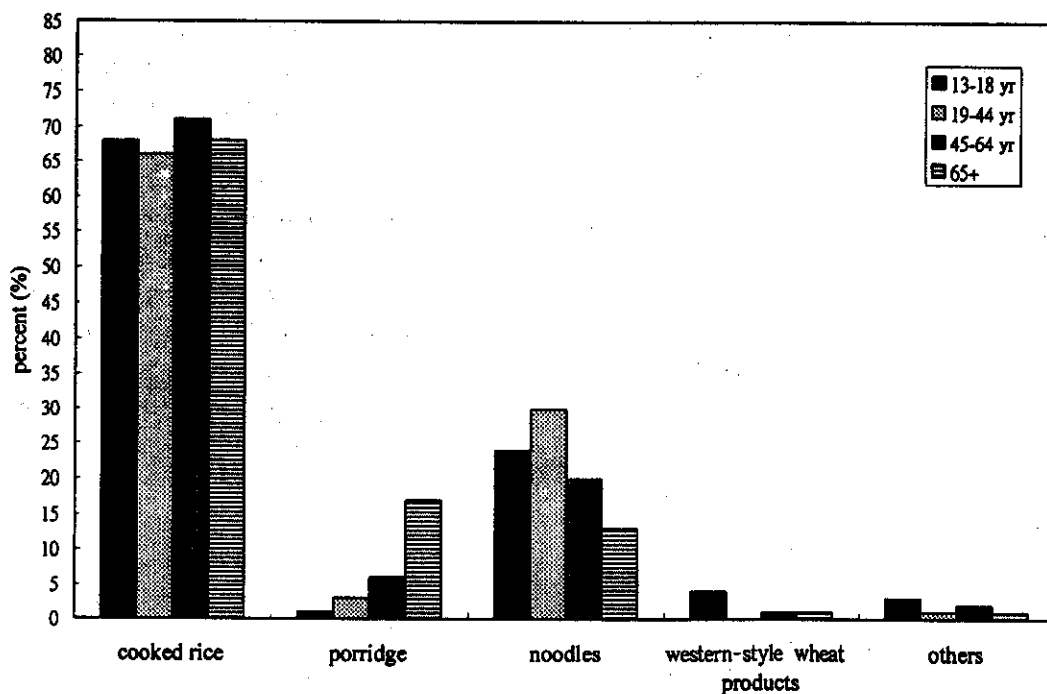


Figure 4 Types of staple food consumed for lunch by females

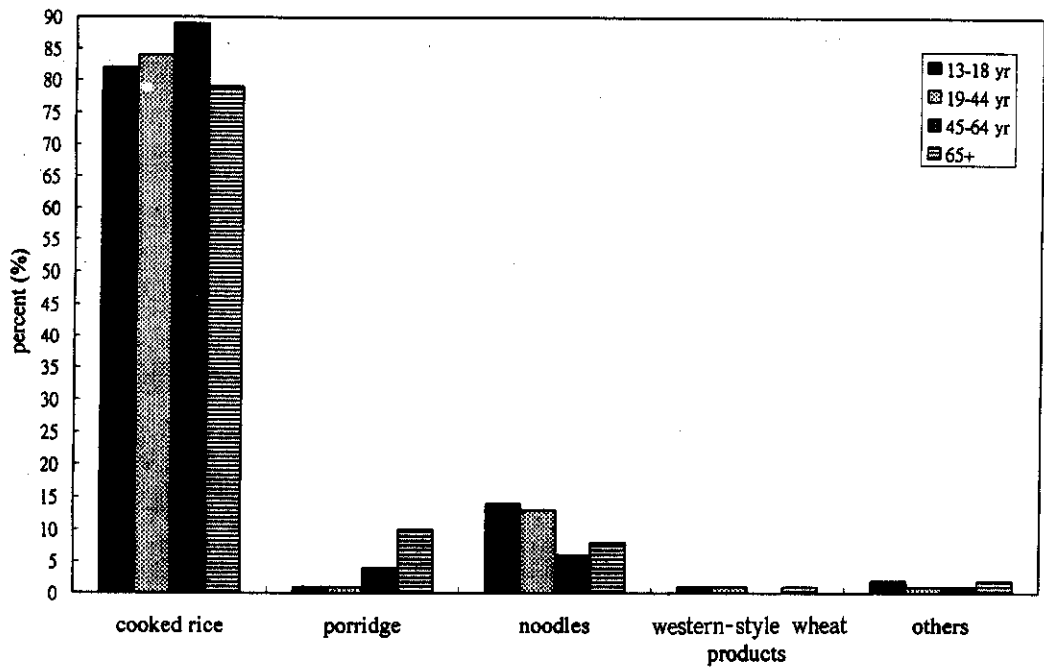


Figure 5 Types of staple food consumed for dinner by males

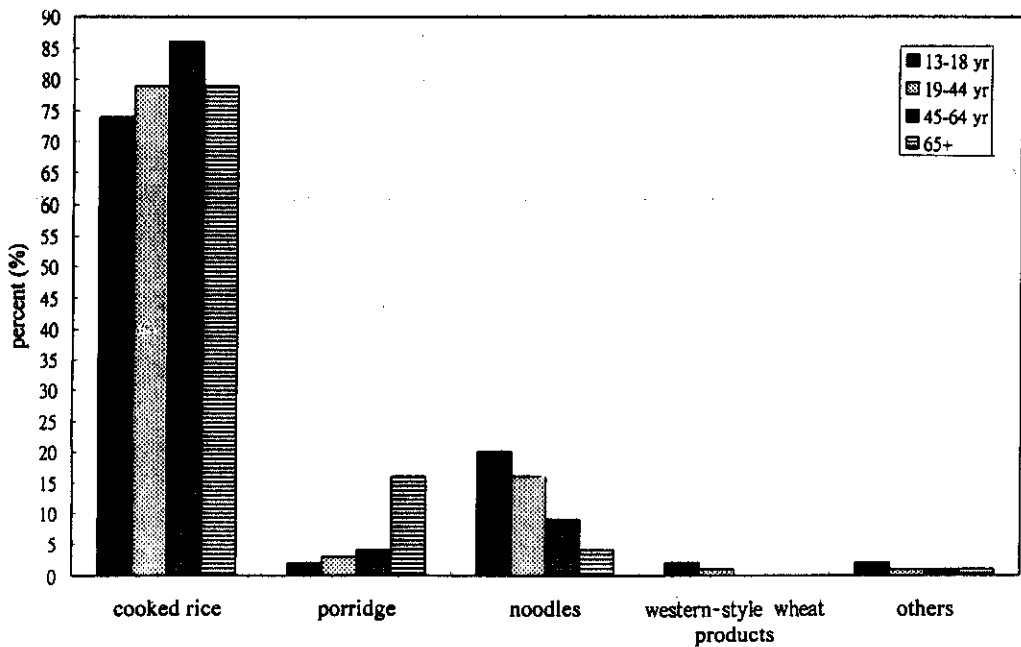


Figure 6 Types of staple food consumed for dinner by females

Table 17 Percentage of vegetarian among different age groups of Taiwanese

Gender	Age (yr)	Vegetarian		All-time vegetarian (%)	Mean duration (yrs)
		n	(%)		
Male	4-6 (n=161)	2	3.7	0	3.5
	7-12 (n=334)	6	3.3	0.9	8.4
	13-18 (n=312)	11	3.7	1.2	4.9
	19-44 (n=327)	4	2.5	1.8	5.4
	45-64 (n=309)	6	3.4	2.5	13.3
	65+ (n=167)	8	4.3	1.9	6.5
	≥ 4 (n=1610)	37	3.1	1.7	7.1
	≥ 19 (n=803)	18	2.9	2.0	7.7
	≥ 45 (n=476)	14	3.7	2.3	10.5
Female	4-6 (n=164)	4	6.3	6.3	4.8
	7-12 (n=332)	8	4.1	3.2	7.5
	13-18 (n=313)	6	1.0	0.8	11.9
	19-44 (n=332)	18	7.8	2.8	6.8
	45-64 (n=298)	31	8.4	1.7	9.4
	65+ (n=166)	32	20.1	10.1	11.8
	≥ 4 (n=1605)	99	7.6	3.2	8.3
	≥ 19 (n=796)	81	9.2	3.3	8.5
	≥ 45 (n=464)	63	12.1	4.4	10.7

Table 18 Types of vegetarian period among different age groups of Taiwanese

Age (yr)	Consistent vegetarian (%)	1 st and 15 th of lunar month (%)	Others (%)
4-6	66.7	.	33.3
7-12	57.1	21.4	21.4
13-18	23.5	47.1	29.4
19-44	40.9	50.0	9.1
45-64	27.0	54.1	18.9
65+	41.5	56.1	2.4
≥ 4	38.0	47.4	14.6
≥ 19	36.0	54.0	10.0
≥ 45	34.6	55.1	10.3

Table 19 Types of vegetarian among different age groups of Taiwanese

Age (yr)	Pure vegetarian (%)	Lacto vegetarian (%)	Ovo-lacto vegetarian (%)
4-6	0	0	100
7-12	14.3	0	85.7
13-18	23.5	5.9	70.6
19-44	31.8	9.1	59.1
45-64	37.8	35.1	27.0
65+	36.6	31.7	31.7
≥ 4	30.7	21.2	48.2
≥ 19	36.0	28.0	36.0
≥ 45	37.2	33.3	29.5

Discussion

People who lived in Penghu islands had the lowest daily vegetable consumption frequency, and people living in metropolitan cities had the second lowest consumption frequency. Lack of the availability of vegetables might be the reason for low vegetable consumption frequency in Penghu islands, but the reason for the second lowest vegetable consumption frequency being in metropolitan cities needs further study. Moreover, the high consumption frequency of fruits, protein foods, and milk by metropolitan city inhabitants might be related to their economic ability or food availability. It was not surprising that the fish consumption frequency was highest among Penghu islanders; however, their consumption frequency of meat, egg, beans and milk was lower than those who living in other areas. These results showed that the nutrient intakes of remote islanders were affected by the food availability. Although teenagers had the highest consumption frequency of milk (0.7-0.8 cup per day) among all age groups, it still did not meet recommendation of the national Daily Food Guide (1-2 cups per day) (6).

The consumption frequencies of drinking sweetened beverages were five times per week for male teenagers, and it was 2.4 times per week for teenage girls. The relationship between drinking sweetened beverages and the increasing prevalence of obese children in Taiwan may be interesting to study.

Teenagers had the highest frequency of eating fried foods, and this decreased with age. Since obesity is related with intake of high fat foods and the prevalence of obesity is increasing in Taiwan nowadays, the phenomenon of high intake of fried food among Taiwanese youngsters needs to be noticed. People living in mountainous area had the highest frequency of meat/poultry with skin/fat. This result was concordant with the high prevalence rate of obesity among people living in mountainous area.

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The types of staple food for breakfast varied among Taiwanese, nonetheless, it was rather simple for lunch and dinner. The selection of types of staple food for main meals was quite different for different age groups. Western style foods, such as cakes and breads, were popular among teenagers, however, middle-aged people preferred rice for their breakfast. For older females, having porridge for breakfast was their favorite. Chinese-style wheat flour products were commonly consumed by people aged 19-44. These different eating habits may reflect not only the influence of living style of different age groups but also the secular trend of changing eating habits among Taiwanese. Since one-third of daily nutrient intakes may be supplied through breakfast and the teenagers preferred cakes or bread for their breakfast, it is worth educating the teenagers how to make good selections. Also, nutritionists can educate bakers to make balanced nutrition products and reduce fat and high sugar in products.

Vegetarianism has several hundred years of history in Asian countries; also, most Buddhists in Taiwan are vegetarians and some people are vegetarians for other religious reasons. For the past several decades, the vegetarian population was increasing in western society; the reasons for being vegetarians are health, religions, to decrease violence, economics, and animal protection, etc (7). In Taiwan, this trend of being vegetarian is increasing in recent years. Research indicates that vegetarians have lower morbidity from coronary heart diseases and colon cancers than those of non-vegetarians (8,9). However, some vegetarians in Taiwan cook their foods by adding too much oil or sugar, so the benefits of being vegetarian may be obscured by this kind of eating behavior. And on the other hand, the high fiber content in vegetarian diet affecting the absorption of trace elements requires attention (10-14). It was not surprising that the percentage of females being vegetarian was higher than that of males. The same phenomenon was found in American teenagers (15). It is noteworthy that 3.3%-6.3% of preschoolers and school children were vegetarians. Studies found that vegetarian infants, preschoolers, or school children were deficient in energy, vitamin B₁₂, iron, calcium, zinc intake (16-19). Whether it is suitable to be vegetarian or how to eat to be healthy for children during such growing period requires further research.

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