Original Article

2005-2008 Nutrition and Health Survey in Taiwan: the nutrition knowledge, attitude and behavior of 19–64 years old adults

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The purpose of this study is to understand nutrition knowledge, attitude, and behavior in Taiwanese adults. Results indicated that adults' knowledge on "relationship between diet and disease" and "comparison of foods in terms of specific nutrients" is acceptable. However, they lack knowledge on "daily serving requirements" and "weight and weight loss". Although they recognize the importance of nutrition, nutrition was not the major concern of food selection. Significant differences were found among gender and age groups. Females of most age groups are better than males in many aspects of nutrition knowledge, attitude and behavior except emotional and external eating behavior. Young (age 19–30) and prime (age 31–44) adults have better knowledge than that of middle adults (age 45–64), while prime adults hold a more positive attitude than young adults. As for nutrition behavior, prime and middle adults are better than young adults. Nutrition knowledge and attitude of adults in urban areas is generally better than those in suburban and remote areas. However, adults in urban areas perform "emotional and external cued eating" more frequently than those in suburban and remote areas. There are significantly positive correlations among nutrition knowledge, attitude and behavior; and attitude has stronger correlation (r=0.42) with behavior than knowledge does (r=0.27). Therefore, to achieve desirable eating behaviors, the adult nutrition education program should include knowledge of what constitutes a balanced diet and what constitutes being overweight. Proper strategies to enhance the behavioral motivation of healthy food selection must also not be neglected.

Key Words: nutrition knowledge, attitude, behavior, adults, NAHSIT

INTRODUCTION

Eating patterns and dietary behavior of Taiwanese people have changed throughout the past two decades. There is a swift from malnutrition to imbalanced nutrient intake. The first Nutrition and Health Survey in Taiwan (NAHSIT) conducted between 1993 and 1996 showed that Taiwanese people tended to consume too much meat,[1] but not enough grains, vegetables and dairy foods. The imbalanced dietary pattern was thought to be the cause of the increasing prevalence of obesity and metabolic diseases.[2] What actions to take in order to improve eating behavior and build a healthy dietary pattern to prevent diseases are, therefore, important nutrition issues in Taiwan. In order to design an appropriate nutrition intervention program, it is important to understand the factors associated with personal food choices, such as nutrition knowledge, attitude and skill.[3,4] In the 1993-96 NAHSIT [5] nine questions about general nutrition knowledge were asked and results showed that on average Taiwanese adults' general nutrition knowledge decreased as their age increased. The 18- to 44-year-old group scored well, with a 77.8% correct answer rate, but the 45- to 64-year-old group scored 61.1% and 64 and older scored 38.9%. Beginning with the NAHSIT elderly survey (1999-2000),[6] a more detailed nutrition knowledge, attitude and behavior questionnaire was conducted, and results indicated that Taiwanese elders' nutrition knowledge was poor (overall, there was a 49.4% correct answer rate), especially concerning the relationship between nutrition and disease (a 41.7% correct answer rate), but their nutrition attitude was fair. The results of NAHSIT Children' survey (2001-2002) indicated that Taiwanese children's basic nutrition knowledge was fair, but they scored poorly in "the physiological function of nutrients", "relationships between diet/nutrients and disease", and "the daily serving requirement for different foods".[7] Taiwanese children valued the importance of nutrition, but the health benefits of foods were not their major concern of food selection. Their dietary quality was not satisfactory; most children's

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diets did not meet the recommended servings for dairy, vegetable, fruit, and cereals/ grains groups. Positive relationships were found among nutrition knowledge, attitude and caring about nutrition behavior, both in the elderly and in children.[6,7] A gap was found between nutrition knowledge, attitude and eating behavior in children, especially vegetable and fruit consumption. The results indicated that the attitude toward eating for health needs to be improved.[7] By adding a knowledge, attitude and behavior (KAB) questionnaire to the nationwide survey NAHSIT, we can understand some of the influencing factors of people's dietary behavior, and can use that information to develop appropriate strategies to improve their diet and enhance their quality of life.

This study investigated the current status of nutrition knowledge, attitude and behavior of adults aged from 19 to 64. By understanding those mediators of dietary behavior, an effective nutrition education program can be developed for adults.

MATERIALS AND METHODS

Samples

This study analyzes the data of adults aged from 19 to 64 years old in the 2005-2008 NAHSIT. There were 1706 valid participants for knowledge, attitude and behavior (KAB) analysis, including young adults (19–30 years old), prime adults (31–44 years old) and middle adults (45–64 years old) residing in the northern-1 area, northern-2 area, central area, southern area and eastern area. The characteristics of the sample are shown in Table 1.

Measures

Information collected by the questionnaire included nutrition knowledge, attitude and behavior. All of the scales were developed by the authors and are similar to those used in NAHSIT Elderly (1999-2000)[5] and NAHSIT Elementary School Children (2001 and 2002).[6] All scales were reviewed by experts in order to establish content validity and then piloted with adults. Examples of questions about nutrition knowledge, attitude, and behavior scales are shown in the appendix.

Nutrition knowledge scale

The nutrition knowledge scale included five subjects: 1) 10 items on the relationship between diet and disease; 2) 10 items on comparison of foods in terms of specific nutrient content (e.g. fat, fiber, calcium, calorie and sodium); 3) 6 items on the daily serving requirements of different food groups; and 4) 5 items on weight and weight loss. The scale was in multiple-choice format with one point awarded for correct answers, and zero otherwise. The inter-item reliability (Cronbach's alpha coefficient) of the nutrition knowledge scale was 0.78.

Nutrition attitude scale

The nutrition attitude scale consisted of 19 items, which were divided into three dimensions based on factor analysis. They were: 1) care about nutrition (8 items); 2) emotional eating (6 items); and 3) recognize the importance of nutrition (5 items). The scale is in 5-point Likert-type format. The response items include "strongly disagree", "disagree", "neutral", "agree" and "strongly agree", as represented by 1 to 5 respectively. Reverse-sentenced items were scored reversely. "No comment" and "I don't know" were included as extra response items and were scored as neutral responses. The Cronbach's alpha coefficient of the nutrition attitudes scale was 0.73.

Nutrition behavior scale

The nutrition behavior scale had 24 items, which were divided into two dimensions based on factor analysis. They were: 1) food selection and care about nutrition (15 items) and 2) emotional and external cued eating (9 items). The scale was in 5-point Likert-type format. The response items included "never", "seldom", "sometimes", "often" and "always", scored from 1 to 5. Reverse sentenced items were scored reversely. "No comment" and "I don't know" were included as extra response items and were score as "sometimes". The Cronbach's alpha coefficient of the nutrition behavior scale was 0.76.

Statistical analysis

Data were analyzed using SAS (version 9.1) for Windows. Data were weighted to represent the Taiwanese population using the models developed by the SUDAAN Software Company, but did not include data for performing Pearson product-moment correlation. One-way and two-way ANOVA were used to compare the differences in nutrition knowledge, attitude, and behavior among adults of different age groups, genders, and residing areas, using the Scheffé post hoc test. The Pearson product-moment correlation coefficient was used to study the relationships between nutrition knowledge, attitude, and behavior. The significant level used was $p<0.05$.

RESULTS

Demographic characteristics of the sample

The characteristics of the subjects are listed in Table 1. The sample was composed of approximately equal numbers of men and women in each age group and each residence region.

Nutrition knowledge, attitude and behavior in adults

The mean, standard deviation and percentage of correct or positive responses on the nutrition knowledge, attitude and behavior scales of adults aged from 19 to 64 are

Table 1. Characteristics of the subjects (N=1706)

	N	%
Age group		
19–30 yrs		
Male	230	13.5
Female	227	13.3
31–44 yrs		
Male	216	12.7
Female	223	13.1
45–64 yrs		
Male	422	24.7
Female	388	22.7
Residential area		
Northern 1 area	347	20.3
Northern 2 area	336	19.7
Central area	341	20.0
Southern area	336	19.7
Eastern area	346	20.3

shown in Table 2.

Nutrition knowledge

The percentage of adults responding correctly to questions of overall nutrition knowledge was 62.7%, indicating an acceptable level of knowledge (Table 2). However, the nutrition knowledge in the four subscales is different. The knowledge level of "relationship between diet and disease" (74.7% correct answer rate) and "comparison of foods in terms of specific nutrients" (69.2%) are acceptable; while knowledge on "daily serving requirements of different food groups" (48.7%) and "weight and weight loss" (42.4%) are inferior. The lowest correct answer rate questions are: "the daily serving requirements for the cereals/grains group" (16.3%), "the daily serving requirements for the meat/protein group" (23.3%), "which food has the highest iron content: pork, chicken or fish" (25.7%), "the relationship between folic acid and anemia" (31.2%), and "the daily serving requirements for the fat/oil group" (31.6%). Adults tend to underestimate the daily serving requirements for the cereals/grains group and the milk group but overestimate the daily serving requirements for the meat/protein group and the fat/oil group. As to knowledge of "weight and weight loss", more than half (53.9%) of the adults had never heard the term "body mass index (BMI)", only 39.1% know the formula for calculating BMI, but 45.9% of the adults chose the right answer for the definition of overweight (BMI>24).

The results of one-way ANOVA (Table 3) showed that the total scores of nutrition knowledge in the five regions of Taiwan (northern-1 area, northern-2 area, central area, southern area and eastern area) are significantly different. By looking at the mean score of knowledge, we found that subjects in the northern-1 area scored highest, while those in the eastern area scored lowest. However, post hoc tests only showed that subjects in the northern-1 area perform better than those in the central area, while those in other regions do not have significant differences. This is possibly due to the wide distribution of scores (large standard deviation). Among the four subscales, only two ("comparison of foods in terms of specific nutrients" and "daily serving requirements of different food groups") reveal significant differences in five regions. Regarding the scores of the subscale "comparison of foods in terms of specific nutrients", post hoc tests indicate that subjects

Table 2. The mean, percentage of correct responses, and average score of each item on nutrition knowledge, attitudes, behavior scales (N=1706)

	Total score	Mean ± SE	% of correct response	average score of each item
Nutrition knowledge	31	19.43±0.19	62.7	
Relationship between diet and disease	10	7.47±0.08	74.7	
Comparison of foods in terms of specific nutrient content	10	6.92±0.07	69.2	
Daily serving requirements of different food groups	6	2.92±0.04	48.7	
Weight and weight loss	5	2.12±0.05	42.4	
Nutrition attitudes	95	67.65±0.22		3.56
Care about nutrition	40	27.80±0.13		3.48
Emotional eating	30	20.79±0.10		3.47
Recognize the importance of nutrition	25	19.06±0.07		3.81
Nutrition behavior	120	76.81±0.42		3.20
Food selection and care about nutrition	75	41.87±0.47		2.79
Emotional and external cued eating	45	34.94±0.23		3.88

Table 3. The results of one-way ANOVA on nutrition knowledge, attitude, behavior of Taiwanese adults, aged 19-64 years, residing in different areas of Taiwan.

	(1)Northern-1 n=347	(2)Northern-2 n=336	(3)Central n=341	(4)Southern n=336	(5)Eastern n=346	F value	post hoc Tests†
Nutrition knowledge	19.9±0.3	19.7±0.6	19.1±0.4	19.2±0.4	18.0±0.6	4.78***	(1)>(3)
Relationship between diet and disease	7.6±0.1	7.5±0.2	7.3±0.1	7.5±0.2	7.0±0.2	2.12	
Comparison of foods in terms of specific nutrient content	7.2±0.1	7.0±0.2	6.9±0.1	6.8±0.2	6.2±0.3	4.69***	(1)>(4)
Daily serving requirements of different food groups	3.0±0.1	3.1±0.1	2.9±0.1	2.9±0.1	2.9±0.1	2.54*	
Weight and weight loss	2.2±0.1	2.2±0.1	2.1±0.1	2.1±0.1	1.9±0.1	1.85	
Nutrition attitudes	67.7±0.5	68.5±0.5	67.3±0.4	67.5±0.3	66.6±0.6	1.50	
Care about nutrition	28.0±0.3	28.3±0.4	27.4±0.2	27.7±0.2	26.9±0.4	2.71*	
Emotional eating	20.6±0.2	20.9±0.2	21.0±0.2	20.8±0.2	21.0±0.2	1.25	
Recognize the importance of nutrition	19.1±0.1	19.3±0.1	18.9±0.2	19.0±0.1	18.7±0.1	2.20	
Nutrition behavior	77.6±0.7	77.5±0.6	75.3±1.0	76.9±0.8	76.6±0.9	2.76*	(1)>(3)
Food selection and care about nutrition	43.4±0.7	42.9±0.5	40.2±1.2	41.3±0.8	40.2±0.8	7.10***	(1)>(3) (4),(2)>(3)
Emotional and external cued eating	34.3±0.5	34.7±0.3	35.1±0.6	35.6±0.2	36.4±0.3	4.69***	(4)>(1)

†summary results of $p<0.05$; *$p<0.05$, ***$p<0.001$

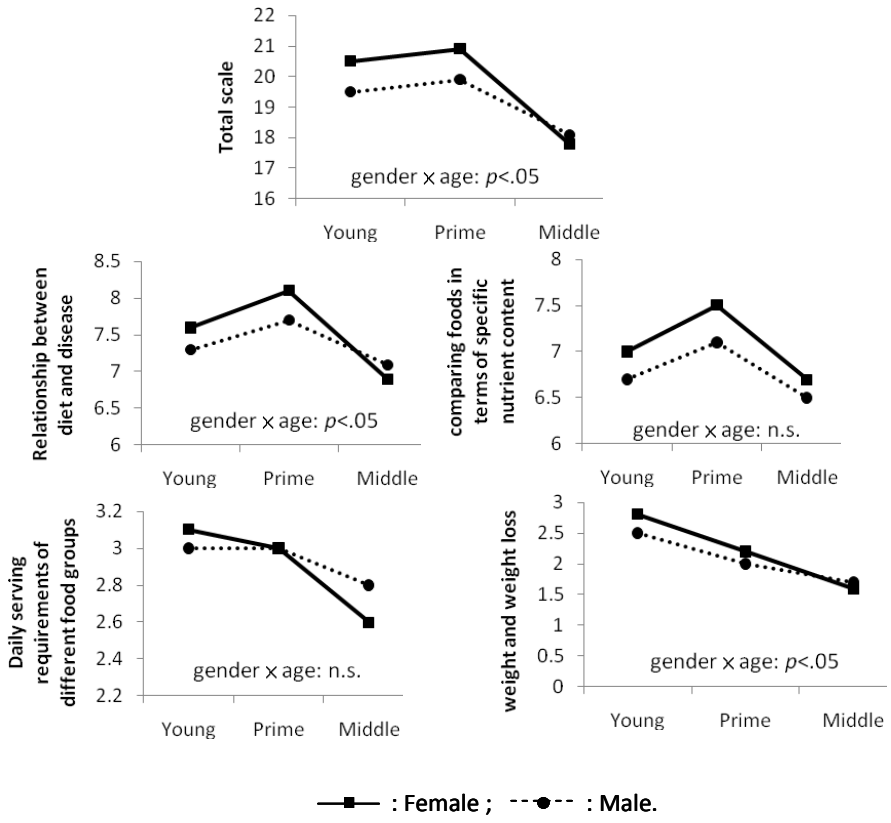

Figure 1. Nutrition knowledge scale: gender × age interaction.

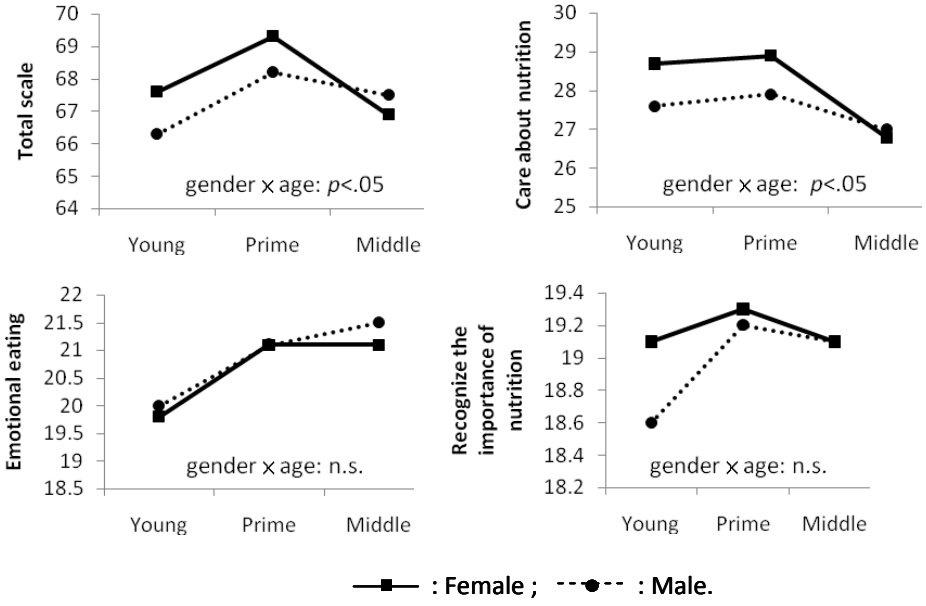

Figure 2. Nutrition attitude scale: gender×age interaction.

in the northern-1 area performed better than those in the southern area, but "daily serving requirements of different food groups" does not reveal significant differences among subjects from the five different regions.

The differences in nutrition knowledge between different age groups (young adults: 19–30 years old, prime adults: 31–44 years old, middle adults: 45–64 years old) and genders were analyzed using two-way ANOVA and Scheffé post hoc tests (Table 4). There were significant interactions between age and gender for total nutrition knowledge, "relationship between diet and disease" and "weight and weight loss", but not for "foods in terms of specific nutrients" and "daily serving requirements of different food groups" (Figure 1). Both male and female middle adults were inferior to young and prime adults in many dimensions of nutrition knowledge. Young and prime female adults scored higher than males in most dimensions of nutrition knowledge except "daily serving requirements of different food groups". Both male and female prime adults scored better than young adults in many dimensions except "weight and weight loss". As to differences in nutrition knowledge between gender and

age, the findings from the five regions in Taiwan were similar to those for the total sample. Due to the limit on the length of this paper, the analytical results of different regions are not discussed.

Nutrition attitude

Regarding attitude toward nutrition (Table 2), the subjects' nutrition attitude was relatively positive. However, regarding three subscales of nutrition attitude ("care about nutrition", "emotional eating" and "recognize the importance of nutrition"), adults' attitude on "recognize the importance of nutrition" is slightly superior to that of "care about nutrition" and "emotional eating". The attitude items about which adults were less positive are listed as followed. More than half (57.4%) agreed or strongly agreed that "it is impossible to eat a balanced diet all the time", one third agreed or strongly agreed that "the amount of food we should eat is innate, man doesn't need to learn", "as long as we can eat, we will not have problems with nutrition", "I should finish all the foods in the meal box no matter how much there is", "eating more foods from the meat/protein group and less from the cereal/grains group is healthy" and " eating a big meal is the best way to celebrate".

Regarding differences in adults' overall nutrition attitudes and three attitude dimensions in the five regions of Taiwan (northern-1 area, northern-2 area, central area, southern area and eastern area) (Table 3), only the "care/neglect about nutrition" attitude reveals a signifi cant difference among the five areas, but this difference is not indicated by the post hoc tests. From the mean we found that the subjects in the northern-2 area (suburban area) scored highest, and those of the eastern area (remote area) score lowest.

We further analyzed the differences in nutrition attitude between age and gender by two-way ANOVA and Scheffé post hoc tests (Table 4). Regarding overall nutrition attitude and "care about nutrition" attitude, there were significant interactions between age and gender, except for the "emotional eating" attitude (Figure 2). In comparison to males, young and prime female adults cared more about nutrition, and tended to recognize the importance of nutrition more than males. Middle adults did not reveal a gender difference in "care about nutrition" attitude. There was no significant difference in emotional eating attitude between males and females in all three age groups. Regardless of gender, young and prime adults held a more positive attitude than middle adults in many dimensions of nutrition attitude, except for emotional eating. Young adults were more supportive of emotional eating. Regarding differences in nutrition attitude between age and gender, findings from the five regions in Taiwan were similar to those of the total sample. Due to the limit on the length of this paper, the analytical results of the different regions are not discussed.

Nutrition behavior

Regarding the scores of overall nutrition behavior, adults' nutrition related behavior was not satisfactory. The average of each item was 3.20, which is only slightly higher than the medium value of 3 (Table 2). Among the two subscales ("food selection and care about nutrition" and

Table 4. The results of two-way ANOVA (gender×age) of nutrition knowledge, attitude, behavior of Taiwanese 19-64 years adults

	Young:19–30yrs (1)		Prime:31–44yr s(2)		Middle:45–64yrs (3)		inter-action	post hoc tests†	
	Male n=230	Female n=227	Male n=216	Female n=223	Male n=422	Female n=388	F value	Compared with gender	Compared with age groups
Nutrition knowledge	19.5±0.3	20.5±0.3	19.9±0.3	20.9±0.4	18.1±0.3	17.8±0.4	4.89**	(1),(2): F>M	M: (1),(2)>(3) F: (1),(2)>(3)
Relationship between diet and disease	7.3±0.1	7.6±0.1	7.7±0.1	8.1±0.2	7.1±0.1	6.9±0.2	4.60*	(2):F>M	M: (2)>(1)>(3) F: (2)>(1)>(3)
Comparison of foods in terms of specific nutrient content	6.7±0.1	7.0±0.1	7.1±0.1	7.5±0.2	6.5±0.1	6.7±0.1	0.83	F>M	(2)>(1)>(3)
Daily serving requirements of different food groups	3.0±0.1	3.1±0.1	3.0±0.1	3.0±0.1	2.8±0.1	2.6±0.1	2.73		(2),(1)>(3)
Weight and weight loss	2.5±0.1	2.8±0.1	2.0±0.1	2.2±0.1	1.7±0.1	1.6±0.1	3.51*	(2):F>M	M: (1)>(2)>(3) F: (1)>(2)>(3)
Nutrition attitudes	66.3±0.6	67.6±0.6	68.2±0.5	69.3±0.5	67.5±0.4	66.9±0.6	3.89*	(1),(2): F>M	M: (1),(2)>(3) F:(2)>(1),(3)
Care about nutrition	27.6±0.3	28.7±0.3	27.9±0.4	28.9±0.3	27.0±0.3	26.8±0.4	4.04*	(1),(2): F>M	M: (2)>(3) F: (1),(2)>(3)
Emotional eating	20.0±0.3	19.8±0.2	21.1±0.2	21.1±0.2	21.5±0.1	21.1±0.2	1.04		(2),(3)>(1)
Recognize the importance of nutrition	18.6±0.1	19.1±0.2	19.2±0.2	19.3±0.2	19.1±0.1	19.1±0.1	2.14	F>M	(2)>(1)
Nutrition behavior	71.3±0.7	73.9±0.8	75.9±1.2	80.9±0.7	77.9±0.6	80.6±0.8	2.28	F>M	(2),(3)>(1)
Food selection and care about nutrition	38.2±0.8	42.7±0.7	40.4±1.2	46.1±0.5	40.2±0.7	43.5±0.9	2.16	F>M	(2)>(3)>(1)
Emotional and external cued eating	33.1±0.5	31.2±0.4	35.5±0.5	34.8±0.5	37.7±0.3	37.0±0.3	2.19	M>F	(3)>(2)>(1)

†summary results of $p<0.05$; *$p<0.05$, **$p<0.01$

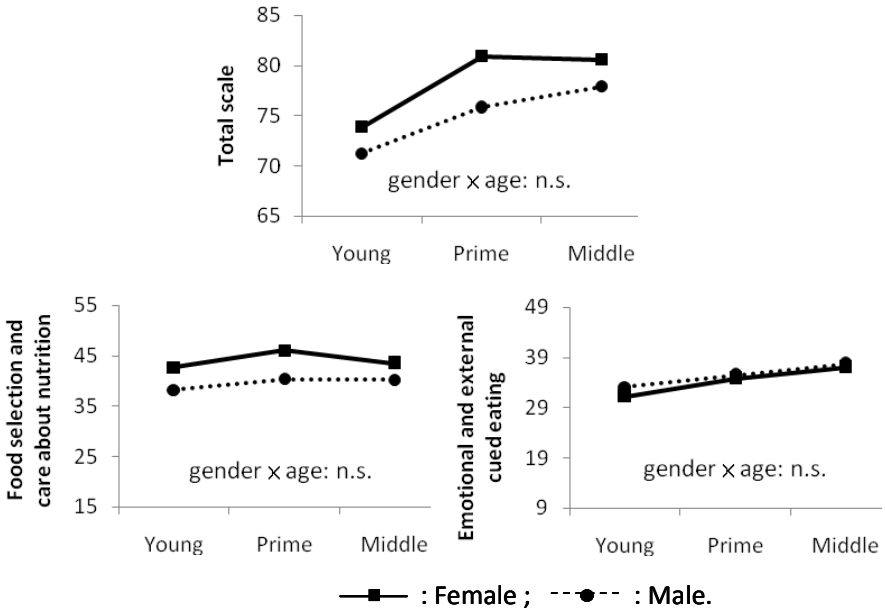

Figure 3. Nutrition behavior scale: gender × age interaction.

"emotional and external cued eating"), adults' "food selection and care about nutrition" behavior was not satisfactory (the average of each item was 2.79, which is lower than the medium value); "emotional and external cued eating" was acceptable (the average of each item was 3.88). This demonstrates that adults were not concerned about and did not pay attention to nutrition when eating or choosing food; however, they did not eat due to external or emotional factors frequently. The behavior items that adults performed less frequently are listed as follows: more than half never or seldom "care about the calories in foods I eat" (53.7%) or "ask people which food is good for health" (52.4%), more than one third never or seldom "pay attention to the food and nutrition information in newspapers, TV, web, radio or books" or "confirm the food and nutrition information in newspapers when there is doubt".

A comparison of the five regions in Taiwan (northern-1 area, northern-2 area, central area, southern area and eastern area) indicated that there was a significant difference between subjects from the five areas in terms of both overall nutrition behavior and the two behavior dimensions (Table 3). Regarding overall nutrition behavior, post hoc tests showed that the subjects in the northern-1 area performed better than those in the central area. In terms of "food selection and care about nutrition", the subjects in the northern-1 area and northern-2 area performed better than those in the central area, while those in the northern-1 area performed better than those in the southern area. However, in the subscale "external and emotional eating", the subjects in the southern area performed better than the northern-1 area, indicating that although adults in the northern-1 area cared more about nutrition than those in the southern area, they tended to eat due to external or emotional factors more frequently, such as eating when in a bad mood or when under pressure.

From two-way ANOVA and Scheffé post hoc tests (Table 4) we found that there was no interaction between age and gender in terms of overall nutrition behavior and two nutrition behavior dimensions (Figure 3). Regarding overall nutrition related behavior, prime and middle adults performed better than young adults, and females performed better than males. As to "care about nutrition", in terms of age, young adults cared least about food selection and nutrition; as to gender, females cared more than males. However, in terms of "emotional eating", in comparison to men, women tended to eat under the influence of external and emotional factors. Compared to older adults, young adults were more likely to eat based on external or emotional factors. The result was similar to the finding of the "emotional and external cued eating" attitude.

Correlation analysis of nutrition knowledge, attitude and behavior

The correlation among nutrition knowledge, attitude and behavior was analyzed using by Pearson's product-moment correlation coefficients. Results indicate that there was a positive and significant correlation among the nutrition knowledge, attitude and behavior of adults (Table 5). Regarding the overall scores, the correlation coefficient between nutrition knowledge and attitude was 0.45, the correlation coefficient between nutrition attitude and behavior was 0.42; and the correlation coefficient between nutrition knowledge and behavior was 0.27. In other words, the correlation between behavior and attitude was stronger than that between behavior and knowledge.

DISCUSSION

The knowledge of adults on the "relationship between diet and disease" and "comparison of foods in terms of specific nutrients" is acceptable. However, they lack knowledge of "daily serving requirements of different food groups" and "weight and weight loss". The result is similar to early investigations with resident doctors and interns (adults)[8] and with children,[7] teenagers[9] and the elderly.[6] They all showed that people lack knowledge

Table 5. Pearson correlation coefficients (r) among nutrition knowledge, attitudes, and behavior of Taiwanese adults of 19-64 years (N=1706)

Variable	Pearson correlation coefficients (r)		
	Nutrition knowledge	Diet and nutrition attitudes	Diet and nutrition behavior
Nutrition knowledge	1.000	0.455***	0.275***
Nutrition attitudes		1.000	0.417***
Nutrition behavior			1.000

***p<0.001

about the daily serving requirements of different food groups as well as about the relationship between nutrition and diseases. Like elementary school children,[7] Taiwanese adults underestimate the daily serving requirements for the cereals/grains group and the milk group, and overestimate the daily serving requirements of the meat/protein groups. Not knowing these daily requirements may be an obstacle to eating a balanced diet.

Due to the increasing prevalence of obesity, people were warned by medical professionals to watch for weight gain. At the same time, eating disorders became a psychiatric problem faced by young females, and one prominent risk factor is body dissatisfaction.[10] Therefore, dieting and restrained eating became a popular practice for weight loss, for reasons of health and beauty. The Taiwanese government and private health and education agencies have supported weight loss programs for school children and adults for many years. The name of the most important adult campaign supported by the Department of Health is "Challenge for 18–24" which implied that the ideal bodyweight for adults is between BMI 18 and 24. We found, however, that more than half of the adults have never heard the term of body mass index (BMI), with only 39.1% knowing the formula for calculating BMI. Nevertheless, 45.9% of the adults chose the right answer for the definition of overweight (BMI>24). We suspect that perhaps many adults have heard about "Challenge for 18–24" and know that over 24 means overweight, but they don't really understand where that number comes from.

As we compare the total score of all subjects and the four subscales of the five regions, subjects in the northern-1 area usually scored highest, while those in the eastern area scored lowest. Among all five regions, the northern-1 area is the most developed urban area and the eastern area is the least developed remote area.

We analyzed the differences in nutrition knowledge between different age groups and genders. The results suggest that, females have more nutrition knowledge than males, and young adults are more knowledgeable than older adults. Previous studies indicate that females' nutrition knowledge is superior to that of males,[9,11-13] however, there is no difference between male and female elementary-school students' nutrition knowledge.[6,14] Regarding the Taiwanese elderly, males have better nutrition knowledge than females.[15] This is probably due to the fact that in Taiwan, elderly women have a lower educational level than men. The 1993-1996 NAHSIT also found that the knowledge score decreased as age increased.[5] Young adults are more knowledgeable than older adults probably also due to their higher education level.

The subjects' nutrition attitude is relatively positive. Results of surveys on elementary school students,[7] teenagers and the elderly in Taiwan all demonstrate that Taiwanese people's nutrition attitudes are relatively positive.[6,9] Their attitude toward "recognize the importance of nutrition" is more positive than those toward "care about nutrition" and "emotional and external cued eating". This indicates that although they recognize the importance of nutrition, their intention to learn more about nutrition is not as strong.

Little difference was found in the nutrition attitudes in the five regions of Taiwan. Only the "care about nutrition" attitude reveals a significant difference among the five areas. From the mean, we found that the subjects in the northern-2 area (suburban area) scored highest, and those of the eastern area (remote area) score lowest. Previous surveys on elementary school students and the elderly in Taiwan also showed that those who live in urban areas have a more positive attitude toward nutrition than those in other areas.[6,7] Differences in the level of knowledge of people from different regions may play a role in this.

Generally speaking, in comparison to male adults, female adults are more concerned about nutrition and recognize the importance of nutrition. According to previous surveys in Taiwan,[6,7] apart from elderly women, female teenagers,[9] young female adults,[16] and female junior-high and elementary school teachers have better nutrition attitude than their male counterparts.[17,18] Foreign research has demonstrated similar results.[19-21] Females have better nutrition knowledge and attitude than males, possibly because of the different social expectations of their gender roles. Females tended to be more concerned about issues related to diet/nutrition since they hold the so-called "gatekeepers" role in the family.

In terms of age group, young adults (19–30 years old) show stronger "emotional eating" attitude, but recognize the importance of nutrition less. Previous research also indicates that young men (18–35 years old) have a stronger negative attitude toward diet.[21] As suggested by various studies, teenagers consider themselves eternal (they feel they will not die), and thus, they do not care about nutrition.[4] Since young adults (19–30 years old) are still young and healthy, like teenagers, they do not think about health problems. Meanwhile, young adults are at their sprint stage and are usually devoted to career. Thus, in comparison to prime and middle adults who have stable careers and possibly already have some health problems, young adults care less about nutrition. However, uncovering the definitive reasons will require further study.

In this survey, Taiwanese adults' nutrition-related behavior is not satisfactory. They are not concerned about nutrition upon eating or choosing food; this is similar to the results of previous investigations concerning teenagers [9] and the elderly.[6] The subjects in the northern-1 area and northern-2 area performed better than those in the central area, while those in the northern-1 area performed better than those in the southern area in "care about nutrition" behavior. However, in the subscale "emotional and external cued eating", the subjects in the southern area performed better than the northern-1 area, indicating that although adults in the northern-1 area care more about nutrition than those in the southern area, they tend to eat under the influence of external or emotional factors. Northern-1 area has the highest degree of urbanization among the five regions, and the eastern area has the lowest. The other three regions can be considered suburban. The results therefore indicate that although urban adults care more about nutrition, their eating behaviors are more easily influenced by external cues and emotions. They are more easily influenced by external cues and emotions than suburban area adults.

Emotional eating is eating as a way to suppress or soothe negative emotions, such as stress, anger, fear, boredom, sadness and loneliness. External (or situational) eating is eating because the opportunity is there, for example, seeing an advertisement for a particular food, passing by a bakery. They are thought to be symptoms of loss of control over eating and probably lead to binge eating.[22] In this survey we used very preliminary and simple evaluations for emotional and external eating. Although the results demonstrate that adults' emotional and external eating behavior is not serious, it is significantly higher among females and young adults than other groups. With a lack of knowledge related to weight and weight loss, we suspect that restrained eating or even eating disorders might occur later on. In order to prevent such a situation, education related to body image and weight control should be enhanced in young people, especially females.

This study finds a positive correlation among nutrition knowledge, attitude and behavior in adults. Studies and surveys on elementary school students, teenagers and the elderly in Taiwan indicate similar results.[6,7,9,23-26] However, some studies suggest a weak or no significant correlation between nutrition knowledge and behavior.[27,28] Thus, some researchers have suggested that the influence of nutrition knowledge on dietary behavior is limited and nutrition attitude is a more important influencing factor on dietary behavior.[23,29-34] Although rich nutrition knowledge cannot guarantee good dietary behavior, without sufficient knowledge, the diet can be inappropriate. A study of university students in the U.S. found that participants who knew more about the food pyramid and dietary guidelines are more likely to adhere to dietary recommendations.[35] Thus, in order to improve the diet of people in Taiwan, nutrition knowledge should be improved, and attitudes toward healthy diet should be enhanced.

This study only analyzed nutrition related behavior measured by scale, and did not probe into actual eating behavior. The results show that Taiwanese adults have basic nutrition knowledge such as "relationship between diet and disease" and "comparison of foods in terms of specific nutrients", but lack knowledge related to the performance of healthy dietary behavior such as "daily serving requirements of different food groups" and "weight and weight loss". Therefore, although Taiwanese adults hold positive attitudes on "recognize the importance of nutrition" and showed that they care about nutrition, this care or recognition may not translate in to desirable eating behavior due to the lack of "how-to" knowledge. Thus, they often do not select food according to the principles of a balanced diet, and do not pay attention to their food selection in order to adhere to nutritional principles and nutrition information. We can infer that nutrition knowledge and attitude are not fulfilled in dietary behavior. People lack knowledge related to "daily serving requirements of different food groups" and "weight and weight loss", and often neglect the nutrition principle in food selection. Moreover, foods containing high levels of sugar, salt, fat and low nutrients are widely served, while the emphasis on slim figures is prevalent, which creates an unfavorable dietary environment. Thus, the dietary quality of Taiwanese adults should be a concern.

Based on the results of this survey, we suggest that for adult nutrition education, the knowledge of what constitutes a balanced diet, and what constitutes being overweight are key subjects, while the behavioral motivation for healthy food selection should also be enhanced. Males and middle-aged adults should be particularly encouraged to participate in the nutrition education program. The adult educational literature supports the idea that the teaching of adults should be approached in a different way from the teaching of children and adolescents. During the planning phase of the program, adults' learning characteristics should be taken into consideration. For example, adults are autonomous and self-centered, and adults learn best when they are active participants in the learning process.[36] New teaching technology (e.g., online courses) may be more practical for reaching working adults than traditional classroom teaching. The key to an effective nutrition education program is not only to enhance nutrition knowledge, but also people's intentions and capabilities (behavioral skills) to change their eating behavior. In order to construct effective behavioral-change strategies, it is necessary to recognize factors of dietary behavior of male and female adults in different age groups, appropriate strategies, and limitations of the environment. An effective nutrition improvement plan can only be established based on local behavioral study results.

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AUTHOR DISCLOSURES

Wei Lin, Chi-Ming Hang, Hsiao-Chi Yang, Ming-Hui Hung, no conflicts of interest.

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Original Article

2005-2008 Nutrition and Health Survey in Taiwan: the nutrition knowledge, attitude and behavior of 19-64 years old adults

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2005-2008 臺灣營養健康家戶調查(NAHSIT)：19-64 歲成人飲食營養知識、態度及行為調查結果

本研究以「2005-2008臺灣營養健康家戶調查(NAHSIT)」之19至64歲成人，共1,706人之資料進行分析。結果發現：19-64歲成人在有關「疾病與飲食的關係」和「營養素含量比較」面向的知識尚可，但對於「食物份量建議」與「體重及減重」面向的知識則較欠缺。在飲食營養態度上整體尚稱正向，「正面及肯定飲食營養重要性」的態度較「關注/忽視飲食營養」與「負面及情緒性飲食」之態度更為正向。在飲食營養相關行為上，「選食與關心飲食營養行為」的表現略差，「外因及情緒性進食行為」的表現尚佳，顯示國人日常不甚關心與注意飲食營養的問題，但也不常受到外在或是情緒性因素而影響進食。針對不同年齡層、性別之成年人比較，發現在各年齡層多以女性的知識、態度、行為較男性佳，僅「外因及情緒性進食行為」是男性較佳。青壯年(19-30歲)及壯年(31-44歲)的營養知識較中年人(45-64歲)為佳，飲食營養態度則為壯年較青壯年佳。飲食營養行為則是壯年及中年較青壯年佳。城市地區成人的飲食營養知識與態度優於鄉鎮及較偏遠地區成人，但是城市地區成人比鄉鎮及較偏遠地區更常有「外因性及情緒性進食」行為。相關性分析結果顯示，成人的飲食營養知識、態度與行為兩兩之間均有顯著正相關性，飲食營養行為與態度之相關(r=0.42)大於其與知識的關係(r=0.27)。故在改善國人飲食策略上，不僅要加強飲食營養的知識，更要提升健康飲食的態度。

關鍵字：飲食營養知識、態度、行為、成年人、NAHSIT