Original Article

Time trend of obesity, the metabolic syndrome and related dietary pattern in Taiwan: from NAHSIT 1993-1996 to NAHSIT 2005-2008

Chih-Jung Yeh PhD[1], Hsing-Yi Chang PhD[2], Wen-Harn Pan PhD[2,3,4]

[1]*Department of Public Health, Chung-Shan Medical University, Taichung, Taiwan*
[2]*Nutrition Medicine Research Program, Division of Preventive Medicine and Health Sciences Research, Institute of Population Health Sciences, National Health Research Institute, Zhunan, Taiwan*
[3]*Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan*
[4]*Department of Biochemical Science and Technology, National Taiwan University, Taipei, Taiwan*

Obesity and the metabolic syndrome (MetS) are challenging public health issues as globesity popularizes. The present study illustrates the trend of obesity and MetS for the last 12 years in Taiwan based on the analysis of Nutrition and Health Survey in Taiwan. Between the two surveys, a large growth on MetS prevalence was observed, from 13.6% to 25.5%. In NAHSIT 2005-2008, the prevalence of MetS in females exceeded that of males in people older than the age of 45. With regard to regional differences, the growing prevalence of obesity and the metabolic syndromes alleviated in the northern area level one, the most urbanized and dense area. Prevalence of obesity and MetS in Hakka, central, and southern areas increased rapidly. Aboriginal areas had the highest prevalence, which increased modestly. Prevalence of MetS rose fast among males, but much slower among females. Comparing the Taiwanese data with other countries, obesity prevalence in Taiwan was higher than in many of Asian countries, but less than in the West. The prevalence of MetS in Taiwanese females reached levels close to that of the West. Reduced rank regression analysis was used to extract a risk reducing dietary pattern in women, featured by not only more vegetables, fruit, lean meat, and fish, but also some specific Taiwanese dietary items including mushrooms, seaweed, and soybean. No apparent increase in intake of certain healthy foods including lean meat, milk, dark-green vegetables, and fruit in the last 12 years, challenges future strategies to promote health.

Key Words: obesity, metabolic syndrome, prevalence, dietary pattern, reduced rank regression

INTRODUCTION

The metabolic syndrome (MetS) has been a challenging public health issue as globesity popularized across populations and age groups in the last ten years.[1] Etiology research indicates that obesity may contribute to MetS development by means of abnormal insulin tolerance.[2,3]

Various risk factors of cardiovascular diseases characterized MetS, such as lowered high density lipoprotein cholesterol (HDL-C), central obesity, high blood pressure, hypertriglyceridemia, and hyperglycemia.[4,5] The Delta Meeting in Adult Treatment Panel (ATP) of National Cholesterol Education Program (NCEP) at the National Heart Lung and Blood Institute, National Institute of Health updates definitions of MetS, and suggested indications according to the research on the above risk factors and cardiovascular diseases. The most frequently cited and most updated definition of MetS is NCEP ATP III.[6]

According to the National Health and Nutrition Examination Survey (NHANES 1988-1994) III data, the prevalence of MetS was 24% in U.S adults.[7] Given the obesity epidemic in the United States,[8] the prevalence of MetS increased rapidly to 35.1% in males and 32.6% in females, as indicated in NHANES 2003-2006.[9] European Society of Cardiology summarized results from seven population-based studies in Europe,[10] and found the prevalence of MetS ranging from 36% to 38%, based on the International Diabetes Federation definition of MetS.

As far as MetS in Asia was concerned, prevalence among adults older than 18-year-old was 9.6% in China and this was relatively low, compared to that in the West.[9] In South Korea, reported prevalence rates of MetS diagnosed by NCEP ATP III in adults older than 20-year-old varied: eg, 5.2%-9% and 14.2%-17.7%, respectively, in Lee's and Park's studies.[11,12] Mitsuyoshi and associates conducted a survey during 2000-2004 in Japan,[13] and reported a prevalence of 5.3%, which was relatively low compared to other Asia countries. According to a nationwide population-based survey conducted in 2002 in Taiwan,[14] obesity prevalence (BMI ≥27) was 19.2% in men

Corresponding Author: Dr Wen-Harn Pan, Division of Health Sciences Research and Preventive Medicine, Institute of Population Health Sciences, National Health Research Institute, 35 Keyan Road, Zhunan, Miaoli County 350, Taiwan.
Tel: 886-2-278999121; Fax: 886-2-27823047
Email: panwh@nhri.org.tw
Manuscript accepted 14 February 2011.

and 13.4% in women; prevalence of MetS (NCEP ATP III) was 18.3% in men and 13.6% in women.

Lifestyle modification was recommended to manage MetS, such as dietary pattern modification, but the ascents of dietary pattern modification were yet to be determined. In the review by Baxter et al,[15] high intake of fruit and vegetables, meat, diary, and minimally processed cereal, were found to be associated with lowered metabolic risk, but fried foods were consistently associated with increased risk.

Since foods are consumed in a pattern-like manner, it is prudent to study dietary pattern rather than single foods. Most commonly applied multivariate techniques to analyze MetS-associated dietary pattern included factor analysis, principal components analysis, cluster analysis, or reduced rank regression (RRR). MetS or related metabolic components have been significantly associated with several indentified food patterns, including a healthy dietary pattern enriched with vegetables, fruit, poultry, legumes;[16] another higher in vegetables, fruits, fish, cereals, legumes;[17] a protected food pattern with diary,[18] and a latent dietary pattern characterized by more fruit, less soft drink, red meat, processed meat, legumes, refined bread;[19] as compared to several western patterns.[16,18]

To understand the magnitude of the problems related to cardio-metabolic diseases in Taiwan and to compare the results with other countries, the present study illustrates the trend of obesity, MetS and dietary pattern for the last 12 years in Taiwan based on the analysis of the Nutrition and Health Surveys in Taiwan (NAHSIT), conducted during 1993-1996 and 2005-2008, respectively; as well as the relationship between the dietary pattern and the risk of MetS.

MATERIALS AND METHODS

Participants

Details of the study population and the sampling design in NAHSIT 1993-1996 and NAHSIT 2005-2008 are described elsewhere.[20,21] There were 2860 and 2787 adults, aged 18 years and older, in NAHSIT 1993-1996 and NAHSIT 2005-2008, respectively. Average sample age and female proportion were 52.9-year-old and 52.9% in NAHSIT 1993-1996 and 54.3-year-old and 51% in NAHSIT 2005-2008.

Taking regional and ethical differences into account, there were eight sampling strata, including: northern area level one (dense population), northern area level two (less dense), central area, southern area, eastern area, offshore island (Penghu), Hakka area, and aboriginal (mountain) area.

Definition of obesity and the Metabolic Syndrome (MetS)

According to the Bureau of Health Promotion, Department of Health, Taiwan, body mass index (BMI) less than 18.5 was defined as underweight, 18.5-24 as normal, between 24 and 27 as overweight, and higher than 27 as obesity. MetS was defined as three or more abnormal features confirmed among five: waist circumference ≥90 cm in males and 80 cm in females, systolic blood pressure ≥130 mmHg and diastolic blood pressure ≥85 mmHg, HDL-C <40 mg/dL in males and 50 mg/dL in females, fasting plasma glucose level (FG) ≥100 mg/dL, and triglyceride ≥150 mg/dL.

Statistical analysis

Analyses were performed by using SAS software, version 9.1 (SAS Institute, Cary, NC, USA). Time trend of obesity and MetS prevalence between NAHSIT 1993-1996 and NAHSIT 2005-2008 were presented and weighted according the sampling probability.

The statistical method, reduced rank regression (RRR), was applied to explore and characterize MetS-related dietary patterns, using the PLS procedure in SAS to derive dietary pattern scores.[22] Compared with principal component analysis or factor analysis, RRR may extract dietary pattern by maximizing the explained variation in intermediate variables or biomarkers which link the diet-disease pathway.[19] We used dietary frequency data on 24 common food items in NAHSIT 1993-1996 and NAHSIT 2005-2008 as predictors; and HDL-C, waist circumference, systolic and diastolic blood pressure, triglyceride (log transformed), and glucose levels as responses to derive the dietary pattern scores. Dietary patterns composed of food items with absolute effect loadings ≥0.2.[19]

RESULTS

Table 1 describes the prevalence of overweight, obesity, and MetS in different age and gender groups. Prevalence of MetS boosted from 13.6% to 25.5%, increasing two fold, during the two surveys conducted 12 years apart. A moderate increase is seen in women. Prevalence of MetS among females younger than 45 was lower than that found among males. However, there was a cross-over between gender after age 45. That is, prevalence was higher in females than in males after age 45. Among females, prevalence of overweight, obesity, and MetS increased moderately or even decreased between two surveys in all age groups. In addition, prevalence of overweight and obesity in 2005-2008 among females was about half of that found in the 45-64-year-old age group, and about 60% of that in the older than 65 group. Approximately 60% of the 45-64-year-old males were overweight or obese in 2005-2008.

Figure 1 shows relative risk by surveys of different BMI groups on MetS, using BMI 18.5-24 as the reference. Relative risk in three BMI groups, below 18.5, 24-27, and beyond 27 were 0.10, 2.92, 7.00 in NAHSIT 1993-1996, and 0.10, 3.70, 6.27 in NAHSIT 2005-2008. Relative risk was three to four times in the overweight group (BMI 24-27), and six to seven times in the obese group (BMI>27). Trend of regional differences in obesity and MetS were shown in Figure 2. Prevalence of obesity and MetS in northern area level one (N1) (urbanized and densed population) increased but not as steeply as that found in Hakka areas (H), central area (C), and southern area (S). Prevalence of MetS escalated from 21.6% to 31.6%, 17.6% to 29.5%, and 20.9% to 30.9% in Hakka areas (H), central area (C), and southern area (S), respectively. The expansions were all above 10%. As far as prevalence of overweight or obesity in the above three areas was concerned, increases from 34.5% to 50.6%, 26.8% to 44.7%, and 26.2% to 45.5% were observed and the increment was around 15-20%. The trend implied a rapid growth in prevalence of MetS and obesity.

Table 1. Prevalence of overweight, obesity, and the metabolic syndrome (MetS) by age, by gender and by survey

Year	Male						Female						Total					
	Overweight		Obese		MetS		Overweight		Obese		MetS		Overweight		Obese		MetS	
	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08	93-96	05-08
Age, yrs																		
19-30	19.2%	17.3%	3.3%	12.6%	1.7%	8.3%	10.3%	9.4%	6.1%	10.1%	6.4%	4.7%	14.9%	13.3%	4.7%	11.3%	4.0%	6.4%
31-44	22.9%	35.8%	11.8%	23.5%	12.5%	22.9%	17.7%	14.5%	8.0%	12.6%	14.1%	15.1%	20.3%	25.3%	9.9%	18.2%	13.3%	19.1%
45-64	32.1%	38.5%	14.8%	20.8%	26.5%	33.2%	29.0%	28.0%	23.4%	22.0%	49.0%	48.4%	30.6%	33.2%	19.1%	21.4%	37.6%	40.9%
≥65	17.4%	33.1%	13.6%	14.7%	23.2%	44.8%	26.7%	32.0%	24.7%	29.5%	77.2%	80.7%	21.8%	32.6%	18.8%	22.0%	48.7%	62.5%

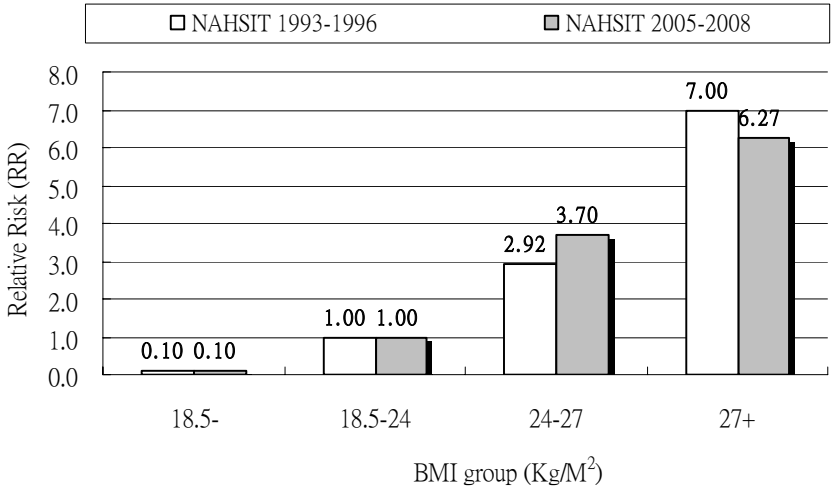

Figure 1. Relative risk of BMI on the metabolic syndrome by surveys

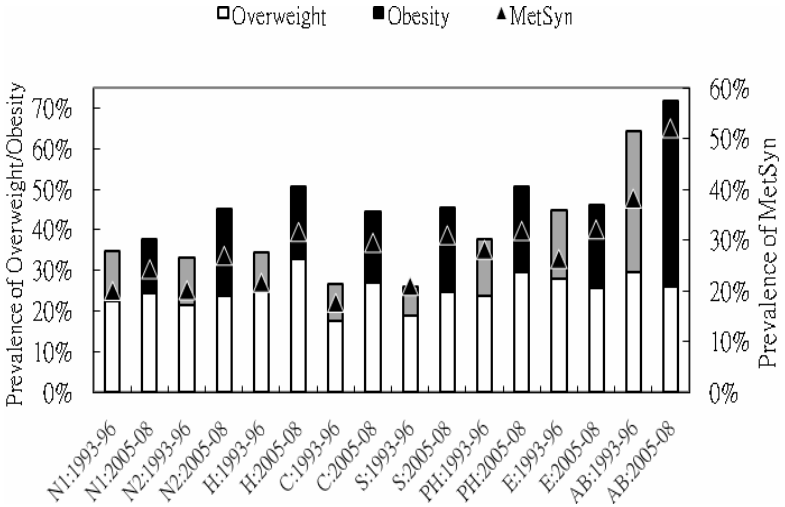

Figure 2. Prevalence of the metabolic syndrome and obesity in different regions of Taiwan
N1: Northern area level 1, N2: Northern area level 2, H: Hakka, C: Central area, S: Southern area, PH: Penghu, E: Eastern area, AB: Aborigine
I: NAHSIT 1993-1996, III: NAHSIT 2005-2008

Prevalence of MetS in Penghu (PH), a major offshore island of Taiwan, had a limited accretion. Nevertheless, overweight or obesity increased from 37.7% to 50.6% in PH. Prevalence of MetS in aborigines intensified from 38.2% to 52.1%,. Prevalence of obesity increased 7%, not as much as of the former. According NAHSIT 2005-2008, one out of two (52.1%) aborigines (AB) suffered from MetS, and seven out of ten (71.6%) were either overweight or obese.

Gender differences in time trend of obesity and MetS are illustrated in Figure 3. Prevalence of MetS and overweight/obesity each increased by approximately 5% in the last 12 years among females, 26.4% to 31.5% and 31.7% to 36.9%, respectively. In other words, three in ten

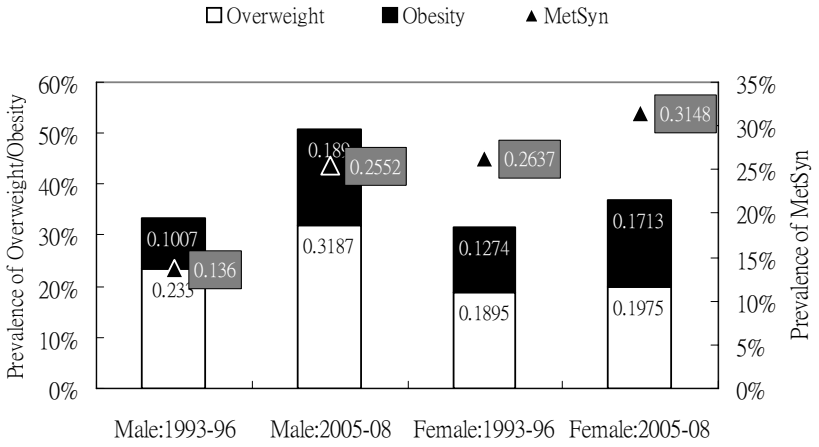

Figure 3. Prevalence of the metabolic syndrome and obesity by gender and by survey

Table 2. International comparison of obesity and the metabolic syndrome prevalence

Country	Year	Age	Definition criteria	MetS Prevalence	Survey or project	Reference
	2005-2008†	≥18	NCEP ATP III§	M: 25.5%; F: 31.5%	NAHSIT†† 2005-2008	This article
Taiwan	2002†	20-80	NCEP ATP III	15.7%	Survey on Hypertension, Hyperglycemia and Hyperlipidemia	14
	1993-1996†	≥18	NCEP ATP III	M: 13.6%; F: 26.4%	NAHSIT 1993-1996	This article
USA	2003-2006†	≥20	NCEP ATP III	M: 35.1%; F: 32.6%	NHANES‖ 2003-2006	9
	2006‡	≥35	NCEP ATP III	M: 31%; F: 35%		
Europe	2005‡		IDF¶	M: 38%; F: 36%	Seven European population-based studies	10
China	2006†	18-66	NCEP ATP III	9.6%	-	9
Japan	2000-2004†	Adult	NCEP ATP III	5.3%	-	13
S Korea	2004‡	20-82	NCEP ATP III	M: 5.2%; F: 9%	-	11
	2004‡	20-79	NCEP ATP III	M: 14.2%; F: 17.7%	-	12
Country	Year	Age	Definition criteria	Obesity Prevalence	Survey or project	Reference
	2005-2008†	≥18	BMI≥27	M: 18.9%; F: 17.1%	NAHSIT III	This article
			BMI≥30	M: 6.1%; F: 6.4%		
Taiwan	2002†	20-80	BMI≥27	M: 19.2%; F: 13.4%	Survey on Hypertension, Hyperglycemia and Hyperlipidemia	14
	1993-1996†	≥18	BMI≥27	M: 10.1%; F: 12.7%	NAHSIT I	This article
			BMI≥30	M: 5.1%; F: 5.4%		
USA	2007-2008†	≥20	BMI≥30	M: 32.2%; F: 35.0%	National survey	23
	2001-2002†	≥20	BMI≥30	30.4%-32.9%	NHANES 1999-2002	33
Canada	2004†	≥18	BMI≥30	M: 22.9%; F: 23.2%	-	23
UK	2003†	≥16	BMI≥30	M: 22.2%; F: 23.0%	-	34
England	2008†	≥16	BMI≥30	M: 24.1%; F: 24.9%	-	23
Scotland	2008†	≥16	BMI≥30	M: 24.9%; F: 26.5%	National survey	23
France	2006†	18-74	BMI≥30	M: 16.1%; F: 17.6%	National survey	23
Germany	2005-2007†	18-80	BMI≥30	M: 20.5%; F: 21.1%	National survey	23
China	2002†	≥18	BMI≥30	M: 2.4%; F: 3.4%	-	23
Japan	2000†	≥20	BMI≥30	M: 2.3%; F: 3.4%	-	23
S Korea	1998†	15-79	BMI≥30	M: 1.6%; F: 3.0%	-	23

†Survey year, ‡report year, §: NCEP ATP III (National Cholesterol Education Program, Adult Treatment Panel III), ¶IDF (International Diabetes Federation), ††NAHSIT (Nutrition and Health Survey in Taiwan), ‖NHANES (National Health and Nutrition Examination Survey)

females had MetS and one in three was overweight or obese. Compared to females, males had a larger accretion in prevalence of MetS and overweight/obesity, 13.6% to 25.5% and 33.4% to 50.8%, respectively. One in four males had MetS and one in two was overweight or obese.

Table 2 is a comparison summary of prevalence among different countries. The prevalence of MetS was much higher in Taiwan than in several other Asia countries, and that in Taiwanese females approached 30%-35%, similar to the female figures in Western countries such as the US and other European countries. MetS prevalence among Taiwanese females, 31.5%, caught up with the western level. For international comparison, obesity was defined as BMI ≥30, and overall about 6.1%-6.4% of the Taiwanese adults was obese, which was lower than that of the French, the German, the British, and the Canadian, and far behind the Americans. But compared to the other Asia countries, Taiwan had a relatively higher prevalence.

Table 3.1 showed gender differences in RRR analysis. No food item had an effect loading larger than 0.2 among females. Items with effect loading below -0.2 included lean meat, egg, soybean, vegetables, dark green vegetables, carrot, fruit, seaweed, and mushroom. Table 3.2 shows how consumption frequency of 24 food items relates to dietary pattern scores in women. It shows the higher the scores, the lower the frequencies of these foods.

To compare women with the highest tertile of the dietary pattern score to those with the lowest tertile, after adjusting age and educational level, odd ratio (OR) of MetS was statistically significant at 1.514. The characteristics of those in the highest tertile were significantly lower in level of HDL-C but higher in levels of waist circumference, systolic blood pressure, diastolic blood pressure, triglyceride, and glucose. The dietary pattern identified in males, as with that found in females, did not have a significant association with risks of MetS.

Table 3.3 presented the changes of female dietary pattern and intake frequency between NAHSIT 1993-1996 and NAHSIT 2005-2008. Items consumed less included: pickled vegetables, lean meat, marble meat, milk, and dark-green vegetables. Items consumed more frequently were: sea water fish, soymilk, vegetables, carrot, and mushroom. According to the RRR analysis on MetS-related dietary pattern among females, the dietary score improved from 0.061 in NAHSIT 1993-1996 to -0.285 in NAHSIT 2005-2008.

DISCUSSION

Trend of obesity and MetS in the last 12 years in Taiwan was elucidated by two Nutrition and Health Surveys in Taiwan, namely NAHSIT 1993-1996 and NAHSIT 2005-2008. There was a rapid growth of obesity and MetS prevalence rates. Among older females, the risk of MetS accelerated and went far beyond males. Approximately 50%-60% of the current Taiwanese middle-aged and elderly are either overweight or obese according to NAHSIT 2005-2008.

Rapid increase was identified particularly among males and in Hakka region, central area, and southern area. Despite slowing down in the increasing trend in aborigines, prevalence was still the highest among aborigines.

When obesity was defined as BMI ≥30 for international comparison, a higher prevalence of obesity in Taiwan compared to several other Asia countries was found.[23] According to the definition of MetS of NCEP ATP III, the prevalence of MetS among Taiwanese females approached that of the West.[9,10] These challenges await to be solved. The prevalence of obesity and MetS among males is lower than that among females. However, compared to females, males had a larger accretion in prevalence of MetS and overweight/obesity in the last 12 years. Change of the dietary pattern may explain part of the variation. Further research in terms of gender difference on health knowledge, attitude, and behavioral change in relation to MetS and obesity is needed.

The protective dietary pattern discovered by the RRR method in females are consistent with literature. In particular, the greater the intake of animal protein (lean meat),[15] fish,[17,24] milk,[15,18,25] vegetables and fruit,[15-17,24] as compared to what we found in this study; including plant protein (soybean), carrot, mushroom and seaweed and so on; the lower the risk of MetS. Our results not only echo the importance of vegetables, fruit, lean meat, and fish; but also pin-point the healthy effect of specific Taiwanese

Table 3.1. The characteristics of the metabolic syndrome (MetS) related dietary patterns derived by reduced rank (RRR) analysis and the association between the pattern score and risk of the MetS in males and females

RRR analysis	Dietary pattern	Tertile of dietary pattern score	OR†	*p*-value	HDL (mg/dL)	Waist (cm)	SBP (mmHg)	DBP (mmHg)	Triglyceride (mg/dL)	Glucose (mg/dL)
MetS (male)	Effect loading ≥0.2: marble meat, viscera, legumes Effect loading ≤-0.2: fermented. seaweed, carrot, cucumber, mushroom, dark green vegetables	T1	1		51.0	80.9	119	75.5	121	96.2
		T2	1.31	NS	54.4‡	81.4	123‡	77.7‡	133	98.8
		T3	1.34	NS	53.7§	81.1	126§	79.9§	137§	102§
MetS (Female)	Effect loading ≥0.2: Effect loading ≤-0.2: lean meat, egg, soybean, vegetables, dark green vegetables, fruit, seaweed, carrot, mushroom	T1	1		63.8	74.2	115	72.3	100	96.7
		T2	1.04	NS	61.4	75.2	117	74.2	101	98.1
		T3	1.51	*p*=0.015	58.4§	75.8§	120§	76.2§	111§	99.6§

T1: bottom tertile , T2: middle tertile, T3: top tertile, †age and educational level adjusted, ‡significance between T2 and T1, §significance between T3 and T1

Table 3.2. The trend of food frequency by dietary pattern score tertiles in females in Taiwan

Food item	T1	T2	T3	Significance†	Food item	T1	T2	T3	Significance†	Food item	T1	T2	T3	Significance†
Fish	4.31	4.17	4.51	NS	Soybean	2.35	1.01	0.72	‡,§	Vegetables	17.7	15.6	12.4	‡,§
Sea fish	1.33	0.88	0.64	‡,§	Soymilk	0.84	0.81	1.31	§	Dark green Vegetables	8.91	6.90	4.35	‡,§
Shell	0.54	0.46	0.54	NS	Milk	3.42	2.93	2.61	§					
Other fish	0.79	0.51	0.39	‡,§	Egg	4.25	2.74	1.84	‡,§	Fruit	9.14	5.92	3.74	‡,§
Poultry	1.75	1.54	1.55	NS	Seaweed	0.97	0.52	0.25	‡,§	Carrot	2.59	1.17	0.63	‡,§
Meat(lean)	5.52	2.91	1.86	‡,§	Pickled	1.03	1.01	1.31	NS	Cucumber	1.51	1.17	1.14	‡
Meat(marble)	1.39	1.51	2.30	§	Fermented	0.77	0.60	0.40	‡,§	Mushroom	1.41	0.74	0.48	‡,§
Liver	0.21	0.16	0.09	§	Legumes	0.97	0.81	1.11	§					
Viscera	0.27	0.19	0.26	NS	Bamboo shoot	0.72	0.73	1.31	§					

T1: bottom tertile (of the dietary pattern score) , T2: middle tertile, T3: top tertile, †age and educational level adjusted, ‡significance between T2 and T1, §significance between T3 and T1

Table 3.3. Time trend of food intake frequency and dietary pattern score in female between NAHSIT 1993-1996 and NAHSIT 2005-2008

Food item	Frequency of intake (times/week) NAHSIT		*p* value	Food item	Frequency of intake (times/week) NAHSIT		*p* value	Food item	Frequency of intake (times/week) NAHSIT		*p* value
	93'-96'	05'-08'			93'-96'	05'-08'			93'-96'	05'-08'	
Fish	4.56	3.69	**	Soybean	1.48	1.40	NS	Vegetables	15.1	16.1	0.0541
Sea fish	0.82	1.30	***	Soymilk	0.87	1.28	**	Darkgreen Vegetable	7.41	7.06	*
Shell	0.48	0.58	NS	Milk	3.10	2.77	*				
Other fish	0.61	0.44	***	Egg	2.77	3.32	NS	Fruit	6.03	7.10	NS
Poultry	1.49	1.81	NS	Seaweed	0.56	0.79	0.0595	Carrot	1.25	2.31	***
Meat(lean)	3.82	2.95	***	Pickled	1.26	0.84	*	Cucumber	1.32	1.30	NS
Meat(marble)	1.97	1.09	***	Fermented	0.67	0.59	NS	Mushroom	0.83	1.19	**
Liver	0.15	0.15	NS	Legumes	1.10	0.86	***				
Viscera	0.28	0.19	**	Bamboo shoot	0.98	0.89	NS	Dietary pattern score	0.06	-0.28	***

*p<0.05, **p<0.01, ***p<0.001

food items including plant protein (soybean), mushroom, and seaweed.

The trend of dietary pattern and MetS prevalence between NAHSIT 1993-1996 and NAHSIT 2005-2008 exhibit the decelerating growth of MetS prevalence coupled with the improvement of MetS-related dietary score in women. In other words, the increasing intake of MetS protective food items (such as sea fish, vegetables, carrot, mushroom, soybean, and seaweed) and the reducing intake of high risk foods (including fatty marble meat) may have contributed to this phenomenon among females. However, intakes of certain low risk food items such as lean meat, milk, dark-green vegetables, and fruit, decreased rather than increased. This suggests that more should be done to improve the dietary pattern not just for men. Fine tuning the dietary habit is also needed for women.[16,24] In all cultures, people consume meals consisting of a variety of foods with complex combinations of nutrients and dietary components. It is essential to use a holistic dietary approach towards healthful diet.[26]

The Taiwan experience on dietary pattern as well as MetS changes among females might shed light on future public health strategies. The lack of increase in intake of healthy food items; including: lean meat, milk, dark-green vegetables, and fruit; in the last 12 years challenges public health practitioners in the field of health promotion and education. In June 2009, Taiwan Society of Nutrition presented a new version of food-based daily dietary guidelines in Taiwan.[27] Importantly and practically in response to the current situation, they emphasized non-refined foods (eg, whole-grain and nuts) and low-fat foods (eg, low-fat milk), prioritize the protein sources in the following order: bean-fish-meat-egg; in addition to stressing varieties from six food groups.

The observation of the decreasing prevalence in urbanized areas with a dense population, as well as in females suggests the effectiveness of health information propagation via governments, related professionals, and NGOs in the last decade. But comparing the Taiwanese data of obesity and MetS to that of other Asian countries such as South Korea and Japan, similar in culture and in economic and societal development,[11,13,23] we are worse off. This might be due to the differences in dietary pattern, health knowledge, attitude, or behavioral pattern. Indenter-cultural comparison is needed in this regard. And we may learn from the prevention strategies for obesity and MetS in these two countries and others;[28] for example, J-STOP-Mets in Japan,[29] and their national guidelines on diet and physical activities.[30-32]

ACKNOWLEDGEMENTS

Data analyzed in the present paper were collected by the research project " 2004-2008 Nutrition and Health Survey in Taiwan (NAHSIT 2005-2008)" sponsored by the Department of Health in Taiwan (DOH94-FS-6-4). This research project was carried out by the Institute of Biomedical Sciences of Academia Sinica and the Research Center for Humanities and Social Sciences, Center for Survey Research, Academia Sinica, directed by Dr. Wen-Harn Pan and Dr. Su-Hao Tu. The Center for Survey Research of Academia Sinica is responsible for data distribution. The assistance provided by the institutes and aforementioned individuals is greatly appreciated. The views expressed herein are solely those of the authors.

AUTHOR DISCLOSURES

None.

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Original Article

Time trend of obesity, the metabolic syndrome and related dietary pattern in Taiwan: from NAHSIT 1993-1996 to NAHSIT 2005-2008

Chih-Jung Yeh PhD[1], Hsing-Yi Chang PhD[2], Wen-Harn Pan PhD[2,3,4]

[1]*Department of Public Health, Chung-Shan Medical University, Taichung, Taiwan*
[2]*Nutrition Medicine Research Program, Division of Preventive Medicine and Health Sciences Research, Institute of Population Health Sciences, National Health Research Institute, Zhunan, Taiwan*
[3]*Institute of Biomedical Sciences, Academia Sinica, Taipei, Taiwan*
[4]*Department of Biochemical Science and Technology, National Taiwan University, Taipei, Taiwan*

臺灣肥胖、代謝症候群與相關飲食型態之變遷趨勢：從 NAHSIT 1993-1996 到 NAHSIT 2005-2008

肥胖及代謝症候群，隨著全球之盛行，為廣受重視及亟待處理之公共衛生議題。本研究以 1993-1996 年及 2005-2008 年之臺灣營養健康調查(NAHSIT)的資料進行分析，探討臺灣代謝症候群及相關飲食型態之變遷趨勢。兩次調查之間，代謝症候群盛行率大幅增加，由 13.6%上升至 25.5%。NAHSIT 2005-2008 顯示，女性代謝症候群盛行率之年齡趨勢於 45 歲與男性之盛行率年齡趨勢交叉，而隨後高於男性。由地區差異來看，都市化程度及人口密度最高之北一地區，肥胖與代謝症候群盛行率之增加趨勢減緩；客家、中部及南部地區，肥胖與代謝症候群盛行率仍快速增加。原住民(山地)地區之肥胖與代謝症候群盛行率仍高居臺灣各地區及族群之首位。男性代謝症候群盛行率近十二年增加快速，而女性之盛行率增加趨勢較緩和。將臺灣之數據與國際間比較，臺灣之肥胖盛行率較亞洲許多國家高，但低於西方國家。但臺灣女性之代謝症候群盛行率相當接近西方國家。減維度迴歸分析顯示在女性中，降低代謝症候群罹患風險之飲食型態，其特徵除蔬菜、水果、瘦肉及魚類之高攝取頻率外，亦包含臺灣特性飲食項目之黃豆類、蕈菇類、海藻類等的高攝取。某些與代謝症候群相關之健康飲食項目，如瘦肉、奶類、深綠色蔬菜、及水果等，在十二年間之攝取頻率未見增加，值得後續健康促進及教育上來努力。

關鍵字：肥胖、代謝症候群、盛行率、飲食型態、減維度迴歸