

Original Article

Prevalence of overweight and obesity and its associated factors in aboriginal Taiwanese: findings from the 2001 National Health Interview Survey in Taiwan

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The study was undertaken to assess the prevalence of obesity in Taiwanese aborigines and to identify the associated factors. Data for this study were from the "2001 National Health Interview Survey (NHIS)" that conducted in-home, face-to-face, interviews on 6,592 households (26,658 persons) of a national probability sample in Taiwan. Aborigine-dense mountainous areas are over-sampled. BMI values were used to indicate obesity status. Logistic regression analyses were used to determine the significance of the association of the variables with the obesity status. Results showed that approximately 10.5% of aboriginal men and 14.5% of women compared to 4.1% and 3.5% of their non-aboriginal counterparts were obese (BMI > 30). An additional 45.1% of aboriginal men and 33.3% of women compared to 27.6% and 17.7% of their non-aboriginal counterparts were overweight (BMI 25-30). Regression analyses revealed few associations with increased risk of obesity in the aborigines. However, the aborigines and non-aborigines were distinctly different from each other in socio-economic status, lifestyle, environmental factors and attitude toward obesity. Results indicate that obesity is more prevalent among the aborigines but the causal reasons are not apparent. The public health authorities should develop more culturally appropriate community-based intervention strategies to promote the health of the aborigines.

Key Words: aborigines, obesity, anthropometrics, lifestyle, Taiwan

INTRODUCTION

Overweight-obesity has been recognized as a major public health concern. The proportion of people who are overweight or obese is increasing at an alarming rate in adults and in children worldwide in both developed and developing countries.^{1,2} In Taiwan, the prevalence of obesity has increased steadily from 1980 to 2000, especially in children and in men.³ Obesity is known to be an important factor to many chronic diseases and health complications such as type II diabetes, metabolic syndrome, coronary heart disease, hypertension, hyperlipidemia, hyperglycemia, some forms of cancer, osteoarthritis, depression and psychological problems.⁴ Obesity can contribute to increased health-care cost.

The ethnic differences in the prevalence of obesity have been observed in many areas.^{5,6} Studies have found that the aboriginal people have higher prevalence of obesity than other ethnicities. In Canada, the aboriginal populations have been estimated to have the highest rate (47.5%) of obesity (body mass index, BMI \geq 30) of the country.^{7,8} In Australia, the proportion of obesity in aboriginal population (BMI \geq 30) was 38% in females and 25% in males⁹ compared to 18% in female and 17% in male of European descendents. The prevalence of obesity in the Taiwanese aborigines has not been well documented but has been implicated to be high in a recent national survey.¹⁰ In the survey, the rate of overweight-obesity (BMI \geq 25) was observed to be 52.5% in men and 55.1% in women (com-

pared to 24.8% in men and 25.5% in women for the total population), 20 years or older, among residents of the mountainous areas. Since 84% of male and 91% of female residents in these areas are aborigines, these data suggest a high prevalence of overweight-obesity among the Taiwanese aborigines.

The aboriginal Taiwanese are known to have unique cultural, lifestyle and health problems. Being in mountainous and remote areas, the aborigines consume more meat (of wild animals) and less milk, fish, seafood and fruit, relative to the Han Chinese. More aborigines are associated with alcohol drinking, cigarette smoking and betel-quin chewing. They have a more laid-back attitude and are more content with life and less concerned about their weight or health problems. Their unique lifestyle and health attitude, presumably, can play a role in their weight status and the etiology of some chronic diseases.

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Although the increase in the prevalence of overweight-obesity in Taiwan has gained the attention of the health

authorities, there are yet few studies addressing the causes of this problem in the aboriginal people in Taiwan. This study aims to determine the prevalence and the potential determinants of obesity in the aboriginal people in Taiwan by analyzing the result of a recent national health interview survey.

MATERIALS AND METHODS

Sampling and data collection

Data for this study were part of the 2001 National Health Interview Survey (NHIS) in Taiwan. NHIS was a government-sponsored survey project conducted to gather information on health status, medical utilization, health behavior and life quality of the citizens. The study was a population representative sample. The design and sampling procedure of the survey have been described elsewhere.^{11, 12} The study employed a multistage stratified systematic sampling method. In the first stage, 359 townships/districts of Taiwan were divided into seven strata according to their geographical location and degree of urbanization. Townships/districts in each stratum were chosen with probability proportional to their population sizes (PPS). In each selected township/district, a number of lins (the smallest administrative unit in Taiwan) were sampled with PPS. Four households from each selected lin were randomly selected to voluntarily serve as study subjects. In all, 6,592 households (26,658 persons) of equal probability samples were selected from the whole Taiwan area. Mountainous areas (where most aborigines live) and offshore islands were over-sampled relative to population sizes in order to assure statistically meaningful numbers. A number of lins were randomly sampled with PPS from the thirty government designated aboriginal districts which are known to have high density of aborigines throughout the island. Households were then randomly selected from each lin. A total of 600 households were sampled from the mountainous areas. An aboriginal household was defined as a family with an aboriginal father, but not with an aboriginal mother, presumably due to the fear of cultural switching once an aboriginal woman is married to a non-aboriginal man. Each member of the selected household underwent an in-home, face-to-face, interview by trained interviewers. The household

and matters related to household members. Individual questionnaires were designed to elicit demographic data, personal health and disease histories, utilization of healthcare services, health behavior, lifestyle, food pattern, nutrition knowledge, self-evaluated health status, employment history, economic status and body weight and height of each household member. The entire interview process took approximately 1-2 hours. Ninety-one percent of the selected households and 94.2% of the individuals completed the survey. For aborigines, 90.7% of individuals completed the survey.

In order to assure meaningful and relevant comparisons, the present study included only subjects residing in less urbanized mountainous areas where most of the aborigines live. Data from the seven largest metropolitan areas where there were few aborigines were excluded from this current analysis. The limitation reduced the total number of observations to 11,065 non-aborigines (mainly Han Chinese) and 336 aborigines, 12 years or older. Further, in this study only data from participants 20 to 64 years old were used for binary logistic regression analysis because the data contained relatively few aboriginal participants younger than 20 years or older than 65 years.

The study variables

BMI was calculated from height and weight data using the equation kg/m^2 . BMI values were used to indicate body fatness status according to two definitions: (a) the Taiwanese definition (BMI 24-27 as overweight and BMI ≥ 27 as obese according to the Department of Health of Taiwan), and (b) the WHO definition (BMI 25-30 as overweight and BMI ≥ 30 as obese). Variables analyzed in the present study included age, sex, years of formal educational, marital status, income status, rice consumption, nutrition attitude, self-rated health status, weight-control measures taken and lifestyle factors (including alcohol drinking, cigarette smoking, betel-nut chewing, physical activity, and dietary habits).

Statistical analysis

Student's t test was used to determine the significance of differences in BMI between the aborigines and non-aborigines. The Chi-square test was employed to deter-

Table 1. BMI (mean \pm SD) of the aboriginal and non-aboriginal Taiwanese stratified by age ranges

Age	Aborigines		Non-aborigines		p
	N	Mean \pm SD	N	Mean \pm SD	
12-19 (y)					
Male	17	22.1 \pm 2.27	903	20.9 \pm 3.55	ns
Female	21	20.7 \pm 2.65	851	19.8 \pm 3.09	ns
20-39 (y)					
Male	87	25.8 \pm 3.56	2359	23.4 \pm 3.47	<0.001
Female	70	24.3 \pm 4.84	2325	21.4 \pm 3.26	<0.001
40-64 (y)					
Male	59	25.8 \pm 2.59	1837	24.2 \pm 3.16	<0.001
Female	58	26.7 \pm 4.12	1754	23.7 \pm 3.39	<0.001
≥ 65 (y)					
Male	16	24.9 \pm 3.14	554	23.0 \pm 2.97	<0.05
Female	5	25.4 \pm 2.45	409	23.6 \pm 3.81	ns

questionnaire was for gathering data on the household

mine the difference in BMI distributions and sociodemo-

graphic and lifestyle factors between the aborigines and non-aborigines. Binary logistic regression analysis was performed to determine the association of sociodemographic or lifestyle parameters with body weight status. A probability of 0.05 was designated as the level of statistical significance but higher levels of significance were also indicated.

RESULTS

Table 1 presents the mean BMI values of the aborigines and non-aborigines stratified by age and gender. Compared to their non-aboriginal counterparts, the aboriginal men and women had significantly higher ($p < 0.05$) BMI in all age groups above 20 years old, except female > 65 years where the number of observation was relatively small. Young aboriginal men and women (12-19 y) also appeared to have higher BMI compared to their non-aboriginal counterparts, but the differences were not statistically significant. The largest differences in BMI were in female in the age ranges of 20-39 y and 40-64 years. During these age ranges, the aboriginal females were approximately 3 BMI units fatter than non-aboriginal females.

Table 2 presents the proportions of overweight and obese of the Taiwanese adult aborigines and non-aborigines classified according to the Taiwanese and the WHO definitions. By the Taiwanese definition, 73% of aboriginal men and 55.5% of aboriginal women were overweight or obese compared to 42.7% and 29.3% of respective non-aborigines. The patterns of BMI distribution between the aborigines and non-aborigines were significantly different from each other in both men and women on basis of Pearson's Chi-square tests. By the WHO definition, the proportions of subjects who were obese were lower in both aborigines and non-aborigines.

Table 3 presents a comparison of the distribution of the status of sociodemographic, lifestyle and health-related parameters between the aborigines and non-aborigines. All parameters were significantly different (all $p < 0.05$) between the two ethnicities. Compared to their non-aboriginal counterparts, the aborigines had fewer years of formal education, less income, more lifestyle vices (alcohol-drinkers, cigarette smoking and betel-quid chewing), and less physical activity. They ate more rice daily, paid

less attention to nutrition information, but were more satisfied with his/her health status and less concerned about his/her body weight. Additionally, results also showed that the aborigines consumed more meat and egg, but less fish, seafood, milk and fruit.

Table 4 presents the results of logistic regression analyses of the impact of sociodemographic and lifestyle factors on the prevalence of obesity in both the aboriginal and non-aboriginal Taiwanese, 20-64 years old. Overall, 31% of both aboriginal men and women compared to 16.1% and 9.5% of their non-aboriginal counterparts were obese based on the Taiwanese definition of BMI ≥ 27 . For aboriginal people, among the factors examined, only one variable, being widowed, was significantly associated with an increased risk of obesity while exercising 1-3 times/wk was significantly associated with reduced risk of obesity. For non-aborigines, being female, higher education and higher income were variables associated with reduced risk of obesity, while being married, separated or widowed, and betel-quid chewing were variables associated with increased risk of obesity. Obese (BMI > 27) is associated with increased risk of the major chronic diseases such as diabetes, hypertension, dyslipidemia and heart disease in both aborigines and non-aborigines. However, the prevalence of self-reported diabetes mellitus, hypertension, and dyslipidemia appeared to be lower in adult aborigines than non-aborigines ($p < 0.1$) (Table 5).

DISCUSSION

Based on a national representative sample, results of this study clearly indicate that obesity is prevalent in the aboriginal Taiwanese. The aborigines are 1.4 folds more likely to be obese than their non-aboriginal counterparts (31% vs. 12.9%). Young aboriginal men and women display a tendency of higher BMI compared to their non-aboriginal counterparts before age 20. Adult aboriginal men and women are 1.5 to 3 BMI units fatter than their non-obese counterparts during all stages of their adult ages. High prevalence of obesity in aboriginal Taiwanese has been implicated in the National Nutrition and Health Survey in Taiwan, 1993-1996 (NAHSIT-I).¹⁰ The survey showed that for people residing in the mountainous areas 10% of men and 23.1% of women were obese (BMI ≥ 30) and additional 42.5% of men and 32.0% of women were

Table 2. Distributions (%) of BMI of adult aborigines and non-aborigines, 20-64 years old, according to the Taiwanese definition and the WHO definition of body fatness

	BMI, Taiwanese Definition				BMI, WHO definition			
	<18.5	18.5-24	24-27	>27	<18.5	18.5-25	25-30	>30
Men								
Aborigines	0.6	24.6	44.2	28.8	0.6	43.8	45.1	10.5
Non-aborigines	3.5	53.7	27.3	15.4*†	3.5	64.8	27.6	4.1*
Women								
Aborigines	5.9	38.5	24.4	31.1	5.9	45.9	33.3	14.8
Non-aborigines	9.7	61	19.1	10.2*	9.7	69.2	17.7	3.5*

*Pattern of distribution significantly different from that of the aboriginal counterpart on basis of Pearson's Chi-square test (all $p < 0.001$)

Table 3. Comparison of the patterns of distribution (%) of sociodemographic, lifestyle and health-related parameters between the aboriginal (n = 274) and non-aboriginal (n = 8245) Taiwanese, 20-64 years old

	Aborigines	Non-aborigines	<i>p</i> [†]
Formal education (y)			<0.001
<6	35.8	21	
7-9	19.7	18.5	
10-12	38.3	33.8	
[‡] 13	6.2	26.7	
Income (NT\$)			<0.001
0	25.2	21.6	
<20K	34.8	24	
20K-40K	27.4	33.5	
[‡] 40K	12.6	21	
Alcohol drinking (times)			<0.001
Non-drinkers	52.9	79.1	
1-2/m	9.9	7.6	
1/wk	17.5	4.7	
2-3/wk	14.2	4.9	
[‡] 4/wk	5.5	3.7	
Cigarette smoking (cigarettes)			<0.05
Non-smokers	62	69.7	
Ex-smokers	1.8	2.7	
1-10/d	2.6	2.1	
11-20/d	26.2	19.3	
>20/d	7.4	6.2	
Betel-chewing			<0.001
Non-chewer	67.5	95.5	
Chewer	32.5	4.5	
Physical activity [‡] (times/wk)			<0.001
0	67.8	62	
1-3	24.9	20.1	
[‡] 4	7.3	17.9	
Sedentary time (hrs/d)			<0.001
<1	4	5.4	
2-3	23	29.6	
4-5	14.6	24	
[‡] 6	58.4	41	
Rice consumption (bowls/d) [§]			<0.001
0-1	3.7	11.4	
2	16.1	37.9	
3	40.3	30.2	
4	19.4	11.9	
[‡] 5	20.5	8.6	
Food label-reading			<0.001
Seldom	22.4	5.2	
Sometimes	35.4	17.2	
Usually	42.2	77.6	
Self-rated health condition			<0.01
Poor	7.7	4.3	
Fair	51.1	58.5	
Good	41.2	37.3	
Weight control measure			<0.001
To reduce	12	13.1	
To maintain	6.2	15.1	
To increase	1.8	1	
Do nothing	79.9	70.8	

Footnotes: [†]The level of significance of the differences in the pattern of distribution between the aboriginal and non-aboriginal Taiwanese. [‡]Number of times of physical activity lasting >30 min in a week. [§]A regular rice bowl holds roughly ½ cup (4 ounces) of cooked rice that contains approximately 120 kcal.

overweight (BMI 25-30) compared to 2.4% of men and 5.6% of women were obese and 22.4% of men and 19.9% of women were overweight in the general population. Since 84% of male and 91% of female subjects in those mountainous areas are aborigines, it is reasonable to assume that these data are indicative of the body fatness status of the aborigines. Obesity is a major health issue in most industrialized populations. The problem may not

seem severe in Taiwan based on WHO's definition of BMI>30 to classify obesity. However, there are studies suggesting that Taiwanese and other Asian populations are different from the Caucasians in their body composition and disease risk at a given BMI and that a BMI of 27 rather than 30 should be used as the cutoff for obesity.^{13, 14}

To the best of our knowledge, the current study is the

Table 4. Binary logistic regression analyses of the impact of sociodemographic and lifestyle factors on the prevalence of obesity in aboriginal and non-aboriginal Taiwanese, 20-64 years old

Variables	Aborigines (n = 274)			Non-aborigines (n = 8245)		
	% of total	% obese [‡]	OR (95% CI) [†]	% of total	% obese [‡]	OR (95% CI) [†]
Total	100	31		100	12.9	
Male	53.3	30.8	1	50.7	16.1	1
Female	46.7	31.3	0.79 (0.38-1.67)	49.3	9.5	0.47 (0.39-0.56)***§
Age (y)						
20-39	69.7	26.7	1	69.4	11.2	1
40-64	30.3	41	2.17 (0.94-5.03)	30.6	16.8	1.06 (0.89-1.27)
Marital status						
Single	29.9	23.5	1	27.1	9.1	1
Married	62	33.9	1.84 (0.85-4.00)	67.4	14.2	1.40 (1.16-1.70)***
Separated	5.5	26.7	1.41 (0.36-5.51)*	3	14.4	1.55 (1.04-2.31)*
Widowed	2.6	71.4	9.49 (1.28-70.4)*	2.5	17.9	1.90 (1.24-2.91)**
Education (y)						
≤6	35.8	35.7	1	21	18.2	1
7-9	19.7	20.4	0.67 (0.26-1.76)	18.5	13.8	0.72 (0.58-0.90)**
10-12	38.3	32.4	1.40 (0.58-3.40)	33.8	12	0.68 (0.55-0.84)***
≥13	6.2	29.4	1.04 (0.25-4.40)	26.7	9.1	0.52 (0.41-0.67)***
Income (NT\$/month)						
0	25.2	33.8	1	21.6	14.5	1
<20K	34.8	27.7	0.92 (0.43-1.95)	24	12.8	0.75 (0.62-0.91)**
20K-40K	27.4	29.7	1.08 (0.46-2.51)	33.5	11.1	0.66 (0.54-0.80)***
≥40K	12.6	41.2	1.46 (0.48-4.44)	21	14.1	0.79 (0.63-0.98)*
Alcohol drinking, frequency						
Nondrinkers [¶]	52.9	33.8	1	79.1	12	1
1-2/m	9.9	22.2	0.39 (0.13-1.15)	7.6	14	0.97 (0.76-1.25)
1/wk	17.5	35.4	0.87 (0.37-2.07)	4.7	18.4	1.21 (0.91-1.60)
2-3/wk	14.2	23.1	0.38 (0.14-1.08)	4.9	17.2	1.00 (0.75-1.33)
≥4/wk	5.5	26.7	0.50 (0.12-1.99)	3.7	15.4	0.73 (0.52-1.04)
Cigarette Smoking, No./day						
Never	62	31.5	1	69.7	11.3	1
Ex-smokers	1.8	20	0.57 (0.05-6.56)	2.7	20.5	1.23 (0.86-1.75)
1-10/d	2.6	57.1	2.11 (0.36-12.3)	2.1	16.6	1.21 (0.80-1.84)
11-20/d	26.2	33.8	1.57 (0.66-3.75)	19.3	15.4	0.88 (0.72-1.07)
>20/d	7.4	15	0.58 (0.14-2.46)	6.2	17.5	1.05 (0.80-1.38)
Betel quid-chewing						
No	67.5	29.5	1	95.5	12.4	1
Yes	32.5	33	1.09 (0.53-2.25)	4.5	23.3	1.55 (1.17-2.06)**
Physical activity (times/wk)						
0/wk	65.8	36	1	55.6	13.5	1
1-3/wk	18.8	24	0.39 (0.19-0.82)*	13.5	12.4	0.96 (0.80-1.15)
≥4/wk	9.4	28	0.62 (0.19-2.06)	13.5	12.3	1.05 (0.88-1.25)

Footnotes: [†]OR = Odds ratio, CI = 95% confidence interval. [‡]BMI >27 (kg/m²). [§]*, ** & ***--Significantly different from the reference at $p < 0.05$, 0.01 & 0.001, respectively. [¶]Non-drinkers include all those who drink less than one time/month.

first report to clearly show the prevalence of overweight and obesity of the Taiwanese aborigines. This is also the first attempt to identify the causal or associated factors of obesity. To our surprise, logistic regression analyses of the sociodemographic and lifestyle variables revealed few associations or potential causal factors with the obesity status of the Taiwanese aborigines. Among the variables analyzed, only two factors, being widowed and exercising 1-3 times/wk showed significant associations with the obesity status ($p < 0.05$). Two other variables, older age and betel-quid chewing, were only nearly significant ($p > 0.1$). Higher education, higher income and higher physical activities, variables often shown to be associated with reduced risk of obesity, are not significantly associated with obesity status in this regression model in the current study.¹⁵⁻¹⁹ Contrary to the regression model of the abo-

rigines, the regression model of the non-aborigines does reveal significant negative associations of obesity risk with female gender, higher education and higher income, and positive associations with "ever being married" (currently married, separated/divorced or widowed) and betel-quid chewing. Alcohol drinking and cigarette smoking are not associated with obesity status in either the aborigines or non-aborigines in the current study.

In addition to using the regression model to examine the association of obesity status with the contributing variables, the current study also attempted to reveal the potential causal factors of aboriginal obesity by comparing the results of the two populations. It is somewhat intriguing to see that higher education and higher income, two major impacting factors that reduce the prevalence of obesity in non-aborigines and in other studies^{2, 4, 15-19}

Table 5. "Self-reported" prevalence (%) of diabetes mellitus, hypertension, dyslipidemia and heart disease in aboriginal and non-aboriginal Taiwanese, 20 years or older, stratified by BMI

Disease	Obese (BMI \geq 27)		Non-obese (BMI<27)	
	Aborigines	Non-aborigines	Aborigines	Non-aborigines
Diabetes mellitus	3.6	7.9 [†]	1.6	2.4
Hypertension	14.3	21.0 [†]	5.3	6.2
Dyslipidemia	16.9	25.0 [†]	3.9	8.4 [‡]
Heart disease	7.2	7.8	2.6	4

[†]Different from the aborigines at $p<0.1$. [‡]Significantly different from the aborigines at $p<0.01$.

showed no significant impact on the obesity status of the aborigines. The exact reason is not known but there are some possible explanations. The relatively small number of observations of the aborigines in the present study is one. There are relatively small proportions of aborigines with higher income and higher education and the magnitude of differences in income and education are relatively small. Finally, in a less urbanized, less privileged, less competitive and more confined society, those few who are somewhat better educated or higher income can easily fall into the norm of the society, failing to maintain a lifestyle different enough to impact their obesity status.

The aborigines do have significant difference in socio-demographic status and lifestyle from their non-aboriginal counterparts. In general, the aborigines not only have less formal education and less income, they are also often associated with unhealthy lifestyle such as sedentary life, alcohol-drinking, tobacco-smoking and betel-quid chewing. The cultural differences and being in remote mountainous, the aborigines also have considerable differences in dietary habits from the Han Chinese. Compared to the diet of the Han Chinese, the aborigines consume more rice, meat and egg and less fish, seafood, milk and fruit but similar amounts of vegetables. The aborigines appear to be more content with their life and health status and are less concerned about the health risks of obesity. While it is not possible to identify the causes of obesity in an observational study, the lack of health education and less access to healthcare services probably plays a major role. It is important that the health authorities increase health education to the Taiwanese aborigines and make them aware of the health risks associated with obesity.

Like many other aborigine populations, the Taiwanese aborigines in general have a more "laid-back" lifestyle. They are associated with more lifestyle vices and are physically less active. These "laid-back" attitudes could play a key role in increased prevalence of obesity. A recent study by Huang *et al.*¹² has shown that in Taiwan, excess weight was related to worse physical measures, but not mental health-related quality of life (HRQOL) and that may present a challenge to preventing the increase in obesity. On the other hand, a genetic predisposition cannot be ruled out. Taiwanese aborigines are different from the non-aboriginal Han Chinese in their genetic composition. For example, the Taiwanese mountainous people (mainly aborigines) are well known for its high prevalence of hyperuricemia and gout, which cannot be fully explained by obesity and alcohol consumption. Genetic predisposition and environmental factors have been sug-

gested as potential causal factors.²⁰ Whether the Taiwanese aborigines possess any genetic predisposition to high risk of obesity remain to be determined. The higher prevalence of overweight-obesity of the Taiwanese aborigines is consistent with findings of aboriginal people in other countries such as Australia^{9,21} and Canada.²²⁻²⁴ It should be reminded that the aboriginal Taiwanese are comprised of several tribes of Malayo-Polynesians or the Austronesians origins with distinctive genetic differences.^{25,26} The Amis is the major tribe. Unfortunately, without tribal identification in the data set, no further statistical analysis could be performed.

It is of interest to note that despite of higher prevalence of obesity among the aborigines than the non-aborigines, results of the present study show that the self-reported prevalence of diabetes mellitus, hypertension, dyslipidemia and heart disease are not higher among the aborigines. In fact, the self-reported prevalence of diabetes, hypertension and dyslipidemia appeared to be lower ($0.05<p<0.1$) than their non-aboriginal counterparts. Similar findings have been observed that the prevalence of type II diabetes or metabolic syndrome is not more prevalent among the aboriginal Taiwanese compared to Han Chinese on the island.^{27,28} It should also be pointed that since original data of this report are self-reports, subjects' recognition of the chronic diseases/condition can certainly impact the accuracy of results.

Results of the current study indicate that obesity is prevalent in the Taiwanese aborigines and the causal factors are not well understood. However, it appears that the lack of the awareness of health risks associated with obesity might play a role. Given the unique culture of the aboriginal Taiwanese, careful consideration should be given to developing culturally appropriate community-based prevention strategies to increase the awareness of the health problems and changing the lifestyle and behavior of the aborigines.

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REFERENCES

1. World Health Organization. Subcommittee on Planning and Programming of the Executive Committee of Pan American Health Organization, Obesity, diet, and physical activity: provisional agenda item 9.5, 2003.
2. Seidell JC. Epidemiology of obesity. *Semin Vasc Med.* 2005;5:3-14.

3. Chu NF. Prevalence of obesity in Taiwan. *Obes Rev*. 2005;6:271-274.
4. Wyatt SB, Winters KP, Dubbert PM. Overweight and obesity: Prevalence, consequences, and causes of a growing public health problem. *Am J Med Sci*. 2006;331:166-174.
5. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. *J Am Med Assoc*. 2002;288:1723-1727.
6. Kumar BN, Holmboe-Ottesen G, Lien N, Wandel M. Ethnic differences in body mass index and associated factors of adolescents from minorities in Oslo, Norway: a cross-sectional study. *Pub Health Nutr*. 2004;7:999-1008.
7. Tremblay MS, Perez CE, Ardern CI, Bryan SN, Katzmarzyk PT. Obesity, overweight and ethnicity. *Health Rep*. 2005;16:23-34.
8. Vanasse A, Demers M, Hemiari A, Courteau J. Obesity in Canada: where and how many? *Int J Obes*. 2006;30:677-683.
9. Guest CS, O'Dea K, Hopper JL, Larkins RG. Hyperinsulinaemia and obesity in aborigines of south-eastern Australia, with comparisons from rural and urban European populations. *Diabetes Res Clin Pract*. 1993;20:155-164.
10. Lin YC, Yen LL, Chen SY, Kao MD, Tzeng MS, Huang PC, Pan WH. Prevalence of overweight and obesity and its associated factors: findings from National Nutrition and Health Survey in Taiwan, 1993-1996. *Prev Med*. 2003;37:233-241.
11. Shih YT, Hung YT, Chang HY, Liu JP, Lin HS, Chang MC, Chnag FC, Hsiung CA, Wu SL. The design, contents, operation and the characteristics of the respondents of the 2001 National Health Interview Survey in Taiwan. *Taiwan J Pub Health*. 2003;22:419-430.
12. Huang IC, Frangakis C, Wu AW. The relationship of excess body weight and health-related quality of life: evidence from a population study in Taiwan. *Int J Obes*. 2006;30:1250-1259.
13. Ishikawa-Takata K, Ohta T, Moritaki K, Gotou T, Inoue S. Obesity, weight change and risks for hypertension, diabetes and hypercholesterolemia in Japanese men. *Eur J Clin Nutr*. 2002;56:601-607.
14. Huang KC, Lee MS, Lee SD, Chang YH, Lin YC, Tu SH, Pan WH. Obesity in the elderly and its relationship with cardiovascular risk factors in Taiwan. *Obes Res*. 2005;13:170-178.
15. Bray GA. Nutrition and obesity. Prevention and treatment. *Nutr Metab Cardiovasc Dis*. 1999;9(Suppl):21-32.
16. Martinez JA, Kearney JM, Kafatos A, Paquest S, Martinez-Gonzalez MA. Variables independently associated with self-reported obesity in the European Union. *Pub Health Nutr*. 1999;2:125-133.
17. Tremblay A. Physical activity and obesity. *Baillieres Clin Endocrinol Metab*. 1999;13:121-129.
18. Jakicic JM. The role of physical activity in prevention and treatment of body weight gain in adults. *J Nutr*. 2002;132:3826S-3829S.
19. Khan LK, Bowman BA. Obesity: a major global public health problem. *Ann Rev Nutr*. 1999;19:viii-xvii.
20. Chang HY, Pan WH, Yeh WT, Tsai KS. Hyperuricemia and gout in Taiwan: results from the Nutritional and Health Survey in Taiwan (1993-96). *J Rheumatol*. 2001;28:1640-1646.
21. Gracey M, Bridge E, Martin D, Jones T, Spargo RM, Shephard M, Davis EA. An aboriginal-driven program to prevent, control and manage nutrition-related "lifestyle" diseases including diabetes. *Asia Pac J Clin Nutr*. 2006;15:178-188.
22. Belanger-Ducharme F, Tremblay A. Prevalence of obesity in Canada. *Obes Res*. 2005;6:183-186.
23. Young TK, Chateau D, Zhang M. Factors analysis of ethnic variation in the multiple metabolic (insulin resistance) syndrome in three Canadian populations. *Am J Hum Biol*. 2002;14:649-658.
24. Razak F, Anand S, Vuksan V, Davis B, Jacobs R, Teo KK, Yusuf S, SHARE Investigators. Ethnic differences in the relationship between obesity and glucose-metabolic abnormalities: a cross-sectional population-based study. *Int J Obes (Lond)*. 2005;29:656-667.
25. Chow RA, Caeiro JL, Chen SJ, Garcia-Bertrand RI, Herrera RJ. Genetic characterization of four Austronesian-speaking populations. *J Hum Genet*. 2005;50:550-559.
26. Sewein B, Cuza FJ, Szmulewicz MN, Rowold DJ, Bertrand-Garcia RL, Herrera RJ. On the genetic uniqueness of the Ami aborigines of Formosa. *Am J Phys Anthropol*. 2002;119:240-248.
27. Chen HD, Shaw CK, Tseng WP, Chen HI, Lee ML. Prevalence of diabetes mellitus and impaired glucose tolerance in aborigines and Chinese in eastern Taiwan. *Diabetes Res Clin Pract*. 1997;38:199-205.
28. Chen KT, Chen CJ, Gregg EW, Engelgau MM, Narayanan KM. Prevalence of type 2 diabetes mellitus in Taiwan: ethnic variation and risk factors. *Diabetes Res Clin Pract*. 2001;51:59-66.

Original Article

Prevalence of overweight and obesity and its associated factors in aboriginal Taiwanese: findings from the 2001 National Health Interview Survey in Taiwan

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臺灣原住民肥胖盛行率及相關因素探討：以2001年臺灣國民健康訪問調查資料進行分析

本研究是要分析臺灣地區原住民肥胖的盛行率及相關因素，研究資料是來自民國90年國民健康局所做的國民健康訪問調查，本調查是全國性的抽樣調查資料，其中少數族群以擴大抽樣的方式來進行抽樣，針對6592戶（26,658人）進行在家，面對面的調查。有關肥胖狀態是以BMI值來表示，並以邏輯斯迴歸來探討與肥胖有關的因素。結果發現，原住民中有將近10.5%的男性及14.5%女性屬於肥胖(BMI>30)，而非原住民中，男女性肥胖的比率則分別為4.1%及3.5%，此外，原住民中有將近45.1%的男性及33.3%女性屬於過重(BMI 25-30)，而非原住民中，男女性過重的比率則分別為27.6%及17.7%。

迴歸分析發現，影響原住民肥胖並沒有許多顯著的危險因子，然而，原住民和非原住民在許多社會經濟狀態、生活型態、環境因素及對於肥胖的態度有明顯的差異。研究結果發現原住民有較高的肥胖盛行率，但相關因子並不明顯，衛生主管機關應發展適合當地文化，以社區為基礎的介入策略來提升原住民的健康。

關鍵字：原住民、肥胖、人體測量、生活型態、臺灣。