

Association of Body Mass Index and Depressive Symptoms in a Chinese Community Population: Results from the Health Promotion Knowledge, Attitudes, and Performance Survey in Taiwan

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Background: The association between obesity and depression remains equivocal. The aims of this study were to examine the association between body mass index (BMI) and depressive symptoms in the Chinese adult population.

Methods: In this study, data from the Health Promotion Knowledge, Attitudes, and Performance Survey, conducted in 2002 among 20,385 Taiwanese adults (aged 18-64 years), were used. Depressive symptoms were assessed by the Taiwanese Depression Questionnaire (cut off point 19). Weight status was categorized as underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5-23.9 kg/m²), overweight (BMI 24-26.9 kg/m²), and obese (BMI ≥ 27 kg/m²).

Results: Bivariate analyses revealed that underweight men and women had higher risks of depressive symptoms than normal weight individuals. After controlling for education, income, occupation, smoking status, marital status, presence of chronic disease, exercise, and weight control measures, we found that underweight men were significantly more likely to have depressive symptoms than normal weight men (Adjusted odds ratio [AOR] 2.68, 95% confidence interval [CI] 1.85-3.88). On the contrary, obese women were significantly less likely to have depressive symptoms than normal weight women (AOR 0.62, 95% CI 0.46-0.83).

Conclusion: The associations of BMI and depressive symptoms were different between genders. Underweight men ran a higher risk of depression than normal weight men, and overweight women had a lower risk than normal weight women. These findings support the “jolly fat” hypothesis among the adult population in the Chinese community.

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Key words: BMI, depression, jolly fat hypothesis

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The associations between body mass index (BMI) and depression have been studied for decades and findings are not consistent.^(1,2) Several epidemiological studies have reported an increased risk of depression among obese people as well as a hypothesis of the reciprocal determination for obesity and depression epidemics.⁽³⁻⁶⁾ Other studies have proposed relatively fewer depressive symptoms among the obese population,^(7,8) and a “jolly fat” hypothesis (in which obesity reduces the risk of depression).^(9,10) In addition, one study uniquely pinpointed a “U-shaped” association between body mass index and depression, suggesting that both the underweight and overweight populations have more depressive symptoms than normal weight individuals.⁽¹¹⁻¹³⁾

A diversity of methods and individualized characteristics could render different results. Although many studies have highlighted factors that could moderate relationships between obesity and mental status, such as gender, age, race and socio-cultural factors,⁽¹⁴⁻¹⁶⁾ the majority of them were conducted among Western populations. Only two studies have used Asian population samples with emphasis on the elderly population,^(7,8) leaving the relationship between obesity and depression in Asian adult populations rather unclear.

Because of the limitations in the preceding studies, we investigated the association of BMI and depression in the Chinese adult population.

METHODS

Study population

Data from the Health Promotion Knowledge, Attitudes, and Performance (HPKAP) Survey 2002, provided by the Bureau of Health Promotion, Department of Health, Taiwan, was used in this study. The sampling frame was based on the National Census Register 2002. A three-stage systemic random sampling procedure was applied to all 21 counties and cities in Taiwan, and randomly selected townships were used as primary sampling units (PSUs). Within each township, some neighborhoods were randomly selected as secondary sampling units. Finally, in each neighborhood, 4 eligible persons (older than 15 years) were randomly selected as tertiary sampling units. A 2-stage systemic random sampling procedure was applied in Taipei and Kaohsiung, 2 major metropolitan cities, where some

neighborhoods were randomly selected from every single district as PSUs. The sampling rates for each city or county, including Taipei and Kaohsiung, differed according to their population levels. The weighting procedure was provided by the Bureau of Health Promotion.⁽¹⁷⁾

The HPKAP Survey, consisting of a structured questionnaire designed to assess current physical and mental health status, common medical conditions, health knowledge and attitudes of the responders, was conducted by the Bureau of Health Promotion, Department of Health, Taiwan. Data were gathered from face-to-face interviews conducted by 323 skilled interviewers who were employed by the Bureau of Health Promotion and trained in a 3-day workshop to standardize the interviews. The response rate of the survey was 81.9%.

To investigate the association between BMI and depressive symptoms in adults, we used the HPKAP data and focused on the 21,528 survey respondents between 18 and 64 years old. We excluded 1,143 subjects who provided incomplete data, for a total sample size of 20,385 in this study (Figure). This study was approved by the Institutional Review Board of Chang Gung Memorial Hospital.⁽¹⁸⁾

Measurements

Body mass index categories

BMI (weight in kilograms divided by height in meters squared) was calculated from the participants’

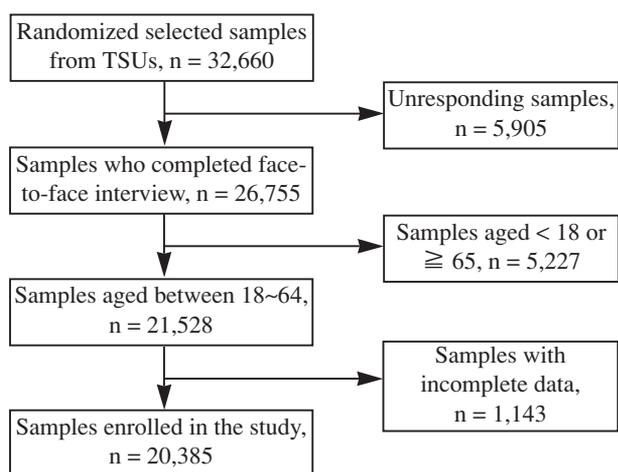


Figure Sampling procedure in the study. TSUs: tertiary sampling units.

self-reported weight and height. On the basis of the definition from the Bureau of Health Promotion, Department of Health, Taiwan, the respondents were categorized as underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5-23.9 kg/m²), overweight (BMI 24-26.9 kg/m²), or obese (BMI ≥ 27 kg/m²).

Depressive symptoms

Depressive symptoms were assessed using the Taiwanese Depression Questionnaire (TDQ), which included 18 items and was designed to evaluate depressive symptoms during the past week. A score of 0, 1, 2, or 3 (0- never, 1-sometimes, 2 -often, and 3- always) was given to each question according to its severity and frequency. The TDQ is a culturally relevant questionnaire compared with the structured clinical interview for DSM-IV-TR axis I disorder. It has a sensitivity of 0.89 and a specificity of 0.92 at a cutoff score of 19 and can be adapted for screening clinical depression, including major depressive disorder, dysthymic disorder, depressive disorder, and not otherwise specified conditions in communities and for epidemiological studies.⁽¹⁹⁾

Covariates

The covariates used in our study were as follows: age (< 20, 20-29, 30-39, 40-49, 50-59, ≥ 60 years), education level (≤ 12 years or > 12 years), monthly income (< 40,000 Taiwan dollars or ≥ 40,000 Taiwan dollars), employment status (employed or unemployed), smoking status (never smoked or former/current smoker), marital status (never married or others), chronic medical condition (presence of hypertension, hyperlipidemia, stroke, heart disease, diabetes, asthma, or chronic renal disease or no chronic condition), regular exercise (1 = yes, 0 = no), and weight control.

Statistical analysis

SPSS 17.0 software (SPSS Inc., Chicago, IL, U.S.A.) was used for data analyses. Bivariate logistic regression was used to investigate the unadjusted relationships between depressive symptoms and BMI categories, with the normal weight category as the reference group. The analyses were conducted separately for men and women, and their relationships were presented as odds ratios (OR) and 95% confidence intervals (CI).

Multivariate logistic regression analysis was

used to estimate the adjusted OR of depressive symptoms for each BMI category, with the normal weight category treated as the reference group. The covariates were selected on the basis of literature reviews, and bivariate logistic regression analyses were performed to identify potential confounders.⁽²⁰⁻²⁶⁾

RESULTS

Baseline characteristics of the study population are shown in Table 1. According to BMI, 7.3% of the population were underweight, 55.9% were normal weight, 23.1% were overweight and 13.7% were obese. The prevalence rate of depressive symptoms in the community adults was 4.7%.

As shown in Table 2, the prevalence of depressive symptoms was 2.9% and 3.6% in overweight and obese men, respectively, similar to 3.3% in the normal weight men; these percentages were 5.8%, 6.1%, and 5.3% in normal weight, overweight and obese women, respectively. Underweight men and women both had higher prevalences of depressive symptoms than any other BMI group for their gender, with percentages of 9.9% and 7.8% respectively.

Table 3 presents the associations between BMI and depressive symptoms in men and women. The unadjusted data showed that both underweight men and women were significantly more likely to have depressive symptoms than normal weight members of their own sex. After adjusting the covariates, underweight men had a significantly increased risk of depressive symptoms compared with normal weight men (AOR 2.68, 95% CI 1.85-3.88). In addition, obese women had a significantly lower risk of depressive symptoms than normal weight women (AOR 0.62, 95% CI 0.46-0.83).

DISCUSSION

This study used a national representative sample of Chinese adults in Taiwan to investigate the association of BMI and depressive symptoms. To our knowledge, this is the first community-based population study conducted to analyze the association between BMI and depressive symptoms in an Asian adult population.

In our sample, 23.1% adults were overweight and 13.7% were obese. The prevalence of over-

Table 1. Baseline Characteristics of the Study Population

	Unweighted N = 20,385	Weighted* %
Sex		
Female	9,943	49.6
Male	10,442	50.4
Age (years)		
< 20	1,001	4.9
20-29	5,000	24.5
30-39	5,015	24.6
40-49	4,849	23.8
50-59	3,168	15.5
60-64	1,352	6.6
Education (years)		
≤ 12	8,008	35.5
> 12	12,377	64.5
Monthly income (TWD)		
≥ 40,000	4,367	23.3
< 40,000	16,018	76.7
Employment status		
Employed	13,618	67.9
Unemployed	6,767	32.1
Smoking status		
Never smoked	12,741	62.9
Previous/current smoker	7,644	37.1
Marital status		
Married/cohabiting	12,940	62.3
Divorced/separated/widowed	1,371	6.3
Never married	6,074	31.4
Presence of chronic disease		
Yes	4,476	21.2
No	15,909	78.8
Exercise		
Yes	11,030	55.2
No	9,355	44.8
Weight control		
Yes	8,718	44.1
No	11,667	55.9
Obesity status		
Underweight (BMI < 18.5)	1,412	7.3
Normal weight (BMI 18.5-23.9)	11,186	55.9
Overweight (BMI 24-26.9)	4,823	23.1
Obese (BMI ≥ 27)	2,964	13.7
Depression		
TDQ ≥ 19	884	4.7
TDQ < 19	19,501	95.3

Abbreviations: TWD: Taiwan dollars; BMI: body mass index; TDQ: Taiwanese Depression Questionnaire; *: The percentage is the proportion of people in the population estimated from the weights assigned to the representative individuals sampled and tested.

weight and obesity was lower than that reported in Western society. In national surveys for the prevalence of obesity from 1999 to 2005, overall obesity in the general population was 13% in Spain, 30.6% in Korea and 32.2% in United States.⁽²⁷⁻²⁹⁾ In a national study in Australia, 48% of men and 30% of women were overweight and 19% of men and 22% of women were obese. In a study in Great Britain, 23% of men and 25% of women were obese.^(30,31) The prevalence of depressive symptoms in our study was 4.7%, lower than that found in a Western study.⁽²⁴⁾ In a US national survey, the prevalence of major depression over 12 months was 10.2% in US-born residents and 4.6% in Chinese.⁽³²⁾ That study coincidentally supports the hypothesis that Chinese people tend to deny depression or express it somatically, and elaborates the reason why their prevalence rate of depression was lower than in the West.⁽³³⁾

Goodman and Whitaker evaluated a cohort study of 9,374 adolescent girls in grades 7 to 12, and found baseline depressed mood predicted obesity at the 1-year follow-up among subjects who were obese at baseline as well as those who were not obese.⁽³⁴⁾ Obese people seeking weight-loss treatment may have elevated rates of depressive disorders.⁽³⁵⁾ In community studies, obesity is associated with major depressive disorder in females.⁽⁵⁾ The results were explained as an effect of binge eating, especially known in women, and depression may increase the risk of weight gain.⁽³⁶⁾ However, most of the studies were derived from Western society.

In our study, we tried to analyze the associations between BMI and depressive symptoms by gender in a Chinese adult community population. We found underweight men had a significantly higher rate of depression than normal-weight men. Among women, a significantly lower risk of depression was found in the obese population than their normal weight counterparts. The associations between BMI and depression in Chinese adults suggest that obesity has protective effects in depression and supports the “jolly fat” hypothesis first proposed by Crisp et al.^(9,10) They found that obesity was significantly associated with low levels of anxiety among both middle-aged suburban men and women and with low levels of depression in men. Our study found that obese Chinese adults were less likely to suffer from depression in the community. One possible reason is that people tend to cope with stress by eating carbohy-

Table 2. Prevalence of Depressive Symptoms by BMI and Gender

Obesity status	Underweight BMI < 18.5		Normal weight BMI 18.5-23.9		Overweight BMI 24-26.9		Obese BMI ≥ 27	
	n	weighted %	n	weighted %	n	weighted %	n	weighted %
Men	n = 378		n = 5,314		n = 2,961		n = 1,789	
Depression								
TDQ ≥ 19	26	9.9	177	3.3	81	2.9	55	3.6
TDQ < 19	352	90.1	5,137	96.7	2,880	97.1	1,734	96.4
Women	n = 1,034		n = 5,872		n = 1,862		n = 1,175	
Depression								
TDQ ≥ 19	76	7.8	309	5.8	95	6.1	65	5.3
TDQ < 19	958	92.2	5,563	94.2	1,767	93.9	1,110	94.7

Abbreviations: BMI: body mass index; TDQ: Taiwanese Depression Questionnaire.

Table 3. Risk of Depressive Symptoms by BMI and Gender

Obesity status	Depressive symptoms Adjusted*	
	OR	95% CI
Men		
Underweight (BMI < 18.5)	2.68 [†]	1.85-3.88
Normal weight (BMI 18.5-23.9)	1.00	
Overweight (BMI 24-26.9)	0.84	0.64-1.11
Obese (BMI ≥ 27)	0.94	0.69-1.27
Women		
Underweight (BMI < 18.5)	1.19	0.93-1.53
Normal weight (BMI 18.5-23.9)	1.00	
Overweight (BMI 24-26.9)	0.95	0.76-1.19
Obese (BMI ≥ 27)	0.62 [‡]	0.46-0.83

Abbreviations: BMI: body mass index; OR: odds ratio; CI: confidence interval; *: adjusting for education, income, occupation, smoking status, marital status, presence of chronic disease, exercise, and weight control; †: $p < 0.001$; ‡: $p < 0.01$.

drate-rich food. Consequently, not only is their mood regulated by increasing central serotonin activity, but they also gain weight in lieu of depression. Sociocultural factors may also play roles in the association of obesity with depression. In the Chinese culture, there is an old saying that becoming fat during middle age brings good fortune. Moreover, the Chinese idiom “Happy mind and fat body”, recorded in classical literature around two thousand years ago, minimizes the stigma associated with obesity in the

Chinese culture.⁽⁸⁾ Li et al. found the obese elderly were less likely to suffer from depressive symptoms than normal-weight elderly in Hong Kong.⁽⁸⁾ In our study, we found that underweight men had a higher risk of depressive symptoms in the community. Underweight people may have low self-esteem and depressive symptoms because of their negative body image. Depressive symptoms may also lead to a poor appetite and subsequent loss of body weight. Because our study was a cross-sectional study, causal relationships between being underweight and having depressive symptoms could not be confirmed. It is possible that being underweight can lead to depression, and vice versa. As the result of our study, it is logical that men are more vulnerable than women to the adverse effects of being underweight; compared with underweight men, underweight women are more accepted by society.

Gender differences in the associations of BMI and depression have been found in several studies. Carpenter et al. found decreased BMI in men and increased BMI in women were associated with major depression in a national survey.⁽²²⁾ Onyike et al. found obesity was associated with past-month depression in women, but not in men.⁽⁵⁾ Our study found underweight men had a significantly higher risk of depressive symptoms than normal weight men. However, it is unclear whether the association was “cause or effect.” Broadly speaking, men do not cope with their depression by craving carbohydrates as often as women, but enjoy smoking owing to one of its side effects and they feel it helpful to keep them fit.⁽³⁷⁾ Our study also found that there were gender differences

in the associations of BMI and depressive symptoms. Underweight men were more likely to suffer from depressive symptoms while obese women had a lower risk of depressive symptoms than their normal weight counterparts.

There are several limitations to our study. First, since the HPKAP Survey is a cross-sectional study, causal relationships between obesity and depressive symptoms could not be determined. Second, the BMI values were calculated using self-reported body weight and height. Obese females particularly tend to underreport their weight, while males with obesity are inclined to overestimate both their height and weight.⁽³⁸⁾ Third, we used the TDQ to assess depressive symptoms. Even though the TDQ is a culturally relevant depression screening questionnaire, it can only reflect the mood states over the past week rather than indicate long-term symptoms. A strength of this study lies in the fact that we used a national, representative, randomly-selected sample to investigate the associations of BMI and depression in Chinese adults; hence, it can be generalized to the whole country.

Conclusion

This study demonstrated that in the Chinese adult community, underweight men have a higher level of depressive symptoms than those with normal weight, while overweight women have a lower level of depressive symptoms than normal weight women. Furthermore, when screening depression in the Chinese adult community, the underweight population should be prioritized in prospective studies in an attempt to retrieve and clarify associations between depressive symptoms and BMI.

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身體質量指數與憂鬱症狀的關聯性： 台灣社區健康促進知識、態度及行為研究結果

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- 背景：**目前肥胖與憂鬱的關係仍然未有定論。本研究之目的在於檢測身體質量指數與憂鬱症狀在一華人社區人口的關聯性。
- 方法：**資料來源是由 2002 年台灣社區健康促進知識、態度及行為調查，選取年紀介於 18-64 歲的成人共 20,385 人進行分析。以台灣人憂鬱症量表評估憂鬱症狀(切分點 19)。依身體質量指數將肥胖程度分為體重過輕(身體質量指數小於 18.5)、正常體重(身體質量指數介於 18.5 到 23.9)、體重過重(身體質量指數介於 24 到 26.9)及肥胖(身體質量指數大於等於 27)，利用統計分析了解憂鬱症狀在不同身體質量指數群之性別差異關係。
- 結果：**雙變量分析發現體重過輕組之男性與女性與正常體重組比有較高比例的憂鬱症狀。在控制教育程度、收入、職業、抽菸狀態、婚姻狀態、有無慢性疾病、運動及飲食控制等共變數後，我們發現體重過輕男性比正常體重男性顯著較有憂鬱症狀(Adjusted odds ratio [AOR] 2.68, 95% confidence interval [CI] 1.85-3.88)。另一方面，肥胖的女性比正常體重女性顯著較少有憂鬱症狀(AOR 0.62, 95% CI 0.46-0.83)。
- 結論：**在身體質量指數與憂鬱症狀關係中，男性與女性是不相同的。男女性分別與其正常體重組比，體重過輕男性有較高的憂鬱症狀風險，而肥胖女性則降低憂鬱症狀風險。這些發現支持華人社區人口心寬體胖的假說。
(長庚醫誌 2011;34:620-7)

關鍵詞：身體質量指數，憂鬱，心寬體胖假說

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