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TITLE OF ARTICLE: GENDER DIFFERENCES IN THE ASSOCIATION BETWEEN QUALITY OF LIFE AND METABOLIC SYNDROME

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ABSTRACT

This study was to assess the association between quality of life (QOL), metabolic syndrome (MetS), and the gender differences in a population of Taiwanese adults. Secondary analysis was conducted using a nationally representative dataset. The data consisted of 2,269 females and 2,298 males. The psychological domain of QOL was found to have a negative association with the prevalence of MetS in both genders. In males, however, overall QOL, general health, the physical domain, and the environmental domain of QOL also had a negative association with MetS; however, the associations did not appear in females. A gender difference in the association between overall QOL, general health, and the physical and environmental domains of QOL and MetS was observed. The findings were consistent between the original WHOQOL-BREF and the WHOQOL-BREF Taiwanese version. In conclusions, subjects with a better QOL were associated with having lower odds of the prevalence of MetS. Furthermore, the association between QOL and MetS was moderated by gender.

KEYWORDS - Quality of life, metabolic syndrome, gender, Taiwan, WHOQOL-BREF

INTRODUCTION

A good quality of life (QOL) is a goal that most people strive to achieve. QOL is also widely recognized as an outcome measure that is used to evaluate the effectiveness of the

treatment of patients with various diseases (Eaglehouse et al., 2016). Some researchers have also revealed that subjects with metabolic syndrome (MetS) experience worse QOL than subjects without MetS (Jahangiry et al., 2016). Which raises the question: Does a good QOL reduce an individual's susceptibility to diseases?

There is an increasing interest in using longitudinal studies to explore QOL in relation to the severity and mortality of chronic disease. Studies have demonstrated that QOL is a risk factor of mortality and morbidity in chronic diseases, such as cardiovascular disease, Type 2 diabetes, and stroke (Benjak & Mavrinac, 2009; Myint et al., 2007; O'Shea et al.,2015). Furthermore, QOL has been shown to be able to predict the mortality of a healthy population over a 4–8-year follow-up period (Kaplan et al., 2007; Otero-Rodriguez et al., 2010). Additionally, researchers have reported that QOL can be a predictor in studies of cross-sectional design, as in the Women's Health in the Lund Area (WHILA) study, where low physical QOL was positively associated with more features of MetS in middle-aged women (Lidfeldt et al., 2003). A previous study showed that people with low QOL have significantly more cardiovascular risk factors and a higher prevalence of obesity (Benjak & Mavrinac, 2009). Therefore, QOL may predict the prognosis of disease, mortality, and MetS. However, we still know little about the reasons responsible for the correlation between impaired QOL, an adverse prognosis, mortality, and MetS.

Literature review

Researchers speculate that poor QOL is conceptualized as a risk factor of mortality because it may serve as a surrogate for important covariates known to predict health, such as possible symptoms, disease severity, and impending complications. QOL might merely reflect patients' perception of the severity of a disease. However, MetS did not appear to be associated with obvious symptoms. Can QOL serve as a predictor of MetS in a pre-disease state, or does the question need further clarification? Myint (2007) speculated that poor physical QOL acted as an independent predictor of stroke incidence during a 7.5-year follow-up because it may reflect underlying biological processes such as chronic inflammation. It is now known that cytokines are involved in inflammatory processes, which have a major role not only in infectious conditions but also in the pathogenesis of vascular disease (Myint et al., 2007). Researchers have also speculated that cytokines is an important etiological agent for MetS (Elks & Francis, 2010). Therefore, we proposed QOL might predict MetS.

MetS is a major public health problem worldwide. It covers a cluster of metabolic disturbances including obesity, hyperlipidemia, hypertension, hyperglycemia, prothrombotic state, and proinflammatory state, as defined by the World Health Organization (WHO) and

the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) of America (NCEP-ATP III, 2001; WHO, 1999). The prevalence of MetS is 12.9–24.2% (Chuang et al., 2004; Sheu et al., 2006). MetS is a risk factor for type 2 diabetes, stroke, and cardiovascular disease, which all increase morbidity, mortality, and medical costs (Wannamethee et al., 2005). Therefore, clarifying the relationship among the risk factors of MetS is an important issue.

The World Health Organization Quality of Life (WHOQOL) Group defines QOL as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (WHO, 1993). There are many instruments for assessing QOL. The WHOQOL-BREF, which has been used broadly, is considered valid and reliable in different countries and different populations (WHO, 1998).

A previous study has revealed gender to have a significant impact on QOL. Kirchengast et al. (2008) suggested that the significant impact of gender on QOL they discovered could be explained by sociocultural, socioeconomic, biomedical, and behavioral factors (Kirchengast & Haslinger, 2008). Gender differences with respect to the prevalence of MetS also are present in the literature (Chuang et al., 2004; Hwang et al., 2006). However, there is little data concerning the relationship between QOL and MetS, especially in terms of gender differences.

Study aim

The present study aimed to explore the association between QOL and MetS in a representative sample of the population of Taiwan and examine whether this association is moderated by gender.

METHODS

Design

The research design was a cross-sectional study. The data analyzed for this study were from a national dataset obtained from two consecutive studies; namely, the 2001 Taiwan National Health Interview Survey (NHIS) (Shih et al., 2003) and the 2002 Taiwanese Survey on Prevalence of Hypertension, Hyperglycemia and Hyperlipidemia (TwSHHH) (Chen, 2003).

Participants

Detailed descriptions of the recruitment and study methodology of the NHIS and the TwSHHH have been reported previously (Chen, 2003; Ni et al., 2013; Shih et al., 2003). The survey in the Taiwanese version of the WHOQOL-BREF in the NHIS exclusively focused on

adults aged 20–65 years. The subjects recruited for the TwSHHH who were younger than 20 years or older than 65 years had no WHOQOL-BREF data and were therefore excluded. In summary, this study included 2269 females and 2298 males aged 20 to 65 years who had completed the lifestyle questionnaire and WHOQOL-BREF in the 2001 NHIS.

Ethical considerations

This study was approved by the Ethics Committee of the Institutional Review Board of Chang Gung Medical Foundation, Taoyuan, Taiwan.

Data collection

The dependent variable was MetS, which was determined to be present in subjects who had three or more of the five component risk criteria identified by the Bureau of Health Promotion and the Department of Health, ROC (Taiwan) (Hwang et al., 2006): abdominal obesity (waist circumference ≥ 90 cm in males and ≥ 80 cm in females); hypertriglyceridemia (serum triglycerides ≥150 mg/dL); low HDL cholesterol (serum HDL cholesterol < 40 mg/dL in males and <50 mg/dL in females); high blood pressure (systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥ 85 mmHg or using antihypertensive medication); high fasting plasma glucose (fasting plasma glucose ≥100 mg/dL or using anti-diabetic medication). Detailed descriptions of the measurement procedures for waist circumference, blood pressure, and laboratory analyses of blood samples have been reported previously (Ni et al., 2013).

The independent variable was QOL, measured by the Taiwanese version of the WHOQOL-BREF, which was assessed with respect to their experiences during the two weeks prior to the interview. The WHOQOL-BREF, a measure developed by the WHOQOL Group, was used to assess QOL. It consists of 26 items and includes four domains: physical (7 items), psychological (6 items), social relationships (3 items), and environmental (8 items). Items are ranked on a 5-point Likert scale from 1 (poor QOL) to 5 (good QOL). The remaining two questions measure a general facet with a 5-point Likert scale about overall QOL ("How would you rate your QOL?") and general health ("How satisfied are you with your health?"). Scores ranged from 1 (very poor) to 5 (very good). The Taiwanese version of the WHOQOL-BREF contains the 26 original items of the WHOQOL-BREF, plus two culture-specific questions. The two additional items are "Do you feel respected by others?", which is included in the social relationships domain, and "Are you usually able to get the things you like to eat?", which was categorized as part of the environmental domain. The original English-language version was translated into Chinese using a method developed by the WHO. The internal consistency, test-retest reliability, and discriminant and content validities of the WHOQOL-BREF are good (WHO, 1998). The Taiwanese version of the

WHOQOL-BREF has been widely used in studies and has shown good reliability and validity for variant populations (WHO, 2005; Yao et al., 2002). In this analysis, two general items and four domains of QOL were used: overall QOL, general health, and four domain scores of physical, psychological, social relationships, and environmental. Subjects reported domain scores ranging from 4 to 20, with higher scores representing better QOL (WHO, 2005).

Age, body mass index (BMI), socioeconomic status, habits of regular exercise, high-fat diet, alcohol consumption, smoking, and betel-nut chewing were used as control variables; all are known to be associated with MetS. A score for socioeconomic status was developed according to Hollingshead's modified "Two Factor Index of Social Position" based on occupation and education status, as described by Lin (Lin, 2005). The socioeconomic score was rescaled into five levels, with levels 1–2 coded as low socioeconomic status and levels 3–5 as high socioeconomic status.

Data analysis

Categorical data were presented as a number and percentage. Continuous data were presented as a mean and standard deviation. Comparisons of categorical and continuous data between females and males were performed by chi-square tests and independent sample t-tests, respectively.

In order to avoid multicollinearity, each domain of QOL was regarded as an independent variable that was utilized separately to assess the association with MetS in logistic regressions. The social relationships domain and the environmental domain were analyzed with the WHOQOL-BREF and the WHOQOL-BREF (Taiwanese version). The results of logistic regression analysis were presented as odds ratios (OR) with 95% confidence intervals. All analyses were stratified by gender to explore the association between QOL and MetS in a gender-specific manner.

P-values of <0.05 indicated statistical significance. Data were analyzed using SPSS for Windows (SPSS 17.0, SPSS Inc., Chicago, IL). Each subject was assigned a weighting coefficient according to gender, age, education, and geographic location within the population structure of Taiwan.

RESULTS

The data in Table 1 shows the characteristics of the subjects in this study. Of 4567 subjects, 2269 were female (49.7%) and 2298 were male (50.3%). The mean age was 41.8 years for females (SD = 13.2) and 41.6 years for males (SD = 13.2). The BMI was higher in males than in females ($P < 0.001$). Males reported significantly more regular exercise, high-

fat diets, alcohol consumption, smoking, and betel-nut chewing than females ($P < 0.05$, 0.001). However, there were no significant gender differences in terms of age and socioeconomic status.

The data in Table 1 shows females expressed less satisfaction with the physical domain ($P < 0.001$) and the psychological domain ($P < 0.001$) than males did according to independent sample t-tests. However, there were no significant differences between females and males for the social relationships or environmental domains ($P = 0.555$, 0.395 respectively), or their modified social relationships (TW), and environmental domain (TW) scores ($P = 0.318$, 0.136 respectively).

The prevalence of MetS was higher in males (20.2%) than in females (13.9%) ($P < 0.001$), as shown in Table 1.

The effect of QOL on MetS in females

In females, without controlling for any potential confounders, the initial univariate analysis indicated that overall QOL, general health, the physical domain, the psychological domain, and the environmental domain were significant predictors of MetS (respective OR = 0.78, 0.73, 0.85, 0.85, 0.94; $P < 0.05$; 95% CI = 0.64–0.94, 0.62–0.85, 0.80–0.90, 0.81–0.89, 0.88–0.99). However, the social relationships domain was not a significant predictor of MetS (see Table 2). In the Taiwanese version, the environmental (TW) domain was a significant predictor of MetS (OR = 0.92; $P < 0.01$; 95% CI = 0.87–0.97), whereas the social relationships (TW) domain was not (see Table 2).

After controlling for age, BMI, socioeconomic status, regular exercise, high-fat diet, alcohol consumption, smoking, and betel-nut chewing with multiple logistic regression, the psychological domain remained negatively associated with MetS (OR = 0.90; $P < 0.01$; 95% CI = 0.84–0.96). An increase of 1 in the psychological domain score was associated with a 10% reduction in the odds of MetS. When potential confounders were considered, the overall QOL, general health, the physical domain, and the environmental domain were no longer significantly associated with MetS, as shown in Table 2. The environmental (TW) domain was also no longer significantly associated with MetS.

The effect of QOL on MetS in males

In males, without controlling for any potential confounders, the initial univariate analysis indicated that overall QOL, general health, the physical domain, the psychological domain, and the environmental domain were significant predictors of MetS (OR = 0.71, 0.73, 0.91, 0.93, 0.93; $P < 0.001$, 0.01; 95% CI = 0.61–0.84, 0.63–0.84, 0.86–0.95, 0.89–0.97, 0.88–0.97). However, the social relationships domain was not a significant predictor of MetS (see Table 3). In the Taiwanese version, the environmental (TW) domain was a significant

predictor of MetS (OR = 0.93; P < 0.01; 95% CI = 0.87–0.97). The social relationships (TW) domain was not a significant predictor of MetS (see Table 3).

After controlling for all confounders with multiple logistic regression, overall QOL, general health, the physical domain, the psychological domain, and the environmental domain remained significantly negatively associated with MetS (respective OR = 0.69, 0.73, 0.91, 0.92, 0.91; P < 0.001, 0.01; 95% CI = 0.57–0.83, 0.62–0.87, 0.85–0.96, 0.87–0.97, 0.85–0.96), as shown in Table 3. An increase of 1 in the single-item overall QOL and general health scores were associated with 31% and 27% reductions in the odds of MetS, respectively. Similarly, an increase of 1 in the physical domain, psychological domain, and environmental domain scores were associated with 9%, 8%, and 9% reductions in the odds of MetS, respectively. In the Taiwanese version, the environmental (TW) domain remained significantly negatively associated with MetS (OR = 0.91; P < 0.01; 95% CI = 0.85–0.96). An increase of 1 in the environmental (TW) domain score was associated with a 9% reduction in the odds of MetS.

Gender is a moderator of QOL

The association between the overall QOL, general health, physical domain, environmental domain, and environmental (TW) domain measures and MetS were different for females and males. Gender was thus a moderator of the association between the measures of overall QOL, general health, physical domain, environmental domain, and environmental (TW) domain and MetS.

DISCUSSION

This study is a secondary analysis, based on a nationally representative sample, that investigated the correlation between QOL and MetS in terms of gender. The results revealed that psychological domain of QOL had a negative association with MetS in both genders. In addition, overall QOL, general health, and physical, environmental, and environmental (TW) domains of QOL had a negative association with MetS in males. Moreover, gender was a moderator of the association between QOL and MetS.

The study indicates that the psychological domain of QOL had a negative association with MetS after adjustment for the control variables in both genders. Similarly, the Women's Health in the Lund Area Study (WHILA) indicated that perimenopausal women with MetS expressed less satisfaction with mental well-being of QOL than women without MetS (Qader et al., 2008). However, we cannot compare the results of the current study to those of other studies because there has been no research on the relationship between psychological domain QOL and MetS in males. Why is the psychological domain of QOL negatively associated

with MetS? One review article cites studies that refer to psychological factors such as depression, anger, hostility, and anxiety. Negative affect increases the risk of MetS or major components, such as abdominal obesity and insulin resistance, through dysregulation of the sympathetic adrenal medullary and hypothalamic-pituitary-adrenal axes, which stimulates the secretion of cortisol and catecholamine. This risk can also be increased through unhealthy behaviors (Goldbacher & Matthews, 2007). Some longitudinal studies provide evidence of significant associations between psychological distress, negative affectivity, hostility, and the development of MetS, hypertension, and obesity (Puustinen et al., 2011; Whittaker et al., 2012). The items of the psychological domain of QOL include "How much do you enjoy life?", "To what extent do you feel your life to be meaningful?", "How well are you able to concentrate?", "Are you able to accept your bodily appearance?", "How satisfied are you with yourself?", and "How often do you have negative feelings, such as blue mood, despair, anxiety, depression?" These items are often featured in stress, anxiety, and depression questionnaires (Beck & Beamesderfer, 1974; Beck et al., 1988; Cohen et al., 1983). Hence, the items of the psychological domain of QOL are similar to stress, anxiety, and depression questionnaires. Therefore, subjects with a low psychological domain QOL may experience more of the aforementioned feelings, which increase the risk of MetS.

Our study reveals that the physical domain of QOL was not associated with MetS in females, in contrast to the finding of a previous study (Lidfeldt et al., 2003). Possible reasons for the difference between our study and the previous study may be, in part, the age of the subjects and the definition of MetS. The subjects of Lidfeldt et al.'s study were middle-aged women (ranging from 50 to 59 years). Menopause is an important event in a middle-aged woman's life that reduces hormone protection, which in turn causes physiological symptoms such as headaches and hot flushes. Therefore, the physical domain of QOL has been regarded as an important issue for middle-aged women. The other possible reason may be the different definitions of MetS. In our study, the definition of MetS was subjects who had three or more of the five total component risk criteria, but subjects with one or more of a total of eight features of MetS were considered as screening positive for MetS in Lidfeldt et al.'s study (Lidfeldt et al., 2003).

Our study reveals that the environmental domain of QOL was not associated with MetS in females, but one item, "Have you enough money to meet your needs?" had a negative association with MetS in both females and males. Subjects who are dissatisfied with their financial resources may experience a greater probability of MetS. We propose that subjects who experience more financial hardship may perceive more stress. Similarly, one

previous study has found a significant negative correlation between economic status and MetS (Malayala & Raza, 2016).

After adjustment of all of the control variables, the relationship between the physical domain of QOL and MetS was stronger in males than in females. In the physical domain of QOL, only one item had a significant association with MetS in females, whereas four items had a significant association with MetS in males. Therefore, we conclude a stronger relationship between the physical domain of QOL and MetS in males than in females. The situation was similar for the association between the environmental domain of QOL and MetS, but the reasons for this are unclear. One possible reason may be that the meaning of QOL itself varies by gender (Choe et al., 2001). Another possible explanation may be that the potential confounders between QOL and MetS themselves contain gender differences.

Our study has several strengths. The study sample was representative of Taiwan. The measurement of QOL using WHOQOL-BREF, which was most widely used in previous studies, had excellent psychometric properties that are valid for the Taiwanese population; it consists of two single-item measures and four separate domains for QOL. In particular, the social relationships (TW) and environmental (TW) domains are unique in that they contain culture-specific items.

This study has several limitations. First, the time span from the measurement of QOL to the data collection of the dependent variable was only 2–14 months. This may not be sufficient to establish a causal relationship. Second, the research employed an observational design, and so it is not clear whether there is a true causal relationship between QOL and MetS. Third, the outcome variable is the prevalence, rather than the incidence, of MetS. MetS could possibly decrease QOL; hence, it is necessary to consider a reverse causation. Fourth, there may be additional confounders, such as depression and chronic diseases, which we did not take into account and which may have influenced the outcome.

This study confirms that QOL is a valid predictor of MetS, but the mechanism remains unclear. Researchers have identified the relationship between QOL and chronic disease with reference to an inflammation process or unhealthy behaviors (Papelbaum et al., 2010). Therefore, future studies could use a long-term longitudinal prospective design to explore the association between QOL and the incidence of MetS in order to determine whether MetS is mediated by an inflammation process or by unhealthy behaviors. Future studies might also design randomized controlled trials, develop possible interventions to improve QOL, and confirm that improving QOL reduces the incidence of MetS.

CONCLUSION

In summary, the psychological domain of QOL had a negative association with MetS for both genders. In addition, overall QOL, general health, physical, environmental, and environmental (TW) domains of QOL had a negative association with MetS in males. Therefore, gender was found to be a moderating variable.

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Table 1: Characteristics of study subjects by gender

Variable	Female		Male		
	n	%	n	%	*P-value*
Control variables					
Age (y)	2269	41.8 ± 13.2	2298	41.6 ± 13.2	0.660
BMI (Kg/m^2)	2125	22.6 ± 3.5	2213	24.1 ± 3.4	< 0.001
Socioeconomic status					0.268
Low	1286	56.7	1340	58.3	
High	983	43.3	958	41.7	
Regular exercise (%)	511	22.5	567	24.7	0.047
High-fat diet (%)	1598	70.5	1936	84.2	< 0.001
Alcohol consumption (%)	269	11.9	1065	46.3	< 0.001
Smoking (%)	103	4.5	1096	47.8	< 0.001
Betel-nut chewing (%)	63	2.8	359	15.6	< 0.001
Independent variable (QOL)					
Physical domain	2262	14.8 ± 2.1	2297	15.2 ± 2.0	< 0.001
Psychological domain	2266	13.4 ± 2.3	2298	13.8 ± 2.2	< 0.001
Social relationships domain	2253	14.3 ± 2.1	2298	14.3 ± 2.2	0.555
Environmental domain	2269	13.1 ± 2.1	2298	13.0 ± 2.1	0.395
Social relationships (TW)[a] domain	2252	14.1 ± 2.1	2298	14.0 ± 2.1	0.318
Environmental (TW)[a] domain	2264	13.3 ± 2.0	2298	13.2 ± 2.0	0.136
Dependent variable					
MetS (%)	2269	13.9	2298	20.2	< 0.001

Values are mean ± SD for continuous variables or percentages for categorical variables. All analyses were weighted by sampling weight.

*$P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

[a] Modified domain, including nation-specific items.

Table 2: The effects of QOL on MetS for females

WHOQOL-BREF domain/item	Univariate (Crude) OR (95% CI)	Multivariate (Adjusted) OR (95% CI)
General facet		
1.Overall QOL	0.78 (0.64-0.94)*	0.83 (0.65-1.07)
2.General health	0.73 (0.62-0.85)***	0.94 (0.77-1.13)
Physical domain	**0.85 (0.80-0.90)*** **	**0.99 (0.92-1.06)**
3. Pain and discomfort[a]	0.80 (0.70-0.92)**	1.03 (0.86-1.33)
4. Dependence on medication or treatment[a]	0.72 (0.64-0.89)***	1.01 (0.86-1.18)
10. Energy and fatigue	0.84 (0.72-0.99)*	1.06 (0.87-1.30)
15. Mobility	0.60 (0.52-0.69)***	0.91 (0.76-1.10)
16. Sleep and rest	1.03 (0.90-1.18)	1.10 (0.92-1.31)
17. Activities of daily living	0.72 (0.61-0.85)***	1.00 (0.80-1.25)
18. Working capacity	0.69 (0.59-0.81)***	0.80 (0.65-0.98)*
Psychological domain	**0.85 (0.81-0.89)*** **	**0.90 (0.84-0.96)****
5. Enjoyment of life	0.67 (0.58-0.77)***	0.67 (0.56-0.81)***
6. Spirituality	0.78 (0.69-0.88)***	0.94 (0.80-1.10)
7. Thinking, learning, memory, and concentration	0.76 (0.66-0.88)***	0.87 (0.72-1.05)
11. Bodily image and appearance	0.62 (0.54-0.71)***	0.74 (0.63-0.89)**
19. Self-satisfaction	0.66 (0.56-0.78)***	0.69 (0.57-0.85)***
26. Negative feelings[a]	0.94 (0.82-1.08)	1.04 (0.87-1.23)
Social relationships domain	**0.95 (0.90-1.00)**	**1.04 (0.97-1.11)**
Social relationships (TW)[b] domain	**0.95 (0.90-1.01)**	**1.04 (0.96-1.11)**
20. Personal relationships	1.11 (0.93-1.32)	1.17 (0.94-1.45)
21. Sexual activity	0.76 (0.65-0.89)**	1.09 (0.88-1.35)
22. Friends' support	0.89 (0.73-1.08)	1.16 (0.92-1.47)
27. Being respected and accepted[c]	0.93 (0.79-1.08)	0.99 (0.81-1.20)
Environmental domain	**0.94 (0.88-0.99)***	**0.97 (0.90-1.05)**
Environmental (TW)[b] domain	**0.92 (0.87-0.97)****	**0.95 (0.88-1.03)**
8. Physical safety and security	1.02 (0.89-1.18)	0.96 (0.81-1.14)
9. Physical environment	1.11 (0.98-1.27)	0.99 (0.83-1.17)

12. Financial resources	0.61 (0.54-0.70)***	0.74 (0.62-0.88)**
13.Opportunities for acquiring new information	0.70 (0.61-0.81)***	0.98 (0.82-1.18)
14. Participation and support of leisure activities	0.85 (0.75-0.97)*	0.97 (0.82-1.14)
23. Home environment	0.97 (0.83-1.14)	0.96 (0.78-1.18)
24. Health and social care: accessibility and quality	1.07 (0.90-1.27)	0.94 (0.75-1.18)
25. Transportation	1.13 (0.95-1.36)	1.20 (0.95-1.52)
28. Eating food[c]	0.82 (0.71-0.96)*	0.91 (0.74-1.10)

Multivariate: Adjusted for age, BMI, socioeconomic status, regular exercise, high-fat diet, alcohol drinking, cigarette smoking, and betel-nut chewing.

*$P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

[a] Q3, Q4, and Q26 are reverse questions that have been reversed coded.

[b] Domain including nation-specific items.

[c] The nation-specific item Q27, ”being respected and accepted”, is included in the social relationships (TW) domain; the nation-specific item Q28, “eating food”, is included in the environmental (TW) domain.

Table 3: The effects of QOL on MetS for males

WHOQOL-BREF domain/item	Univariate (Crude) OR (95% CI)	Multivariate (Adjusted) OR (95% CI)
General facet		
1.Overall QoL	0.71 (0.61-0.84)***	0.69 (0.57-0.83)***
2.General health	0.73 (0.63-0.84)***	0.73 (0.62-0.87)***
Physical domain	**0.91 (0.86-0.95)*** **	**0.91 (0.85-0.96)** **
3. Pain and discomfort[a]	0.99 (0.87-1.12)	1.06 (0.92-1.22)
4. Dependence on medication or treatment[a]	0.81 (0.72-0.90)***	0.84 (0.74-0.96)*
10. Energy and fatigue	0.84 (0.73-0.96)**	0.81 (0.69-0.96)*
15. Mobility	0.79 (0.69-0.89)***	0.91 (0.77-1.07)
16. Sleep and rest	0.88 (0.78-0.99)*	0.77 (0.66-0.90)**
17. Activities of daily living	0.86 (0.74-0.99)*	0.86 (0.72-1.04)
18. Working capacity	0.77 (0.67-0.88)***	0.71 (0.60-0.84)***
Psychological domain	**0.93 (0.89-0.97)** **	**0.92 (0.87-0.97)** **
5. Enjoyment of life	0.93 (0.82-1.05)	0.88 (0.76-1.02)
6. Spirituality	0.84 (0.75-0.94)**	0.81 (0.71-0.93)**
7. Thinking, learning, memory, and concentration	0.89 (0.78-1.01)	0.92 (0.79-1.08)
11. Bodily image and appearance	0.88 (0.78-0.99)*	0.90 (0.78-1.05)
19. Self-satisfaction	0.78 (0.68-0.90)**	0.78 (0.66-0.93)**
26. Negative feelings[a]	0.90 (0.80-1.02)	0.86 (0.74-0.99)**
Social relationships domain	**0.98 (0.94-1.03)**	**0.99 (0.93-1.04)**
Social relationships (TW)[b] domain	**0.98 (0.93-1.03)**	**0.98 (0.93-1.04)**
20. Personal relationships	1.09 (0.94-1.27)	1.05 (0.87-1.27)
21. Sexual activity	0.94 (0.81-1.08)	0.90 (0.76-1.07)
22. Friends' support	0.81 (0.69-0.95)*	0.92 (0.76-1.13)
27. Being respected and accepted[c]	0.95 (0.83-1.08)	0.97 (0.83-1.14)
Environmental domain	**0.93 (0.88-0.97)** **	**0.91 (0.85-0.96)** **
Environmental (TW)[b] domain	**0.93 (0.88-0.97)** **	**0.91 (0.85-0.96)** **
8. Physical safety and security	0.88 (0.78-0.99)*	0.82 (0.70-0.95)**
9. Physical environment	0.96 (0.85-1.08)	0.84 (0.72-0.96)*
12. Financial resources	0.84 (0.76-0.94)**	0.87 (0.77-0.99)*

13.Opportunities for acquiring new information	0.85 (0.75-0.96)**	0.88 (0.76-1.02)
14. Participation and support of leisure activities	0.81 (0.72-0.90)***	0.82 (0.71-0.94)**
23. Home environment	0.90 (0.79-1.03)	0.86 (0.73-1.02)
24. Health and social care: accessibility and quality	0.93 (0.81-1.06)	0.88 (0.75-1.04)
25. Transportation	0.99 (0.86-1.16)	0.92 (0.76-1.10)
28. Eating food[c]	0.92 (0.80-1.05)	0.93 (0.80-1.09)

Multivariate: Adjusted for age, BMI, socioeconomic status, regular exercise, high-fat diet, alcohol drinking, cigarette smoking, and betel-nut chewing.

*$P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

[a] Q3, Q4, and Q26 are reverse questions that have been reversed coded.

[b] Domain including nation-specific items.

[c] The nation-specific item Q27, ”being respected and accepted”, is included in the social relationships (TW) domain; the nation-specific item Q28, “eating food”, is included in the environmental (TW) domain.