Relationship Between Depression, Generalized Anxiety, and Metabolic Syndrome Among Buddhist Temples Population in Nakhon Pathom-Thailand

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Abstract

Background: Depression and anxiety have been associated with type 2 diabetes in studies predominantly in high-income countries, but little is known about this association in Southeast Asia.

Objectives: The objective of this study was to investigate the prevalence of major depressive disorder (MDD), generalized anxiety disorders (GAD), and metabolic syndrome (MetS) and the relationship between these variables in Nakhon Pathom province in Thailand.

Methods: A cross-sectional sample of temple members (35 - 65 years) from 12 randomly selected Buddhist temples in Nakhon Pathom province participated in the study in 2016. MetS components were assessed using blood chemistry and anthropometric measurements. MDD and GAD were assessed with the Patient Health Questionnaire-9 (PHQ-9) and the Generalized anxiety disorder 7-item (GAD-7) scale, respectively. Logistic and linear regression was used to determine associations between MDD, GAD, and MetS.

Results: Of the 401 participants, 144 (35.9%) fulfilled MetS criteria. 61 (15.2%) participants screened positive for MDD and 25 (6.2%) for GAD. The prevalence of MDD (Odds Ratio, OR = 1.55, Confidence Interval, CI = 0.81-2.95) and GAD (OR = 1.20, CI = 0.53 - 2.75) was higher among participants with MetS than among those without MetS, but this was not significant.

Conclusions: There are no significant relationships between MDD, GAD, and MetS among the Buddhist temples population in Nakhon Pathom in Thailand.

Keywords: Anxiety, Depression, Metabolic Syndrome, Thailand

1. Background

Metabolic syndrome (MetS) constitutes a group of risk factors (central obesity, dyslipidemia, raised blood pressure, and raised fasting glucose) for cardiovascular disease and type 2 diabetes mellitus (1). Understanding the mechanisms involved in and factors associated with MetS is of significant interest given the high prevalence of MetS as 20% to 25% in the adult population globally (2) and 24.0% according to the International Diabetes Federation (IDF) criteria in the Thai adult population (3). There is an increasing attention to the relationship between MetS and common psychological disorders (depression and anxiety) and if causal links are involved (4, 5). The proposed relationship is consistent with the findings that depression is associated with the development of diabetes (6). People with depression are prone to MetS due to poor health behaviors

(7). Recent systematic reviews and meta-analyses found a relationship between depression and metabolic syndrome (MetS) (8) and a positive association between anxiety and MetS (5). Some studies also found that anxiety and depression were correlated with a greater number of components of MetS (9, 10), and other investigations found that anxiety and/or depression were correlated with individual components of the MetS (11-13).

2. Objectives

The objective of this investigation was to assess the current prevalence of MDD, GAD, and MetS, and the relationship between these variables in Nakhon Pathom province in Thailand.

3. Materials and Methods

3.1. Sampling

In a cross-sectional study, temple members (35 - 65 years old) from 12 randomly selected Buddhist temples in Nakhon Pathom province were consecutively screened for prehypertension and prediabetes by research nurses, using a diabetes risk screen and blood pressure assessment.

Individual inclusion criteria included men and women, 35 to 65 years old, visiting the temple, and having a diagnosis of prehypertension and pre-diabetes (having systolic blood pressure (SBP)/diastolic blood pressure (DBP) $\geq$ 120 - 139/80 - 89 mmHg or fasting plasma glucose (FPG) $\geq$ 100 and < 126 mg/dL). Exclusion criteria were temple members under the age of 35 and above 65 years, having a diagnosis of cardiovascular disease, type 2 diabetes, hypertension, substance abuse, and taking psychotropic medication.

For sample size calculation based on the literature of studies, the prevalence of MetS in the adult population was found to be 20 to 25% globally and 24% in Thailand (2,3), and the prevalence of depression among adults in Thailand was 10.6% (14). MetS with depression was approximately 40% (15) and MetS with depression was 39.9 % (16). The sample size was calculated using EpiInfo Version 7 (CDC web) with screening and meeting criteria in a population of 770, expected the frequency of maximum possible of 50%, an acceptable margin of errors of 5, and a design effect of 1. At a confidence level of 99%, the minimum sample size required for this study was 356.

3.2. Instruments

Blood pressure (BP) was assessed with an automated digital BP monitor (validated) based on Thai guidelines (17). Prediabetes was first screened with the Thai diabetes risk score tool (having a score of seven or more) (18). In a confirmatory testing, a professional nurse collected fasting venous blood samples from the temple members for lipid profile and FPG test. The lipid profile and plasma glucose were determined by using cholesterol oxidase-phenol aminophenazone (CHOD-PAP) and uniform glucose oxidase-peroxidase methods, respectively.

Participants with a fasting glucose level from 100 to 125 mg/dL (5.6 to 7.0 mmol/L) and/or systolic blood pressure between 120 and 139 mmHg and/or a diastolic blood pressure of 80 - 89 mmHg, and those not taking any hypertension and/or glucose influencing drugs were included in the study. The consensus definition (incorporating IDF and AHA/NHLBI definitions) was used for MetS (1): "Any three of the following: Elevated waist circumference (WC) (according to the Southeast Asian population definitions: WC of 90 cm or more in men and 80 cm or more in women),

Triglycerides 150 mg/dL or greater, HDL-cholesterol < 40 mg/dL in men and < 50 mg/dL in women, BP 130/85 mmHg or greater, and fasting glucose 100 mg/dL or greater".

3.2.1. Anthropometric Measurements

Anthropometric measurements were conducted using standardized procedures (19-21). Body mass index (BMI) was expressed as weight in kilograms divided by height in meters squared.

Questionnaires on depression, anxiety, substance use, and sociodemographic information were interview-administered by trained researchers. They included the following:

3.2.2. The Patient Health Questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9) was used to screen participants suffering from MDD (22). It has demonstrated high sensitivity (0.84) and specificity (0.77) in a validation study in Thailand, using a cut-off score of nine or more as indicative for MDD (14) (Cronbach's alpha 0.81).

3.2.3. The Generalized Anxiety Disorder 7-Item Scale

The Generalized anxiety disorder 7-item (GAD-7) scale was used to screen and measure the severity of generalized anxiety, with a score of 10 or more indicating moderate or severe GAD (23) (Cronbach's alpha 0.88).

3.2.4. Hazardous or Harmful Alcohol Consumption

Hazardous or harmful alcohol consumption was measured with the alcohol use disorder Identification test (AUDIT)-C (24) (Cronbach's alpha 0.86).

Smoking was assessed with the question, "Do you currently smoke tobacco?" Response options (yes, daily; yes, less than daily; no, not at all) (25).

3.3. Statistical Analysis

Descriptive statistics were used to describe the sample. Differences in proportions were analyzed using the Pearson Chi-square test and parametric and non-parametric tests. Logistic regressions were conducted with having or not having MetS and individual components of MetS as dependent variables and multivariable linear regression with the number of components of MetS as the dependent variable. P values of < 0.05 were classified as significant. Statistical analyses were performed using IBM-SPSS 24.0 (SPSS Inc., Chicago, IL, USA).

3.4. Ethical Consideration

The study was approved by the Committee for Research Ethics (Social Sciences), Mahidol University (MU-SSIRB: 2016/053-B1). Written informed consent was attained from all study participants.

Table 1. Descriptive Characteristics of Persons with MetS Positive and MetS Negative

Variable	MetS+ (N = 144)[a]	MetS- (N = 257)[a]	P Value
Age (y)	52.0 (11)	51.0 (11)	0.761
BMI (kg/m^2)	27.3 (4.2)	23.9 (3.5)	< 0.001
Waist circumference (cm)	91.5 (8.9)	82.9 (9.1)	< 0.001
Fasting blood glucose (mg/dL)	102.8 (11.9)	95.1 (9.8)	< 0.001
Systolic BP (mm Hg)	129.9 (7.9)	125.7 (7.7)	< 0.001
Diastolic BP (mm Hg)	81.6 (7.1)	77.7 (7.1)	< 0.001
Total cholesterol (mg/dL)	215.9 (38.6)	205.2 (35.2)	0.006
TG (mg/dL)	158.0 (94)	106.0 (35)	< 0.001
HDL-C (mg/dL)	47.0 (7)	52.0 (11)	0.316
LDL-C (mg/dL)	133.3 (37.9)	126.0 (34.6)	0.052
	N (%)	N (%)	
Female	117 (81.3)	177 (68.9)	0.007
Secondary or higher education	51 (35.4)	114 (44.4)	0.081
Current smoker	8 (5.6)	19 (7.4)	0.481
Hazardous or harmful drinker	12 (8.3)	30 (11.7)	0.295
MDD (scores 9 or more)	27 (18.8)	34 (13.2)	0.140
GAD (scores 10 or more)	10 (6.9)	15 (5.8)	0.660

Abbreviations: GAD, generalized anxiety disorder; M, mean; MDD, major depressive disorder; MED, median; IQR, interquartile range; SD, standard deviation.
[a]Values are expressed as M (SD) or MED (IQR).

4. Results

Of the 770 participants consecutively screened in a community setting, 144 (35.9%) fulfilled MetS criteria and 257 (64.1%) did not. None of the participants had been taking psychotropic treatment. The median age of the overall sample was 52 years (IQR = 11, range 35 - 65), and there were 107 men (26.7%) and 294 women (73.3%). 61 (15.2%) participants screened positive for moderate to severe MDD, 25 (6.2%) for moderate to severe GAD, and 16 (4.0%) for both MDD and GAD (see Table 1).

In the binary logistic regression analysis, the prevalence of depressive and generalized anxiety disorders was higher among participants with MetS than among those without MetS, but this was not significant. Among the different MetS components, the prevalence of depressive symptoms was also higher among participants having the MetS components than those without it, but none was significant. The prevalence of anxiety symptoms was higher in individuals with high fasting blood glucose, elevated waist circumference, and high triglycerides than individuals without, but all were non-significant (see Table 2).

Multiple linear regression with the number of metabolic syndrome factors as the dependent variable showed only negative effects for having higher educational levels, and MDD and GAD were also not found to be significantly associated with the number of metabolic syndrome factors (see Table 3).

5. Discussion

This study did not find, contrary to the general findings of two meta-reviews (5, 8), an association between MDD, GAD, and MetS among a temples population in Nakhon Pathom in Thailand. However, these findings are consistent with a number of other studies such as in China (11).

5.1. Limitations

The study assessed common mental disorders using screening questionnaires, which has its limitations in terms of a correct psychiatric diagnosis. Further, the study was cross-sectional and no causative conclusions can be drawn.

Acknowledgments

Table 2. Associations of Major Depressive and Generalized Anxiety Disorders and Metabolic Syndrome and Its Components

Variable	Crude Odds Ratio (95% CI)	P Value
MetS		
MDD (scores 9 or more)	1.55 (0.81, 2.95)	0.185
GAD (score 10 or more)	1.20 (0.53, 2.75)	0.660
Components of Metabolic Syndrome		
High fasting blood glucose ($\geq$ 100 mg/dL)		
MDD (scores 9 or more)	1.16 (0.67, 2.01)	0.607
GAD (score 10 or more)	1.02 (0.44, 2.31)	0.970
High BP ($\geq$ 130/85 mmHg)		
MDD (scores 9 or more)	1.58 (0.91, 2.73)	0.104
GAD (score 10 or more)	0.87 (0.40, 1.88)	0.718
Elevated WC (men $\geq$ 90 cm; women $\geq$ 80 cm)		
MDD (scores 9 or more)	1.25 (0.70, 2.25)	0.450
GAD (score 10 or more)	1.18 (0.50, 2.80)	0.713
High TG ($\geq$ 150 mg/dL)		
MDD (scores 9 or more)	1.03 (0.56, 1.89)	0.934
GAD (score 10 or more)	1.84 (0.80, 4.23)	0.151
Low HDL-C (men < 40 mg/dL; women < 50 mg/dL)		
MDD (scores 9 or more)	1.20 (0.68, 2.11)	0.539
GAD (score 10 or more)	0.79 (0.32, 1.94)	0.608

Abbreviations: BP, blood pressure; GAD, generalized anxiety disorder; HDL-C, high density lipoprotein-cholesterol; MDD, major depressive disorder; TG, triglycerides; WC, waist circumference.

Table 3. Predictors of the Number of Metabolic Syndrome Factors

Predictor Variable	B	(95% CI)	P Value
MDD (scores 9 or more)	0.03	(-0.02, 0.07)	0.275
GAD (score 10 or more)	-0.17	(-0.73, 0.40)	0.568
Age	-0.002	(-0.02, 0.02)	0.844
Educational level (high)	-0.29	(-0.54, -0.03)	0.028
Current smoker	0.10	(-0.41, 0.60)	0.712
Hazardous or harmful drinker	-0.22	(-0.53, 0.20)	0.302

Abbreviations: GAD, generalized anxiety disorder; MDD, major depressive disorder.

Footnotes

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