



Research paper

An association of health behaviors with depression and metabolic risks: Data from 2007 to 2014 U.S. National Health and Nutrition Examination Survey



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ABSTRACT

Background: Both depression and metabolic syndrome (MetS) confer an increased risk of developing type 2 diabetes (T2D) and cardiovascular disease. Accumulating evidence suggests healthy behaviors are crucial to maintain, improve and manage chronic disease and mental health; and unhealthy diet and sedentary behavior were found two major risk factors of MetS. The objective of this study was to investigate whether health behaviors (alcohol consumption, smoking, diet and recreational physical activity) are associated with depression and metabolic syndrome simultaneously.

Methods: This study included 1300 participants aged 20 years and over who had answered mental health-depression screener questions (PHQ-9) and finished examinations and laboratory tests related to five risk factors of MetS during the U.S. National Health and Nutrition Examination Survey (NHANES) 2007–2014. A set of series of weighted logistic regression models were used to investigate the aforementioned relationship.

Results: The prevalence of depression among U.S. adults is 15.08%. The two most often reported depression symptoms were “Trouble sleeping or sleeping too much” and “Feeling tired or having little energy”, with rates of 14.68% and 13.09%, respectively. Participants who engaged in only light physical activity were more likely to have been identified as experiencing depression and MetS than those who engaged in vigorous physical activity with odd ratios 3.18 (95% CI: 1.59, 6.37) and 3.50 (95%CI: 2.17, 5.63), respectively. Individuals in the study having poor diets were more likely to suffer from depression than those eating good diets (OR = 2.17, 95%CI: 1.47, 3.22).

Conclusion: Physical activity is strongly and inversely associated with depression and MetS. Diet is significantly associated with depression rather than MetS in this study.

1. Introduction

Depression and Metabolic Syndrome (MetS) are diseases of major public health concerns in the U.S. Depression is the most common, recurrent and incapacitating psychiatric illness associated with high rates of morbidity and mortality affecting adults (Van Dooren et al., 2012; Rosengren et al., 2004; Nabi et al., 2013). In 2014, about 6.6% of all U.S. adults, an estimated 15.7 million people, aged 18 and older had experienced at least one major depressive episode in the past year (CBHSQ, 2015). MetS, on the other hand, is a cluster of metabolic pathologies such as central obesity, hyperglycemia, dyslipidemia and hypertension (IDF, 2006). The overall prevalence of MetS from the period of 2011–2012 was 34.7% (Aguilar et al., 2015).

Both depression and metabolic syndrome (MetS) are risk factors for

type 2 diabetes mellitus (T2DM) and cardiovascular disease with current evidence indicating a bi-directional association between them (Rosengren et al., 2004). In a meta-analysis, individuals diagnosed with depression had a 1.5 times higher odds of developing MetS compared to matched general population controls. Conversely, a meta-analysis of cohort studies found a 49% increase in the odds of depression among those with MetS (Vancampfort et al., 2014). Physiological studies propose that the interaction of some central neurotransmitters and inflammatory mediators leads to metabolic syndrome in depression (Nabi et al., 2013; Rotella and Mannucci, 2013).

Behavioral risk factors may modify this observed duplex relationship, which includes the increased likelihood of poor diet, low physical activity levels and poor sleep habits among depressed individuals. These could in turn trigger the development of MetS, or a sedentary

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lifestyle and negative self-perception due to obesity linked to an increased risk of depression (Singh et al., 2012).

Pathways for the relationship between behavioral risk factors with depression and MetS have been proposed. Diet and exercise regulate important biological processes, such as inflammation, oxidative stress, the stress response, brain plasticity and function and mitochondria performance, which are related to mood disorders (Berk et al., 2011; Berk and Jacka, 2012; Lopresti et al., 2013). As a result, obesity resulting from poor diet and a sedentary lifestyle is associated with an increased risk of type 2 diabetes, high blood pressure, high total cholesterol, LDL cholesterol and triglyceride levels and lower HDL cholesterol levels (Singh et al., 2012). Current evidence indicates the beneficial effects of physical activity on the features of metabolic syndrome and depression (Rimer, 2012).

Regarding other behavioral risk factors like alcohol and smoking, it has been suggested that high levels of alcohol use release an increased amount of rebound glutamate from brain synapses that when combined with dysregulated monoamine and neuroendocrine pathways may trigger dysphoria (Clapp et al., 2008). Also, very high levels of alcohol consumption have been linked to hypertension (Stranges et al., 2004). Elevated levels of cortisol in smokers and the inhibitory effect of tobacco smoke on monoamine oxidase is indicative of increased risk of depression (Badrick et al., 2007). The negative impact of smoking on lipoprotein metabolism, endothelial function and insulin resistance has been attributed to the increased risk of metabolic disorders in smokers (Kong et al., 2001).

These associations may imply that the risk of T2DM and cardiovascular disease, prevalent in those with MetS and/or depression, can potentially be decreased by addressing behavioral risk factors. Prior research on this topic focused mainly on the effects of single behavioral risk factors on the risk of depression or MetS (Lai et al., 2014). However, in real life, individuals may engage in various risk behaviors at the same time or at different periods in their lives. Therefore, the more comprehensive approach taken here analyzes the impact of multiple behavioral risk factors on the development of depression and MetS. The purpose of this study is to determine the impact of four behavioral factors – alcohol consumption, smoking, physical inactivity and diet – on the risk of depression or MetS. Additionally, the study also examines whether MetS and depression have a common behavioral risk factor.

2. Subjects and methods

2.1. Study population

The data used in this current study was from four biennial NHANES (2007–2014) which aimed to assess the health and nutritional status of Americans. A stratified, multistage, probability sampling was applied to non-institutionalized U.S. population. The data were collected from interviews and physical examinations. This study identified 1300 individuals representing more 56 million US adults aged 20–80 years who had completed interviews related to demographics, mental health-depression screener and health behaviors and physical examinations related to five risk measures of MetS. The National Center for Health Statistics (NCHS) research Ethics Review Board (ERB) approved the study (NCHS IRB/ERB Protocol # 2005-06 (used for 2005–2010) and #2011–2017).

3. Depression assessment

The participants' depression were evaluated in the mobile examination center (MEC) by trained interviewers using the computer assistant personal interviewing system. The Patient Health Questionnaire (PHQ-9) consists of nine symptoms. A 4-point ascending Likert scale 0–3) scored each symptom. Zero means the individual has not suffered the symptom at all over the past two weeks and 3 indicates that the

individual suffered the symptom “nearly every day”. The sum of total scores on the PHQ-9 ranged from 0 to 27. A total score greater than 10 was used to indicate at least moderate depression and this cut-off point had been validated by previous studies with evidence showing a high sensitivity (88%) and specificity (88%) (Kim et al., 2016).

4. Clinical and lab data for metabolic risk factors

MetS was identified with five risk factors: (1) waist circumference: at least 35 in. for women and at least 40 in. for men. (2) Fasting blood glucose at least 100 mg/dL. (3) Serum triglycerides at least 150 mg/dL. (4) Blood pressure at least (SBP/DBP) 130/85 mm Hg. (5) HDL (“good”) cholesterol lower than 40 mg/dL for men or 50 mg/dL for women (Kaur, 2014). MetS is defined as an individual has three or more risk factors. Waist circumferences were read with a standing position after an instruction was given. Body height is measured using a stadiometer with a fixed vertical backboard and adjustable head piece. Body weight were read in kilogram as the participant stood on the center of the digital weight scale platform. Blood pressure was measured up to four times by certified examiners after the participant had rested in a sitting position for 5 min. The average of SBP and DBP were calculated for each individual in this study. More details can be found <http://www.cdc.gov/nchs/nhanes>.

5. Behavioral variables

Four behavioral factors were included in this study: smoking status, alcohol use, physical activity and diet. These factors are widely used to predict other chronic disease including MetS, diabetes and cardiovascular disease (Lopresti et al., 2013; Rimer et al., 2012; Stranges et al., 2004; Badrick et al., 2007). However, few articles used these four factors simultaneously. The smoking has three categories: not at all, smoking every day or some days. Alcohol consumption indicated whether a participant drank more than 12 alcoholic beverages last year. One drink was indicated by a 12 oz. beer, a 5 oz. glass of wine or 1.5 oz. of liquor. Metabolic equivalent of task (MET) measures the intensity level of physical activity and indicates the rate of energy consumption in activity. Physical activity was categorized into three intensity levels – light, moderate and vigorous according to MET score (Liu, 2014). The original self-evaluated diet quality diet is a five level Likert scale and was reclassified as good and poor.

6. Demographics and socioeconomics

Age, gender and race were examined as demographic control variables. Age was categorized into age group ranges of “20 – 39 years old”, “40 – 59 years old” and “60 and older”. Race was classified as Mexican American, other Hispanic, Black, Caucasian, Asian and any other race. Two indicators of socioeconomic status (SES) used were education and family poverty level. Education reflects the completion of highest grade or degree with three categories: < 12 year, 12 year (high school diploma) and > 12 year. Family poverty income ratio (PIR), a ratio of poverty income to the federal poverty threshold considering the size of family and age of its members measured poverty status and was categorized into three groups: poor (PIR < 1), near poor (1 ≤ PIR < 3) and non-poor (PIR ≥ 3).

7. Statistical analysis

First, the weighted prevalence of each symptom of depression was examined. The weighted prevalence of depression and metabolic syndrome within groups of each explanatory variable was assessed. The Rao-Scott test was used to investigate bivariate association between explanatory variables and two outcome variables: depression and MetS. Mean scores of depression and five risk factors of metabolic syndrome were obtained and compared to reference group A Tukey post-hoc test

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