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Original Article

Major depressive disorder and cardiometabolic disease risk among sub-Saharan African adults

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ABSTRACT

Objective: We sought to evaluate the extent to which major depressive disorder (MDD) is associated with cardiometabolic diseases and risk factors.
Methods: This was a cross-sectional epidemiologic study of 1924 employed adults in Ethiopia. Structured interview was used to collect sociodemographic data, behavioral characteristics and MDD symptoms using a validated Patient Health Questionnaire-9 (PHQ-9) depression scale. Fasting blood glucose, insulin, C-reactive protein, and lipid concentrations were measured using standard approaches. Multivariate logistic regression models were fitted to estimate odds ratios (OR) and 95% confidence intervals (95% CI).
Results: A total of 154 participants screened positive for MDD on PHQ-9 (8.0%; 95% CI: 6.7–9.2%). Among women, MDD was associated with more than 4-fold increased odds of diabetes (OR = 4.14; 95% CI: 1.03–16.62). Among men the association was not significant (OR = 1.12; 95% CI: 0.63–1.99). Similarly, MDD was not associated with metabolic syndrome among women (OR = 1.51; 95% CI: 0.69–3.29) and men (OR = 0.61; 95% CI: 0.28–1.34). Lastly, MDD was not associated with increased odds of systemic inflammation.
Conclusion: The results of our study do not provide convincing evidence that MDD is associated with cardiometabolic diseases among Ethiopian adults. Future studies need to evaluate the effect of other psychiatric disorders on cardiometabolic disease risk.

1. Introduction

The global prevalence of cardiometabolic risk such as cardiovascular disease (CVD), diabetes and obesity is increasing at an alarming rate, with the majority of cases occurring in low and middle income countries [1]. A growing body of epidemiologic evidence shows that incidence of cardiometabolic diseases are increasing in sub-Saharan Africa [2–6]. Kearney et al. [7] reported that in the year 2000 an estimated 639 million individuals had hypertension in low and middle income countries and this number is expected to rise to 1.15 billion by 2025. In 2006, 10.8 million sub-Saharan Africans were estimated to have diabetes. This number is expected to rise to 18.7 million by 2025 [8]. The rise in cardiometabolic disease prevalence is driven, in part, by significant changes in dietary habits, physical activity levels, and increased stress as a result of increased urbanization and economic development [1]. An expanding body of evidence now implicates unipolar major depressive disorder (MDD) as one of the major risk factors for and conditions co-occurring with cardiometabolic disease [9–11]. Several studies, primarily conducted in developed countries, have documented associations of MDD with cardiometabolic disease including hypertension, diabetes, metabolic syndrome, myocardial infarction, sudden death, and other cardiac events [12–15]. Some investigators, however, have found no

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significant associations between cardiometabolic disease risk and MDD [16–18]. Reasons for these inconsistent findings are unclear.

Although causal relationships, and biological mechanisms underlying associations of MDD with cardiometabolic diseases have yet to be clearly established, understanding the epidemiological characteristic of these disorders (e.g., assessment of comorbidity) may help inform health promotion and disease control efforts [11]. For example, investigators have reported that individuals with comorbid diabetes and MDD are more likely than individuals with diabetes alone to have poor glycemic control and consequently to have more severe complications and lower quality of life [11,19]. Given the increased burden of cardiometabolic disease risk and the available body of evidence documenting the association between MDD and cardiometabolic disease risk, we sought to evaluate the extent to which MDD is associated with cardiometabolic disease risk factors among an epidemiologically well characterized occupational cohort of bankers and teachers residing in Addis Ababa, Ethiopia.

2. Materials and methods

2.1. Design and participants

This study was conducted in Addis Ababa, Ethiopia, during the months of December 2009 and January 2010. Study participants were permanent employees of the Commercial Bank of Ethiopia and teachers in government and public schools of Addis Ababa. These workplaces were selected based on their high stability of workforce and willingness to participate in the study. Multistage sampling was done by means of probability proportional to size (PPS) sampling [20]. This was performed for both institutions, and all individuals at selected locations were invited to participate. The original study population was comprised of 2207 individuals. Subjects were excluded due to missing anthropometric information ($n = 35$), pregnancy ($n = 21$), and incomplete laboratory measures ($n = 227$), the final analytical sample included 1924 (1165 men and 759 women) participants. Participants who were excluded were similar in sociodemographic and lifestyle characteristics to those who were included in the analysis.

2.2. Data collection and variable specification

Each participant was interviewed by a trained interviewer in accordance with the WHO STEPwise approach for non-communicable diseases surveillance in developing countries [21]. The approach had three levels: (1) questionnaire to ascertain demographic and behavioral characteristics, (2) simple physical measurements, and (3) biochemical tests. Some questions were added to supplement the WHO questionnaire reflect on the local context. Questions were also included regarding behavioral risk factors such as tobacco, alcohol, and khat consumption. Khat is an evergreen plant with amphetamine-like effects commonly used as a mild stimulant for social recreation and to improve work performance in Ethiopia [22,23]. The modified questionnaire was first written in English and then translated into Amharic by experts and was translated back in to English. The questionnaire was pretested before the initiation of the study and contained information regarding socio-demographic characteristics, tobacco and alcohol use, nutritional status, and physical activity. A 5-day training of the contents of the STEPs questionnaire, data collection techniques, and ethical conduct of human research was provided to research interviewers prior to the commencement of the study. Details regarding data collection methods and study procedures have been previously described in detail [5,24].

2.2.1. Cardiometabolic disease risk factors

Blood pressure was digitally measured (Microlife BP A50, Microlife AG, Switzerland) after individuals had been resting for 5 min. Two additional blood pressure measurements were taken with 3 min elapsing between successive measurements. In accordance with the WHO recommendation the mean systolic and diastolic BP from the second and third measurements were considered for analyses. For the collection of blood samples, individuals were advised to skip meals for 12 h. Blood samples of 12 mL were obtained, using proper sanitation and infection prevention techniques. The collected aliquots of blood were used to determine participants' fasting blood glucose (FBG) concentrations and lipid profiles. Serum was used for the measurement of triglycerides (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), glucose concentrations, insulin and C-reactive protein (CRP). These were measured at the International Clinical Laboratory (ICL) in Addis Ababa, Ethiopia. ICL is the only clinical laboratory in East Africa accredited by the Joint Commission International (JCI) of USA. TG concentrations were determined by standardized enzymatic procedures using glycerol phosphate oxidase assay. HDL-C was measured using the Ultra HDL assay which is a homogeneous method for directly measuring HDL-C concentrations in serum or plasma without the need for off-line pretreatment or centrifugation steps. Participants' FBG was determined using the standardized glucose oxidase method. Serum CRP concentrations were measured by an ultrasensitive competitive immunoassays. All laboratory assays were completed without knowledge of participants' medical history. Lipid, lipoprotein and FBG concentrations were reported as mg/dL and CRP as mg/L.

Height and weight were measured with participants wearing light clothing and no shoes [21]. Waist circumference measurements were performed with a fixed tension tape, at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. This was done in a private place over light clothing. Hip circumference measurements were conducted in a similar manner, at the point of the maximum circumference of the buttocks.

2.2.2. Analytical variable specification

2.2.2.1. Metabolic syndrome. We defined abdominal obesity using the International Diabetes Federation (IDF) criteria [25] where those having a waist circumference of $\geq$94 cm for men and $\geq$80 cm for women. Low HDL-C was defined to be $<$40 mg/dL in men and $<$50 mg/dL in women. We defined elevated blood pressure as having systolic blood pressure (SBP) of $\geq$135 mmHg or a diastolic blood pressure (DBP) $\geq$85 mmHg. Impaired fasting glucose was defined to be $\geq$100 mg/dL (5.6 mmol/L) or with a previous history of diabetes. Elevated TG was defined as $\geq$150 mg/dL. Metabolic syndrome was defined in accordance with the IDF as presence of abdominal obesity and presence of two or more metabolic syndrome components described above [25].

According to the definitions of the American Heart Association and the National Cholesterol Education Program [26] we grouped fasting blood glucose in to normal ($<$100 mg/dL), impaired fasting glucose (100–125 mg/dL), and diabetes ($\geq$126 mg/dL or a previous history of diabetes or currently on medication). LDL concentrations were classified as: optimal ($<$100 mg/dL); near or above optimal (100–129 mg/dL); and high ($\geq$130 mg/dL). Total cholesterol concentrations were classified as: desirable ($<$200 mg/dL), borderline high (200–239 mg/dL), and high ($\geq$240 mg/dL). HDL concentrations levels were grouped as: low ($<$40 mg/dL), normal, (40–59 mg/dL), and high ($\geq$60 mg/dL). We grouped triglyceride concentrations as desirable ($<$200 mg/dL), borderline high (200–239 mg/dL), and high ($\geq$240 mg/dL).