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The Influence of Sociodemographic Characteristics, Lifestyle, and Metabolic Syndrome on Anxiety and Depression Symptoms in Adults in Banja Luka

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Abstract

Objective. This study aimed to explore the influence of sociodemographic characteristics and lifestyle on the occurrence of anxiety and depression, and the interrelationship between metabolic syndrome (MS) and anxiety and depression. **Methods.** A total of 685 adults were divided into two groups (with and without MS) using the International Diabetes Federation's definition of MS. In both groups, we used the Beck Inventory for Anxiety and Depression. The influence of sociodemographic and other characteristics on the occurrence of MS, anxiety, and depression was observed. The multivariate logistic regression model was appropriate for determining which variables (especially anxiety and depression) affected the presence of MS in the participants. **Results.** MS was observed in 37.5% of participants. Women with mild and severe anxiety were statistically significantly more represented in the group with MS than in the group without MS (26.2% : 12.0%, P=0.001; 16.7% : 4.8%, P=<0.001), as well as women with severe depression (6.3% : 1.9%, P=0.038), while there was no significant difference in men. Sociodemographic characteristics such as female gender, older age, employment status (retirees and homemakers), lower level of education, marital status (divorced and widowed), and more children affected the occurrence of anxiety and depression in participants. Physical inactivity during leisure time, high-risk drinking, and a higher level of cardiovascular risk showed significant influence on the presence of anxiety and depression, while smoking was inversely associated with the presence of depression but not with anxiety. **Conclusion.** The association between MS and anxiety and depression was confirmed. Women with MS were at a higher risk of anxiety and depression symptoms, whereas this was not confirmed in men.

Key Words: Metabolic Syndrome ▪ Anxiety ▪ Depression.

Introduction

The metabolic syndrome (MS) is a pathological condition that includes a collection of biological factors: abdominal obesity, dyslipidaemia, hypertension, and high blood sugar (1). The most common definitions of MS in research and diagnosis are those of the Third Report of the National Cholesterol Education Program (NCEP ATP III), the International Diabetes Federation (IDF) (2), and the World Health Organization (WHO) (1). The main difference between these definitions concerns central obesity values, an obligatory component of the IDF definition, which has a lower borderline value than the National Heart, Lung and Blood Institute and the American Heart Association definitions. The IDF recommended borderline waist circumference values based on sex and ethnic characteristics using numerous studies as data sources (2).

MS incidence is usually associated with obesity and diabetes mellitus type 2 (T2DM). According to data from the Centers for Disease Control and Prevention (CDC) published in 2018, 12.2% of adults in the United States of America (USA) had T2DM, of which a quarter were unaware of their disease. The prevalence of prediabetes or MS is three times higher (3, 4). Global obesity research conducted in 2015 in 195 countries revealed that 604 million adults and 108 million children suffer from obesity (5).

According to the results of longitudinal studies, people with MS are more likely to suffer from psychological diseases, such as depression (6). The connection between MS and anxiety and depression has specific sex-related characteristics (7). The occurrence of depression and MS was observed in a cross-sectional study conducted from 2000 to 2008 on 5125 relatively healthy women and men during preventive exams at the Cooper Center (Dallas, Texas, USA). Women and men with symptoms of depression had statistically higher MS prevalence compared to those without symptoms of depression (women, 15.4% vs. 7.2%; men, 31.6% vs. 22.8%) (8). However, the direction of causality between MS and depression remains unclear, or it could be said to be bidirectional. Akbaraly et al. evaluated MS (NCEP ATP III criteria) in middle-aged British clerks. They established that of the MS components, central obesity, high triglyceride levels, and low HDL cholesterol levels were associated with symptoms of depression (9). Depression was followed by decreased physical activity and irregular dietary habits, which are risk factors for MS. Although this association has been the subject of previous studies (10-12), little is known about the factors that contribute to the development of depression and anxiety in people with MS.

This study aimed to explore the influence of sociodemographic characteristics and lifestyle on the presence of anxiety and depression in the adult population of Banja Luka, Bosnia and Herzegovina, and the interrelationship between MS and anxiety and depression.

Methods

Study Participants

This longitudinal study was conducted from 1 October to 31 December 2012, in the region of Banja Luka, the second-largest city in Bosnia and Herzegovina. Before drawing a sample, the principal investigator defined the population. At the time of the survey, Banja Luka had 142,116 inhabitants older than 18 years of age. A list of inhabitants was obtained from the Primary Healthcare Centre Patients' Registry and used as a sampling framework. Each registered patient was assigned a unique number. Computer-generated random numbers were used to select a simple random sample. Age, gender, and geographic location were included in the sampling; however, occupation, religion, and ethnicity were not included. The Department of Informatics followed a normal distribution for the bound and confidence interval to provide correct coverage of the general population. A systematic and proportional sample of 700 individuals was selected. A list of study participants was created, containing the patient's name, demographic characteristics, family practice registration number, and family physician's name.

Invitation letters were sent to 103 family physicians whose patients were randomly selected to participate in this study. The letters described the purpose of the study in detail. After signed consents were obtained, the principal investigator provided the list of designated patients. Physicians contacted patients by telephone, informed them about the objectives of the study, and asked for enrolment permission.

The study was conducted according to the guidelines established by the Declaration of Helsinki, and the Ethical Committee of the Primary Healthcare Centre approved all procedures and measurements. All study participants provided signed informed consent.

Procedure

Definition of the Metabolic Syndrome

The metabolic syndrome was defined according to the IDF definition (2). According to this definition, the obligatory component for MS diagnosis is central obesity. The borderline value for central obesity in Europeans is ≥94 cm for men and ≥80 cm for women. To diagnose MS, in addition to this obligatory component, at least two of the following factors should be present:

- Blood pressure ≥130/80 mmHg or a previous diagnosis of hypertension (use of antihypertensive drugs),
- Triglycerides ≥1.7 mmol/l or previously treated hypertriglyceridemia,
- HDL cholesterol <1.03 mmol/l for men and <1.29 mmol/l for women, or already treated lipid disorder of this type, and
- Morning fasting glycemia ≥5.6 mmol/l or previously diagnosed type 2 diabetes.

A sociodemographic questionnaire was designed to collect personal data about the patients: age, gender, level of education (no schooling, incomplete primary or primary education, secondary school, post-secondary and university education), employment status (employed, self-employed, retirees, homemakers, students, unemployed), marital status (married, informal marriage, unmarried, divorced, widowed), and information on the number of children (one, two, and three or more children). The classification of education was made in accordance with the educational categories and levels of the International Standard Classification of Education – ISCED 97 (13). The occupational classification used for this study is the standard occupational classification established by the Republic Institute of Statistics, according to the principles and system of the International Standard Occupational Classification (14). The data were published elsewhere (15).

Clinical Measurements

Blood Pressure Measurements

Blood pressure was measured according to international standards using a calibrated mercury sphygmomanometer. Blood pressure was measured three times consecutively with a one-minute interval between measurements (to redistribute blood in the upper arm). The mean value of the second and third measurements was used as the final blood pressure value (16, 17).

Anthropometric Measurements

The anthropometric measurements performed during this study included body weight, body height, and waist circumference. To measure body weight, regularly calibrated „GIMA" scales with a balanced scale were used in the following manner. The reading values were expressed in kg. Height was measured using a measuring stick. The reading values were expressed in cm. Waist circumference was measured using a flexible non-elastic measuring tape (meter). The reading value in the mean axillary line, at breathing out, expressed in cm, was entered into the questionnaire (18).

Laboratory Analysis

For this study, laboratory analyses (blood glucose [BG] and lipid status) were performed at the biochemical laboratory of the Primary Healthcare Centre in Banja Luka. Venous blood was extracted in the morning during fasting, after 12 to 14 h of non-food consumption. Biochemical analysis of BG and lipid status was performed using the Cobas Integra 400 + ISE analyser (Roche Diagnostics). Blood glucose levels were determined using UV photometry with the hexokinase enzyme. Total cholesterol was determined using automatic photometry with cholesterol oxidase. Triglycerides were measured using photometry with glycerol oxidase, HDL was determined using a homogenous enzymatic method with polyethylene glycol (PEG), and LDL was calculated mathematically.

Depression Symptoms

Depression symptoms were evaluated using the Beck Depression Inventory (BDI–II). In its current version, the BDI-II is designed for individuals aged 13 and older, and is composed of items relating to symptoms of depression, such as hopelessness and irritability; cognitions, such as guilt or feelings of being punished; and physical symptoms, such as fatigue, weight loss, and lack of interest in sex. The BDI–II contains 21 items. Each item comprises four statements based on the intensity of a particular depression symptom, which is scored from 0 to 3. Participants chose the answer that best described their condition or how they felt during the last two weeks, including the day they completed the questionnaire. The maximum number of points is 63. According to the score, the grade of depression in participants was determined as follows: 0–13, minimal depression; 14–19, mild depression; 20-28, moderate depression; and 29-30, severe depression (19). Cronbach's alpha coefficient of 0.893 for the BDI-II was found to be adequate.

Anxiety Symptoms

The Beck Anxiety Inventory (BAI) was used to assess anxiety symptoms. BAI contains 21 items. Each item is a simple description of anxiety symptoms and covers one of the following four aspects: subjective, neurophysiological, autonomic, and panic. Participants report the extent to which the symptoms of each of the 21 items manifested during the past month, including on the day of completing the questionnaire. Each item (symptom) has four possible answers: no (I have no feeling); mild (I feel it, but it does not bother me); moderately heavy (It was very hard, but I could handle it); and severe (It bothers me a lot, I could hardly bear it). Answers are rated: no=0; mild=1; moderately heavy=2; severe=3. The values for each item are aggregated, and the total sum ranges from 0 to 63. Scores of 0–7, 8–15, 16–25, and 26–63 are interpreted as minimum, mild, moderate, and severe anxiety, respectively (20). Cronbach's coefficient was 0.915.

Covariables

The following covariables (lifestyle of the respondents) were selected for the study: degree of leisure-time physical activity and degree of physical workload, smoking status, nutritional habits, estimated alcohol consumption, and degree of ten-year fatal cardiovascular risk. The researcher filled out this form for each participant individually based on the questionnaire data using the appropriate definitions, formulas, and scores. According to the WHO recommendations for leisure-time physical activity, participants were divided into active, moderately active, and inactive (21). The assessment of physical activity was performed based on the answer to the question: "How often, in your leisure time, do you engage in physical activities for at least 30 minutes, so that you get out of breath or sweat at least a little?" The participants answered one of the 7 answers offered. Participants were categorized into the active group if they were physically active four or more times per week. Participants were categorized into the moderately active group if they were physically active less than four times a week, but at least 2-3 times a month. Participants were categorized into the inactive group if they were physically active several times a year or not physically active at all.

In accordance with the WHO recommendations (21), the assessment of physical activity at work was performed based on the answer to the question: "How strenuous is the work you do?". Three answers were offered: 1. mostly sitting; 2. mostly standing, but not carrying a load, not walking much, not climbing stairs, and/or lifting loads; 3. hard physical work, lifting, and/or bearing of heavy loads. Based on their answers, the participants were divided into three groups: 1. they work in a sedentary job; 2. work moderately heavily; and 3. do hard physical work. In accordance with the recommendations from the "Program for the Prevention and Control of Non-Communicable Diseases in the Republic of Srpska" (18), the questionnaire included a question on smoking status with three possible answers: smoker, ex-smoker, and non-smoker. Based on their answers, the participants were classified into one of the three categories. The association between nutritional status and MS in our participants was estimated based on questions related to the regularity of eating meals. According to current recommendations, daily energy requirements should be divided into three main meals and two snacks (22). The number of meals per day the respondents ate was determined with the question: "How many times a week: 1. Do you have breakfast; 2. Have a snack before noon; 3. Have lunch; 4. Have a snack in the afternoon, and 5. Have dinner?". The possible answers for each meal were: never, sometimes, or every day. The American guidelines (23) were used for alcohol consumption, according to which participants were divided into non-drinkers, moderate-risk drinkers (the total number of standard drinks consumed weekly for women <7, and <14 for men), and high-risk drinkers (the total number of standard drinks consumed weekly for women ≥7, and for men ≥14) (abstinence, moderate-risk drinking, high-risk drinking). The social background of the participants was determined by surveying their age, gender, occupation, educational level, marital status, employment status, and number of children. Education was classified according to the educational categories and levels of the International Standard Classification of Education – ISCED 97 (24). For each participant, fatal cardiovascular (CV) risk was determined for the next 10 years using the European electronic version of Heart Score charts and the following participant data: month and year of birth (age), sex, smoking status, systolic blood pressure, and total cholesterol. After the values were obtained in percentages, the participants were classified into one of four groups of CV risk: very high CV risk (≥10%), high CV risk (≥5%-10%), moderate CV risk (1-5%), and low CV risk (<1%) (25).

Ethics Statement

The Ethics Committee of the Banja Luka Health Centre approved this study (No. 01-1819-1).

Statistical Analysis

Participants were sorted into two groups based on the presence of MS: an MS group and a control group of participants without MS. The presence and degree of depression and anxiety were observed in both groups. The association between depression and anxiety with MS was determined based on the difference in the degree of their presence in the observed groups. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20 (IBM Corp., Armonk, NY, USA). The chi-square test of independence was used to investigate whether there was a statistically significant association between two categorical variables. P-values smaller than 0.05 were considered significant. Cramer's V test was included as an additional test to assess the significance of the differences and their strength. Cramer's V test values were interpreted as follows: V=0, there is no relationship between the variables; V=1, there is a complete connection of variables; V<0.25, there is a weak connection between the variables; V>0.75, there is a strong relationship between the variables; and 0.25<V<0.75, there is a significant relationship between the variables. Fisher's exact test was used to check the results obtained by Pearson's chi-square test.

The analysis of MS predictors aimed to extract the participants' characteristics that significantly affected the occurrence of MS. As binary logistic regression is used for this purpose, it is first necessary to define a binary variable that will categorize the participants into two groups:

- Participants with MS (binary variable with a value of 1) and
- Participants without MS (binary variable with a value of 2).

The defined variables were dependent variables in the logistic regression models. The analysis was organized into two stages. The first stage involved the implementation of a series of univariate logistic regressions (one independent variable and one dependent variable in the model) that aimed to extract the participants' individual characteristics that were significant in the univariate models. The second stage relates to the implementation of the multivariate logistic regressions (several independent variables and one dependent variable), which includes only those characteristics of participants in the model that have been proven significant in the univariate models. The choice of variables used in the multivariate model was determined by the significance level (P<0.1) in the univariate logistic regression or the significance of the univariate model itself. All other variables that are not presented in the table were not significant in the univariate model, the univariate model was not significant, or there was already a variable in the multivariate model that was collinear with the variable that was observed.

Results

The questionnaire was completed by 685 participants (response rate=97.85%), of whom 348 (50.8%) were men and 337 (49.2%) were women. The average age of the participants was 48.77±17.888 years. Most participants were employees (41.7%) and retirees (26.30%). The most frequent categories of occupation among the employees were service workers and traders (25.6%). The most frequent level of education was secondary school (58.1%). According to marital status, most participants were married (60.1%).

Anxiety and Sociodemographic Characteristics of Respondents

According to the BAI, out of 679 participants who completed this scale, 400 had no symptoms of anxiety or their symptoms were minimal, making up 58.9% of the sample. As shown in Figure 1, anxiety symptoms were statistically significantly more prevalent in women than in men (P<0.001). Cramer's V test confirmed (Table 1) a significant relationship between anxiety and gender (V=0.297).

Pearson's chi-square test revealed that anxiety symptoms were statistically significantly more common with increasing age, statistically significantly less common in employees than in retirees, homemakers, and the unemployed, and statistically significantly decreased with an increase in the level of education. Furthermore, anxiety symptoms were significantly more prevalent among parents with many children and among divorced persons than among other marital status categories. However, Cramer's V test showed a weak relationship between these variables.

Anxiety and Lifestyle

Table 1 shows that anxiety symptoms statistically significantly increased with decreasing leisure-time physical activity (P<0.001). Severe anxiety symptoms were statistically significantly more common in participants who drank alcohol moderately or at high risk than in those who did not drink (P<0.001). However, in both cases, Cramer's V test showed a weak relationship between the variables (V=0.132). Cardiovascular risk was associated with

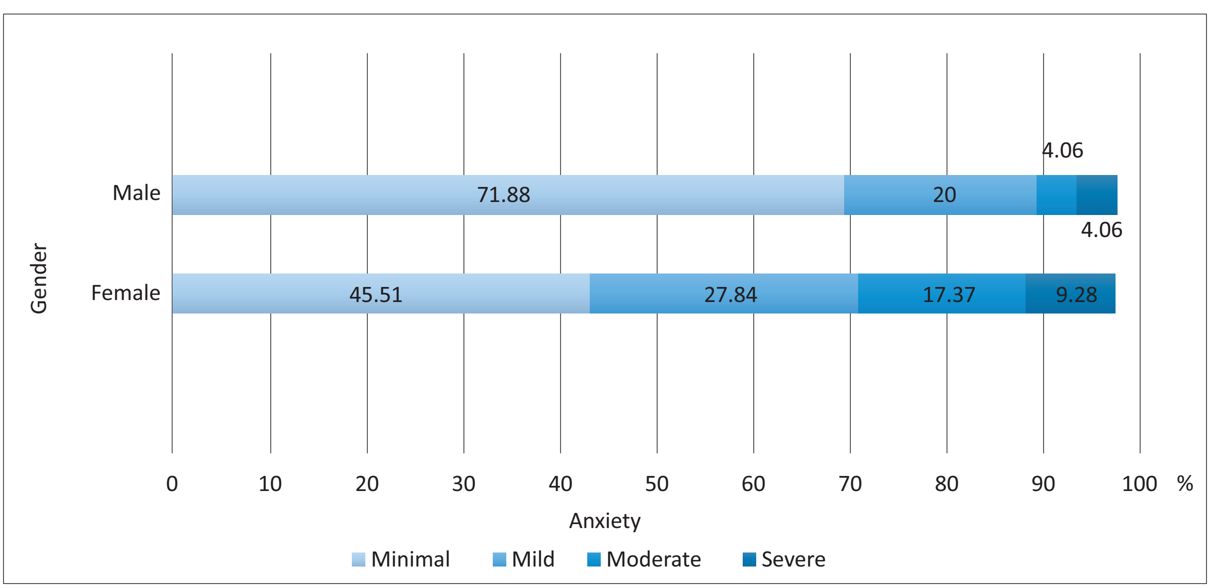

Figure 1. The presence of anxiety depending on gender.

Table 1. The Correlation Between Anxiety Levels and Sociodemographic Characteristics and Lifestyle

Sociodemographic characteristics	Anxiety N (%)				Pearson's chi-square† P	Cramer's V
	Minimal (0 – 7)*	Mild (8 – 15)*	Moderate (16 – 25)*	Severe (26 – 63)*		
Gender						
Male	248 (71.88)	69 (20)	14 (4.06)	14 (4.06)	59.744 <0.001	0.297
Female	152 (45.51)	93 (27.84)	58 (17.37)	31 (9.28)		
Age						
18-29	84 (68.85)	29 (23.77)	7 (5.74)	2 (1.64)	68.662 <0.001	0.184
30-39	98 (42.42)	26 (11.26)	7 (3.03)	2 (0.87)		
40-49	66 (68.75)	17 (17.71)	9 (9.38)	4 (4.17)		
50-59	73 (55.73)	33 (25.19)	16 (12.21)	9 (6.87)		
60-69	44 (44.44)	26 (26.26)	16 (16.16)	13(13.13)		
70+	35 (35.71)	31 (31.63)	17 (17.35)	15 (15.31)		
Employment status						
Employed	187 (66.55)	63 (22.42)	23 (8.19)	8 (2.85)	69.404 < 0.001	0.185
Self-employed	9 (50.00)	7 (38.89)	2 (11.11)	0 (0)		
Retired	80 (44.94)	47 (26.40)	28 (15.73)	23(12.92)		
Homemaker	14 (30.43)	14 (30.43)	10 (21.74)	8 (17.39)		
Student	43 (70.63)	9 (16.67)	1 (1.85)	1 (1.85)		
Unemployed	63 (64.29)	22 (22.45)	8 (8.16)	5 (5.10)		
Level of education						
No schooling	8 (29.63)	5 (18.52)	4 (14.81)	10(37.04)	69.404 <0.001	0.184
Incomplete primary or elementary education	3 (13.04)	10 (43.48)	5 (21.74)	5 (21.74)		
Secondary school	31 (46.27)	15 (22.39)	15 (22.39)	6 (9)		
Post-secondary and university education	238 (61.34)	99 (25.52)	33 (8.51)	18 (4.64)		
Marital status						
Married	243 (60.00)	96 (23.70)	41 (10.12)	25 (6.17)	55.521 <0.001	0.166
Informal marriage	6 (54.55)	1 (9.09)	4 (36.36)	0		
Unmarried	113 (11.30)	32 (20.38)	8 (5.10)	4 (2.55)		
Divorced	9 (42.86)	8 (38.10)	3 (14.29)	1 (4.76)		
Widowed	27 (33.33)	25 (30.86)	15 (18.52)	14 (17.28)		
Number of children						
No children	134 (67)	44 (22)	14 (7)	8 (4)	28.965 0.004	0.120
1 child	62 (60.19)	27 (26.21)	12 (11.65)	2 (1.94)		
2 children	157 (72.02)	73 (33.49)	39 (17.89)	22(10.09)		
3 or more children	33 (55.93)	14 (23.73)	3 (5.08)	9 (15.25)		
Covariables (lifestyle)						
Number of meals per day						
One	7 (63.63)	3 (27.27)	0	1 (9.09)	8.356 0.757	0.064
Two	42 (59.15)	16 (22.54)	7 (9.86)	6 (8.45)		
Three	159 (55.02)	78 (26.99)	34 (11.76)	18 (6.23)		
Four	149 (63.34)	50 (20.92)	22 (2.21)	18 (7.53)		
Five	43 (62.32)	15 (21.74)	9 (13.04)	2 (2.90)		

Continuation of Table 1.

Sociodemographic characteristics	Anxiety N (%) Minimal (0 – 7)*	Mild (8 – 15)*	Moderate (16 – 25)*	Severe (26 – 63)*	Pearson's chi-square† P	Cramer's V
Leisure-time physical activity						
Active	136 (64.15)	43 (20.28)	24 (11.32)	9 (4.25)	36.544 <0.001	0.165
Moderately active	203 (62.65)	77 (23.77)	31 (9.57)	13 (4.01)		
Inactive	57 (42.22)	41 (30.37)	15 (11.11)	22 (16.30)		
Physical workload (employed and self-employed)						
Sedentary work	104 (61.18)	41 (24.12)	16 (7.06)	9 (5.29)	5.309 0.505	0.082
Moderately hard work	124 (64.25)	49 (25.39)	14 (7.25)	6 (3.11)		
Hard work	20 (71.43)	3 (10.71)	4 (14.29)	1 (3.57)		
Smoking status						
Smoker	107 (62.57)	38 (22.22)	19 (11.11)	7 (4.10)	4.582 0.598	0.058
Ex-smoker	57 (61.29)	21 (22.58)	7 (7.53)	8 (8.60)		
Non-smoker	236 (56.87)	103 (24.82)	46 (11.08)	30 (0.72)		
Alcohol consumption						
High risk	40 (68.97)	8 (13.79)	5 (8.62)	5 (8.62)	35.451 <0.001	0.132
Moderate risk	297 (63.60)	108 (23.13)	42 (8.99)	20 (8.43)		
Abstinence	62 (62.00)	44 (1.91)	24 (18.46)	19 (4.07)		
Cardiovascular risk						
Very high	63 (39.87)	50 (31.65)	25 (15.82)	20 (12.66)	5.4473 <0.001	0.164
High	64 (55.17)	23 (19.87)	15 (12.93)	14 (12.07)		
Moderate	186 (70.45)	54 (20.45)	17 (6.44)	7 (2.65)		
Low	87 (61.70)	35 (24.82)	15 (10.64)	4 (2.84)		

*Points; †Pearson's chi-square test results were confirmed using Fisher's exact test.

anxiety (P<0.001). The prevalence of severe anxiety symptoms increased with an increase in cardiovascular risk (2.84%, 2.65%, 12.07%, and 12.66%). Cramer's V test revealed a weak relationship between the variables (V=0.164).

Depression and Sociodemographic Characteristics of Respondents

The results of the study revealed that of the 682 participants who completed the BDI-II, 558 (81.8%) had no or minimal symptoms of depression. Figure 2 shows that the presence of depressive symptoms was statistically significantly reduced with increasing educational level (P<0.001). Cramer's V test confirmed (Table 2) the significant relationship between the mentioned variables (V=0.252).

The results showed (Pearson's chi-square) a statistically significantly higher presence of depressive symptoms in women than in men, retirees and homemakers than in other groups of work status, and widows compared to other groups of marital status. Symptoms were statistically significantly more prevalent in parents with a larger number of children and increased with age. However, Cramer's V test showed a weak relationship between these variables and depression.

Depression and Lifestyle

The results obtained by Pearson's chi-square test, presented in Table 2, show a statistically significant association between leisure-time physical activity and the prevalence of depressive symptoms

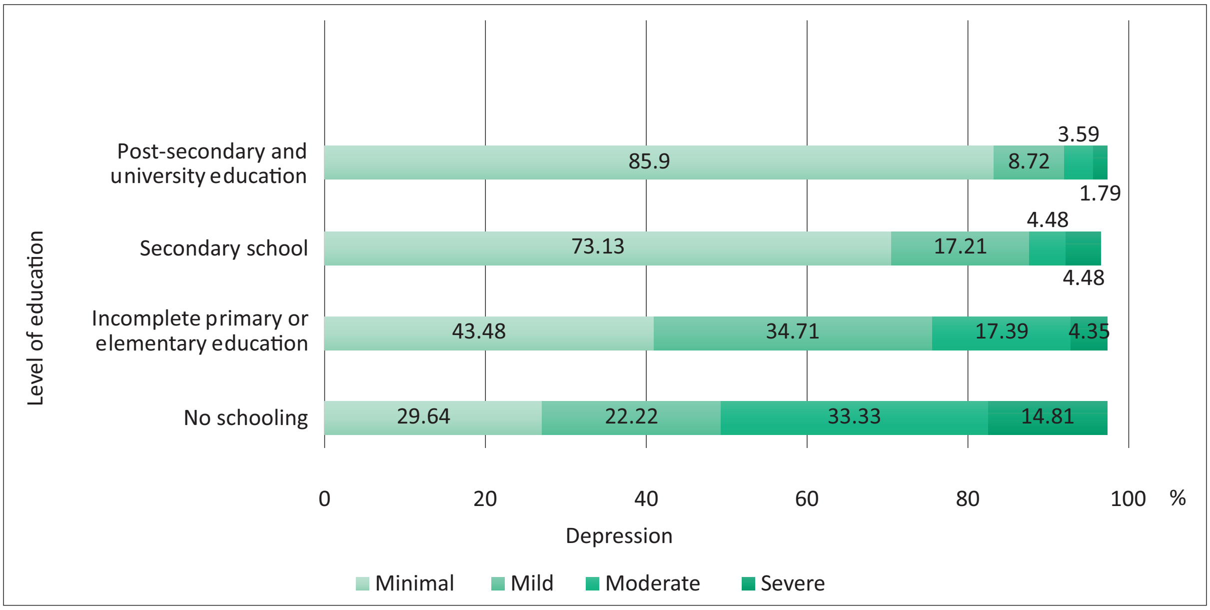

Figure 2. The presence of depression depending on the level of education.

Table 2. The Correlation Between Depression Levels and Sociodemographic Characteristics and Lifestyle

Sociodemographic characteristics	Depression N (%)				Pearson's chi-square[†] P	Cramer's V
	Minimal (0 – 13)[*]	Mild (14 –19)[*]	Moderate (20 – 28)[*]	Severe (29 –63)[*]		
Gender						
Male	304 (87.86)	30 (8.67)	9 (2.60)	3 (0.87)	19.925 <0.001	0.171
Female	254 (75.60)	46 (13.69)	24 (7.14)	12 (3.57)		
Age						
18-29	114 (92.68)	7 (5.69)	2 (1.63)	0	96.801 <0.001	0.218
30-39	123 (92.48)	8 (6.02)	1(0.75)	1(0.75)		
40-49	87 (90.63)	5 (5.21)	2 (2.08)	2 (2.08)		
50-59	109 (82.58)	15 (11.36)	7 (5.30)	1 (0.76)		
60-69	74 (74.00)	16 (16.00)	5 (5.00)	5 (5.00)		
70+	51 (52.04)	25 (25.51)	16 (16.33)	6 (6.25)		
Employment status						
Employed	258 (91.17)	22 (7.77)	0	3 (1.06)	109.256 <0.001	0.23
Self-employed	15 (83.33)	2 (11.11)	1 (5.56)	0		
Retired	116 (64.80)	37 (20.67)	18 (10.06)	8 (4.47)		
Homemaker	28 (60.87)	8 (17.39)	8 (17.39)	2 (4.35)		
Student	52 (89.66)	0	2 (3.45)	0		
Unemployed	86 (87.76)	7 (7.14)	4 (4.08)	1 (1.02)		
Unable to work	1 (50.00)	0	0	1 (50.00)		
Level of education						
No schooling	8 (29.64)	6 (22.22)	9 (33.33)	4 (14.81)	128.229 <0.001	0.252
Incomplete primary or elementary education	10 (43.48)	8 (34.78)	4(17.39)	1 (4.35)		
Secondary school	49 (73.13)	12 (17.21)	3 (4.48)	3 (4.48)		
Post-secondary and university education	335 (85.90)	34 (8.72)	14 (3.59)	7 (1.79)		

Continuation of Table 2.

Sociodemographic characteristics	Depression N (%) Minimal (0 – 13)*	Mild (14 –19)*	Moderate (20 – 28)*	Severe (29 –63)*	Pearson's chi-square† P	Cramer's V
Marital status						
Married	343 (84.28)	41 (10.07)	16 (3.93)	7 (1.72)	55.628 <0.001	0.165
Informal marriage	10 (9.09)	0	1 (9.09)	0		
Unmarried	139 (87.97)	15 (9.49)	2 (1.27)	2 (1.27)		
Divorced	19 (90.48)	1 (4.76)	0	1 (4.76)		
Widowed	45 (55.56)	18 (22.22)	13 (16.05)	5 (6.17)		
Number of children						
No children	179 (89.50)	15 (7.50)	3 (1.50)	3 (1.50)	39.452 <0.001	0.139
1 child	89 (86.41)	8 (7.77)	5 (4.85)	1 (0.97)		
2 children	230 (78.50)	39 (13.31)	16 (5.46)	8 (2.73)		
3 or more children	46 (78.00)	8 (13.56)	3 (5.08)	2 (3.39)		
Covariables (lifestyle)						
Number of meals per day						
One	56 (76.71)	9 (12.33)	6 (8.22)	2 (2.74)	10.859 0.541	0.073
Two	236 (81.66)	37 (12.80)	12 (4.15)	4 (1.38)		
Three	201 (83.75)	20 (8.33)	12 (5)	7 (2.92)		
Four	58 (84.06)	7 (10.14)	2 (2.90)	2 (2.90)		
Five	7 (63.64)	3 (4.35)	1 (1.45)	0		
Physical activity						
Active	177 (83.10)	25 (11.74)	9 (4.23)	2 (0.94)	45.698 <0.001	0.181
Moderately active	285 (87.96)	29 (8.95)	7 (2.16)	3 (0.93)		
Inactive	91 (66.91)	19 (13.97)	17 (12.5)	9 (6.62)		
Physical workload (employed and self-employed)						
Sedentary work	147 (86.47)	14 (8.24)	4 (2.35)	5 (2.94)	4.012 0.675	0.072
Moderately hard work	172 (89.12)	15 (7.77)	4 (2.07)	2 (1.04)		
Hard work	23 (82.14)	4 (14.29)	0	1 (3.57)		
Smoking status						
Smoker	149 (87.13)	13 (7.60)	7 (4.09)	2 (1.17)	15.922 0.014	0.108
Ex-smoker	81 (86.17)	4 (4.26)	8 (8.51)	1 (1.06)		
Non-smoker	328 (78.66)	59 (14.15)	18 (4.32)	12 (2.88)		
Alcohol consumption						
High risk	53 (91.38)	2 (3.45)	3 (5.17)	0	53.867 <0.001	0.162
Moderate risk	403 (86.30)	44 (9.42)	17 (3.64)	3 (0.64)		
Abstinence	99 (65.13)	28 (18.42)	13 (8.55)	12 (7.89)		
Cardiovascular risk						
Very high	103 (65.19)	27 (17.08)	19 (12.03)	9 (5.70)	67.974 <0.001	0.182
High	85 (72.65)	21 (17.95)	7 (5.98)	4 (3.42)		
Moderate	242 (91.32)	17 (6.42)	4 (1.51)	2 (0.75)		
Low	128 (90.14)	11 (7.75)	3 (2.11)	0		

*Points; †Pearson's chi-square test results were confirmed using Fisher's exact test.

(P<0.001). Depressive symptoms were most prevalent in inactive participants compared to moderately active and active participants. Smoking was associated with depression (P=0.014). The prevalence of smokers decreased with an increasing presence of depressive symptoms. Alcohol consumption was statistically significantly associated with the prevalence of depressive symptoms. With an increase in the consumption levels of alcohol, the prevalence of depression symptoms decreased. Cramer's V test showed a weak relationship between the degree of depression and the monitored covariates (leisure-time physical activity, V=0.181; smoking, V=0.108; and alcohol consumption, V=0.162). Cardiovascular risk was statistically significantly highly associated with the presence of depression symptoms (P<0.001). With an increase in cardiovascular risk, the prevalence of depressive symptoms also increases. Cramer's V test showed a weak relationship between the variables (V=0.182).

The Association Between Metabolic Syndrome and Anxiety and Depression

MS was recorded in 37.5% of participants; 36.8% of men and 38.2% of women (Table 3). There was no confirmation of the association between MS and anxiety in men, but there was in women. Table 3 shows that women with moderate and severe anxiety were statistically significantly more represented in the MS group than in the group without MS (P<0.001). Cramer's V test confirmed a significant association between the presence of anxiety symptoms in women and MS (V=0.331). The data in Table 3 show that there was no confirmation of the association between MS and the presence of depressive symptoms in men, but there was in women. Women with severe depression were statistically significantly more represented in the group with MS than in the group without MS (P=0.007). However, Cramer's V test shows the weak strength of this relationship (V=0.191).

Table 3. The Association Between Metabolic Syndrome and Anxiety and Depression

Characteristics	Total	Metabolic syndrome		Pearson's chi-square† P	Cramer's V
		Yes (N; %)	No (N; %)		
	N=685	257 (37.5)	428 (62.5)		
The degree of anxiety according to the Beck Anxiety Inventory					
Male					
Minimal (0 – 7 points)	248 (71.9)	86 (67.7)	162 (74.3)	4.043 0.257	0.108
Mild (8 – 15 points)	69 (20.0)	26 (20.5)	43 (19.7)		
Moderate (16 – 25 points)	14 (4.1)	7 (5.5)	7 (3.2)		
Severe (26 – 63 points)	14 (4.1)	8 (6.3)	6 (2.8)		
Female					
Minimal (0 – 7 points)	152 (45.5)	34 (27.0)	118 (56.7)	36.610 <0.001	0.331
Mild (8 – 15 points)	93 (27.8)	38 (30.2)	55 (26.4)		
Moderate (16 – 25 points)	58 (17.4)	33 (26.2)	25 (12.0)		
Severe (26 – 63 points)	31 (9.3)	21 (16.7)	10 (4.8)		
Total					
Minimal (0 – 7 points)	400 (58.9)	120 (47.4)	280 (65.7)	33.903 0.000	0.223
Mild (8 – 15 points)	162 (23.9)	64 (25.3)	98 (23.0)		
Moderate (16 – 25 points)	72 (10.6)	40 (15.8)	32 (7.5)		
Severe (26 – 63 points)	45 (6.6)	29 (11.5)	16 (35.6)		

Continuation of Table 3.

Characteristics	Total	Metabolic syndrome		Pearson's chi-square† P	Cramer's V
		Yes (N; %)	No (N; %)		
	N=685	257 (37.5)	428 (62.5)		
The degree of depression according to the Beck Depression Inventory					
Male					
Minimal (0 – 13 points)	304 (87.9)	109 (85.8)	195 (89.0)	1.626 0.654	0.069
Mild (14 – 19 points)	30 (8.7)	12 (9.4)	18 (8.2)		
Moderate (20 – 28 points)	9 (2.6)	4 (3.1)	5 (2.3)		
Severe (29 – 63 points)	3 (0.9)	2 (1.6)	1 (0.5)		
Female					
Minimal (0 – 13 points)	254 (75.6)	84 (65.6)	170 (81.7)	12.266 0.007	0.191
Mild (14 – 19 points)	46 (13.7)	23 (18.0)	23 (11.1)		
Moderate (20 – 28 points)	24 (7.1)	13 (10.2)	11 (5.3)		
Severe (29 – 63 points)	12 (3.6)	8 (6.3)	4 (1.9)		
Total					
Minimal (0 – 13 points)	558 (81.8)	193 (75.7)	365 (85.5)	12.612 0.006	0.136
Mild (14 – 19 points)	76 (11.2)	35 (13.7)	41 (9.6)		
Moderate (20 – 28 points)	33 (4.8)	17 (6.7)	16 (3.7)		
Severe (29 – 63 points)	15 (2.2)	10 (3.9)	5 (1.2)		

†The results of Pearson's chi-square test were confirmed using Fisher's exact test.

As Table 4 shows, the highest value of the cross-odds ratio is for the variable related to the level of anxiety (1.525). This means that in this multivariate model, people with elevated anxiety levels have a higher chance of having metabolic syndrome. Furthermore, in this multivariate model, employed people had a higher chance of having metabolic syndrome than other work status groups (OR=0.861). Finally, in this multivariate model, individuals with low cardiovascular risk (according to variable modality) had a lower chance of having metabolic syndrome (OR=0.488).

Table 4. Risk Factors for Metabolic Syndrome: Regression Analyses of Sociodemographic, Lifestyle, Cardiovascular, Anxiety, and Depression Variables

Variable	B	S.E.	Wald	df	Sig.	95% C.I. for EXP (B)	
						Lower	Upper
Age	-0.020	0.091	0.047	1	0.828	0.821	1.171
Employment status	-0.149	0.055	7.316	1	0.007	0.773	0.960
Level of education	-0.044	0.088	0.245	1	0.621	0.805	1.138
Number of children	0.114	0.099	1.321	1	0.250	0.923	1.360
Physical activity	0.048	0.128	0.137	1	0.711	0.815	1.349
Alcohol consumption	0.098	0.175	0.311	1	0.577	0.782	1.555
Cardiovascular risk	-0.718	0.129	31.148	1	0.000	0.379	0.628
The degree of anxiety according to the Beck Anxiety Inventory	0.425	0.116	13.469	1	0.000	1.219	1.919
The degree of depression according to the Beck Depression Inventory	-0.213	0.164	1.682	1	0.195	0.585	1.115
Constant	0.928	0.940	0.975	1	0.323	-	-

Discussion

This study aimed to determine the influence of sociodemographic characteristics and lifestyle on the presence of anxiety and depression. Of all the sociodemographic characteristics, the highest association with the presence of anxiety was shown by female gender, and a low level of education with the presence of depression. Physical inactivity during leisure time and risky alcohol consumption were associated with a higher presence of anxiety and depression. Cigarette smoking showed an inverse association with the presence of depression (smokers had less depression than non-smokers), while there was no association with anxiety. The second goal of this study was to determine the relationship between metabolic syndrome and anxiety and depression, which was confirmed in this study. Anxiety and depression were statistically significantly more prevalent in the group of respondents with MS than in the group without MS.

We conducted the research on the adult population in Banja Luka, the second largest city in Bosnia and Herzegovina. The results showed that out of a total of 679 participants, according to the BAI score, 400 respondents (58.9%) had no or minimal anxiety symptoms. Dolanbay et al. (26) conducted a study on the presence of anxiety symptoms among health workers in the emergency department and the factors that influence these results. They found that 43.8% of the participants had a BAI score greater than 7, which is similar to our result (41.1%). However, Dolanbay et al.'s study included employed respondents. Our research has shown that anxiety symptoms are statistically significantly less prevalent among employees than among retirees, homemakers, and the unemployed. The aforementioned authors showed that anxiety symptoms were more prevalent in women than in men and in singles compared to those who are married. Using the χ^2 test, we also confirmed a statistically significantly higher presence of anxiety symptoms in women than in men, and Cramer's V test showed a significant strength of this relationship. In our study, anxiety symptoms were statistically significantly more common with increasing age; they decreased statistically significantly with an increase in the level of education; and they were statistically significantly more prevalent in parents with a larger number of children and in widowers than in other categories of marital status. However, for these variables, the strength of this relationship was weak. Chlapecka et al. (27) examined the relationship between the level of education and anxiety symptoms in a sample of 77,792 middle-aged and older people in Europe. Similar to our study, they showed that higher levels of education were associated with a lower likelihood of anxiety symptoms, independent of sociodemographic and health-related factors. The relationship was stronger among women, middle-aged people, and in Central and Eastern Europe, but was not evident in Northern Europe.

Many studies have shown that physical activity can have a positive impact on anxiety (28, 29), including anxiety as measured by the Beck Anxiety Inventory (BAI), while both smoking and alcohol consumption are associated with increased anxiety (30-32). Our study showed that reduced physical activity during leisure time increased the presence of anxiety symptoms. The prevalence of severe anxiety was higher among those who consumed alcohol (both moderately and at risk) than among those who did not consume alcohol. Cigarette smoking was not associated with anxiety, as measured by the BAI. Kim et al. (28) found a connection between physical activity and anxiety symptoms. Compared with the sedentary group (0–600 METs-min/week), participants who achieved 600–6,000 METs-min/week had a significantly lower risk of anxiety symptoms. However, engaging in physical activity of more than 6,000 METs-min/week was not associated with the risk of anxiety symptoms (U-curve).

The results of our research using the BDI II showed that in the examined group of 682 participants with an average age of 48.77 years, 81.8% of the respondents had minimal symptoms of depression. Using the BDI II, Economou et al. (33) investigated the presence of depressive symptoms in a Greek population of 542 participants with an average age of 64.89 years and found that

364 (67.2%) participants scored in the minimally depressed range. In our study, the average age of the subjects was lower; therefore, it is expected that the number of subjects without symptoms or with minimal symptoms of depression was higher than that in the Greek study. As we did in Bosnia and Herzegovina, the Greek authors examined the presence of symptoms of depression depending on age, level of education, and gender. In both studies, the $\chi 2$ test showed that the presence of depressive symptoms decreased with increasing education level, increased with increasing years of life, and that depressive symptoms were more frequent in women than in men. In both studies, the correlation between age and depression was weak. The association of gender and age with the onset of depressive symptoms was confirmed in a representative sample of 12,677 Brazilian students using the BDI-II with 21 items (34). Czech authors Cihrova et al. (35) examined the association between demographic characteristics and the presence of depressive symptoms among 450 respondents. Similar to our study, they showed that women and participants with lower education levels tended to have more depressive symptoms than men and participants with higher education levels. However, unlike our study, there was no significant relationship between age and the presence of depressive symptoms.

Our results showed a connection between physical activity during leisure time and the presence of depressive symptoms. The presence of depressive symptoms decreased with increasing physical activity. However, the physical workload at work among employed respondents did not show such a connection. A Brazilian study published in 2025 also investigated the association between depressive symptoms and physical activity levels in a large representative cohort of 58,445 adults (36). High physical activity, as well as any level of physical activity, was associated with a lower probability of depressive symptoms. Clinical factors (BMI, presence of hypertension, and diabetes mellitus) and behavioural factors (smoking status, perceived stress risk, and alcohol consumption level) were associated with a higher likelihood of depressive symptoms. In this study, subjects with depressive symptoms were younger, had a higher BMI, and spent more time in a sedentary lifestyle than those without depressive symptoms. However, our research showed that non-smokers had statistically significantly more depressive symptoms than smokers. Those who did not drink alcohol had a greater presence of depressive symptoms than those who drank moderately or at high risk. However, the strength of this association was weak in both cases (Cramer's V=0.108; V=0.162). In their meta-analysis of 30 articles, Maier et al. reported that alcohol consumption and smoking yielded heterogeneous results (37).

Compared to males, female study participants more frequently reported moderate to severe anxiety and depression symptoms. Considering gender, since no significant differences were found in the literature (38) regarding internal factors (neuroticism), external factors (mental disorders, substance abuse), and adverse life events (trauma, negative parenting, violence), it has been proposed that the higher prevalence of depression in women might be explained by biological contributors (39). According to previous research, contraceptive use is associated with lower rates of depression and anxiety symptoms, indicating a relationship between oestrogen balance and mental health. In addition to numerous physiological, environmental, and behavioural factors, oestrogen status may be the link between metabolic syndrome and depression symptoms in women. Oestrogen deficiency affects mood-regulating neurocircuits through the serotonergic system but simultaneously increases the deposition of adipose cells in intra-abdominal tissue (triggering visceral obesity) and has a full effect on proinflammatory cytokines. By affecting neurotransmitter systems, cytokines contribute to depression through inflammatory profiles and generate obesity-mediated insulin resistance and inflammation of the coronary arteries (40).

The lower prevalence of anxiety and depression among men may be related to hormonal and neural developmental differences, such as dimorphic brain nuclei in men or, throughout a lifetime, less variation in testosterone levels compared to oestrogen cycles in women (38). Men experience symptoms differently (aggression, anger, and risky behaviour versus physical and emotional symptoms) (41, 42). However, they are also less inclined to report depression due to the fear of being stigmatized, as seeking medical help and treatment is often seen as a sign of weakness (43).

Consistent with other studies, participants who were physically active, non-smokers, abstained from alcohol, and had low cardiovascular risk reported moderate-to-severe anxiety and depression symptoms less frequently than individuals with high cardiovascular risk and risky habits (44, 45). Proinflammatory lifestyle choices play an essential role in the shared pathophysiology of mental disorders and metabolic syndrome, suggesting that health promotion procedures in family medicine could potentially affect the prevention and early detection of both cardiovascular disease and mental disorders (46).

Many studies have shown that metabolic syndrome is associated with both anxiety and depression (47, 48). Hiles et al. showed that the prevalence of anxiety was approximately 10% higher among people with MS than among those without MS (49). Our research has shown that anxiety symptoms are significantly more prevalent in the group with MS than in the group without MS. The greater presence of anxiety symptoms in women with MS compared to those without MS was statistically highly significant. Cramer's V test showed that the strength of the association between metabolic syndrome and the presence of anxiety symptoms in women was significant. However, there was no statistically significant difference in the presence of anxiety symptoms in the group of men with MS compared to the group of men without MS. In a meta-analysis that included 24 studies (20 studies used metabolic syndrome as a dependent variable, and four studies used anxiety as a dependent variable), Li et al. (50) concluded that the association between anxiety and metabolic syndrome remains controversial. Three studies were cohort studies: two found an association between initial anxiety and the risk of metabolic syndrome, and one showed no significant association between initial metabolic syndrome and the risk of anxiety. In our study, using a multivariate analysis in which we used metabolic syndrome as a dependent variable, we showed that individuals with a higher degree of anxiety assessed using the BAI II had a greater chance of developing metabolic syndrome.

Our research showed that depressive symptoms (score BAI II ≥14) were statistically significantly more prevalent in the group with MS than in the group without MS; however, according to the results of Cramer's V test, the relationship was weak. There was no statistically significant difference in the presence of depressive symptoms between men with MS and those without MS. Depressive symptoms were statistically significantly more prevalent in women with MS than in those without MS; however, this relationship was weak. Miettola et al. demonstrated that subjects with MS had significantly higher BDI-21 scores than those without MS (51), which is consistent with our results. Meanwhile, Moradi et al. (52) published a meta-analysis that included 49 studies, showing that the probability of metabolic syndrome was higher in depressed people than in non-depressed people. However, the multivariate regression analysis in our study did not confirm that the presence of depressive symptoms represented a risk factor for the development of MS. Contrary to the results of the studies mentioned above, but consistent with our results, Ribeiro et al. found no association between MS and depression (53). In the current study, significant associations between depression symptoms and MS detected by univariate analysis were attenuated in the multivariate regression model. It is possible that other variables, such as overall health, are stronger determinants of MS than depression. The majority of participants had minimal depression symptoms, reported by the patients, and not diagnosed by psychiatric interview, which might have influenced the findings. In the future, the effectiveness of depression screening in patients with MS at the family medicine level needs to be explored.

The results of the studies analysing the association between depression and MS are discordant (53-55). Dunbar identified depression as a common comorbidity in patients with MS and cardiovascular diseases (54). Due to a loss of energy, interest, and negative self-perception, individuals with depression are prone to a sedentary lifestyle and the consumption of unhealthy food. Poor lifestyle choices cause glucose intolerance, obesity, hyperlipidaemia, and hypertension, which are the cardinal components of MS. Due to its chronicity, depression adversely affects short-term metabolic health (48). Womac et al. found that the association between MS and depression in women was weakened when adjusted for cardiovascular risk factors and antidepressant use, suggesting the role of neurotransmitters and the hypothalamic-pituitary-adrenal (HPA) axis in the development of this association (55). According to Rebolledo-Solleiro et al., leptin dysregulation may explain the missing link between mood disorders and metabolic syndrome (56).

Limitations of the Study

This study has several limitations. Frequencies and exposures were measured in a random sample of the population of interest, but only at one point in time. The study design does not allow for determining whether depression/anxiety symptoms or metabolic syndrome came first. The study was conducted in primary healthcare centres; therefore, the enrolment process might have been biased. Symptoms of depression and anxiety were self-reported and not diagnosed through a psychiatric interview. Various variables not analysed in this study might have affected the results. Prospective studies are needed to explore the bidirectional link between mental health and metabolic syndrome.

Conclusion

The association between MS and anxiety and depression was confirmed in adults from Banja Luka. Women with MS were at higher risk of anxiety and depression symptoms, while this was not confirmed in men. Sociodemographic characteristics such as female gender, older age, employment status (retirees, homemakers), lower level of education, marital status (being divorced or widowed), and having more children affected the presence of anxiety and depression in adults in Banja Luka. Leisure-time physical inactivity, high-risk drinking, and higher levels of cardiovascular risk showed significant influence on the presence of anxiety and depression, while smoking was inversely associated with the presence of depression but not with anxiety.

What Is Already Known on This Topic:

The simultaneous presence of several risk factors makes metabolic syndrome one of the most important causes of atherosclerosis, which results in several diseases of the heart and blood vessels, such as angina pectoris, myocardial infarction, stroke, and peripheral vascular disease. Chronic diseases also affect mental health. There is a significant connection between metabolic syndrome and mental disorders such as depression and anxiety. Individuals with mental disorders are more likely to develop metabolic syndrome.

What This Study Adds:

This study aimed to provide MS data for the adult population of Banja Luka, Bosnia and Herzegovina. The connection between depression and anxiety with MS, as well as the already known key predictors for the occurrence of MS, has been confirmed in the population of interest. We emphasize that this study identified increased glycaemia as the leading predictor, which increases the chance of MS by elevenfold. Physical inactivity during leisure time, high-risk alcohol consumption, and a higher level of cardiovascular risk have been determined to be the factors that contribute the most to depression and anxiety in the population of interest.

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