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Analysis of the association between anxiety, depression and obesity in individuals with metabolic syndrome

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Objective. The aim of this study was to verify the association between anxiety, depression, and obesity in metabolic syndrome (MetS) patients.

Methods. It is a retrospective study with 142 volunteers with MetS of both genders and age ≥20 years. Every subject responded to the hospital anxiety and depression scale (HADS). Data are shown as absolute and relative frequencies for categorical variables and a Pearson's chi-square test was performed to verify the association between anxiety or depression and body mass index (BMI). The value of $p \leq 0.05$ was considered to be statistically significant.

Results. The frequency of anxiety and depression was 18.3% (n=26) and 12% (n=17), respectively. There was no significant association between anxiety or depression and BMI (p=0.481 and 0.079, respectively) in individuals with MetS.

Conclusions. Although no association among anxiety, depression and obesity was found, the psychological factors should be added to the MetS treatment contributing to a more effective health care in order to find answers to manage and adhere to the conducts carried out from a more humanized and transdisciplinary perspective. The data also indicate that large sample and case-control methodology are required to obtain a more specific evaluation of this association.

Key words: anxiety, depression, obesity, metabolic syndrome

Mental illnesses or psychiatric disorders currently affect thousands of people worldwide. The number of cases is gradually increasing, especially in the developing countries (Molina et al. 2012). In addition, according to World Health Organization (WHO), mental health disorders are one of the main causes of morbidity in contemporary societies (Gavin 2013). In Brazil, anxiety and depression are the mental disturbances that most affect population's health (Lopes and Santos 2018).

In the last decades, changes in social, cultural, and economic context led to an important increase in the prevalence of depression and anxiety in general population. Between 2005 and 2015, the number of cases of depression increased by 18% worldwide, while anxiety reached 3.6% in global prevalence. Brazilian studies have shown that the prevalence of depression is 5.8%, while anxiety reaches 9.3% in Brazil, which characterizes the country with the highest prevalence of this disorder (Fernandes et al. 2018; Goncalves et al. 2018).

Fernandes et al. (2018) have defined anxiety as an emotional condition inherent to human expectations. It works as an alert that enables the subjects to deal

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with a threat or risky situation on a daily basis, since the perception of physical or psychological danger is constant. The contemporary lifestyle has intensified the anxiety symptoms, which affect the quality of life, interpersonal relationships, and daily activities (Gavin 2013). Anxiety seems to be a predictor of depression (Nechita et al. 2018), which is defined as a myriad of manifestations that involve isolation, negative thoughts, insomnia, negative feelings such as discouragement, anxiety, sadness, excessive fear, and desire to cry (Gavin 2013; Ramos et al. 2015).

Sharovsky (2010) has reported that the symptoms of anxiety and depression are also associated with a significant decrease in productivity and quality of life. Consecutively, it may alter the glycemic profile in individuals with diabetes and/or the insulin resistance intensify, a crucial element for the development of metabolic syndrome (MetS). Previous studies have shown an association between depression and anxiety with MetS. To explain this association, the main hypothesis is that people with depression adopt several inappropriate health habits, such as physical inactivity, smoking, alcohol consumption, and inadequate food intake, besides the predisposing genetic load. Subjects with anxiety and depression may also have a hyper-activation of the hypothalamic-pituitary-adrenal axis (HPA), which increases cortisol levels (Franco 2012; Tang et al. 2017) and thus, have some physiological alterations that may be observed in gluconeogenesis, leptin synthesis, adipocyte differentiation, and antagonism of insulin actions (Franco 2012). The stimulation of HPA axis causes hypercholesterolemia, which consequently increases obesity, especially the central obesity, a major component of MetS. Considering these issues, this study was aimed to verify the association between anxiety, depression, and obesity in MetS patients.

Material and Methods

Study design and ethical considerations. This is a retrospective study with secondary data of 142 MetS patients. Some of these subjects spontaneously looked for our nutrition consultation at the Nutrition Clinic of the University of State of Bahia (UNEB) and some came from the Roberto Santos' General Hospital (Hospital Geral Roberto Santos – HGRS, Salvador-BA, Brazil). The HGRS is a large hospital with high complexity, tertiary care, and assistance character, composing the Health Care Network of the Brazilian Unified Health System (RAS-SUS). This study was approved by the Ethics Committee of UNEB (protocol number: 03409712.9.0000.0057). Every subjects signed a written consent form, expressing their will to participate in the research.

Study subjects and data collection. The study included adults and elderly subjects of both genders, aged 20 years or older, diagnosed with MetS according to the International Diabetes Federation (IDF) criteria (Alberti et al. 2006), as shown in Table 1. Pregnant and lactating women and patients with autoimmune diseases, medical history of Crohn's disease, ulcerative colitis, irritable bowel, diverticulitis, chronic renal failure, and liver diseases (with the exception of hepatic steatosis) were not included into this research. In addition, people taking medication to control appetite, and/or in chronic use of corticosteroids were excluded from this study.

Sociodemographic (age, gender, race, instruction level, and family income) and anthropometric data (weight, height, body mass index – BMI, and waist circumference) were collected during the nutritional anamnesis. Aiming to verify the presence of anxiety and depression, the study population answered the hospital anxiety and depression scale (HADS) – a questionnaire applied by the psychology team members of the Center for Research and Extension in Nutritional Genomics and Metabolic Dysfunction (GENUT, UNEB).

Anthropometric data. Weight and height were measured using a digital scale with a fixed stadiometer. BMI was calculated according to WHO criteria for adults, and the subject's data were stratified into three groups: eutrophic (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obesity (≥30 kg/m^2) (WHO 1995). In elderly subjects, BMI was calculated using the Pan American Health Organization's criteria: 23–28 kg/m^2 – eutrophic, 28–30 kg/m^2 – overweight, and >30 kg/m^2 - obese (OPAS 2001). Waist circumference was measured using an inelastic tape.

Table 1
Criteria for the metabolic syndrome (MetS) diagnosis

Components	Reference values
Waist circumference[a]	≥80 cm for women ≥94 cm for men
Fasting blood glucose	≥100 mg/dL
Triglycerides	≥150 mg/dL
HDLc	<50 mg/dl in women <40 mg/dl in men
Blood pressure	≥130/85 mmHg

Abbreviations: HDLc – high density lipoprotein cholesterol. [a]High waist circumference is mandatory for diagnosis of MetS, associated with two or more diagnostic criteria. Source: Adapted from International Diabetes Federation (IDF) (Alberti et al. 2006).

Table 2
Clinical and sociodemographic data and results of HADS application of the study population

Variables	Total	
	n	(%)
Age		
Adult	80	56.3
Elderly	62	43.7
Sex or gender[a]		
Female	118	83.1
Male	23	16.2
Skin color[b]		
Black	69	48.6
Brown	35	24.6
White	14	9.9
Instruction level		
Illiterate	6	4.2
Incomplete basic education	57	40.1
Complete basic education	10	7.0
Incomplete upper secondary education	7	4.9
Complete upper secondary education	45	31.7
Incomplete higher education	10	7.0
Complete higher education	7	4.9
Income[c]		
Up to 1 minimum wage	49	34.5
From 1 to 2 minimum wages	61	43.0
From 2 to 3 minimum wages	21	14.8
From 3 to 4 minimum wages	5	3.5
From 4 to 5 minimum wages	2	1.4
Above 5 minimum wages	3	2.1
BMI		
Eutrophy	18	12.7
Overweight	32	22.5
Obesity	92	64.8
Anxiety		
Unlikely	79	55.6
Possible	37	26.1
Likely	26	18.3
Depression		
Unlikely	87	61.3
Possible	38	26.8
Likely	17	12.0

Abbreviations: BMI – body mass index; HADS – hospital anxiety and depression scale. [a]There are missing data from 1 participant; [b]there are missing data from 24 participants; [c]there are missing data from 1 participant.

Anxiety and depression screening. Data from HADS were used to identify the anxiety and depression symptoms. It contains 14 multiple-choice questions equally distributed into two subscales, one for anxiety and one for depression. Subjects were instructed to answer the questions considering the latest week events. In each subscale, the global score ranges from 0 to 21. People with scores from 0 to 7 were classified as 'non-case', which means that they do not suffer from depression or anxiety. Scores from 8 to 11 were classified as 'doubtful case', which means that a patient may suffer from anxiety or depression. Finally, a 'clinical case' of depression and/or anxiety is considered when subjects had scores from 12 to 21 points in HADS. In the latter, it is very likely that patients suffer from one and/or another disease (Botega et al. 1995; Snaith 2003).

Statistical analysis. Descriptive analysis was performed and data were expressed as mean and standard deviation (SD) for continuous variables, and absolute and relative frequencies for categorical variables. A Chi-square test was performed to assess the association between anxiety and depression with a BMI and $p \leq 0.05$ was considered as significant. Data were tabulated in Microsoft Excel spreadsheet – version 2013, and analyzed by help of the Statistical Package for the Social Sciences (SPSS) for Windows, version 20.0.

Results

Table 2 shows the clinical and sociodemographic data of the studied population. The sample (142 patients) was mostly composed of adults (56.3%), with a mean age of 57.13±9.17 years. There was a high frequency of females (83.1%) and most participants self-reported skin color as black (48.6%). However, some of the participants did not self-reported the skin color (16.9%). Regarding the instruction level and family income, there was a predominance of incomplete primary education (40.1%), and an income of 1 to 2 minimum wages (43%). In addition, the study sample was predominantly obese (64.8%) and mean BMI was 33.29±5.83 kg/m^2. Results of the HADS (Table 2) show that the prevalence of anxiety and depression was 18.3% (n=26) and 12% (n=17), respectively.

There was no statistical significance in the association between obesity and anxiety (r=0.404; p=0.481), nor between obesity and depression (r=0.061; p=0.079) (Table 2).

After stratifying the study population into three groups according to BMI classification, the prevalence

of anxiety (doubtful+clinical cases) was 31% in the obese group (of 142 patients) (Table 3). Table 4 depicts data regarding the depression. It was observed that 26.1% of obese individuals (of 142 patients) had depression (doubtful+clinical cases).

Discussion

In the present study, no significant differences in the prevalence of anxiety or depression among the study groups were found.

Regarding the results about sociodemographic data, our study found a predominance of women (83.7%) in the study sample, which was similar to the findings of Ferreira et al. (2017), who have conducted a study with 645 people of a basic health center in the state of Alagoas (n=645) and found that 86.2% was represented by women. A study conducted by Zart Krebs (2015), which aimed to characterize the users of a basic care center (n=129), has also found a high predominance of women, which reached 80.6% of the sample. In contrast, Oliveira and Souza (2016) have found low female incidence, 31.4% (n=175), in a study performed in individuals with risk factors for MetS.

It is discussed in scientific literature that women are more attentive to health care. One explanation is their concern with aesthetics and body image. In addition, it is worth noting that the prevalence of anxiety and depression tends to be high in women (Ludwing et al. 2012).

Considering the demographic characteristics in this study, a high frequency of individuals in adulthood was similar to the findings of Oliveira and Souza (2016) and Zart Krebs (2015). In Oliveira and Souza's study (2016), 59.4% (104 out of 175 individuals) with risk factors for developing MetS were adults. The other author has found that 69% of the study sample (n=129) was represented by adults (Zart Krebs 2015).

Other data from our study were the skin color variable. In our study, most subjects self-reported as black, which differs from the study conducted by Oliveira and Souza (2016). The latter authors have evaluated the epidemiological profile of patients with risk factors for developing MetS and most subjects (73.7%) self-reported as brown (Oliveira and Souza 2016). Although this study did not evaluate the association between skin color and mental disorders, one causal mechanism that links skin color to the prevalence of mental disorders may be due to stress caused by the determination of the skin color in socioeconomic position (Smolen and Araujo 2017; Smolen et al. 2018).

According to a meta-analysis, the perception of ethnical prejudice is directly related to mental disorders and such experiences may produce intense psychological stress. Experiencing ethnical prejudice

Table 3
Prevalence of anxiety based on the body mass index (BMI)

BMI	Anxiety			
	Non-cases n (%)	Doubtful cases n (%)	Clinical cases n (%)	Total in each group n (%)
Eutrophy	13 (72.2)	4 (22.2)	1 (5.6)	18 (100)
Overweight	18 (56.2)	7 (21.9)	7 (21.9)	32 (100)
Obesity	48 (52.1)	26 (28.3)	18 (19.6)	92 (100)
Total	79 (55.6)	37 (26.1)	26 (18.3)	142 (100)

Pearson's chi-square test was performed (n=142 participants; r=0.404; p=0.481).

Table 4
Prevalence of depression according to body mass index (BMI)

BMI	Depression			
	Non-cases n (%)	Doubtful cases n (%)	Clinical cases n (%)	Total in each group n (%)
Eutrophy	14 (77.8)	3 (16.7)	1 (5.5)	18 (100)
Overweight	18 (56.3)	13 (40.6)	1 (3.1)	32 (100)
Obesity	55 (59.8)	22 (23.9)	15 (16.3)	92 (100)
TOTAL	87 (61.2)	38 (26.8)	17 (12.0)	142 (100)

Pearson's chi-square test was performed (n=142 participants; p=0.079, r=0.061).

is equally harmful to anyone's health. However, it is worth noting that black population are the ethnical group that historically have the biggest socioeconomic burden due to prejudice (Smolen and Araujo 2017). Finally, other fact that supports our result is the high frequency of black skin color in Salvador-BA, according to data from the Brazilian Institute of Geography and Statistics (IBGE 2014).

Regarding the instruction level, most subjects have incomplete basic degree, followed by complete upper secondary degree. Sharovsky (2010) has evaluated anxious and depressive symptoms in MetS patients and found that 50.6% of the educated population had studied until elementary school (complete or incomplete basic degree). Similarly, Oliveira and Souza (2016) have shown that most subjects (34.9%) also did not complete the basic instruction degree.

Instruction level and monthly income have a strong relation. A large proportion of our study population has low family income (up to 2 minimum wages). Both Oliveira and Souza (2016) and Garcia et al. (2018) have reported similar findings. Garcia et al. (2018) have evaluated the association of anxiety and depression symptoms and food compulsion in patients with cardiovascular disease (n=97) and the prevailing monthly income was 1 to 3 minimum wages (87.4%). In many cases, instruction level is a limiting factor for jobs and wages reflecting low individual's income, which may lead to a psychic suffering. In the contemporary society, which links purchasing power to social position, individuals with low monthly income may have feelings of distress, insecurity, discouragement, and despair characterizing anxious and depressive symptoms (Oliveira et al. 2010).

Although the total number of the depression cases was low in our study, most positive cases were seen among the obese individuals. Our findings were similar to the study conducted by Goncalves et al. (2018) in the state of Minas Gerais with 1,958 adult women (n=1,958), in which the depression was detected in 19.7% of the studied population. In a study with obese patient's candidates for bariatric surgery, Heberle (2015) has found a high frequency of anxiety (33.4%) and depression (59.3%) symptoms.

Anxiety and depression may be related to low wages, low instruction level, and even skin color; i.e., issues that have been addressed by some studies (Sharovsky 2010; Smolen and Araujo 2017). Despite lacking significant statistical associations between the aforementioned disorders with BMI in our study, a negative self-perception may contribute to the developing of anxious and depressive symptoms, especially in overweight and obese people (Melca and Fortes 2014). The lack of a significant association in our results may be due to the small sample size, since some other studies have found statistically important associations. Tyrrell et al. (2019) have reported significant association between BMI and depression. Melca and Flores (2014) have observed positive association between obesity and anxiety as well as obesity and depression. They argue that one disturb may reciprocally lead the other's onset. Heberle (2015) has also noted by using the Beck anxiety scale that anxiety may affect the obesity degree.

Conclusion

Low prevalence of anxiety and depression was observed in this study and no significant association between anxiety or depression and obesity was found. Although no association was found, the psychological factors should be added to the MetS treatment contributing to a more effective health care in order to find answers to manage and adhere to the conducts carried out from a more humanized and transdisciplinary perspective. It is important to comprehend the interaction between the factors that lead to a mental illness in order to prevent further health complications.

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Conflict of interest: *The authors declare no conflict of interest.*

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