



Obesity and mental disorders: prevalence analysis in a group of employees of a large multinational company in Brazil

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Abstract

Obesity is a 21st-century pandemic that is associated with cognitive and mental health problems, non-communicable diseases, and premature death. Several studies have associated obesity with the occurrence of mental disorders, including depression. Considering the high prevalence of the two comorbidities and the importance of their impact on people's lives, the objective of this work was to analyze the correlation between obesity and mental disorders, including depression, in adult employees of a large multinational company based in Brazil. This study followed a prospective observational longitudinal and comparative model, following the STROBE rules. This study was approved by the Ethics and Research Committee. 3706 electronic medical records of occupational medicine consultations of employees from different regions of Brazil of a large multinational company were evaluated, between the years 2020 and 2021. For the present study, the BMI profile was crossed, according to the BMI classification. Brazilian Association of Nutrology (ABRAN) with data from the assessment of the mental state of employees considering the results of the Self Report Questionnaire (SQR20). The results obtained showed an association between the two variables and allowed us to conclude that overweight/obese employees have a higher incidence of mental disorders; employees with low and normal weight are primarily in the age group under 40; overweight/obese employees are preferably between the ages of 40 and 60; men have a higher incidence of overweight and a lower rate of mental disorders; women have a higher incidence of normal weight and

a higher rate of mental disorders; Underweight employees are less likely to suffer from mental disorders.

Keywords: Obesity. Mental disorder. Overweight. Occupational medicine.

Introduction

Obesity is a disease caused by the accumulation of adipose tissue due to the imbalance between energy absorption and consumption [1,2], being one of the main public health problems, with a high worldwide prevalence and associated increased cardiovascular risks [1]. It is considered a pandemic of the 21st century, being associated with cognitive and mental health problems, non-communicable diseases, and premature death. Several studies have associated obesity with the occurrence of mental disorders, including depression [1-7].

Depression is a serious psychiatric illness with a lifetime prevalence of up to 20%. The main symptom is a lack of pleasure; is a major mood disorder that affects people of all ages [2]. According to the World Health Organization (WHO), depression currently affects more than 300 million people. The National Alliance on Mental Illness (NAMI) reported that 7.2% of people experience a major depressive episode in the United States. It is a huge global health problem and costs the economy trillions of dollars worldwide [3].

When observing the association between obesity and depression, it was identified that patients with mood disorders often experience significant weight gain or loss, due to their medical condition, change in lifestyle,

and pharmacological treatment. Depression and obesity are stress disorders that, regardless of their origin, are associated with a cascade of biological changes in the body [4].

The Western diet causes obesity and also negatively affects behavior, cognition, and emotion. There is scientific evidence that shows the crucial role in brain function and behavior of the gut-brain axis and microbiota [5]. One of the main reasons for obesity in patients with psychological disorders is medication, which can lead to a weight gain of 2 to 17 kg throughout clinical treatment [6]. Despite the great association cited in the literature, there are few proposals for integrated treatments for the two conditions [7]. Considering the high prevalence of the two comorbidities and the importance of their impact on people's lives, the objective of this work was to analyze the correlation between obesity and mental disorders, including depression, in adult employees of a large multinational company based in Brazil.

Methods

Study Design

The present study followed a prospective observational and cross-sectional model, following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) rules. Available at: <https://www.strobe-statement.org/checklists/>. Accessed on: 02/21/2024.

Ethical Approval

This study followed the ethics committee's compliance. It preserved the patient's anonymity, as well as preserving the rights and care of the patient and their information as recommended by the Declaration of Helsinki of 1964. The research protected the secrecy and confidentiality of the data and the preservation name of the participants in this research, with only the data stipulated and described in this study being characterized and used jointly.

Participants and Research Instruments

For the present study, 4315 electronic medical records of occupational medicine consultations of employees from different regions of Brazil of a large multinational company were initially analyzed. The inclusion criterion was the presence of data on Body Mass Index (BMI), mental disorder, age, and gender. After preliminary analysis, 609 records were excluded due to the absence of any of this information, and 3,706 employee records were used for the study.

Of this total, 2,199 were female and 1507 were male, with an age range ranging from 18 to 71 years

and an average of 37 years and 2 months. The records used were from employees hired and/or monitored in the last 2 years and contained information on occupational health, including mental health history and Body Mass Index (BMI). For the present study, BMI values were chosen, according to the classification of the Brazilian Association of Nutrology (ABRAN) [8], to categorize employees according to the following relationship presented in Table 1.

Table 1. BMI values.

Low weight	BMI < 18.5 kg/m ²
Normal weight	BMI between 18.5 and 24.9 kg/m ²
Overweight	BMI between 25 and 29.9 kg/m ²
Obesity	BMI > 30 kg/m ²

Source: Brazilian Association of Nutrology.

To assess the mental state of employees, the results of the Self Report Questionnaire (SQR20), in the annex, were considered. According to this questionnaire, employees with at least 7 affirmative answers are proven to be affected by mental suffering/disorder. The data obtained were tabulated considering male and female genders and treated statistically.

Data Analysis

The data were analyzed descriptively and inferentially. SPSS 25.0 software was used. In the descriptive analysis of the quantitative variable, measures of central tendency (mean and median), variability (standard deviation), and position (minimum, maximum, first, and third quartiles) were calculated. In the descriptive analysis of nominal qualitative variables, the absolute frequency and relative percentage frequency were calculated. The association between nominal qualitative variables was performed using the Pearson Chi-Square test. A significance level of 5% was considered for inferential analyses.

Results

A total of 3,706 employees aged between 18 and 71 years participated in this study, an average of 37 years and two months (Table 2). The employees were most frequently under the age of 40 (n=2263; 61.06%) and female (n=2,199; 59.34%), as shown in Table 3. Table 4 shows that overweight employees were more frequent (n=1,470; 39.67%) in the BMI classification. There was an association between BMI and age group [**X²(6) = 75,962; p<0.001**]. A significant association was observed for underweight BMI and age group under 40 years; normal weight and age group under 40 years; overweight and aged 40 to 60 years; and, obesity and age group 40 to 60 years (Table 5).

Table 2. Descriptive analysis of the age variable.

Variable	Mean	SD	Minimum	Maximum	1Q	Median	3Q
Age	37.20	8.77	18.00	71.00	31.00	37.00	43.00

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 3. Descriptive analysis of the variables age group and sex.

Variable and categories	N	%
Age range		
<40	2,263	61.06
40-60	1,416	38.21
>60	27	0.73
Gender		
Male	1,507	40.66
Female	2,199	59.34

Descriptive analysis

Legend: n=absolute frequency; %=relative frequency

Table 4. Descriptive analysis of the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorder.

Variable and categories	N	%
BMI		
Under weight	171	4.61
Normal weight	1,384	37.34
Overweight	1,470	39.67
Obesity	681	18.38
DH Mental Disorder		
No	3,517	94.90
Yes	189	5.10

Descriptive analysis

Legend: n=absolute frequency; %=relative frequency

Table 5. Association between the variables BMI and age group.

			BMI				Total	Q	DF	p-value
			Under weight	Normal weight	Overweight	Obesity				
Age Range	<40	n	148	894	857	364	2,263			
		%	4.0%	24.1%	23.1%	9.8%	61.1%			
	40-60	n	23	480	603	310	1,416			
		%	0.6%	13.0%	16.3%	8.4%	38.2%	75.962	6	<0.001*
	>60	n	0	10	10	7	27			
		%	0.0%	0.3%	0.3%	0.2%	0.7%			
	Total	n	171	1,384	1,470	681	3,706			
		%	4.6%	37.3%	39.7%	18.4%	100.0%			

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

There was no association between the variables diagnostic hypothesis (DH) of Mental Disorder and age group (Table 6). Table 7 shows that there was an association between BMI and sex [$\chi^2(3) = 66.337$; $p < 0.001$]. An association was observed between

normal weight BMI and female sex; and overweight BMI and male gender. It can be seen in Table 8 that there was an association between mental disorder DH and sex [$\chi^2(1) = 16.664$; $p < 0.001$]. An association was observed between the male sex and the absence of DH as a mental disorder, and between the female sex and the presence of DH as a mental disorder.

Table 6. Association between the variable diagnostic hypothesis (DH) of Mental Disorder and age group.

			DH Mental Disorders		Total	Q	DF	p-value
			No	Yes				
Age Range	<40	n	2,155	108	2,263	1.470	2	0.479
		%	58.1%	2.9%	61.1%			
	40-60	n	1,337	79	1,416			
		%	36.1%	2.1%	38.2%			
	>60	n	25	2	27			
		%	0.7%	0.1%	0.7%			
Total	n	3,517	189	3,706				
	%	94.9%	5.1%	100.0%				

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 7. Association between the variables BMI and gender.

		IMC				Total	Q	DF	P-value
		Under weight	Normal weight	Overweight	Obesity				
Gender	Male	n	46	476	701	284	1,507		
		%	1.2%	12.8%	18.9%	7.7%	40.7%	66.33	<0.001*
	Female	n	125	908	769	397	2,199	7	
		%	3.4%	24.5%	20.8%	10.7%	59.3%		
Total		n	171	1,384	1,470	681	3,706		
		%	4.6%	37.3%	39.7%	18.4%	100.0%		

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 8. Association between the variables diagnostic hypothesis (DH) of Mental Disorder and gender.

			DH Mental Disorders		Total	Q	DF	p-value
			No	Yes				
Gender	Male	n	1,457	50	1,507	16.664	1	<0.001*
		%	39.3%	1.3%	40.7%			
	Female	n	2,060	139	2,199			
		%	55.6%	3.8%	59.3%			
Total	n	3,517	189	3,706				
	%	94.9%	5.1%	100.0%				

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

There was an association between BMI and mental disorder DH [$\chi^2(3) = 8.221$; $p = 0.042$]. An association was observed between underweight BMI and absence of mental disorder DH; and between obesity BMI and presence of mental disorder DH (Table 9). There was no association between the variables Body Mass Index (BMI) and diagnostic hypothesis (DPH) of Mental Disorder when employees aged under 40 years old were analyzed separately (Table 10), with those aged between 40 and 60 years old (Table 11) and aged over 60 years (Table 12).

Table 9. Association between the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorder.

		BMI				Total	Q	DF	p-value			
		Under weight	Normal weight	Overweight	Obesity							
DH Mental Disorders	No	n	168	1,310	1,403	636	3,517	8.221	3	0.042*		
		%	4.5%	35.3%	37.9%	17.2%	94.9%					
	Yes	n	3	74	67	45	189					
		%	0.1%	2.0%	1.8%	1.2%	5.1%					
Total		n	171	1,384	1,470	681	3,706					
		%	4.6%	37.3%	39.7%	18.4%	100.0%					

Pearson Chi-Square Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 10. Association between the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorder in employees under 40 years of age.

			BMI				Total	Q	DF	p value		
			Under weight	Normal weight	Overweight	Obesity						
DH Mental Disorders	No	n	145	848	820	342	2,155	4.41	3	0.220		
		%	6.4%	37.5%	36.2%	15.1%	95.2%					
	Yes	n	3	46	37	22	108					
		%	0.1%	2.0%	1.6%	1.0%	4.8%					
Total		n	148	894	857	364	2,263					
		%	6.5%	39.5%	37.9%	16.1%	100.0%					

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 11. Association between the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorder in employees aged between 40 and 60 years.

		BMI				Total	Q	DF	p-value			
		Under weight	Normal weight	Overweight	Obesity							
DH Mental Disorders	No	n	23	453	573	288	1,337	3.134	3	0.371		
		%	1.6%	32.0%	40.5%	20.3%	94.4%					
	Yes	n	0	27	30	22	79					
		%	0.0%	1.9%	2.1%	1.6%	5.6%					
Total		n	23	480	603	310	1,416					
		%	1.6%	33.9%	42.6%	21.9%	100.0%					

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 12. Association between the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorders in employees aged over 60 years.

		BMI				Total	Q	DF	P-value			
		Under weight	Normal weight	Overweight	Obesity							
DH Mental Disorders	No	n	9	10	6	25	2,155	1.381	2	0.501		
		%	33.3%	37.0%	22.2%	92.6%	95.2%					
	Yes	n	1	0	1	2	108					
		%	3.7%	0.0%	3.7%	7.4%	4.8%					
Total		n	10	10	7	27	2,263					
		%	37.0%	37.0%	25.9%	100.0%	100.0%					

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

No association was found between the variables Body Mass Index (BMI) and diagnostic hypothesis (DH) of Mental Disorders when male employees (Table 13) and female employees (Table 14) were analyzed separately.

Table 13. Association between the variables BMI and diagnostic hypothesis (DH) of Mental Disorders in male employees.

		BMI				Total	Q	DF	p-value			
		Under weight	Normal weight	Overweight	Obesity							
DH Mental Disorders	No	n	46	458	680	273	1,457	2.397	3	0.494		
		%	3.1%	30.4%	45.1%	18.1%	96.7%					
	Yes	n	0	18	21	11	50					
		%	0.0%	1.2%	1.4%	0.7%	3.3%					
Total		n	46	476	701	284	1,507					
		%	3.1%	31.6%	46.5%	18.8%	100.0%					

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Table 14. Association between the variables BMI and diagnostic hypothesis (DH) of Mental Disorders in female employees.

			BMI				Total	Q	DF	p-value
			Under weight	Normal weight	Overweight	Obesity				
DH Mental Disorders	No	n	122	852	723	363	2,060	6.805	3	0.078
		%	5.5%	38.7%	32.9%	16.5%	93.7%			
	Yes	n	3	56	46	34	139			
		%	0.1%	2.5%	2.1%	1.5%	6.3%			
Total		n	125	908	769	397	2,199			
		%	5.7%	41.3%	35.0%	18.1%	100.0%			

Pearson Chi-Square

Legend: n=absolute frequency; %=relative frequency; DF=degrees of freedom

Discussion

The interest in carrying out this research came from the opportunity to obtain robust data from around 3,706 medical records, on a probable correlation between overweight/obesity and mental disorders. The company's employees are periodically evaluated by the local medical team and the data is monitored throughout their time working at the company. The observation of the large number of employees with overweight/obesity generated interest in researching possible correlations. The pandemic, in turn, increased the number of employees with complaints related to mental suffering. For this reason, the study of the probable correlation between these variables proved to be pertinent, as the literature reinforces these findings [1-7].

BMI is an index widely used to classify the world population and possible complications related to each type. That is why it was the index of choice for this work. The SRQ20 is a questionnaire used as a reference for screening individuals regarding their level of mental suffering. This is an instrument that is usually used in companies through occupational medicine, with great indicative value for carrying out more specialized assessments, when it presents results greater than or equal to 7 affirmative questions. In the company in question, employees who are subsequently evaluated by psychiatrists demonstrated a strong correlation between the indication made in the screening and the occurrence of mental disorders. As it is something used by all employees, it was the instrument of choice for this work.

Table 2 shows the description of the age variable in the studied population. Despite the wide variation, the mean and median ages are quite close. The age group <40 years old is the one that best represents the majority of employees (Table 3). Table 3 presents the descriptive analysis of the age group and gender variables. It is observed that the sample is primarily composed of women under 40 years of age.

In Table 4, it is observed that the majority of the sample has an overweight BMI, followed by a normal weight BMI. These data are in line with findings from the global literature [1,5]. Table 5 correlates the different BMI levels with the age groups. There is an association between low weight/normal weight BMI and age group under 40 years. It is known that, in general, younger people are more concerned about body aesthetics, which justifies the practice of diets and regular physical exercise, leading to a decrease in body weight. There is also an association between overweight/obesity and the age group of 40 to 60 years. It is known that throughout life, caloric expenditure (CE) tends to decrease. It is also common during this period to experience the climacteric, which is often responsible for weight gain. Therefore, the data obtained in the research are following these facts.

Table 6 shows that there is no association between mental disorder and age group. This data demonstrates that mental disorders are present in all age groups of the sample, justified by the different demands and challenges of each period of life. Table 7 presents the association between BMI and gender. This association is positive between normal weight and female gender, as well as overweight and male gender. This data reflects women's greater concern with aesthetics and body health. It is extremely common for women to look for doctors, nutritionists, and physical educators, which results in greater health and physical well-being. Generally, men still do not take these precautions regularly, which results in a greater occurrence of overweight. Other than that, society tends to demand more from women for this type of care.

Table 8 shows the association between mental disorders and gender. This association is positive between the male gender and the absence of mental disorders, as well as the female gender and the presence of mental disorders. Cultural and social aspects tend to generate greater demands on women about double professional and domestic work shifts. Men are generally more dedicated to their professional careers. This difference in the level of requests seems to justify the occurrence of more disorders in women than in men.

Table 9 shows the association between the BMI variables and mental disorders. This is the main focus

of the present study. The findings show an association between low weight and the absence of a mental disorder, as well as obesity and the presence of a mental disorder. The relationship between low weight and the absence of mental disorders may be related to greater satisfaction with the body, generating a feeling of greater acceptance and self-esteem, despite the existence of eating disorders related to excessive thinness, such as bulimia nervosa.

The relationship between obesity and the presence of mental disorders is by the literature [1-7]. Several possibilities justify this relationship. It is known that obesity can induce an inflammatory response. Some peripheral inflammatory factors can cross the blood-brain barrier and cause an inflammatory response in the brain; this can cause depression through mechanisms of neuronal injury, excessive activation of glial cells, and impaired neurogenesis [2]. Another possibility is the use of antidepressant medications, which have weight gain as an adverse effect [7].

Tables 10 to 12 demonstrate the non-association between the BMI variables and mental disorders in specific age groups, which shows that the factors that interfere with weight gain and mental disorders occur in different age groups, reinforcing the particular way an individual perceives the demands and demands of modern life. In Tables 13 and 14, the findings demonstrated the absence of an association between BMI and mental disorders when men and women were analyzed separately. As can be seen, everyday problems and how they face them are more characteristic of people's personalities than of their gender. Thus, the findings allow the establishment of relationships that are extremely relevant for the evaluation, prevention, and treatment of the variables studied, as well as understanding the genesis of these factors.

Conclusion

From the analysis of the correlation between obesity and mental disorders, including depression, in adult employees of a large multinational company based in Brazil, it is concluded that overweight/obese employees have a higher incidence of mental disorders; employees with low and normal weight are primarily in the age group under 40; overweight/obese employees are preferably between the ages of 40 and 60; men have a higher incidence of overweight and a lower rate of mental disorders; women have a higher incidence of normal weight and a higher rate of mental disorders; Underweight employees are less likely to suffer from mental disorders.

CRedit

Author contributions: **Conceptualization** - Leonardo Benhame Rodrigues Kyrillos, Amanda Medeiros Rocha; **Data curation** - Leonardo Benhame Rodrigues Kyrillos; **Formal Analysis** - Amanda Medeiros Rocha; **Investigation** - Leonardo Benhame Rodrigues Kyrillos, Amanda Medeiros Rocha; **Methodology** - Leonardo Benhame Rodrigues Kyrillos; **Project administration** - Leonardo Benhame Rodrigues Kyrillos, Amanda Medeiros Rocha; **Supervision** - Amanda Medeiros Rocha; **Writing - original draft** - Leonardo Benhame Rodrigues Kyrillos; **Writing-review & editing** - Amanda Medeiros Rocha.

Acknowledgment

Not applicable.

Ethical Approval

This study followed the ethics committee's compliance. It preserved the patient's anonymity, as well as preserving the rights and care of the patient and their information as recommended by the Declaration of Helsinki of 1964. The research protected the secrecy and confidentiality of the data and the preservation name of the participants in this research, with only the data stipulated and described in this study being characterized and used jointly.

Informed Consent

It was applicable.

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Data Sharing Statement

No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

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