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Analysis of heart rate variability and anthropometric measurements to compare obesity classes II and III in patients undergoing bariatric surgery

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Abstract

Introduction: obesity is an important public health problem worldwide. It is believed that obese candidates for bariatric surgery present cardiac autonomic dysfunction and that weight reduction achieved through surgical treatment of obesity may promote improvement in autonomic nervous system activity, minimizing cardiovascular risks.

Objective: thus, the objective of this study is to assess the impact of surgical bariatric weight reduction on HRV and on anthropometric measurements (BMI, WHtR, and WC) comparing obesity classes II and III.

Method: the study included 25 obese individuals who underwent a preoperative assessment. Anthropometric measurements and heart rate varability (HRV) were collected preoperatively. The participants were then divided into two groups: obesity class II and obesity class III (class II: BMI from 35 to 39 k/m2, and class III: BMI from > 40 kg/m2). Thirty days after surgery, a postoperative assessment was performed and the data were compared.

Results: our results confirm that both class II and III obesity groups presented altered HRV preoperatively and that the participants in the obesity II group showed a statistically significant increase in the HRV index when compared to the obesity III group, through the mean RR, PNN50, SNS, and stress index.

Conclusion: the findings confirmed the important contribution that bariatric surgery makes to improving metabolic health and lowering important obesity indices. The varying alterations in heart rate variability indicate subtle advantages concerning autonomic function, especially for individuals classified as obese II.

Keywords: Obesity management; Heart rate monitoring; Bariatric surgery.

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Authors summary

Why was this study done?
The study was conducted to verify the impact of weight reduction after bariatric surgery on Heart Rate Variability (HRV) and anthropometric measurements, comparing obesity classes II and III.

What did the researchers do and find?
Obese individuals of class II and III who underwent bariatric surgery were selected. They participated in pre- and post-operative evaluations, which included: anthropometric measurements and heart rate variability. The results showed the benefits of bariatric surgery for both groups. Benefits in relation to autonomic function were also observed, especially for individuals classified as obese class II.

What do these findings mean?
Our research confirmed the contribution of bariatric surgery in improving metabolic health and reducing obesity rates. An increase in heart rate variability after surgery indicates better autonomic function, especially for individuals classified as obese class II.

Highlights
Obese individuals of classes II and III reduced anthropometric measurements after bariatric surgery.
Benefits related to cardiac autonomic function were observed, mainly in the obese class II group.

INTRODUCTION

Obesity is a condition characterized by excessive adipose tissue accumulation in the body, resulting in a body mass index (BMI) equal to or greater than 30 kg/m² (Lin & Li, 2021). This chronic condition has been associated with a number of predisposing factors, including genetic factors, social determinants, and environmental and behavioral conditions (Cockerham et al, 2017). The prevalence of obesity has increased due to an increase in sedentary lifestyles and alterations in dietary patterns, such as the high ingestion rate of foods with high energy density (Alsulami et al, 2023). According to worldwide epidemiological data, more than 1 billion people worldwide are obese – 650 million adults, 340 million adolescents, and 39 million children, and this number is still increasing. The WHO estimates that by 2025, approximately 167 million more people will have become less healthy because they are overweight or obese (WHO, 2022).

Three key anthropometric markers are used in obesity research to evaluate the prevalence, risk, and outcomes associated with obesity (Parente et al 2020; Lee et la 2021 and Moltrer et al 2022): body mass index (BMI), waist-height ratio (WHtR), and waist circumference (WC). BMI is instrumental in categorizing individuals according to weight status, providing a generalizable measure for the epidemiology of obesity across populations. WHtR and WC, on the other hand, offer insights into central adiposity—a critical factor linked to metabolic syndrome, cardiovascular diseases, and type 2 diabetes. Collectively, BMI, WHtR, and WC encapsulate the complexity of obesity, emphasizing the importance of both overall and central adiposity in comprehensive obesity management and research.

Obesity is classified into three categories with increasing BMI (class I: BMI 30 to 34.9 kg/m2 class II: BMI from 35 to 39.9 kg/m2, and class III: BMI from > 40 kg/m2 and above) (Weir & Jan, 2023). Although there are three categories, obesity classes II and III present a higher level of danger due to the potential to trigger serious physiological disturbances.

These categories likely present a greater variety of comorbidities, including diabetes mellitus, dyslipidemia, hypertension, cardiovascular diseases, obstructive sleep apnea, chronic obstructive pulmonary diseases, cancer, morbidity and mortality from chronic diseases, premature death, and atrial fibrillation (Endalifer & Diress, 2020 and Fruh, 2017).

Considering cardiovascular diseases, studies have consistently demonstrated that excessive adiposity, a hallmark of obesity, can disrupt the delicate balance between sympathetic and parasympathetic control over the heart (Osailan et al, 2020). This dysregulation often manifests as reduced heart rate variability, indicating a compromised ability of the autonomic nervous system to adapt to physiological demands (Guarino et al, 2017).

Additionally, individuals with obesity frequently exhibit increased sympathetic tone, leading to heightened cardiovascular reactivity and an elevated risk of hypertension, arrhythmias, and other cardiovascular complications (Bray et al, 2017; Shariq & McKenzie, 2020 and Thorp & Schlaich, 2015).

Thus, it is important to provide specific treatment for obesity, as it is a complex and multiple physiological condition, requiring various interventions to advance the treatment and prevention, including bariatric and metabolic surgery (Ruban et al, 2019).

In this line of therapeutic option, surgical treatment of obesity appears to be an effective and long-lasting clinical option, providing short-term results in reducing body mass and reestablishing bodily functions based on the better functioning of organs and systems, demonstrating a return to homeostasis, which makes this surgical intervention a procedure in constant evolution and increasing in absolute numbers around the world, with a view to controlling obesity, especially in those of grade II and III (Valezi et al, 2023).

Complications of obesity, such as diabetes, hypertension, atherosclerosis, coronary artery disease and stroke, obstructive sleep apnea, depression, as well as arthropathies related to body weight, an increase in the prevalence of endometrial and breast cancer, characterize this disease. as a serious current public health problem. Furthermore, a body weight 20% above the ideal for age, sex and height represents a serious health risk. Therefore, there is evidence that bariatric surgery results in greater long-term weight loss than the best available non-surgical interventions for obesity (Gulinac et al, 2023).

This beneficial process provided by intervention with bariatric surgery promotes autonomic functional reorganization, providing a reduction in cardiovascular risks (Srinivasan et al, 2022).

Restoration of autonomic balance, combined with weight loss-induced improvements in metabolic parameters and inflammation, may contribute to the reduction in the incidence of cardiovascular events such as myocardial infarction, stroke, and heart failure.

In the observational field of the effects of bariatric surgery on cardiac autonomic modulation, there appears to be an increase in parasympathetic control over heart rate (HR) events, heart rate variability and a decrease in HR. There is a need for a better understanding of these effects, given that there is a gap in the literature regarding robust scientific evidence of the effects of this bariatric surgery in patients classified as classes II and III of obesity (Benjamin et al, 2021).

Thus, the objective is to evaluate the effects of weight reduction after bariatric surgery on heart rate variability and anthropometric measurements.

METHODS

Study Design and Location

This is a prospective observational study comparing patients with obesity before and after bariatric surgery, carried out at a health promotion institute in a city located in the interior of the State of Minas Gerais.

Sample characterization

The sample consisted of class II and III obese adult subjects of both sexes, diagnosed with a degree of obesity with indication for the bariatric surgical intervention procedure to be carried out by a qualified medical professional.

The research was submitted to the Ethics and Research Committee of the University of Franca (UNIFRAN) and was approved under protocol number 3,899,280.

Inclusion criteria

Obese subjects of both sexes, over 18 years old with class II and III obesity, were included in the research.

Exclusion criteria

Those who do not sign the Informed Consent Form and have a pacemaker.

Discontinuity criteria

Patients who presented changes in the electrocardiogram or any level of hemodynamic instability were discontinued from the sample composition throughout the evaluation procedure.

To characterize the sample, anamnesis was carried out using a questionnaire to collect information such as age, sex, comorbidities, medications and past history.

Procedures

The study was carried out in two main stages: pre and post assessment of patients undergoing bariatric surgery. Both the pre and post-surgery evaluations consisted of measurements of BMI, WHtR, WC and HRV.

After the first evaluation, the participants were separated into 2 groups: Obesity II and Obesity III, according to the BMI classification obtained. The participants then were underwent bariatric surgery. Thirty days after the procedure, the participants were instructed to attend the health institute for reassessment (BMI; WHtR, WC, and HRV).

Anthropometric variables

For the measurement of body weight, a previously calibrated Welmy® precision scale was used. Participants were instructed to remain barefoot, wearing light clothing, and to stand erect with heels together to record weight in kilograms (Kg).

Height was recorded using a stadiometer with a graduation of 1 millimeter (mm) and a field from 0 to 2.20 meters. Participants were instructed to remain erect, looking forward, heels together, and back aligned with the stadiometer. The height value was observed where the end of the ruler touched the top of the head and the value in meters was recorded.

The BMI was calculated by the coefficient of weight and height squared (kg/m2). The classification was based on the reference proposed by the World Health Organization (WHO, 2010).

Waist circumference was obtained using a tape measure in centimeters (cm) placed between the iliac crest and the lateral costal margin (midpoint between the hip and the last rib). This measurement was considered as an indicator of central obesity (Ross et al, 2020).

With the objective of verifying cardiovascular risk, the WHtR was calculated using the WC measure divided by the height, both in cm, with the maximum result of the equation being equal to one (Peer, 2020).

Heart rate variability

The volunteers were instructed to abstain from alcohol, tea, coffee, and physical activity for 24 hours prior to data collection, and to have a good night's sleep, in order not to interfere with the results. To guarantee that all the instructions were followed, all participants answered a questionnaire regarding their activities on the day prior to the assessment, which was matched to the guidelines.

For collection of HRV data, the participants were placed in an acclimatized room, with the temperature controlled at 23ºC, between 08:00 and 11:00 in the morning. After 20 minutes of rest, aiming for the stability of the hemodynamic variables, the HRV was recorded using an HR monitor strap (Polar H10®) and transferred through a signal interface to a cell phone.

The analysis was concluded using Elite HRV software and Kubios HRV software, version 3.0®. The HRV was measured by linear methods, through time and frequency domains. In the time domain, the following variables were recorded: the mean HR (Mean HR); mean of heartbeat intervals (Mean RR); standard deviation of all normal RR intervals (SDNN) recorded in ms, which represents the global variability; and the root-mean-square of the differences between adjacent normal RR intervals (RMSSD) recorded in ms, which represents parasympathetic activity.

In the frequency domain, the following variables were measured: the low-frequency index (LF) component reflecting the global action (vagal and sympathetic components) on the heart, but with a predominance of sympathetic activity, including variations between 0.04 and 0.15 Hz; the high-frequency index (HF) component indicating the action of the vagus nerve on the heart, including variations from 0.15 to 0.4 Hz; and finally, the LF/HF ratio, reflecting the sympathovagal balance (Vanderlei et al, 2009).

The sympathetic index (SNSi) and parasympathetic index (PNSi) have been proposed to separately assess the synergistic functions of the autonomic nervous system, using the timing of the heartbeat from the observation that cholinergic and adrenergic impulses have different temporal dynamics. The PNSi is calculated based on three parameters:

1. mean RR interval; 2. RMSSD, with high values of this index indicating high parasympathetic cardiac activation; 3. Poincare plot index SD1 in normalized units. The SNSi index is calculated based on: 1. mean HR range (higher heart rate is associated with higher sympathetic cardiac activation);

2. Baevsky stress index (Stressi), a geometric measure of HRV that reflects the stress of the cardiovascular system, with high Stressi values indicating reduced variability and high sympathetic cardiac activation;

3. Poincare plot index SD2 in normalized units. Values of PNSi and SNSi around zero indicate that the parameters reflecting the respective activity (parasympathetic and sympathetic) are, on average, equal to the normal population mean. Accordingly, a positive index value reflects parameters above the normal population mean and a negative index value reflects parameters below the normal population mean (Papa et al, 2023 and Baevsky, 2017).

Data analysis

For the independent variables, the chi-square test was used for categorical variables and the independent t-test for the continuous variable (age). As dependent variables, we considered anthropometric measurements and HRV indices. Data were submitted to MANOVA with 2 (Groups: Obesity II and Obesity III), by 2 (Assessments: Pre and Post) with repeated measures in the last factor. The LSD post-hoc test was used (Least Significant Difference) (Agbangba et al., 2024).

The graph data are presented as mean and standard error. The partial Eta squared (ŋp2) was reported to measure the effect size and interpreted as small (effect size> 0.01), medium (effect size> 0.06), or large (effect size> 0.14) (Lakens, 2013). The statistical package used was SPSS, version 26.0. P-values <0.05 were considered significant (Loffing, 2022).

RESULTS

From September 2019 to September 2021, 66 subjects were evaluated. Of these, 42 withdrew after inclusion, and one participant was excluded for presenting hemodynamic instability, totaling 25 individuals evaluated; 8 with a diagnosis of grade II obesity and 17 with a diagnosis of grade III obesity.

The demographic data are shown in Table 1, demonstrating that the groups were homogeneous.

Table 1: Demographic data.

Variables	Obesity II	Obesity III	p-value
	n = 8 Mean±SD	n = 17 Mean±SD	
Age (years)	39.0±6.0	33.2±8.0	0.314
Sex	n (%)	n (%)	
Male	0 (0.0)	2 (11.8)	0.453
Female	8 (100.0)	15 (88.2)	
Comorbidities pre	n (%)	n (%)	
Hypertension	0 (0.0)	6 (35.3)	0.070
Diabetes	2 (25.0)	4 (23.5)	0.651
Dyslipidaemias and other components of metabolic syndrome	1 (12.5)	1 (5.9)	0.547
Comorbidities post	n (%)	n (%)	
Hypertension	0 (0.0)	3 (17.6)	0.296
Diabetes	0 (0.0)	0 (0.0)	1.000
Dyslipidaemias and other components of metabolic syndrome	0 (0.0)	0 (0.0)	1.000

Data presented as Mean ± Standard Deviation (SD) or number (percentage); independent t test for age and chi-square for sex and comorbidities (between groups).

Anthropometric measurements

Main effects were found for the Assessments factor for BMI ($F_{1, 23}$= 205.2; $p < 0.001$, ηp2= 0.89), Waist-to-height ratio ($F_{1, 23}$= 51.6; $p < 0.001$, ηp2= 0.69), and Waist circumference ($F_{1, 23}$= 50.1; $p < 0.001$, ηp2= 0.68), and for the Group factor for BMI ($F_{1, 23}$= 23.7; $p < 0.001$, ηp2= 0.50), Waist-to-height ratio ($F_{1, 23}$= 9.2; p = 0.006, ηp2= 0.28), and Waist circumference ($F_{1, 23}$= 6.7; p = 0.016, ηp2= 0.22), with an interaction between Assessment and Group in BMI ($F_{1, 23}$= 5.69; p = 0.026, ηp2= 0.19; Figure 1). Post-hoc comparisons showed that both groups (Obesity classes II and III) presented differences in the two assessments (pre and post bariatric surgery) for all variables (BMI, Waist-to-height ratio, and Waist circumference), with Obesity class III presenting higher values. Additionally, both groups showed a decrease in all variables from the pre to post surgery assessments (Obesity II: BMI pre 37.2, post 32.9; Waist-to-height ratio pre 69.4, post 62.4; Waist circumference pre 112 cm, post 101 cm; Obesity III: BMI pre 44.3, post 38.3; Waist-to-height ratio pre 76.1, post 68.6; Waist circumference pre 124 cm, post 111 cm).

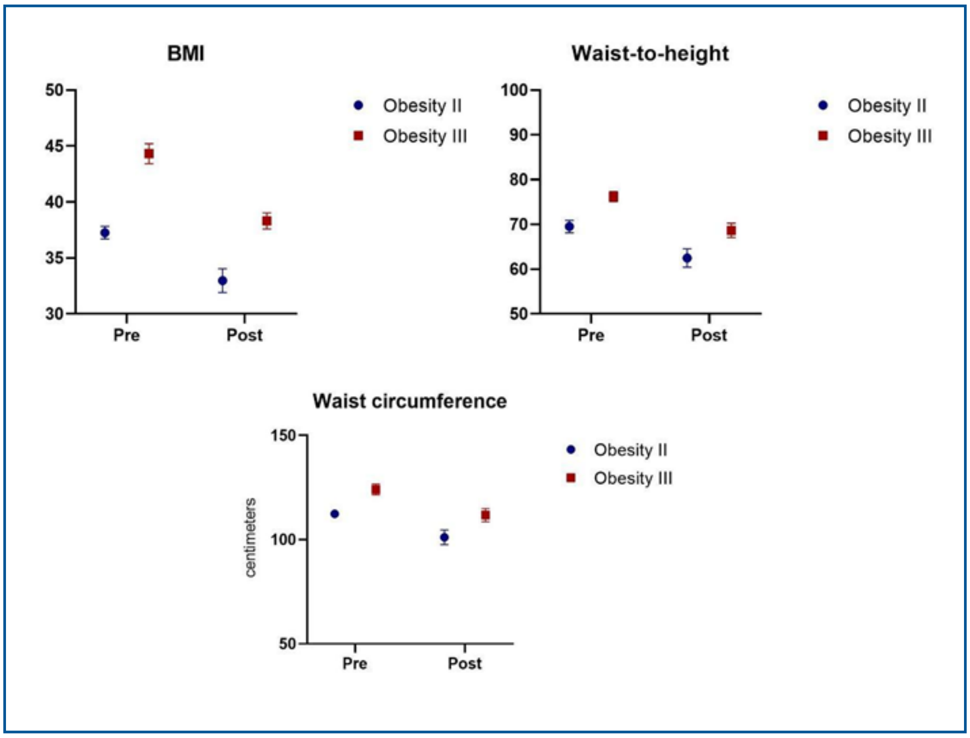

Figure 1: Representation of the mean and standard error of BMI, waist-to-height ratio, and waist circumference between Groups and Assessments.
BMI: body mass index; Pre: preoperative assessment; Post: postoperative assessment. Differences were observed between groups and between pre and post assessments in all variables - BMI, WHtR, and WC).

Heart rate variability
Linear indices - Time and Frequency domains

The MANOVA did not find main effects or interactions between the Time and Frequency domain indices. Separate follow-up repeated measures (RM-ANOVAs) for the Time domain and Frequency domain are reported in the paragraphs below.

Considering the Time domain indices, no main effects were found, but we found an interaction between Group and Assessments, in the Mean RR index ($F_{1, 23}$= 5.46; p = 0.028, ηp2= 0.19). Post-hoc comparisons showed that the Obesity II group presented an increase in the Mean RR from pre (M = 704 ms) to post (M = 795 ms; p = 0.042) assessments. Additionally, in the pre assessment, the Obesity III group had a higher PNN50 than the Obesity II group (M = 12.2; M = 0.7 respectively; p = 0.048), and this difference did not occur in the post assessment (Figure 2).

For the Frequency domain indices, no main effects were found, and no interactions between them (Figure 3).

Parasympathetic (PNS), Sympathetic (SNS), and Stress index

The main effect for the evaluations factor, in the Stress index ($F_{1, 23}$= 4.32; p = 0.049, ηp2= 0.15), and an interaction between Assessments and Group, for the SNS index ($F_{1, 23}$= 4.44; p = 0.046, ηp2= 0.16) and Stress index ($F_{1, 23}$= 4.34; p = 0.049, ηp2= 0.15). Post-hoc comparisons showed that for both the SNS index and Stress index, the Obesity II group presented higher values than the Obesity III group in the pre assessment (SNS index M = 3.2; M = 1.7 respectively; p = 0.042; Stress index M = 21.8; M = 14.6 respectively; p = 0.024), and the Obesity II group presented a decrease in both indices from pre to post assessment (SNS index M = 3.2; M = 1.2 respectively; p = 0.024; Stress index M = 21.8; M = 14.6 respectively; p = 0.019). No main effect was found for the PNS index (Figure 4).

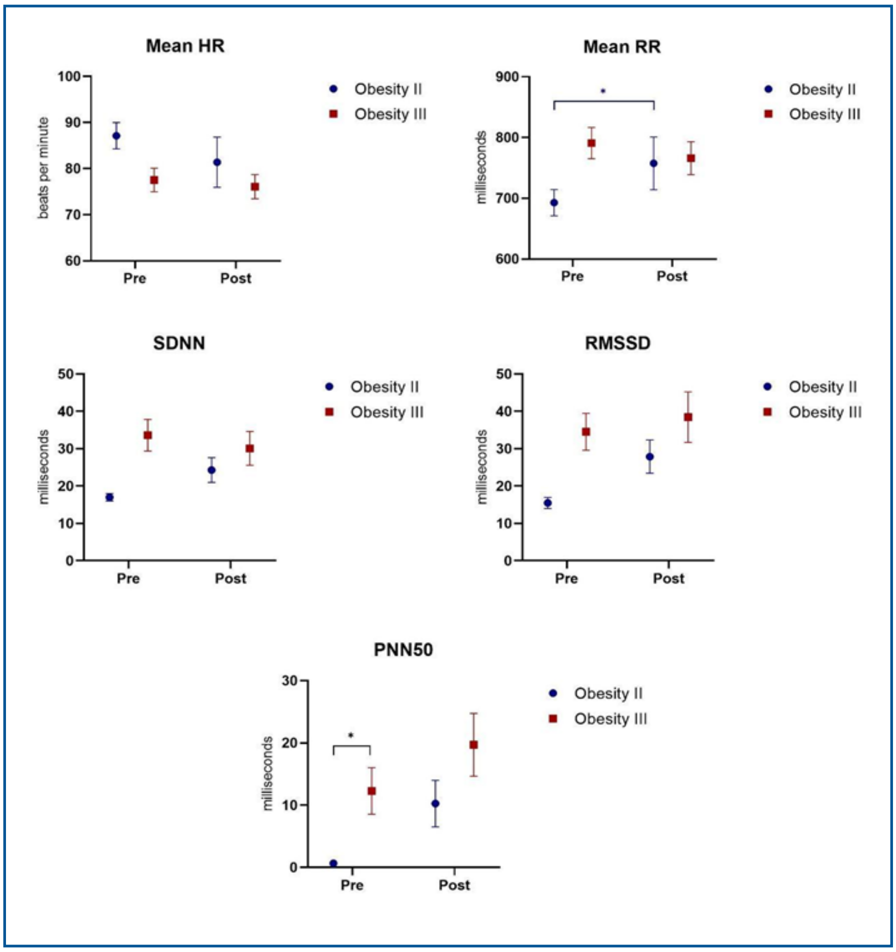

Figure 2: Representation of the mean and standard error of time domain indices of HRV between Groups and Assessments.

Mean RR: mean of intervals between heartbeats; Mean HR: mean heart rate; SDNN: standard deviation of the mean of all RR intervals over a period; RMSSD: square of the root mean difference of successive RR intervals; PNN50: percentage of adjacent RR intervals with a difference in duration greater than 50 milliseconds; Pre: preoperative assessment; Post: postoperative assessment; * $p < 0.05$.

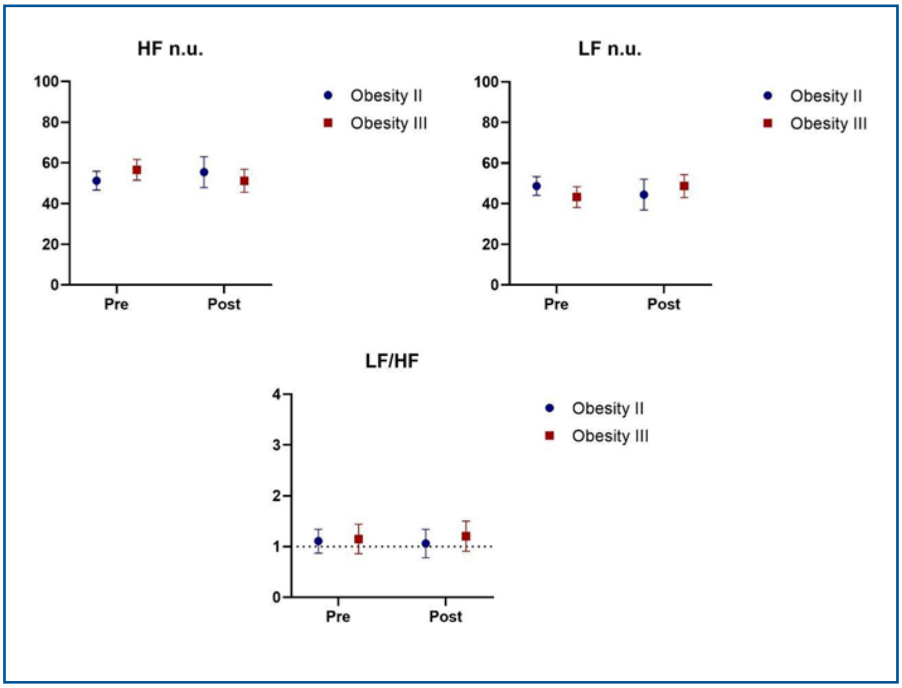

Figure 3: Representation of the mean and standard error of frequency domain indices of HRV between Groups and Assessments.

HF: high frequency; LF: low frequency; LF/ HF: ratio of low frequency and high frequency. Pre: preoperative assessment; Post: postoperative assessment.

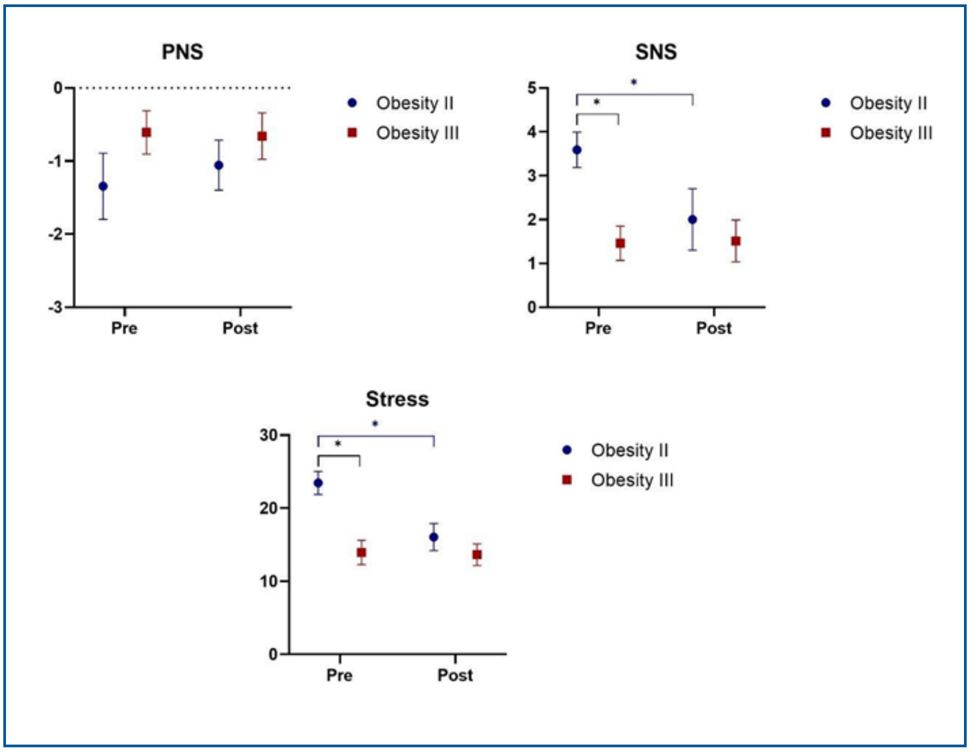

Figure 4: Representation of the mean and standard error of PNS, SNS, and Stress indices of HRV between Groups and Assessments.

PNS: index of parasympathetic nervous system; SNS: index of sympathetic nervous system; Stress index: geometric measure of HRV that reflects the stress of the cardiovascular system. Pre: preoperative assessment; Post: postoperative assessment; * $p < 0.05$.

DISCUSSION

In the current study, we investigated the behavior of the autonomic nervous system after weight loss, achieved through bariatric surgery in obesity groups II and III. Our hypotheses were partially confirmed: both groups demonstrated weight loss, with reductions in in BMI, waist-height ratio, and waist circumference after surgery, as expected. However, different from our hypothesis, before surgery, obesity group II presented lower parasympathetic activity, and higher sympathetic activity and cardiovascular stress than obesity group III. Moreover, only obesity group II presented a statistically significant difference in the modulation of the autonomic nervous system 30 days after bariatric surgery, demonstrated by a reduction in the SNS index and Stress index, and an increase in Mean RR. We will discuss important elements of these results below.

Weight loss and anthropometric measurements

Overall, changes in BMI, WC, and the WHtR following bariatric surgery reflect the effectiveness of the procedure in promoting weight loss and improving metabolic health. These measurements are important indicators of the success of bariatric surgery in reducing obesity-related health risks and improving overall quality of life for affected individuals (Nguyen et al, 2017; Gloy et al, 2013).

BMI reduction post-surgery is a well-documented phenomenon, that is consistent with our findings and corroborated by numerous studies. This sustained decrease in BMI is pivotal, as it signifies a substantial reduction in excess body weight and is associated with notable improvements in obesity-related health conditions, such as type 2 diabetes, cardiovascular diseases, and certain cancers (Sjöström et al, 2004, Maggard, et al, 2005, Courcoulas, et al, 2015, Lechea, et al, 2019). Indeed, longitudinal studies spanning several years have consistently demonstrated persistent weight loss and BMI reduction following bariatric surgery, underscoring its long-term efficacy in improving metabolic health (O'Brien et al, 2019, Puzziferri, 2014, Buchwald, et al, 2004).

Likewise, the observed decrease in WC aligns with previous research that assessed changes in waist circumference post-bariatric surgery (Maggard, et al, 2005, O'Brien et al, 2019). Notably, reductions in waist circumference are indicative of diminished visceral adiposity, a critical factor for metabolic health and cardiometabolic risk (Gomez, et al, 2011; Ashwell et al, 2012). These improvements in metabolic parameters, including insulin sensitivity and lipid profiles, contribute to reducing the risk of obesity-related complications, thus emphasizing the significance of waist circumference reduction in the context of bariatric surgery outcomes (Sjöström et al, 2004; Risstad et al, 2015).

The reduction in WHtR observed in our study reflects results from previous research investigating the effects of bariatric surgery on weight loss, central obesity, and metabolic health. The decrease in WHtR signifies a favorable redistribution of body fat away from the abdominal area, mitigating metabolic abnormalities and lowering the risk of cardiovascular disease. This underscores the comprehensive metabolic benefits of bariatric surgery beyond mere weight loss (Risstad, et al, 2015; Neovius et al, 2012).

Heart rate variability

An interesting finding observed before surgery, was that the obesity II group had a lower HRV when compared to the obesity III group. However, 30 days after surgery only the obesity II group presented statistically significant differences in the modulation of the autonomic nervous system and a reduction in cardiovascular stress.

In general, obesity decreases parasympathetic tone and increases sympathetic activity (Michael et al, 2017, Banerjee et. al 2022 and Benjamim et al, 2021), as found in our study. The unexpected findings regarding HRV in the present study are that, pre-bariatric surgery, individuals of the obesity II group demonstrated lower parasympathetic activity, higher sympathetic activity, and increased cardiovascular stress compared to those with obesity level III, contrary to the literature. These results can be justified through several plausible physiological and methodological considerations.

There is heterogeneity within the obese population. Individuals classified as obesity level II may have developed maladaptive autonomic responses due to prolonged exposure to metabolic stressors, leading to impaired parasympathetic activity and heightened sympathetic drive, which are not as pronounced in individuals with obesity level III. This counterintuitive result may be due to a phenomenon known as the "obesity paradox," where moderately obese individuals sometimes exhibit worse cardiovascular autonomic function than those with more severe obesity; a higher BMI is not always associated with a higher health risk (Lavie et al, 2009 and Carbone et al, 2019).

Secondly, the role of fat distribution and the presence of metabolically active visceral fat should be considered. Obesity level II individuals may have a higher proportion of visceral fat, contributing to a greater metabolic disturbance and autonomic imbalance compared to level III, where the excess adiposity might be more subcutaneous (Kautzky-Willer et al, 2003). Visceral fat is known to be more metabolically active and has a stronger association with cardiovascular risk factors, which could explain the higher sympathetic activation and stress (Després, 2006).

On the other hand, although the HRV was decreased in the obesity II group before surgery, 30 days after surgery the individuals of this group demonstrated a significant reduction in sympathetic activity. Although these findings corroborate with studies that investigated changes in HRV after bariatric surgery (Alam et al, 2009; Jabbour & Salman, 2021; Gomide Braga et al, 2020). the changes were not significant in the obesity III group. This could be explained due to the period after surgery when the HR was collected. Researchers have investigated changes in HRV following bariatric surgery and observed continuing increases in parasympathetic activity in all HRV time domain variables at three, six, and 12 months after surgery (Nault et al, 2007, Belize et al, 2023 and Benjamim, 2021).

Limitations

The study's conclusions are subject to certain limitations. The follow-up period post-surgery was short, and longer-term outcomes on obesity-related metrics are crucial for assessing the persistence of the benefits of bariatric surgery. The sample size may be considered small, potentially affecting the generalizability of the results. Additionally, the study did not account for the psychological factors that can significantly impact obesity and HRV, nor did it control for inter-individual variability in surgical response. Lastly, the findings related to the "obesity paradox" should be interpreted with caution due to its contentious nature in current obesity research. These factors should be carefully considered when interpreting the results and planning future research directions.

CONCLUSION

It was found that weight reduction after 30 days of the bariatric surgery procedure showed a decrease in the anthropometric measurements of obese individuals of class II and III. In addition, there was a change in cardiac autonomic modulation, which was more evident in the class II obesity group. Statistically significant changes were evidenced by the reduction of the SNS (Sympathetic Nervous System) indices, Stress index, and an increase in the average RR interval. Such results suggest an improvement in the autonomic regulation of the cardiovascular system, indicating less physiological stress and a greater capacity of the autonomic nervous system to regulate cardiovascular functions in a balanced manner, contributing to a better health condition of this population.

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Declaration of conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions:

JRGR, DFG, and MGMT carried out data collection and organization of the study. FHM, MM, and CBMM were responsible for organizing the research and coordinating the topics of the publication. IAPM, APS and JPM participated in the statistical analysis and discussion of the research. All authors read and approved the final version of the study.

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Resumo

Introdução: a obesidade é um importante problema de saúde pública em todo o mundo. Acredita-se que obesos candidatos à cirurgia bariátrica apresentem disfunção autonômica cardíaca e que a redução de peso obtida através do tratamento cirúrgico da obesidade possa promover melhora na atividade do sistema nervoso autônomo, minimizando os riscos cardiovasculares.

Objetivo: assim, o objetivo deste estudo é avaliar o impacto da redução de peso cirúrgica bariátrica na VFC e nas medidas antropométricas (IMC, RCEst e CC) comparando obesidade classes II e III.

Método: foram incluídos no estudo 25 indivíduos obesos que foram submetidos à avaliação pré-operatória. Medidas antropométricas e variabilidade da frequência cardíaca (VFC) foram coletadas no pré-operatório. Os participantes foram então divididos em dois grupos: obesidade classe II e obesidade classe III (classe II: IMC de 35 a 39 k/m2 e classe III: IMC de > 40 kg/m2). Trinta dias após a cirurgia foi realizada avaliação pós-operatória e os dados comparados.

Resultados: nossos resultados confirmam que ambos os grupos de obesidade classe II e III apresentaram VFC alterada no pré-operatório e que os participantes do grupo obesidade II apresentaram aumento estatisticamente significativo no índice de VFC quando comparados ao grupo obesidade III através da média RR PNN50 SNS e índice de estresse.

Conclusão: os achados confirmaram a importante contribuição que a cirurgia bariátrica dá para a melhoria da saúde metabólica e redução de importantes índices de obesidade. As diversas alterações na variabilidade da frequência cardíaca indicam vantagens sutis em relação à função autonômica, especialmente para indivíduos classificados como obesos II.

Palavras-chave: Manejo da obesidade; Monitoramento da frequência cardíaca; Cirurgia bariatrica.