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Research Article

Pandemic Effect on Body Composition. Single-Center Analysis of 2.771 Cases

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Abstract

Background: The SARSCOV-2 pandemic has led to a dramatic increase in the levels of sedentary lifestyles and unhealthy dietary habits. A worsening in populational obesity levels and body composition (BC) is strongly awaited but has not yet been documented.

Objective: To compare the BC profile measured by bioelectrical impedance analysis (BIA) between prepandemic (P1-03/15/2017 to 03/16/2020) and pandemic (P2-3/17/2020 to 3/10/2021) periods.

Materials and Methods: BIA was grouped according to the time it was performed. Two comparisons were made: an independent sample comparison (ISC) and a paired sample comparison (PSC), considering patients with at least one BIA in P1 and P2. Age, height, sex, weight, body mass index (BMI), body fat mass (BFM), free fat mass (FFM), skeletal muscle mass (SMM), percentage of body fat (PBF), and visceral fat area (VFA) were compared. The statistical significance level was defined for a p value < 0.05.

Results and Discussion: 3.358 BIA was performed, and 2.771 and 112 were selected for IS and PS, respectively. In ISC, despite an unchanged weight, BFM, FFM, PBF, and VFA increased, and SSM decreased on P2 ($p < 0.015$ for all). Using PBF as a dependent variable, a multivariate linear regression model showed P2 as an independent predictor ($\beta = 0.38$ 95% CI 0.19 to 0.56). In the PSC, PBF also increased from P1 to P2 ($p = 0.015$). To our knowledge, this is the first documentation of worsening BC after the pandemic. Health authorities should be alert to this phenomenon and its clinical consequences in the future.

Keywords: SARS-CoV-2 Pandemic; Body Composition; Bioelectrical Impedance Analysis

Introduction

The SARS-CoV-2 pandemic has led to a dramatic increase in the levels of a sedentary lifestyle and a worsening in the population's dietary habits [1,2]. Although essential, social distancing recommended to control the spread of SARS-CoV-2 triggered a substantial social, financial, and psychological burden [3]. It is well known that sitting time and the total weekly training volume are linked to cardiovascular disease risk and mortality [4,5]. Being confined does not obligatory equate to being sedentary.

It would not be surprising to see a significant rise in the number of people who were overweight or obese after the end of this period of imposed home reclusion. However, body composition (BC) is also of utmost importance. Not only weight is a driver of cardiovascular risk. The percentage of body fat and the visceral fat area are also important markers of cardiometabolic clinical endpoints [6-8].

To the best of our knowledge, there are no trials assessing the amount of body fat gained since the beginning of the COVID-19 pandemic in Brazil at the population level. Considering the magnitude of the detrimental effects of this period of worsened lifestyle has clinical relevance. It may inform public health authorities about one of the downsides of social isolation that should be kept in mind when one evaluates the risk-to-benefit analysis preceding the decision regarding this sanitary approach.

This retrospective analysis aims to compare the profile of BC through bioelectrical impedance analysis (BIA) in a large population referred for physical evaluation in an exercise medicine outpatient clinic before and after the SARS-CoV-2 pandemic.

Materials and Methods

The BIA carried out between March 15th, 2017, and March 10th, 2021, was analyzed using the device Inbody® 770 (Inbody Co., LTD, Seoul, Korea). BIA was performed as a routine measurement before the cardiopulmonary exercise test. According to the previously published recommendation, all individuals were instructed [9].

Two analyses were performed. In the first one, only one measure per individual was taken. For those with repeated measures, only the first one was considered. For comparison, BIA was split into two groups according to its period: pre-pandemic (P1-between March 15th, 2017, and March 16th, 2020) and pandemic (P2: between March 17th, 2020, and March 10th, 2021). Age, height, sex, weight (W), body mass index (BMI), body fat mass (BFM), free fat mass (FFM), skeletal muscle mass (SMM), percentage of body fat (PBF), and visceral fat area (VFA) were compared between the periods.

Moreover, we compared BIA for the same individual performed in the P1 and P2 timeframes. In the case of more than a single measurement in one of the periods, only the first was taken for analysis. Age, W, BMI, BFM, FFM, SMM, PBF, and VFA were compared.

Because of the study's exploratory nature, no sample size calculation was performed, and an all-comers design was adopted.

Data distribution for each variable was analyzed using the Kolmogorov–Smirnov test. Continuous variables are expressed as the mean ± SD and were compared by Student's t-test and by paired Student's t-test for the first and second analyses, respectively. Categorical variables were expressed as a percentage and compared with the chi-squared test. Cohen's d measured effect size (ES). The qualitative assessment of the ES was interpreted as follows: < 0.2: very small; 0.2 to 0.49: small; 0.5 to 0.79: medium, 0.8 to 1.19: large, 1.2 to 1.99 very large, and ≥2.0 huge. A linear regression analysis was performed using PBF as the dependent variable and age, sex, W, height, SSM, and the period as independent variables. The regression analysis met the assumptions for linearity, homoscedasticity, multicollinearity, and normality of residuals. The statistical significance level was defined for a p value < 0.05.

Statistical analysis was carried out using the Statistical Package for the Social Sciences software (IBM SPSS Statistics for Windows, version 22.0, IBM Corp., Armonk, NY) and Jamovi [The Jamovi project (2021). Jamovi (Version 1.6)].

The Ethics Committee approved this study of the Hospital Federal de Bonsucesso under protocol number 33729120.5.0000.5253. All the procedures in this study followed the 1975 Helsinki Declaration, updated in 2013.

Results

The selection of participants for the present study is summarized in figure 1.

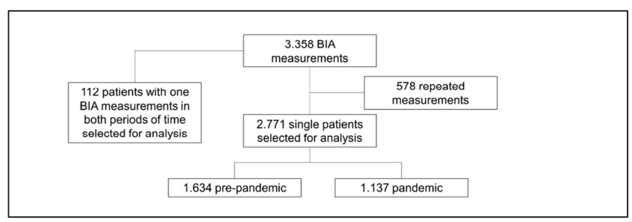

Figure 1: Flowchart of case selection for analysis.

For the first analysis, 2.771 patients were included, 1.634 and 1.137 in P1 and P2, respectively. Table 1 summarizes the univariate analysis.

Although W did not change, BFM, FFM, PBF, and VFA increased, and SMM decreased in P1 compared to P2 (Figure 2). A small ES was observed for PBF, and a very small ES was observed for all other BC variables.

Table 2 shows the multivariate linear regression analysis. After adjustment for the previously mentioned variables, P2 was directly related to PBF (β = 0.38; 95% CI 0.19 to 0.56; p < 0.001).

	P1	P2	Cohen's d (95%CI)	p value
N	**1634**	**1137**		
Time	03/15th/17 to 03/16th/20	03/17th/20 to 03/10th/21		
Age	46.3 ± 18.6	46.7 ± 18.4	0.02 (-0.05 to 0.10)	0.521
Male Gender	1051 (64.3%)	718(63.1%)		0.528
Weight (kg)	74.5 ± 17.5	75.1 ± 17.9	0.03 (-0.04 to 0.10)	0.442
Height (cm)	173.1 ± 69.3	170.1 ± 11.3	-0.05 (-0.13 to 0.02)	0.145
BMI (Kg/m^2)	25.5 ± 4.9	25.7 ± 4.9	0.18 (0.05 to -0.02)	0.208
BFM (Kg)	20.5 ± 11	22.3 ± 11.2	0.16 (0.09 to 0.24)	< 0.001
FFM (Kg)	54.1 ± 12.9	52.8 ± 12.7	-0.10 (-0.17 to -0.02)	0.009
SMM (Kg)	30 ± 7.8	29.3 ± 7.7	-0.09 (-0.17 to -0.02)	0.012
PBF (%)	26.7 ± 10.9	28.9 ± 10.4	0.21 (0.13 to 0.28)	< 0.001
VFA (cm^2)	94.2 ± 57.5	103.7 ± 57.4	0.1651 (0.08 to 0.24)	< 0.001

Table 1: Univariate analysis comparing pre-pandemic (P1) with pandemic times (P2).
BFM: Body Fat Mass, BMI: Body Mass Index; FFM: Free Fat Mass; SMM: Skeletal Muscle Mass; PBF: Percentage Body Fat; VFA; Visceral Fat Area

Figure 2: Descriptive plot shows 95% confidence intervals for the mean PBF (A) and SSM (B) in
The pre (P1) and pandemic (P2) periods.

	β	95%CI	p-value
Age	0.040	0.035 to 0.046	< 0.001
Gender	2.12	1.85 to 2.39	< 0.001
Weight	0.80	0.79 to 0.81	< 0.001
Height	-0.03	-0,03 to -0.029	< 0.001
SMM	-1.75	-1.78 to -1.73	< 0.001
Pandemic	0.38	0.19 to 0.56	< 0.001

Table 2: Linear multivariate regression analysis.
SSM: Skeletal Muscle Mass

For the second analysis, 112 paired measurements were included. Table 3 demonstrates the pairwise

comparison. Among BC variables, only PBF increased in P2 compared to P1. A small ES was observed.

Discussion

To our knowledge, this is the first population study comparing BC before and after the SARS-CoV-2 pandemic.

Despite the no differences in W, a less healthy BC profile characterized mainly by higher PBF (↑8.2%) and lowered SSM (↓4,2%) was shown. After adjustment for some vital health and BC determinants, such as age, gender, and SSM, the pandemic period was an independent PBF determinant. Likewise, the paired sample showed a higher PBF during the pandemic than pre-pandemic.

Since the beginning of the SARS-CoV-2 pandemic, many authors have been alerting the risk of increasing unhealthy behaviors such as sedentarism, alcoholism, excessive energy intake, worsened diet composition, and their consequences on metabolic health [10-12].

PBF is closely related to many cardiovascular risk factors and is a better predictor than the traditional and widely used BMI. Zeng.,

N = 112	P1	P2	Cohen's d (95%CI)	p value
Age (Years)	42.27 ± 16.7	43.46 ± 16.7	1.76 (1.48 to 2.05)	< 0.001
BMI (kg/cm2)	25.59 ± 4.48	25.82 ± 4.58	0.10 (-0.07 to 0.29)	0.264
FFM (kg)	57.53 ± 12.35	57.51 ± 11.91	-0.01 (-0.19 to 0.17)	0.948
SMM (kg)	32.27 ± 7.52	32.2 ± 7.27	-0.03 (-0.21 to 0.15)	0.722
BFM(Kg)	19.47 ± 10.64	20.34 ± 11.05	0.16 (-0.02 to 0.35)	0.077
PBF (%)	24.59 ± 10.34	25.58 ± 9.89	0.23 (0.04 to 0.42)	0.015
VFA (cm2)	86.9 ± 53.68	90.5 ± 52.69	0.16 (-0.02 to 0.34)	0.093

Table 3: Pairwise comparison of the 112 individuals with BIA in both time frames.
BMI: Body Mass Index; BFM: Body Fat Mass, FFM: Free Fat Mass; SMM: Skeletal Muscle Mass; PBF: Percentage Body Fat; VFA: Visceral Fat Area

et al. [13] showed a 3%, 5%, and 3% risk increment in hypertension, dyslipidemia, and hyperglycemia per 1% increase in PBF. Nagaya., *et al*. [14] showed that PBF was a better predictor of a worse lipid profile than BMI.

How will this worse body composition impact hard clinical endpoints such as infarction, stroke, and cardiovascular death after the pandemic? Clinical studies are currently picturing this scenario [15].

This research has some limitations that are worth highlighting. First, as a single center, we cannot guarantee that the same profile will be observed among the different populations. Nevertheless, we hope that our results will encourage other researchers. Second, the pandemic brought more sick/unhealthy people to our clinic, mainly COVID-19 survivors with long-term symptoms. Although the pandemic period remained highly directly related to PBF even after adjusting for covariates, we cannot affirm that our results would be the same, including comorbidities and physical activity behavior in the model. Again, this is an exciting subject for future research.

Conclusion

In conclusion, our data show an increase in PBF and a decrease in SSM during the pandemic compared to the pre-pandemic period. As Hall., *et al.* (15) reported, we are currently confronted with two cooccurring pandemics. The world will recover from the COVID-19 pandemic, and regular activities will resume. However, the physical inactivity/sedentary behavior pandemic will continue, and more troublingly, we may be at risk for this pandemic to worsen due to COVID-19. As a global society, we cannot let this happen.

It is comprehensible that, currently, health authorities' efforts should focus on the SARS-CoV-2 pandemic's control, such as vaccination and hospital facilities for critical cases. However, unhealthy behaviors' potential chronic disease burden must not be lost. Public health policies should be implemented in this regard.

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