

Impact of Social Distancing Associated with The COVID-19 Pandemic on Physical Activity Levels and Associations With Mood State: An Internet-Based Survey

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Research Article

Keywords: Pandemic, Social distancing, COVID-19, Physical exercise, Mood state, Depression, Anxiety.

Posted Date: December 7th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-113847/v1>

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Version of Record: A version of this preprint was published on March 1st, 2021. See the published version at <https://doi.org/10.1186/s12889-021-10470-z>.

Abstract

BACKGROUND: The coronavirus disease 2019 (COVID-19) pandemic has resulted in a strong negative impact on economic and social life worldwide. It has also negatively influenced people's general health and quality of life. The aim of the present study was to study the impact of social distancing on physical activity level, and the association between mood state (depression and anxiety level) or sex with actual physical activity levels, the change in physical activity during social distancing period, the adherence level to social distancing, the adoption time of social distancing, family income and age.

METHODS: A self-administered questionnaire with personal, quarantine, physical activity, and mood state disorders information's was answered by 2,140 female and male Brazilians who were recruited through online advertising.

RESULTS: Thirty percent of the participants presented symptoms of moderate/severe depression and 23.3% displayed moderate/severe anxiety symptoms. A greater presence of symptoms related to anxiety and depression were associated with low physical activity levels, low family monthly income, and younger age. A higher percentage of men who had no mood disorders was observed among those who were very active than among those less active.

CONCLUSION: The COVID-19 pandemic has a negative impact on physical activity. Those who reduced their level of physical activity had the highest levels of mood disorders. Therefore, considering all the non-communicable diseases and mental diseases associated with physical inactivity, humans are likely to be much more vulnerable during this period of social distancing, including that of combating a possible COVID-19 disease. Therefore, physical activity programs should be encouraged, while respecting the necessary social distancing to prevent the spread of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

Background

The coronavirus disease 2019 (COVID-19) pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) raised questions about public health, economic, and political crisis [1].

Currently, there are neither vaccines nor clinically proven effective therapeutics to prevent and treat the disease [2]. Therefore, the implementation of physical distancing and isolation in conjunction with hygiene strategies to contain the spread of SARS-CoV-2, have been considered fundamental methods [3]. However, besides the substantial negative economic impact of introducing physical distancing strategies such as stay-at-home orders, closure of commerce, restaurants, parks, gymnasiums and fitness centers, schools, and universities to contain the spread of SARS-CoV-2, it also may negatively impact the daily physical activity of the population [3–9].

Physical inactivity has been considered a global pandemic since 2012 [10], and it is estimated that 28% of the world population (1.4 billion people) remain physically inactive [11]. This scenario is extremely

worrying because physical inactivity is one of the leading causes of cardiovascular diseases, diabetes, obesity, and premature mortality in the world [11–13]. Therefore, if the population's physical activity levels fall during this physical distancing period, it will be an even greater challenge for public health agencies, as this condition may further complicate the pandemic scenario since the presence of diabetes, obesity, hypertension, and other comorbidities associated with physical inactivity can worsen the COVID-19 prognosis [3, 13].

In addition, physical distancing/isolation measures and the continuous spread of the pandemic are also expected to influence the mental health of the population [14]. Excessive information, uncertainties regarding the future and one's health, frustration due to interruption of projects, boredom, reduction of family income, as well as a political and economic crisis, can generate or exacerbate symptoms of depression and anxiety levels [15, 16]. These problems associated with low levels of physical activity may also negatively impact mental health.

This scenario may exacerbate existing health issues and social inequities for the female population [17, 18]. Descriptive studies reveal that women have a significantly higher risk than men of developing anxiety and depression disorders [19–21]. Moreover, some studies have reported that women consistently have lower physical activity levels than men [22, 23]. However, the effects of physical distancing on physical activity levels between the different sexes are still unknown. It is reasonable to assume that the impact on physical activity levels would be greater in women, as they accumulate professional tasks with household tasks such as taking care of children now the schools are closed [24].

Study aims

The aims of this study are as follows:

1. to study the impact of social distancing on physical activity level
2. To study the association between mood state (depression and anxiety level) with current physical activity levels, the change in physical activity levels in relation to those prior to social distancing, the adherence level to social distancing, the adoption time of social distancing, total family income and age in a sample of the Brazilian population.
3. To study the association level between sex with mood state (depression and anxiety level), current physical activity levels, the change in physical activity levels in relation to those prior to social distancing, the adherence level to social distancing, and total family income in a sample of the Brazilian population.

Methodology

Study Design

This was a cross-sectional study based on questionnaires. The questionnaires were structured and shared using the digital platform Google Forms and were conducted between 02 and 12 June 2020. The

questionnaires were self-administered in Portuguese language and contained six sections as described below.

Questionnaires

The first section dealt with general data regarding the participant demographics . It contained questions related to sex (men or women), age (open-ended question), body mass (open-ended question), height (open-ended question), total family income measured in multiples of the minimum wage (less than 1 minimum wage, minimum wage between 1-2, minimum wage between 3-6, minimum wage between 7-10, more than 11 minimum wages). For analysis purposes, scores from 0 to 4 were assigned to total family income, where 0 referred to the lowest income (less than 1 minimal wage) and 4 to the highest family income (more than 10 minimal wage).

The second section contained questions related to behavior during quarantine regarding to individual's level of restriction concerning routine activities (taking complete measures of social distancing and did not go out to perform any activity, leaving only for essential non-work activities, leaving only for essential activities including work activities, and not taking any measures of social distancing) . For analysis purposes, scores from 0 to 3 were assigned to individual's level of restriction, where 0 referred to the higher restriction level and 3 to the lower restriction level. The second section also contain questions for how many days he or she adopted the social distancing measures (less than 30 days, between 30-45 days, between 46-60 days, between 61-75 days, between 76 -90 days, more than 91 days). For analysis purposes, scores from 0 to 5 were assigned to the duration of the social distancing measurements adopted, where 0 referred to the lower duration (less than 30 days) and 5 to the higher duration (more than 91 days).

The third section was dedicated to assessing the volunteers' current physical activity level. To this end, the International Physical Activity Questionnaire (IPAQ) proposed by the World Health Organization in 1998 was used. This instrument has acceptable measurement properties for estimating physical activity levels with previously reported internationally validated results [25] and was validated for the Portuguese language in 2001 [26, 27]. According to the answers provided by the participants, the level of physical activity was classified into 5 categories according to Matsudo et al (2001)[27]: very active (those who perform vigorous activities 5 days/week and ≥ 30 min per session or vigorous activities ≥ 3 days/week and ≥ 20 min per session + moderate activities ≥ 5 days/week and ≥ 30 min per session), active (those who perform vigorous activities ≥ 3 days/week and ≥ 20 min per session; or moderate activities ≥ 5 days/week and ≥ 30 min per session; or any combined activity: ≥ 5 days/week and ≥ 150 min/week such as walking + moderate + vigorous), irregularly active A (those who perform physical activities but it is insufficient to be classified as active because it does not comply with the recommendations regarding frequency or duration), irregularly active B (those who perform physical activity but it is insufficient to be classified as irregularly active A because it does not comply with either the frequency or duration recommendations), not active (those who do not perform any physical activity for at least 10 continuous minutes during the week). For the purpose of analysis, scores from 0 to 4 were assigned to activity levels,

where 0 referred to the lowest level of activity (not active) and 4 to the highest level of activity (very active).

The fourth section aimed to screen for possible mood disorders. The Patient Health Questionnaire-9 (PHQ-9) and General Anxiety Disorder-7 (GAD-7) questionnaires were applied. PHQ-9 is an instrument, validated for Portuguese, which is widely used to identify individuals at risk of depression [28, 29]. The questionnaire provides a final score ranging from 0 to 27. Scores of ≤ 4 suggest minimal depression, scores from 5 to 9 suggest mild depression, scores from 10 to 14 suggest moderate depression, scores from 15 to 19 suggest moderately severe depression, and scores of 20 or greater suggest severe depression. For the purpose of analysis, scores from 0 to 4 were assigned to the levels of depression, where 0 referred to the lowest level of depression (minimal depression) and 4 to the highest level of depression (severe depression). GAD-7 aims to identify possible generalized anxiety disorders and also has a validated Portuguese version [30, 31]. The questionnaire provides a final score ranging from 0 to 21. Scores of ≤ 4 suggest no anxiety disorder, scores from 5 to 9 suggest mild anxiety, scores from 10 to 14 suggest moderate anxiety and scores of 15 or greater suggest severe anxiety disorder. For the purpose of analysis, scores from 0 to 3 were assigned to the anxiety levels, where 0 referred to the lowest level of anxiety (no anxiety disorder) and 3 to the highest level of anxiety (severe anxiety disorder).

The last section again used the IPAQ questionnaire to assess physical activity. However, unlike the third section, the questions concerned the exercise routine in the period prior to quarantine and the recommended social distancing measures (prior to March, 2020). To analyze the effect of social distancing on the level of physical activity, the difference in the level of physical activity was calculated as the IPAQ score obtained in the current condition minus the score obtained according to the condition before the period of social distancing (Δ IPAQ). For analysis purposes, scores from -1 to 1 were assigned to the difference in the level of physical activity between current and previous pandemic level, where -1 referred to a reduction in the physical activity level, 0 referred to no difference in physical activity level, and 1 referred to an increase in physical activity level.

Participants

Participants were invited to partake in the study through websites, e-mail, and social networks (Instagram, Facebook, and Whatsapp) of the researchers and institutions involved.

The inclusion criteria were being literate, over 18 years of age, and being familiar with online questionnaires. Exclusion criteria were those who did not complete the questionnaire or answered it inappropriately. Individuals from 26 Brazilian states and the Federal District answered the questionnaire.

Table 1 shows the description of the sample.

A total of 2,140 questionnaires were answered voluntarily. Among them, 287 were excluded for not meeting the inclusion criteria totaling 1,853 (1,110 female and 743 male) selected participants, as shown in **Figure 1**.

Table 1 - Descriptive characteristics of participants.

Variables	Male N = 743	Female N = 1110	t and p value	Effect size	CI (95%)
Age (years)	39.7 ± 12.2	37.9 ± 12.4*	t (1851) = 3.00 p < 0.001	d = 0.14	0.07 to 0.21
Body mass (kg)	81.0 ± 12.6	65.0 ± 11.5*	t (1842) = 28.17 p < 0.001	d = 1.32	1.00 to 1.60
Body height (cm)	176.8 ± 6.9	163.5 ± 6.2*	t (1851) = 42.70 p = 0.003	d = 1.99	1.50 to 2.50

Values were expressed as mean ± SD. * p < 0.05; t (t test value); d (cohen's d); CI (confidence interval); WHO5 (World Health Organization Well-Being Index).

Statistical analysis

According to the Kolmogorov-Smirnov test, no variables presented a normal distribution. Variables were expressed as median and interquartile range. Categorical variables were expressed in absolute numbers and/or percentages. The Mann-Whitney test was used to verify differences between sexes according to age, body mass and height. The measurements of the effect size were calculated by dividing the mean difference by the standard deviation. The magnitude of the effect sizes was judged according to the following criteria: d=0.2 considered a 'small' effect size; 0.5 represented a 'medium' effect size; and 0.8 a 'large' effect size [32]. For comparison between sexes and family income, IPAQ at social distancing period, PHQ-9, GAD-7, and ΔIPAQ, a chi-square test was employed. Chi-square tests were also employed in order to compare PHQ-9 and GAD-7 with IPAQ during the social distancing period, ΔIPAQ, and family income. Data were grouped so that all expected frequencies were higher than five. The Kruskal-Wallis test was used to verify age differences between each level of the PHQ9 and GAD7 questionnaire. The Kruskal-Wallis test was complemented by post hoc tests (pairwise analysis). Statistical analysis was performed using SPSS v 21.0 (Chicago, Illinois, USA). In all comparisons, p values < 5% were considered statistically significant.

Results

Of the 1853 survey participants, 9.6% (male 12.9% and female 7.4%) were in social distancing for less than 30 days, 9.6% (male 10.2% and female 9.1%) between 30 and 45 days, 12.8% (male 13.3% and female 12.4%) between 46 and 60 days, 26.6% (male 25% and female 27.6%) between 61 and 75 days, 26.9% (male 24% and female 28.8%) between 76 and 90 days and 14.6% (male 14.5% and female 14.6%) for more than 91 days. Of this total of participants, 9.4% (male 6.7% and female 11.2%) completely adhered to the social distancing recommendations and did not go out to perform any activity, 52.4%

(male 49.4% and female 54.4%) maintained partial restriction, leaving only for essential non-work activities, 32.6% (male 33.9% and female 31.8%) maintained partial restriction, leaving only for essential activities including work activities and 5.6% (male 10% and female 2.6%) did not adhere to the social distancing recommendations.

Regarding family monthly income, 2.3% (male 1.9% and female 2.6%) responders receive up to 1 minimum wage, 4.8% (male 3.5% and female 5.7%) receive up to 2 minimum wages, 35.8% (male 36.9% and female 35.1%) receive up to 6 minimum wages, 18.6% (male 17.4% and female 19.5%) receive up to 10 minimum wages and 38.4% (male 40.4% and female 37.1%) receive more than 10 minimum wages.

For the entire sample (n=1,853), during the social distancing period, 4.6% (male 4% and female 5%) were not active, 11.3% (male 9% and female 13%) irregularly active B, 7.6% (male 7% and female 9%) irregularly active A, 37.4% (male 34% and female 39%) active and 39.1% (male 46% and female 34%) were very active. Regarding to the difference between the current (social distancing period) and pre-pandemic categories of IPAQ, 36.9% (male 33.6% and female 39.1%) reduced their physical activity level, 56.7% (male 61.1% and female 53.8%) did not alter their physical activity level, and 6.4% (male 5.2% and female 7.1%) increased their physical activity level.

Concerning the levels of depression, 34.3% (male 46% and female 26%) suffered minimal depression, 36.2% (male 32% and female 38%) mild depression, 16.4% (male 13% and female 18%) moderate depression, 8.4% (male 5% and female 10%) moderately severe depression and 4.8% (male 3% and female 6%) severe depression. Finally, for the entire sample, 40.5% (male 51% and female 33%) have no anxiety disorder, 36.4% (male 33% and female 38%) have mild anxiety, 14.3% (male 11% and female 17%) moderate anxiety, and 8.9% (male 5% and female 12%) have severe anxiety disorder.

The frequency response for each sex for family monthly income, level of restriction adopted during the pandemic COVID-19 period (**Figure 2**), the period of time for which social distancing measures were adopted (time of adoption), current IPAQ categorization (**Figure 3**), depression level (PHQ9), anxiety level (GAD7) and the difference between the current and pre-pandemic categories of IPAQ (Δ IPAQ) (**Figure 4**) were investigated.

There were significant differences between sex (male or female) and the level of restriction adopted during the pandemic, current and pre-pandemic IPAQ values, Δ IPAQ, PHQ9 score, and GAD7 score, but not in relation to family monthly income. These data were analyzed using the Chi-square test, and the results are shown in **Table 2**.

Table 2 – Chi-square test of association between sex and analyzed variables.

Variables	Median (25 and 75th percentile)	Df	p value	Cramér's V	
Family income	4 (3 and 5)	8.07	4	0.09	0.06
Restriction level	2 (2 and 3)	55.39	3	<0.001*	0.17
IPAQ current	3 (3 and 4)	24.54	4	<0.001*	0.11
IPAQ pre-pandemic	4 (3 and 4)	27.03	4	<0.001*	0.12
PHQ9	1 (0 and 2)	91.26	4	<0.001*	0.22
GAD7	1 (0 and 1)	68.69	3	<0.001*	0.19
Δ IPAQ	0 (-1 and 0)	10.22	2	0.06	0.07

* Statistically significant association ($p \leq 0.05$); IPAQ - International physical activity questionnaire; PHQ-9 - Patient Health Questionnaire-9; GAD-7- General Anxiety Disorder-7; Δ IPAQ - the difference between the current and pre-pandemic categories of IPAQ; X^2 – chi-square result; df – degrees of freedom.

There were significant associations between depression level (PHQ9) and family monthly income, level of restriction adopted during the pandemic period, current IPAQ, and Δ IPAQ, but not regarding the period for which social distancing measures were adopted. These data were analyzed using the Chi-square test and the results are shown in **Table 3**.

Additionally, age differences regarding each depression level (PHQ-9) were investigated using the Kruskal-Wallis test. The results showed a significant difference between age and PHQ9 categories [$H(4)=214.5$; $p<0.001$]. The age [43 (19) years old] of the responders who have no depression was significantly older than that of those who were moderately depressive [34 (14) years old], which was also older than the median age of those who were severely depressive [30 (15 years old)].

Table 3 – Chi-square test of association between PHQ-9 and analyzed variables.

Variables	Median (25 and 75th percentile)	Df	p value	Cramér's V	
Family income	4 (3 and 5)	104.95	16	<0.001*	0.12
Restriction level	2 (2 and 3)	33.28	12	<0.001*	0.07
Time of adoption	4 (3 and 5)	19.97	20	0.46	0.05
IPAQ current	3 (3 and 4)	88.82	16	<0.001*	0.11
Δ IPAQ	0 (-1 and 0)	61.89	8	<0.001*	0.18

* Statistically significant association ($p \leq 0.05$); IPAQ - International physical activity questionnaire; PHQ-9 - Patient Health Questionnaire-9; Δ IPAQ - the difference between the current and pre-pandemic categories of IPAQ; X^2 – chi-square result; df – degrees of freedom.

There were significant associations between anxiety level (GAD7) and family monthly income, level of restriction adopted during the COVID-19 pandemic period, current IPAQ, and Δ IPAQ, but not regarding the period which social distancing measures were adopted. These data were analyzed using the Chi-square test, and the results are shown in **Table 4**.

Table 4 – Chi-square test of association between GAD7 and analyzed variables.

Variables	Median (25 and 75th percentile)		Df	p value	Cramér's V
Family income	4 (3 and 5)	50.50	12	<0.001*	0.09
Restriction level	2 (2 and 3)	21.96	9	0.009*	0.06
Time of adoption	4 (3 and 5)	14.49	15	0.48	0.05
IPAQ current	3 (3 and 4)	35.09	12	<0.001*	0.08
Δ IPAQ	0 (-1 and 0)	36.99	6	<0.001*	0.14

* Statistically significant association ($p \leq 0.05$); IPAQ - International physical activity questionnaire; GAD-7-General Anxiety Disorder-7; Δ IPAQ - the difference between the current and pre-pandemic categories of IPAQ; χ^2 – chi-square result; df – degrees of freedom.

Finally, age differences regarding each anxiety level (GAD-7) were investigated via the Kruskal Wallis test. The results also showed a significant difference between the age of the different anxiety groups ($N(3)=176.4$; $p<0.001$). The age of the responders who had no anxiety disorder [42 (30) years old] was significantly higher than that of those who were mild anxiety [35 (15)] years old), which was also higher than the age of those who presented severe anxiety disorder [31.5 (13) years old].

Discussion

The main findings from the present study were: (i) the physical activity level adopted during the period of social distancing was significantly lower than that prior to this period, (ii) about 30% of the respondents presented moderate or severe symptoms of depression, and around 23.3% showed moderate or severe symptoms of anxiety during the social distancing period, (iii) low levels of physical activity, low family monthly income and the participants' age were associated with higher incidences of anxiety and depression, (iv) individuals who did not alter their physical activity level after the adoption of social distancing experienced lower levels of depression and anxiety than those who decreased their physical activity level and, (v) there was a higher frequency of men who were very active, who did not change their physical activity level during the social distancing period and who had no symptoms of depression and anxiety.

The level of physical activity was significantly reduced during the social distancing period. Prior to the COVID-19 pandemic period, 69% of the volunteers (83% male and 46% female) were classified as very

active, and during the social distancing period, this percentage dropped to 39% (50% male and 31% female). To be classified as a very active person, it is necessary to perform at least 30 min of vigorous activity 5 times a week (or 20 min of vigorous activity 3 times a week plus 30 min of moderate activity 5 times a week) (IPAQ) [27]. This physical activity level has been associated with several healthcare benefits, including a lower risk of cardiovascular morbidity and mortality [33]. On the other hand, a lower physical activity level due to sustained social distancing potentially increases the risk of damaging the immune, respiratory, cardiovascular, musculoskeletal systems as well as compromising mental health [3]. This known damage from low physical activity can be especially harmful during this pandemic period. Although the SARS-CoV-2 usually first compromises the functioning of the lungs, it can also infect almost all major organs in the body. Therefore superior cardiorespiratory conditioning should also help to combat the disease. Strong respiratory muscles and aerobic conditioning may help individuals who develop COVID-19 and require ventilator support, mainly during the ventilator weaning process [3]. Regarding the sex difference for physical activity, the results showed that the men presented higher physical activity levels, mainly in very activity domain, which is according to previous literature data [34]. Indeed, during the pandemic, men and women presented a decrease in physical activity levels, however, the difference between sex remain.

In addition to the decrease in the physical activity level, there was also a significant increase (174%) in the number of inactive people (inactive males increased 460% and inactive females increased 122%). This result is concerning because physical inactivity was classified by the World Health Organization (WHO) [35] as the fourth leading risk factor for global mortality, and there is recent evidence suggesting that a sedentary lifestyle is independently associated with traditional cardiovascular diseases [36].

Another worrying result found in the present study concerned the incidences of symptoms related to depression and anxiety. Thirty percent of the total sample (20% male and 34% female) presented moderate or severe depression symptoms, and 23% of the total sample (15% male and 27% female) presented symptoms of moderate or severe anxiety. Cao et al. (2020) [37] and Gao et al. (2020) [38] also found similar percentages for cases of anxiety (22.6% and 22.4%, respectively) for a Chinese sample of both sexes. On the other hand, Choi et al. (2020) [39] demonstrated that 19% suffered from depression, and 14% from anxiety in a cross-sectional study conducted in Hong Kong. The same criteria for depression and anxiety were used in the above studies (PHQ-9 score ≥ 10 and GAD score ≥ 10). In addition to the COVID-19 pandemic, Brazil's president, Jair Bolsonaro, continues to discourage physical distancing measures along with the use of face masks, contrary to the recommendations of health organizations [40]. This has led to an increased sense of insecurity and anxiety amongst the Brazilian population regarding the Covid-19 disease [41]. Moreover, the political and economic instability that the country is undergoing may also be contributing to the high incidences of depression and anxiety. Beyond the pandemic, according to WHO, the prevalence of depression and anxiety is highest than world prevalence (5.8 and 9.3%, respectively while world prevalence is 4.4 and 3.6%, respectively) [42]. Prior to the pandemic, WHO figures for the prevalence of depression and anxiety in Brazil (5.8 % and 9.3%, respectively) were higher than those recorded for world prevalence (4.4% and 3.6%, respectively). This data places Brazil as world-leader in mental disorders.

Indeed, there is a significant association between both anxiety and depression and physical activity. Very active people displayed fewer incidents of depression and anxiety than those less active.

In the current study, the importance of physical activity related to mental health, the difference in physical activity levels between the pre-pandemic and physical distancing (current period) was also assessed. Those who did not alter their level of activity, and therefore managed to remain active in some way, reported a lower frequency of depression and anxiety. These findings reinforce the importance of home-based exercise programs and stimuli to interrupt physical inactivity and sedentary behavior, resulting from the necessary confinement policies to contain the spread of SARS-CoV-2. There are some useful tips for Home-Based Physical Activity suggested by Ricci et al. (2020) [43] and by Viana & de Lira (2020) [44], such as taking active short breaks, walking, following online exercise classes, playing with children or helping the elderly to stay active.

One of the factors associated with PHQ-9 and GAD-7 scores are the level of physical distancing level adopted by participants. Participants who did not adhere to physical distancing recommendations presented fewer symptoms of anxiety and depression, suggesting that physical distancing may not have affected mental health. Another factor studied was the family monthly income. A significant result to note was that an extremely high percentage of individuals who receive less than one minimum wage (which corresponds to less than 200 dollars US per month) with severe depression or anxiety. This situation is very worrying because the necessary physical distancing measures not only have an impact on human health but also can result in a devastating threat to economy, which may reduce a family's income even further. The unemployment situation and the lack of prospects of returning to work are other factors that can have a negative impact on mental health [38, 45]. In a previous systematic review, Vindegaard & Eriksen Benros (2020) [46] also pointed out the importance of steady family income to preserve mental health. Interestingly enough, the period of time for which an individual is in social distancing has not impacted mental health.

Finally, there is also a significant difference between age groups, according to the PHQ-9 and GAD-7 questionnaire. Younger respondents presented more symptoms of depression than the older ones. In relation to anxiety levels, younger respondents were also found to be more anxious than older ones. Gao et al. (2020) [38] also evaluated people between 18 to 85 years old, and the authors also found a higher incidence of depression among those between 21 and 30 years of age. One possible reason may be that increased anxiety, and depression symptoms among young people are due to their higher social media exposition, one of the main channels used for updating COVID-19 information [38, 47]. However, considering age as a risk factor for depression and anxiety provided inconsistent data, given that the elderly (over 60 years of age) also presented high levels of these mental illnesses [45].

Regarding sex differences in relation to depression and anxiety levels, the results showed that women presented a higher frequency of depression and anxiety. This had already been demonstrated in studies of Chinese and Italian populations [45, 48]. Furthermore, according to WHO, women present a higher prevalence of mental disorders than men in all world regions [42]. There is also a higher frequency of

male participants who were very physically active and a higher frequency of males who did not change their physical activity level during the social distancing period. There was a higher frequency of male participants who did not adhere to the social distancing recommendations, which may be a contributing factor to their lower frequency of anxiety and depression. However, the design of the present study design does not allow us to affirm if there is a causal relationship between these factors.

A limitation of the present study is that it was a cross-sectional study, and the answer about the level of physical activity adopted before the COVID-19 pandemic was answered retrospectively. The study was also disseminated via e-mail and social networks, which may not be representative of the entire population of the country, but only of people who have access to the internet.

Conclusion

Considering the dramatic change in lifestyle linked to physical inactivity and all non-communicable diseases associated with this condition, such as diabetes, cardiovascular disease and obesity as well as the significant association between physical inactivity and mental diseases, it is clear that people during this social distancing period are becoming much more physically and mentally vulnerable, which affects their ability to combat a possible COVID-19 infection. Therefore, physical activity programs should be encouraged, given that they respect the required social distancing to contain the spread of SARS-CoV-2.

Abbreviations

PHQ-9 - Patient Health Questionnaire-9

GAD-7 - General Anxiety Disorder-7

IPAQ – International Physical Activity Questionnaire

Declarations

Acknowledgments

The authors would like to thank all those who responded to the questionnaire. RLV is a productivity fellowship at the Fundação de Amparo à Pesquisa e Inovação do Espírito Santo (FAPES) agency (Edital Nº 18/2018-Bolsa Pesquisador Capixaba).

Funding

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The study was approved by the Human Research Ethics Committee of the Federal University of São Paulo UNIFESP (Approval number: 4.073.442) and conformed to the principles outlined in the Declaration of Helsinki. Before responding the survey, the volunteers read and agreed to the informed written consent.

Competing interests

The authors declare that they have no competing interests

Consent for publication

Not applicable

Authors' contribution

The idea presented was conceived by PJP. The theory was developed by PJP and TSC. The survey was elaborated and divulged by PJP, TSC and AS. Data analyses and interpretation were performed by AS and MSA. All authors were involved in discussing the results. The manuscript was written by PJP, TSC, AS and MSA in consultation with CABL and RLV. CABL, RLV. The final manuscript was revised by MSA.

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Figures

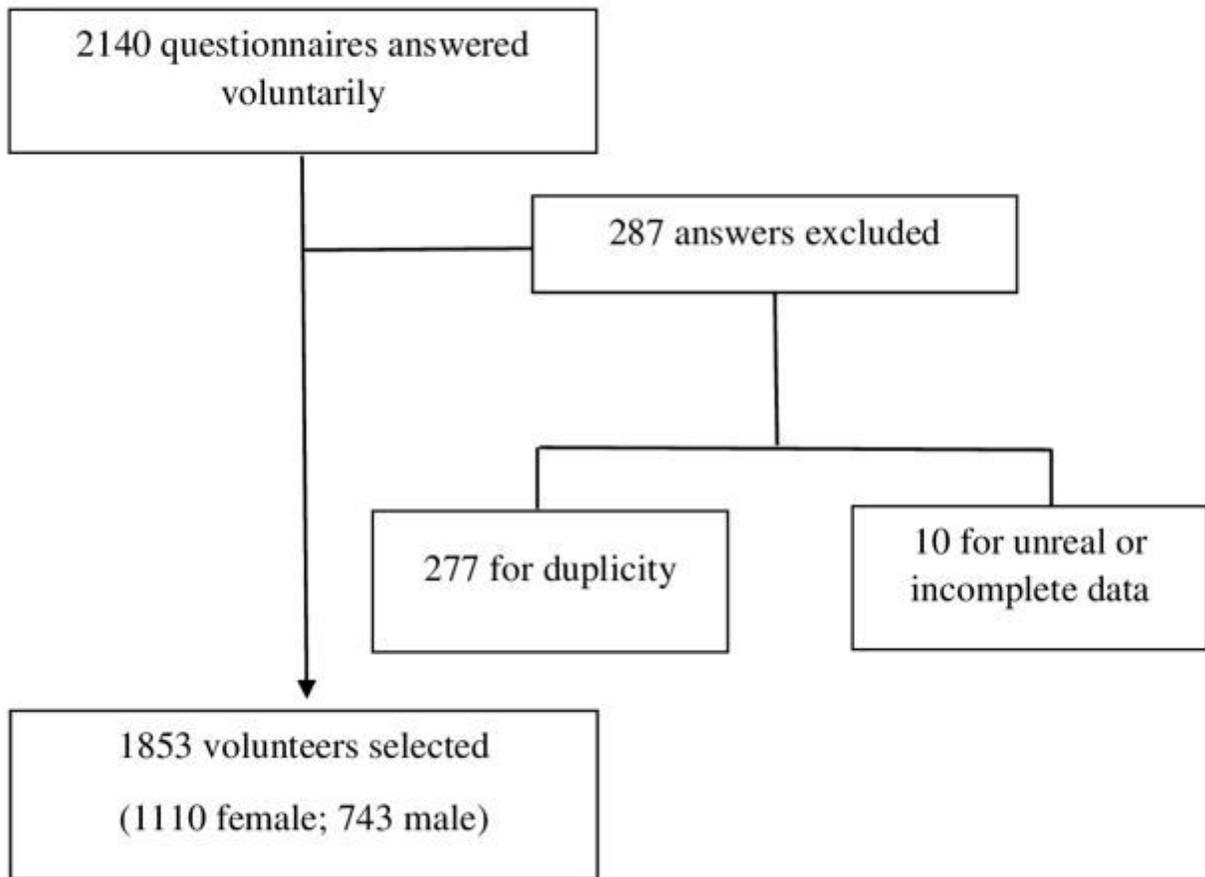


Figure 1

Flowchart of the study

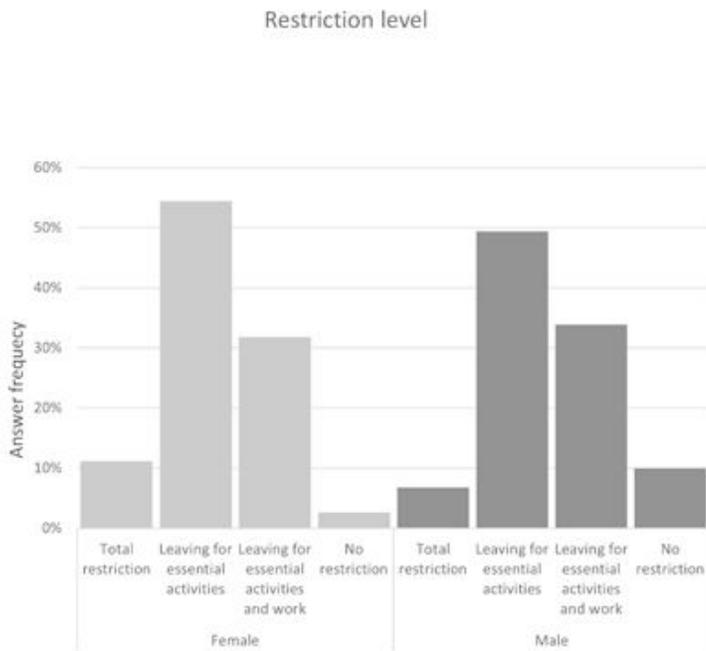
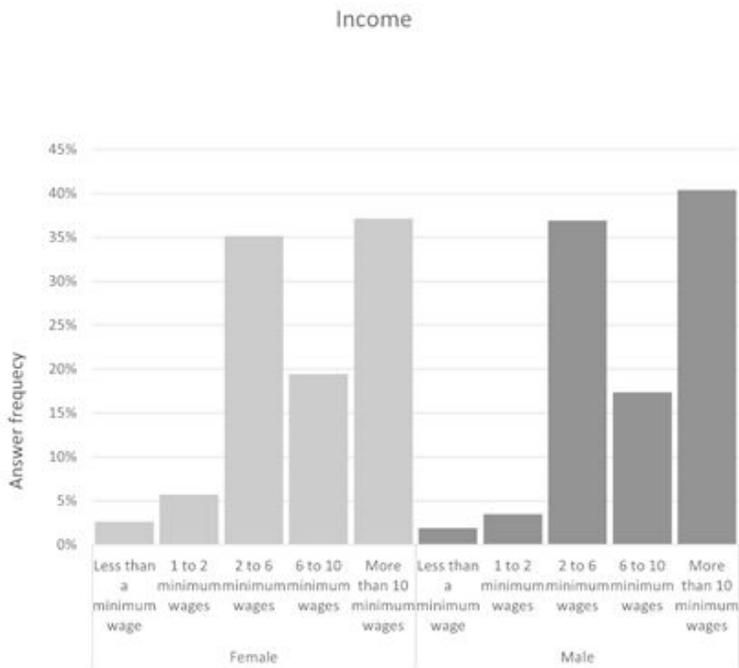


Figure 2

Frequency response for each sex for family monthly income and level of restriction adopted during the pandemic COVID-19 period

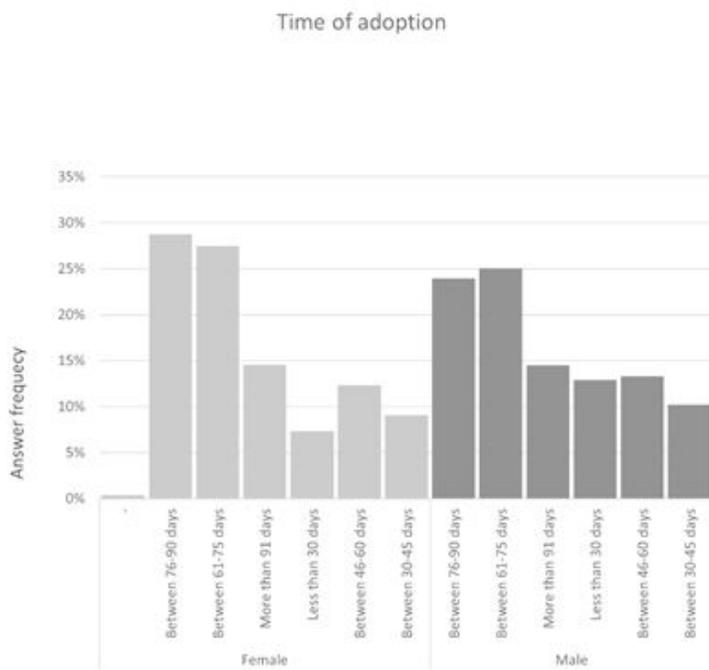
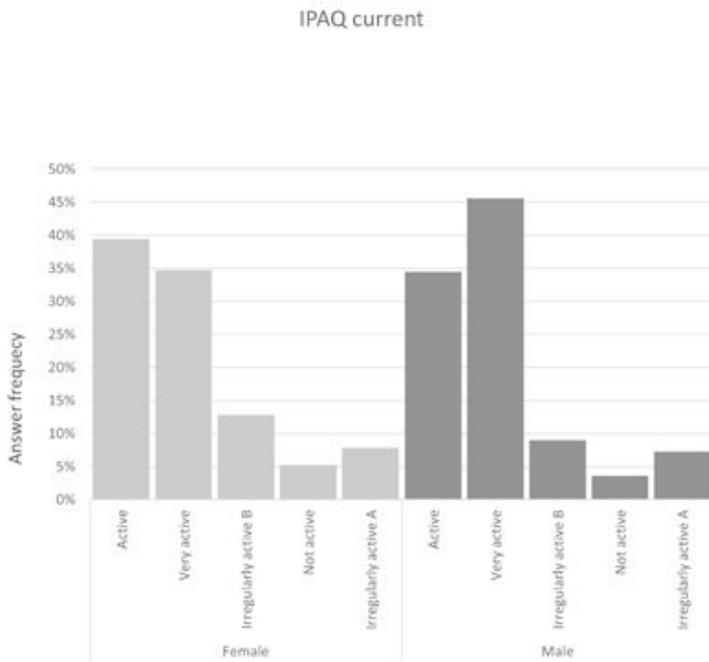


Figure 3

Frequency response for each sex for the period of time for which social distancing measures were adopted (time of adoption) and current IPAQ categorization.

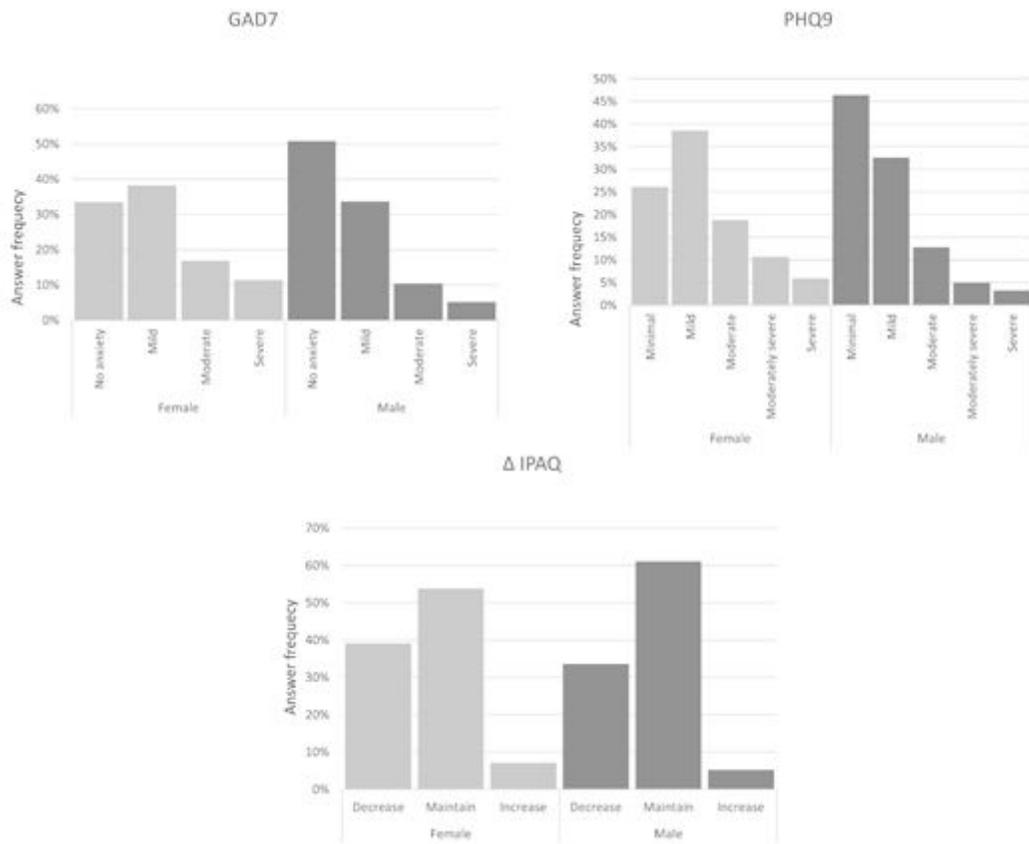


Figure 4

Frequency response for each sex for depression level (PHQ9), anxiety level (GAD7) and the difference between the current and pre-pandemic categories of IPAQ (Δ IPAQ).