ORIGINAL ARTICLE

Influence of physical activity on psychological states in adults during the covid-19 pandemic

Influência da atividade física nos estados psicológicos de adultos durante a pandemia de covid-19

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RESUMO:

Introdução: Longos períodos de confinamento em casa podem levar ao medo, pânico, ansiedade e depressão, o que, por sua vez, pode estar relacionado à diminuição dos hábitos de atividade física. **Objetivo:** Determinar a associação entre as características da atividade física praticada e o risco de apresentar problemas de saúde mental em pessoas durante o confinamento. **Métodos:** Foi realizado um estudo multicêntrico, transversal e observacional em países ibero-americanos com uma amostra de 4.948 participantes, selecionados por meio de uma técnica de amostragem em bola de neve. O estudo teve início em 15 de março de 2020 e foi concluído em Agosto de 2020 por meio de um formulário online que incluiu perguntas sobre dados sociodemográficos e de saúde, além da avaliação do estado de saúde mental e características de atividade física. **Resultados:** As mulheres brasileiras com idade compreendida entre 18 e 29 anos que ficaram em casa mais de 19 horas por dia apresentaram um risco mais elevado para todos os problemas de saúde mental analisados neste estudo. Um baixo nível de atividade física durante o período de isolamento apresentou a maior probabilidade de risco de depressão em comparação com níveis mais elevados (OR = 1,317). Além disso, a utilização de um recurso não profissional para fazer atividade física foi um fator preditivo de estado de saúde mental adverso (OR Ansiedade = 1,396, OR Depressão = 1,452, e OR Estresse = 1,220). **Conclusões:** Um baixo nível de atividade física durante o período de isolamento está associado a maior prevalência de depressão, e a utilização de recursos profissionais para a atividade física pode ser um fator de proteção para os distúrbios de saúde mental.

Palavras-Chave: Ansiedade, Atividade física, Autoconceito, Isolamento social, Saúde Mental.

ABSTRACT

Introduction: Long periods of home confinement may lead to fear, panic, anxiety, and depression states, which, in turn, could drive to a reduction of active lifestyles. **Objetive**: To determine the association between the characteristics of the physical activity performed and the risk of experiencing mental health issues among people during confinement. **Methods**: A multicenter, cross-sectional, and observational study design was conducted in Iberoamerican countries with a sample of 4,948 participants, selected through a snowball sampling technique. The study started on March 15th, 2020, and was completed in August 2020 through an online survey that included demographic and medical data, mental health status, and physical activity characteristics. **Results**: Brazilian women aged between 18 and 29 who stayed at home more than 19 hours per day presented a relevant higher risk for all the mental health problems analyzed in this study. A low level of physical activity during the isolation period presents the highest probability of depression compared to higher levels (OR = 1.317). In addition, using a no professional resource to do physical activity is a predictive factor of adverse mental health status (OR Anxiety = 1.396, OR Depression = 1.452, and OR Stress = 1.220). **Conclusions**: A low level of physical activity during a long isolation period is associated with a higher prevalence of depression, and the use of professional resources for physical activity may be a protective factor for mental health disorders.

Keywords: Mental Health, Self concept, Anxiety, Physical activity, Lockdown

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has affected many countries, with more than 4,000,000 deaths as of July 1, 2021[1]. On March 11th, 2020, the World Health Organization (WHO) declared COVID-19 as a global pandemic, posing a new alarming international public health emergency. Several measures were implemented in order to prevent the further spread of the virus in the first quarter of 2020[2,3], such as nationwide confinement and the restriction of individuals to their homes, which caused the greatest global confinement in history—at different levels depending on the different governments[4].

During this period of lockdown, personal limitations at different degrees were established, limiting the freedom of movement to the home environment; therefore, people could only leave their homes to cover their basic needs[5]. Though these measures have been vital for preventing the spread of COVID-19, they may have also resulted in adverse health effects[6]. Firstly, the ensuing reduction in social and physical opportunities to exercise may have had a direct effect on the sedentary lifestyle and physical inactivity of the population[7,8]. Secondly, unhealthy behaviours, especially those related to sedentary behaviours, may have a direct impact on mental health indicators[9].

In this sense, recent systematic reviews showed that the lockdown affected different mental health indicators, including distress and increased symptoms of depression and anxiety[10–13]. Besides, regarding mental health and physical activity, or more specifically distress, anxiety, and depression, some demographics (e.g., sex[13–19], age[13,14,16–19]), educational and work status[20], number of symptoms[20], and number of days in confinement[19,21,22] outcomes, seem to be associated with these outcomes or directly reduce or increase its levels.

A recent study indicates that persons with higher stress, depression, and anxiety levels performed low levels physical activities[23]. In general, some research shows that the physical activity habits were modified during the lockdown and that the level of physical activity dropped[24–27]. For instance, in Spain, during the lockdown, the intensity and quantity of physical activity decreased[28], the type of PA performed was modified[28,29] and the practice scenarios changed[30]. Although some sports activities were maintained during confinement thanks to different social media, the American College of Sport Medicine (ACSM) has recommended exercise counselling from a professional to improve the performance of these activities in the home environment[31]. Even though many physiological effects of the lack of exercise have been described, there are still few studies on the effects of lockdown on the habits of physical activity, which can be associated with higher risk of mental disorders[22].

Of this way, a better understanding the role of physical activity to predict mental health outcomes in people going through confinement and social isolation may contribute greatly in designing tools and in organizing optimum counseling during and after lockdown[10,32]. Thus, the aims of the present study were to determine the association between the characteristics of the physical activity performed during confinement and the risk on mental health among people in quarantine.

METHODOLOGY

Design and setting

A multicenter, cross-sectional, and observational study design was used to address the objectives of this study. Although an invitation was made to 12 Iberoamerican countries, only three countries complied with the requirement of an ethics committee approval. Data collection was carried out during the lockdown period after the WHO declared COVID-19 a public health emergency of international concern. The study began on March 15th, 2020, and was completed in June 2020. Current participating sites are listed in the clinical trial registry (NCT04352517, Study Completion, September 30th, 2020).

Participants

The electronic invitation was chosen to avoid face-to-face interaction. The sample comprises

people over 18 years of age from Spain, Brazil, and Chile. For recruiting the general public living in Ibero-American countries during the epidemic of COVID-19, the snowball sampling technique was used. The online survey was disseminated in 4 phases: a) firstly, the dissemination strategy was set via e-mail, social networks, smartphone apps, infographics, and video, b) contacting various socio-cultural communities, universities, and social networking groups, c) contacting personal contacts and encourage them to pass the survey on to others from the whole community, and d) seeking diverse volunteers through initial contacts. This study was conducted following the principles established by the protocol, the Declaration of Helsinki, the Ethical Guidelines for Clinical Research[33], and relevant laws and regulations. Researchers ensured that all necessary regulatory submissions were provided following local regulations, including local data protection regulations. Ethics approval was obtained from three countries participating in the study (CEC 08-20 Universidad Autónoma de Chile (Chile); 144//2020 Universidad de Extremadura (Spain); 30477320.5.0000.5659 Universidade de São Paulo (Brazil)). The study team was responsible for study reporting and interpretation, including interim data analyses and subgroup analyses.

Procedure

Study endpoints and data collection

Data collection took place over the confinement period from the second week of confinement to the confinement cessation. Previous surveys on the psychological impacts of SARS and influenza outbreaks were reviewed. The structured questionnaire consisted of questions that covered several areas: (1) demographic data; (2) health status, (3) mental health status; and (4) physical activity characteristics.

Measures

Demographics and medical history*:* sociodemographic data on gender, age, parental status, marital status, residential location, household size, education, and employment status were collected. Health status included physical symptom variables. Physical symptom variables included fever, chills, headache, myalgia, coughs, difficulty in breathing, dizziness, coryza, sore throat, and persistent fever. Lastly, days of quarantine and hours staying at home per day were collected.

Mental health status: It was measured using the Depression, Anxiety, and Stress Scale (DASS-21), which is an instrument designed to assess the negative emotional states of depression, anxiety, and stress. DASS-21 is comprised of seven items per emotion scored in a four-point Likert scale (varying from 0 to 3) and ranging from "Strongly Disagree" to "Totally Agree". The scores calculations were based on a previous study[34]. The depression subscale was formed by questions 3, 5, 10, 13, 16, 17, and 21. Questions 2, 4, 7, 9, 15, 19, and 20 formed the anxiety subscale. The stress subscale was formed by questions 1, 6, 8, 11, 12, 14, and 18. The total scores categorize each subscale into three levels: mild, moderate, and severe. Finally, the participants were divided into no risk (< 6) or risk (> 6). The DASS has been demonstrated to be a reliable and valid measure in assessing mental health in the Ibero-American population[35–37]. The DASS-21 was previously used in research related to SARS[34].

Physical activity characteristics: The International Physical Activity Questionnaire (IPAQ) short form was used. The metabolic equivalent of the total physical activity task (MET)-minutes/week was calculated using the following equation: sum of walking + moderate activity + vigorous MET-minutes/week[38]. Using guidelines for the IPAQ data processing and analysis, participants were divided into those who are (≥600 MET-minutes/week) and those who are not (<600 MET-minutes/week) sufficiently active. The IPAQ has been validated in different populations and countries, and showing acceptable validity (Spearman's ρ = 0.30, 95% CI: 0.23–0.36) and reliability (Spearman's ρ = 0.81, 95% CI: 0.79–0.82). Also, the questionnaire included questions about physical activity characteristics such as type of physical activity (general o specific) or used resource (non-professional or professional).

Statistical Analysis

Sample Size

The snowball sampling technique was employed to select the subjects. It is a special non-probability method used often in populations that are difficult for researchers to access. Like other non-probability sampling methods, the major drawback of snowball sampling is sampling bias; that is, the ability to generalize the study results may be limited[40]. To compensate for the weaknesses of snowball sampling, collecting a sample twice as large as the sample size for simple random sampling is currently an accepted and appropriate practice[41]. Therefore, a total of 258 participants from each country are needed, accepting alpha and beta risks of 0.05 and 0.20, respectively, with an effect size >0.50 (large), an estimated follow-up loss rate of 20%, and a design effect of 2.0.

Analysis

Descriptive statistics were calculated for sociodemographic characteristics, physical symptoms, and physical activity characteristics variables. To calculate the association between sociodemographic characteristics, physical symptoms, physical activity characteristics, and mental health symptoms (depression, anxiety, and stress), a bivariate analysis was used for quantitative variables and a Standard chi-squared for qualitative variables.

A logistic regression crude and adjusted by gender, age, educational level, professional situation, country, number of symptoms, and days of isolation was used to calculate the univariate associations between physical activity-related parameters and mental health outcomes such as anxiety, depression, and stress. All tests were two-tailed, with a significance level of $p < 0.05$. Statistical analyses were performed using SPSS Statistic 21.0 (IBM SPSS Statistics, New York, United States).

RESULTS

The characteristics of the sample included in the current study are shown in table 1. Among the 4,948 participants, a higher percentage were women, and most participants were younger than 40. The sample was recruited principally in Brazil and Spain, with a lower representation from Chile. Most of the participants presented an educational level at the bachelor's level, more than 80% were employed, and only a minority were unemployed. The descriptive results showed that participants stayed most of the time during the day at home.

Associations between the demographic variables of participants and mental health status are showed in Table 2. Being a woman meant a higher risk concerning all the mental health problems analyzed in this study. In addition, Brazilian participants aged between 18 and 29 who reported staying at home more than 19 hours per day presented a statistically relevant higher frequency than those without risk.

Results of logistic regressions testing the association between physical activity-related parameters and mental health outcomes such as anxiety, depression, and stress are showed in Table 3. The level of physical activity during the lockdown predicted the mental health outcomes in the crude model. Besides, a moderate level presents higher odds in comparison to the lower level. Otherwise, when adjusted by cofounders, the level of physical activity only predicts depression. A low level of physical activity during the lockdown presents the highest probability of depression compared to higher levels (OR = 1.317, 95% CI = 1.127 – 1.540). In addition, using a no professional resource to do physical activity is a predictive factor of adverse mental health status (OR Anxiety = 1.396, 95% CI = 1.213 - 1.607; OR Depression = 1.452, 95% CI = 1.272 - 1.658; OR Stress = 1.220 – 95% CI = 1.072 - 1.387). Furthermore, doing physical activity was a protective factor against the mental health outcomes analyzed, but only doing general physical activity showed a statistically significant odds ratio (OR Anxiety = 0.689, 95% CI = 0.582 - 0.816; OR Depression = 0.579, 95% CI = 0.492 - 0.681; OR Stress = 0.843 – 95% CI = 0.719 - 0.988).

DISCUSSION

The main findings of this study show that women, between 18 and 29 years old isolated du-

ring the pandemic present a higher risk of experiencing mental health disorders. In addition, a low level of physical activity during the period studied is associated with depression, and it is important to highlight that the use of professional resources for physical activity protected against anxiety, depression, and stress during the pandemic.

In the general population, the prevalence of mental health disorders is associated with demographic variables such as gender (prevalence is more common among women), age (more common in older people), or socioeconomic status (higher risk in unemployed people)[42]. For example, the latest report on the Spanish population[43] shows that the prevalence of mental disorders is higher in women, older people, and the unemployed. In the same way, based on the Global Burden of Disease Study[44], in the Region of the Americas, 7.7% of the female population are estimated to suffer from anxiety disorder versus 3.6% for the male population.

In a pandemic situation, the prevalence of mental health disturbances could increase even above 20%[17,44]. Female participants showed a significantly higher risk of experiencing mental disorders than their male counterparts. This is in accordance with previous studies that have observed that women are much more vulnerable to suffer mental disorders than men, also under isolation[10,12,17,45]. As above-mentioned, the prevalence of mental health problems is usually higher among women, generally because of having to balance caregiving with work and, usually, household tasks, being a more vulnerable group in this situation of overload[46]. As for age, young adults (18 – 30 years) reported higher values of stress, depression, and anxiety than those who are older[10]. A large amount of information from social media, the economic impact, and the growing hopelessness among young adults may explain these findings[10,17,47]. Besides, students between 18 – 24 years old had to adapt quickly, going from a face-to-face environment to an online one[48,49], increasing the pressure to succeed and postgraduate career plans. On the other hand, a modest variation in the global rate of prevalence has been shown in WHO regions[43], where Brazil leads the list of countries with the highest prevalence of anxiety (9.8% of the population) and, in addition, is among the countries with the highest prevalence of depression (5.8% of the population). This may explain why the highest scores were obtained by the Brazilian population in the present study, considering that the prevalence of mental health disorders is usually higher in this country.

Physical Activity Guidelines recommend that adults should engage in at least 150 minutes a week of moderate-intensity exercise or 75 minutes a week of high-intensity exercise (50). Among other benefits, regular physical activity has been associated with the alleviation of anxiety and depression symptoms[9,51]. In this sense, the benefits of physical activity on depression are well-established in the literature[9,51]. Additionally, physical activity may be a good indicator of adaptation to problems and motivation changes in closed environments[53]. After 520-days of the isolation period, exercise results to be a suitable method to counteract psycho-physiological deconditioning during confinement. In line with the findings of the present study, during the isolation period caused by the COVID-19 pandemic, previous studies have shown that the increase in regular physical activity is related to lower levels of depression in the Spanish and Latin-American populations[11,13,22,54].

However, the frequency and quality of information on the exercise routine would affect the degree of achievement of benefits and change the behaviour. Thus, the effectiveness depends on the awareness, knowledge, attitudes, and communication competence of health care professionals[55,56]. In this sense, physical activity professionals have been reported repeatedly as an important factor in the initiation of and adherence to exercise interventions (Motion for your mind, Study Completion 2019). To our knowledge, this is the first research that analyses the influence of sources (non-professional and professional) of exercise information on mental health during the lockdown caused by the COVID-19 pandemic. The present findings may corroborate the importance of using professional sources for physical activity, as it protects against the mental health outcomes studied. Despite this, a previous study suggested that most people could have used non-professional sources (> 80%) to search for information to do physical activity[57] during the lockdown caused by COVID-19.

Anyway, being regularly physically active may decrease the impact of the pandemic on mental health[58]. Previous studies indicate strong associations between reductions in physical activity and a higher risk of impaired mental health status[58,59]. Similarly, the present study shows that general physical activity is enough to protect against the mental health outcomes studied.

The major strength of this study is that it included the association between different characteristics of the physical activity performed, not only concerning the level of physical activity but also other variables less commonly analyzed such as type (general or specific) and source (professional or non-professional). Also, the study faced challenges such as recruiting participants from multiple countries and cities, which was particularly difficult due to the exceptional isolation situation that people were experiencing. One limitation of the study is its open-label observational nature, as data were self-reported and not verifiable from other sources. Besides, the linear regression analysis that was composed limits inferences about causality. To date, observational studies have been limited by various factors, including the number of participants, the participating countries, and the extent and duration of data collection. Therefore, data from this study are anticipated to be highly valuable.

Anyway, as exercise is a modifiable protective factor, easily promoted, and instantiated during lockdown situations, public and private sport health services may be able to adapt their services to those in greater danger of developing mental disorders. Finally, to enable physical activity professionals to provide such support, their curricula should include the positive effects of physical activity on mental health and tools for increasing the physical activity level of this population during special moments such as isolation periods or pandemics.

CONCLUSIONS

A low level of physical activity during a long isolation period is associated with a higher prevalence of depression; the use of professional resources for physical activity may protect against mental health disorders. Furthermore, the results suggest that Brazilian women aged between 18 and 29 who reported more than 19 h per day of isolation during pandemic situations are more likely to report higher levels of stress, depression, and anxiety state.

REFERENCES

1. World Health Organization. Weekly epidemiological update on COVID-19 - 29 June 2021 [Internet]. 2021 [cited 2021 Jul 2]. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---29-june-2021
2. Wilder-Smith A, Freedman DO. Isolation, quarantine, social distancing and community containment: Pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. Journal of Travel Medicine. 2020.
3. WHO. Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19). Who. 2020;
4. WHO. Covid-19: Cronología de la actuación de la OMS. Organización Mundial de la Salud. 2020.
5. García-Tascón M, Sahelices-Pinto C, Mendaña-Cuervo C, Magaz-González AM. The impact of the covid-19 confinement on the habits of pa practice according to gender (Male/female): Spanish case. International Journal of Environmental Research and Public Health [Internet]. 2020 Oct 1 [cited 2021 May 16];17(19):1–19. Available from: https://pubmed.ncbi.nlm.nih.gov/32977571/
6. Constandt B, Thibaut E, de Bosscher V, Scheerder J, Ricour M, Willem A. Exercising in times of lockdown: An analysis of the impact of COVID-19 on levels and patterns of exercise among adults in Belgium. International Journal of Environmental Research and Public Health. 2020;17(11).
7. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of COVID-19 home confinement on physical activity and eating behaviour preliminary results of the ECLB-COVID19 international online-survey. medRxiv. 2020.
8. Martinez E, Silva F, Morigi T, Zucoloto ML, Silva TL, Joaquim AG, et al. Physical activity in periods of social distancing due to covid-19: A cross-sectional survey. Ciencia e Saude Coletiva. 2020;
9. Carek PJ, Laibstain SE, Carek SM. Exercise for the treatment of depression and anxiety. International Journal of Psychiatry in Medicine [Internet]. 2011 Jan 1 [cited 2021 May 16];41(1):15–28. Available from: https://pubmed.ncbi.nlm.nih.gov/21495519/
10. Filgueiras A, Stults-Kolehmainen M. Risk Factors for Potential Mental Illness Among Brazilians in Quarantine Due To COVID-19. Psychological Reports [Internet].

2021 [cited 2021 May 16]; Available from: https://pubmed.ncbi.nlm.nih.gov/33567978/

11. Planchuelo-Gómez Á, Odriozola-González P, Irurtia MJ, de Luis-García R. Longitudinal evaluation of the psychological impact of the COVID-19 crisis in Spain. Journal of Affective Disorders [Internet]. 2020 Dec 1 [cited 2021 May 16];277. Available from: https://pubmed.ncbi.nlm.nih.gov/33065825/

12. Paz C, Mascialino G, Adana-Díaz L, Rodríguez-Lorenzana A, Simbaña-Rivera K, Gómez-Barreno L, et al. Behavioral and sociodemographic predictors of anxiety and depression in patients under epidemiological surveillance for COVID-19 in Ecuador. PLoS ONE [Internet]. 2020 Sep 1 [cited 2021 May 16];15(9 September). Available from: https://pubmed.ncbi.nlm.nih.gov/32997705/

13. Martinez EZ, Silva FM, Morigi TZ, Zucoloto ML, Silva TL, Joaquim AG, et al. Physical activity in periods of social distancing due to covid-19: A cross-sectional survey. Ciencia e Saude Coletiva [Internet]. 2020 Oct 1 [cited 2021 May 16];25:4157–68. Available from: https://orcid.org/0000-0003-0159-9644

14. Malta DC, Szwarcwald CL, Barros MB de A, Gomes CS, Machado ÍE, Souza Júnior PRB de, et al. A pandemia da COVID-19 e as mudanças no estilo de vida dos brasileiros adultos: um estudo transversal, 2020. Epidemiologia e servicos de saude : revista do Sistema Unico de Saude do Brasil [Internet]. 2020 Jan 1 [cited 2021 May 16];29(4):e2020407. Available from: https://pubmed.ncbi.nlm.nih.gov/32997069/

15. Bartoszek A, Walkowiak D, Bartoszek A, Kardas G. Mental well-being (Depression, loneliness, insomnia, daily life fatigue) during COVID-19 related home-confinement—A study from Poland. International Journal of Environmental Research and Public Health [Internet]. 2020 Oct 2 [cited 2021 May 16];17(20):1–12. Available from: https://pubmed.ncbi.nlm.nih.gov/33053787/

16. Castañeda-Babarro A, Coca A, Arbillaga-Etxarri A, Gutiérrez-Santamaría B. Physical activity change during COVID-19 confinement. International Journal of Environmental Research and Public Health [Internet]. 2020 Sep 1 [cited 2021 May 16];17(18):1–10. Available from: https://pubmed.ncbi.nlm.nih.gov/32967091/

17. González-Sanguino C, Ausín B, Castellanos MÁ, Saiz J, López-Gómez A, Ugidos C, et al. Mental health consequences during the initial stage of the 2020 Coronavirus pandemic (COVID-19) in Spain. Brain, Behavior, and Immunity [Internet]. 2020 Jul 1 [cited 2021 May 16];87:172–6. Available from: https://pubmed.ncbi.nlm.nih.gov/32405150/

18. Rogers NT, Waterlow NR, Brindle H, Enria L, Eggo RM, Lees S, et al. Behavioral Change Towards Reduced Intensity Physical Activity Is Disproportionately Prevalent Among Adults With Serious Health Issues or Self-Perception of High Risk During the UK COVID-19 Lockdown. Frontiers in Public Health [Internet]. 2020 Sep 30 [cited 2021 May 16];8. Available from: https://pubmed.ncbi.nlm.nih.gov/33102424/

19. Shah SMA, Mohammad D, Qureshi MFH, Abbas MZ, Aleem S. Prevalence, Psychological Responses and Associated Correlates of Depression, Anxiety and Stress in a Global Population, During the Coronavirus Disease (COVID-19) Pandemic. Community Mental Health Journal [Internet]. 2021 Jan 1 [cited 2021 May 16];57(1):101–10. Available from: https://pubmed.ncbi.nlm.nih.gov/33108569/

20. González-Sanguino C, Ausín B, Castellanos MÁ, Saiz J, López-Gómez A, Ugidos C, et al. Mental health consequences during the initial stage of the 2020 Coronavirus pandemic (COVID-19) in Spain. Brain, Behavior, and Immunity. 2020;

21. Werneck AO, Silva DR, Malta DC, Souza-Júnior PRB, Azevedo LO, Barros MBA, et al. Changes in the clustering of unhealthy movement behaviors during the COVID-19 quarantine and the association with mental health indicators among Brazilian adults. Translational behavioral medicine. 2021 Mar 16;11(2):323–31.

22. Werneck AO, da Silva DR, Malta DC, de Souza-Júnior PRB, Azevedo LO, Barros MB de A, et al. Lifestyle behaviors changes during the COVID-19 pandemic quarantine among 6,881 brazilian adults with depression and 35,143 without depression. Ciencia e Saude Coletiva [Internet]. 2020 Oct 1 [cited 2021 May 16];25 (suppl 2):4151–6. Available from: https://pubmed.ncbi.nlm.nih.gov/33027351/

23. Filgueiras A, Stults-Kolehmainen M. The Relationship Between Behavioural and Psychosocial Factors Among Brazilians in Quarantine Due to COVID-19. SSRN Electronic Journal. 2020;

24. Maugeri G, Castrogiovanni P, Battaglia G, Pippi R, D'Agata V, Palma A, et al. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. Heliyon. 2020;

25. Lesser IA, Nienhuis CP. The impact of COVID-19 on physical activity behavior and well-being of canadians. International Journal of Environmental Research and Public Health. 2020;

26. Sánchez-Sánchez E, Ramírez-Vargas G, Avellaneda-López Y, Orellana-Pecino JI, García-Marín E, Díaz-Jimenez J. Eating habits and physical activity of the spanish population during the covid-19 pandemic period. Nutrients. 2020;

27. Rogers NT, Waterlow NR, Brindle H, Enria L, Eggo RM, Lees S, et al. Behavioral Change Towards Reduced Intensity Physical Activity Is Disproportionately Prevalent Among Adults With Serious Health Issues or Self-Perception of High Risk During the UK COVID-19 Lockdown. Frontiers in Public Health. 2020;

28. IBV. Actividad Física en Tiempos COVID-19. Informe de Resultados. 2020.

29. García-Tascón M, Sahelices-Pinto C, Mendaña-Cuervo C, Magaz-González AM. The impact of the covid-19 confinement on the habits of pa practice according to gender (Male/female): Spanish case. International Journal of Environmental Research and Public Health. 2020;

30. Irazusta-Astiazarán J, Ara-Roy I. Actividad Física en la Población Universitaria Durante el Confinamiento Por Covid-19: Determinantes y Consecuencias Sobre el Es-

tado de Salud y la Calidad de Vida. [Internet]. 2020 [cited 2021 Jan 31]. Available from: https://www.csd.gob.es/sites/default/files/media/files/2020-06/Resumen%25%0A20Ejecutivo%2520Proyecto%2520AF%-2520confinamiento%2520universitarios%2520200605_FINAL%2520....pdf

31. ACSM. Staying active during the Coronavirus pandemic. Exercise is Medicine. 2020.

32. Constant A, Conserve DF, Gallopel-Morvan K, Raude J. Socio-Cognitive Factors Associated With Lifestyle Changes in Response to the COVID-19 Epidemic in the General Population: Results From a Cross-Sectional Study in France. Frontiers in Psychology [Internet]. 2020 Sep 29 [cited 2021 May 16];11:2407. Available from: www.frontiersin.org

33. World Medical Association declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA - Journal of the American Medical Association. 2013.

34. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. International journal of environmental research and public health. 2020;

35. Bados A, Solanas A, Andrés R. Psychometric properties of the Spanish version of Depression, Anxiety and Stress Scales (DASS). Psicothema. 2005;

36. Daza P, Novy DM, Stanley MA, Averill P. The depression anxiety stress scale-21: Spanish translation and validation with a Hispanic sample. Journal of Psychopathology and Behavioral Assessment. 2002;

37. Antúnez Z, Vinet E V. Escalas de depresión, ansiedad y estrés (DASS - 21): Validación de la versión abreviada en estudiantes universitarios Chilenos. Terapia Psicologica. 2012;

38. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003/08/06. 2003;35(8):1381–95.

39. Magnani R, Sabin K, Saidel T, Heckathorn D. Review of sampling hard-to-reach and hidden populations for HIV surveillance. AIDS, Supplement. 2005.

40. Johnston LG, Chen YH, Silva-Santisteban A, Raymond HF. An empirical examination of respondent driven sampling design effects among HIV risk groups from studies conducted around the world. AIDS and Behavior. 2013;

41. Depression and Other Common Mental Disorders Global Health Estimates.

42. Encuesta L. Encuesta Nacional de Salud ENSE, España 2017 [Internet]. [cited 2021 May 16]. Available from: https://www.mscbs.gob.es/estadEstudios/estadisticas/encuestaNacional/encuesta2017.htm

43. Reddy KS. Global Burden of Disease Study 2015 provides GPS for global health 2030 [Internet]. Vol. 388, The Lancet. Lancet Publishing Group; 2016 [cited 2021 May 16]. p. 1448–9. Available from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)31743-3/fulltext

44. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. The Lancet. 2020.

45. Alexander JL, Dennerstein L, Kotz K, Richardson G. Women, anxiety and mood: a review of nomenclature, comorbidity and epidemiology. [Internet]. Vol. 7, Expert review of neurotherapeutics. Taylor & Francis; 2007 [cited 2021 Jul 2]. p. S45–58. Available from: https://www.tandfonline.com/doi/abs/10.1586/14737175.7.11s.S45

46. Haro JM, Palacín C, Vilagut G, Martínez M, Bernal M, Luque I, et al. Prevalence of mental disorders and associated factors: Results from the ESEMeD-Spain study. Medicina Clinica [Internet]. 2006 Apr 1 [cited 2021 May 16];126(12):445–51. Available from: https://pubmed.ncbi.nlm.nih.gov/16620730/

47. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations [Internet]. Vol. 33, General Psychiatry. BMJ Publishing Group; 2020 [cited 2021 May 16]. p. 100213. Available from: /pmc/articles/PMC7061893/

48. Ozamiz-Etxebarria N, Dosil-Santamaria M, Picaza-Gorrochategui M, Idoiaga-Mondragon N. Stress, anxiety, and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain. Cadernos de Saude Publica [Internet]. 2020 [cited 2021 May 16];36(4). Available from: https://pubmed.ncbi.nlm.nih.gov/32374806/

49. Beiter R, Nash R, McCrady M, Rhoades D, Linscomb M, Clarahan M, et al. The prevalence and correlates of depression, anxiety, and stress in a sample of college students. Journal of Affective Disorders [Internet]. 2015 Mar 1 [cited 2021 May 16];173:90–6. Available from: https://pubmed.ncbi.nlm.nih.gov/25462401/

50. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour [Internet]. Vol. 54, British Journal of Sports Medicine. BMJ Publishing Group; 2020 [cited 2021 May 23]. p. 1451–62. Available from: http://bjsm.bmj.com/

51. Cooney GM, Dwan K, Greig CA, Lawlor DA, Rimer J, Waugh FR, et al. Exercise for depression: Some benefits but better trials are needed. Saudi Medical Journal [Internet]. 2013 Nov [cited 2021 May 16];34(11):1203. Available from: https://pubmed.ncbi.nlm.nih.gov/24026850/

52. Mon-López D, Bernardez-Vilaboa R, Fernandez-Balbuena AA, Sillero-Quintana M. The influence of COVID-19 isolation on physical activity habits and its relationship with convergence insufficiency. International Journal of Environmental Research and Public Health [Internet]. 2020 Oct 2 [cited 2021 May 16];17(20):1–9. Available from: https://pubmed.ncbi.nlm.nih.gov/33053701/

53. Schneider S, Brümmer V, Carnahan H, Kleinert J, Piacentini MF, Meeusen R, et al. Exercise as a countermeasure to psycho-physiological deconditioning during long-term

confinement. Behavioural Brain Research [Internet]. 2010 Aug [cited 2021 May 16];211(2):208–14. Available from: https://pubmed.ncbi.nlm.nih.gov/20346985/

54. Pieh C, Budimir S, Probst T. The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria. Journal of Psychosomatic Research. 2020 Sep 1;136:110186.

55. Machaczek KK, Allmark P, Goyder E, Grant G, Ricketts T, Pollard N, et al. A scoping study of interventions to increase the uptake of physical activity (PA) amongst individuals with mild-to-moderate depression (MMD). BMC Public Health [Internet]. 2018 Mar 21 [cited 2021 May 16];18(1):1–22. Available from: https://doi.org/10.1186/s12889-018-5270-7

56. Motion for your mind [Internet]. 2019 [cited 2021 May 16]. Available from: http://www.euro.who.int/pubrequest

57. Sánchez-Sánchez E, Ramírez-Vargas G, Avellaneda-López Y, Orellana-Pecino JI, García-Marín E, Díaz-Jimenez J. Eating habits and physical activity of the spanish population during the covid-19 pandemic period. Nutrients [Internet]. 2020 Sep 1 [cited 2021 May 16];12(9):1–12. Available from: /pmc/articles/PMC7551353/

58. Meyer J, McDowell C, Lansing J, Brower C, Smith L, Tully M, et al. Changes in physical activity and sedentary behavior in response to covid-19 and their associations with mental health in 3052 us adults. International Journal of Environmental Research and Public Health [Internet]. 2020 Sep 2 [cited 2021 May 23];17(18):1–13. Available from: /pmc/articles/PMC7559240/

59. Stanton R, To QG, Khalesi S, Williams SL, Alley SJ, Thwaite TL, et al. Depression, anxiety and stress during COVID-19: Associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. International Journal of Environmental Research and Public Health [Internet]. 2020 Jun 1 [cited 2021 May 23];17(11):1–13. Available from: https://pubmed.ncbi.nlm.nih.gov/32517294/

Conflict of interest

The authors declare they have no conflict of interest.
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Table 1

General characteristics of participants isolated during COVID-19 pandemic (N = 4,948)

Gender	
Woman	3,245 (65.6%)
Man	1,703 (34.3%)
Age group	
18 to 29 years old	2,317 (46.8%)
30 to 39 years old	1,197 (24.2%)
40 to 49 years old	700 (14.1%)
50 to 59 years old	501 (10.1%)
> 60 years old	233 (4.7%)
Country	
Spain	1,030 (20.8%)
Chile	532 (10.8%)
Brazil	3,386 (68.4%)
Educational Level	
Lower secondary school	424 (8.6%)
High school	1,025 (20.7%)
University-Bachelors	2,352 (47.55%)
University-Masters	696 (14.1%)
University-Doctorate	451 (9.1%)
Employment status	
Unemployed	403 (8.1%)
Farmers	177 (3,6%)
Retired	167 (3.4%)
Student	1,697 (34.3%)
Employed	2,501 (50.6%)
Missing	3 (0.1%)
Staying at home (hours)	
Less than 10 hours per day	150 (3%)
Between 10 and 19 hours per day	566 (11.4%)
More than 19 hours per day	4,229 (85.5%)
Missing	3 (0.1%)
Number of symptoms	1.74 ± 1.54
Time of isolation (days)	23.29 ± 15.39
Total physical activity (MET/week)	3,189.67 ± 2,802.23
Sitting time (minutes/week)	2,210.56 ± 1,252.45

Results presented as a frequency or mean±standard deviation.

Table 2

Sample characteristics and association with the risk of mental health problems during the COVID-19 lockdown (N = 4,948)

	Stress			Anxiety			Depression		
	No Risk	Risk	p	No Risk	Risk	p	No Risk	Risk	p
Gender			<0.001			<0.001			<0.001
Woman	1,582 (57.8%)	1,663 (75.1%)		2,094 (60.0%)	1,151 (79.1%)		1,916 (61.8%)	1,329 (72.0%)	
Man	1,153 (42.2%)	550 (24.9%)		1,398 (40.0%)	305 (20.9%)		1,186 (38.2%)	517 (28.0%)	
Age groups			<0.001			<0.001			<0.001
18 to 29 years old	1,096 (40.1%)	1,221 (55.2%)		1,491 (42.7%)	826 (56.7%)		1,192 (38.4%)	1,125 (60.9%)	
30 to 39 years old	671 (24.5%)	526 (23.8%)		871 (24.9%)	326 (22.4%)		808 (26.0%)	389 (24.2%)	
40 to 49 years old	425 (15.5%)	275 (12.4%)		511 (14.6%)	189 (13.0%)		511 (16.5%)	189 (14.1%)	
50 to 59 years old	357 (13.1%)	144 (6.5%)		413 (11.8%)	88 (6.0%)		394 (12.7%)	107 (10.1%)	
> 60 years old	186 (6.8%)	47 (2.1%)		206 (5.9%)	27 (1.9%)		197 (6.4%)	36 (4.7%)	
Country			<0.001			<0.001			<0.001
Spain	696 (25.4%)	334 (15.1%)		781 (22.4%)	249 (17.1%)		779 (25.1%)	251 (13.6%)	
Chile	342 (12.5%)	190 (8.6%)		379 (10.9%)	153 (10.5%)		386 (12.4%)	146 (7.9%)	
Brazil	1,697 (62.0%)	1,689 (76.3%)		2,332 (66.8%)	1,054 (72.4%)		1,937 (62.4%)	1,449 (78.5%)	
Educational Level			<0.001			<0.001			<0.001
Lower secondary school	279 (10.2%)	145 (6.6%)		314 (9.0%)	110 (7.6%)		300 (9.7%)	124 (6.7%)	
High school	547 (20.0%)	478 (21.6%)		678 (19.4%)	347 (23.8%)		601 (19.4%)	424 (23.0%)	
University-Bachelors	1,264 (46.2%)	1,088 (49.2%)		1,640 (47.0%)	712 (48.9%)		1,428 (46.0%)	924 (50.1%)	
University-Masters	385 (14.1%)	311 (14.1%)		509 (14.6%)	187 (12.8%)		453 (14.6%)	243 (13.2%)	
University-Doctorate	260 (9.5%)	191 (8.6%)		351 (10.1%)	100 (6.9%)		320 (10.3%)	131 (7.1%)	
Employment status			<0.001			<0.001			<0.001
Unemployed	184 (6.7%)	219 (9.9%)		244 (7.0%)	159 (10.9%)		212 (6.8%)	191 (10.4%)	
Farmers	101 (3.7%)	76 (3.4%)		125 (3.6%)	52 (3.6%)		123 (4.0%)	54 (2.9%)	
Retired	133 (4.9%)	34 (1.5%)		142 (4.1%)	25 (1.7%)		140 (4.5%)	27 (1.5%)	
Student	776 (28.4%)	921 (41.6%)		1,083 (31.0%)	614 (42.2%)		837 (27.0%)	860 (46.6%)	
Employed	1,539 (56.3%)	962 (43.5%)		1,896 (54.3%)	605 (41.6%)		1,788 (57.7%)	713 (38.6%)	
Staying at home (hours)			<0.001			0.05			<0.001
Less than 10 hours per day	82 (3.0%)	68 (3.1%)		99 (2.8%)	51 (3.5%)		53 (3.1%)	97 (2.9%)	
Between 10 and 19 hours per day	372 (13.6%)	194 (8.8%)		431 (12.4%)	135 (9.3%)		146 (13.6%)	420 (7.9%)	
More than 19 hours per day	2,278 (83.4%)	1,951 (88.2%)		2,959 (84.8%)	1,270 (87.2%)		1,647 (83.3%)	2,582 (89.2%)	

Results presented as a frequency (percentages) or mean ± standard deviation.

Table 3

Odds ratio for risk of anxiety, depression, and stress based on different physical activity indicators during the lockdown.

	Anxiety		Depression		Stress	
	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
Level of Physical Activity						
Model 0, crude						
High	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
Moderated	1.275 (1.095,1.485)	0.002	1.354 (1.172,1.564)	<0.001	1.265 (1.099,1.457)	0.001
Low	1.188 (1.022,1.382)	0.025	1.276 (1.107,1.471)	0.001	1.111 (0.967,1.276)	0.139
Model 1, adjusted[a]						
High	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
Moderated	1.115 (0.946,1.315)	0.195	1.289 (1.100,1.511)	0.002	1.137 (0.974,1.328)	0.104
Low	1.072 (0.911,1.262)	0.401	1.317 (1.127,1.540)	0.001	1.045 (0.897,1.217)	0.576
Resources used						
Model 0, crude						
Professional	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
No professional	1.497 (1.315,1.704)	<0.001	1.493 (1.323,1.685)	<0.001	1.280 (1.139,1.440)	<0.001
Model 1, adjusted[a]						
Professional	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
No professional	1.396 (1.213,1.607)	<0.001	1.452 (1.272,1.658)	<0.001	1.220 (1.072,1.387)	0.003
Physical activity type						
Model 0, crude						
Do not do exercise	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
General	0.662 (0.567,0.773)	<0.001	0.601 (0.519,0.695)	<0.001	0.802 (0.695,0.927)	0.003
Specific	0.844 (0.708,1.006)	0.058	0.800 (0.676; 0.945)	0.009	0.902 (0.764,1.064)	0.221
Model 1, adjusted[a]						
Do not do exercise	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
General	0.689 (0.582,0.816)	<0.001	0.579 (0.492,0.681)	<0.001	0.843 (0.719,0.988)	0.035
Specific	0.951 (0.786,1.152)	0.610	0.890 (0.740,1.070)	0.214	1.044 (0.871,1.253)	0.639

OR: odds ratio; 95%CI: confidence interval.

[a] Model 1 was adjusted by gender, age, educational level, professional situation, country, number of symptoms, and days of isolation.