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PHYSICAL EXERCISE DURING THE PANDEMIC: A SYSTEMATIC REVIEW USING PRISMA

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ABSTRACT

This systematic review analyzed the impact of physical exercise during the COVID-19 pandemic. Several academic databases were used combining the MeSH search terms: “Covid-19”, “exercise” and the DeCS terms: “Pandemic”, “exercise”, using PRISMA’s guidelines. Articles that were available in the databases, which were written in the years 2020 and 2021, were extracted, 16,385 articles were found. After making additional filters, 160 articles were included which were recorded in a spreadsheet. The items included in the check list of the PRISMA methodology were applied, resulting in 32 articles considered in the present paper. From the selected articles, 3 are systematic reviews,

7 scientific notes and 22 are quantitative researches. We concluded that physical exercise is a necessary tool to address the negative consequences of the pandemic and of the measures taken to mitigate infections, however, some processes are limited to repeating the WHO recommendations for the practice of physical activity.

KEY WORDS

covid-19, pandemic, physical activity, physical exercise.

INTRODUCTION

In December 2019 in Wuhan, China, the first epidemic outbreak of Covid-19 occurred and since then the world has never been the same: commercial activity ceased, isolation was taken as the main measure, gyms, schools, universities, parks, supermarkets, among others, were closed and countries implemented confinement measures to prevent the rapid spread of this virus. This is due to the fact that this infectious disease is transmitted from person to person quickly; all it takes is for someone infected to cough, sneeze or leave particles of their saliva in the air, which quickly fall to the surface, generating a high risk of contagion for anyone who comes into contact with the contaminated surface and touches their face (eyes, nose or mouth).

There are currently more than 146 million infected people in the world. The United States ranks first in the list of infected people with more than 31.9 million infections and more than 571,000 deaths; it is followed by India with 16.6 million confirmed cases and more than 189,000 deaths; in South America, Brazil ranks third with 14.2 million infected and 386,000 deaths. Colombia has more than 2 million infected and more than 70,000 deaths. positive case was identified in the population (data obtained from the Johns Hopkins University data repository). It is noted that while most people who become ill with Covid-19 have mild to moderate symptoms and recover successfully, it is still (despite the global vaccination status) a disease with a high mortality rate that also requires intensive care for those with more severe symptoms.

Due to the high rate of spread of the virus and the mortality condition, one of the most effective measures is isolation, which implies changes in the usual conditions of citizens. On 22 March 2020, the President of the Republic of Colombia issued Decree 457, in which he ordered the mandatory preventive isolation of all inhabitants of the Republic of Colombia, from 00:00 a.m. on 25 March 2020 until 00:00 a.m. on 13 April 2020, within the framework of the health emergency due to the COVID-19 Coronavirus, which extends until the beginning of 2021. This period of isolation or quarantine implies "separation or isolation from family and friends and restriction of movement, which is so necessary for human beings. It also means a break with routines, hobbies, leisure activities and freedom" (1).

Months of home confinement can drastically increase physical inactivity (2); as Antilao (3) puts it, the health measures taken, which restrict mobility, can lead to prolonged periods of physical inactivity at home, where watching television, using the computer, mobile phone and sitting most of the day can negatively affect physical health and functional status; This is how people, at home, started to look for options to try to avoid negative consequences such as obesity and sedentary lifestyles which are associated with multiple health consequences just as lethal as Covid-19; in this way social networks such as Instagram, Facebook and YouTube were flooded with people giving advice on how to exercise and have healthy eating habits, which in addition to promoting the well-being of people, helped to have clear objectives during the time of confinement.

It is not only physical health that is affected by inactivity and confinement; in fact, perhaps one of the most commonly heard concepts related to covid-19 is mental health. This is because, in both healthy people and those infected or at risk of covid-19 infection, emotions and psychological disorders seem to be on the rise. According

to Andreu (1), in the general population, anxiety and fear may develop due to the feeling of living through a global catastrophe, uncertainty about the future, personal frustration which can lead to apathy or over-information which can sometimes lead to hypochondria. Also, depending on the support network and the people with whom they live, confinement can generate feelings of loneliness, sadness, anhedonia or emotional ups and downs that can affect their relationships and communication at home. In the case of children and adolescents, symptoms of post-traumatic stress, aggressiveness and disorders in sleeping and eating patterns are reported, "children will have problems in emotional and behavioural regulation, as they are in full development and suffer from a deprivation of movement, street play and social interaction. In addition, they need routines and habits to feel secure, achieve stability and follow their biological rhythm. Restriction of movement will lead to anger, crying, fear, eating disorders and some hyperactivity" (1). Another phenomenon observed with the pandemic, and related to mental health, is financial loss, which has reached households due to unemployment as a result of the closure of commerce and other activities, generating greater indicators of anxiety and stress.

To further elucidate clearly the effects of confinement on individuals, China conducted a cross-sectional study at the onset of the pandemic that collected data on 7-day physical activity behaviour and found that almost 60% of older adults did not meet the physical activity volume requirements to confer a health benefit. During non-epidemic periods, only 14% of Chinese residents do not follow WHO physical activity recommendations (4). Social isolation further exacerbates health deterioration during the Covid-19 pandemic (5). A prolonged period of physical inactivity can dramatically increase the progression of comorbidities, sarcopenia and frailty (6; 7), which may significantly affect people's quality of life, decreasing their caloric expenditure and mobility, leading to sedentary behaviour and an increase in the number of health disorders, which affect the respiratory, cardiovascular and neurological systems, as well as mental health. Physical exercise is used as a non-pharmacological treatment in many chronic diseases, so it could be used for the effects caused by Covid-19, producing anti-inflammatory and anti-fibrotic effects that allow the transport of oxygen to the whole body, reducing these effects (8).

Strengthening routines, musical classes and routines of all training methods began to accompany people at home while they were in confinement; the fitness and wellness industry began its rise with the sale of sports equipment such as dumbbells, mats, multifunctional, exercise bikes, elliptical, treadmills, trx, elastic bands among others that served to build a small gym in the living room of their homes and thus not lose shape or even begin to gain it, people understood that they did not require a gym to practice physical activity (1); (1); finding in physical activity at home a way to occupy their free time, to isolate themselves from the global situation and to maintain their health despite confinement. Even platforms such as YouTube, and video game consoles increased their popularity; pandemic games such as Ring Fit Adventures (Nintendo Switch), Wii Fit (Wii), Aces Of The Multiverse (PS4) and Zumba Fitness World Party (Xbox) were massively sold; likewise, it should be noted that guides and recommendations for physical activity and exercise at home began to be published on the internet for multiple populations (1), which allowed different alternatives to be found for those who wished to continue doing physical activity and/or exercise.

In accordance with the above, the aim of this systematic review is to identify the research that related the practice of physical activity and exercise with the

confinement resulting from Covid-19 and the impacts that it could generate in the population.

MATERIALS Y METHODS

The present systematic review used the PRISMA guidelines for systematic reviews and meta-analyses to ensure that the included articles met the eligibility conditions, thus using the 27-item checklist to facilitate the preparation and presentation of the report.

Inclusion and exclusion criteria: the search was limited to articles in English or Spanish that had the full text published and included the key words of the study. Theses, opinion articles, letters to the editor, guides and commentaries were excluded. In addition, articles in which the intervention was a survey, online survey, telephone survey, questionnaire, online questionnaire, telephone questionnaire, interviews, semi-structured interviews, test application (unrelated to the exercise) were also excluded.

Search strategy: The electronic databases of ScienceDirect, Scopus, PubMed, Taylor and Francis and Oxford were consulted during the month of April 2021, combining the MeSH search terms: "Covid-19", "exercise" and the DeCS terms: "pandemic", "exercise"; articles were extracted that were available in the databases, that were written in the years 2020 and 2021, were related to medicine or health sciences and psychology, excluding those related to physiotherapy and the use of exercise for the treatment of pre-existing diseases; likewise, articles related to other topics such as communication, politics and others that were identified in the databases consulted despite the filters applied were filtered again to exclude those that were related to other topics such as communication, politics and others that were identified in the databases consulted despite the filters applied.

For the eligibility of the articles, the titles, abstracts and keywords of all the identified studies were initially reviewed, and in the event that the abstract did not make it possible to assess the eligibility of the article, the full article was reviewed.

Once this information was accessed and articles were selected, the PRISMA 2020 checklist was implemented.

Data extraction strategy: A drive spreadsheet was used in which the following elements were recorded: title, authors, year of publication, objective, methodological design, type of intervention, participants and results.

Figure 1 below details the process of this review.

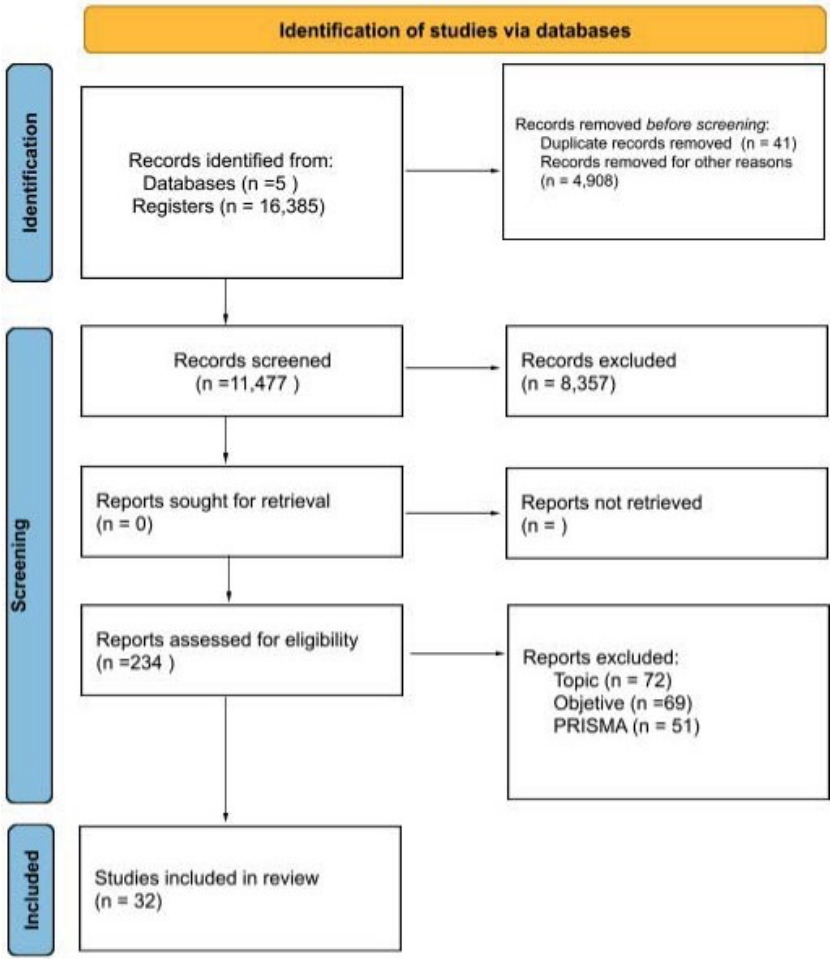

Figure 1. Study selection flow according to the PRISMA statement.

RESULTS

A total of 16,385 articles were found using the descriptors (2,269 in PubMed, 2,469 in Scopus, 6,046 in Science Direct, 4,040 in Taylor and Francis and 1,561 in Oxford); after applying the filters in each database, 1,734 articles were selected in the PubMed database, 1,266 in the Scopus database, 1,611 in Science Direct, 2,994 in Taylor and Francis and 1,104 in Oxford. 104 in the Oxford database; however, after additional filtering of each article according to the title and objectives, a total of 160 articles were included in this research, which were registered in a spreadsheet in Drive; the items included in the checklist of the PRISMA methodology were applied to these articles, resulting in 32 articles to be considered in this research. The results of the search are identified in figure 1 presenting the selection route of relevant articles. Table 1 presents the characteristics of the 32 included research studies; of these, three are systematic reviews developed between 2020 and 2021 that aimed to assess and/or analyse the effects of physical activity or exercise in the population during the pandemic. Likewise, seven scientific notes were identified within the research found,

in which the authors focus on providing guidelines on how physical exercise should be performed, its benefits and how it reduces the risk of death from Covid-19.

Twenty-two investigations included in this review are quantitative, of which eleven are descriptive correlational, in which the authors relate physical exercise with Covid-19, carrying out studies where surveys are used to generate the results; ten are experimental, in which a manipulation of the variables is carried out under controlled conditions, through virtual and face-to-face exercise programmes, where the subjects were measured at different times and one is causal comparative, in which the authors relate physical exercise with Covid-19 to find out its positive and negative effects.

Study	Population		Characteristics						Results
	Total (items / persons)	Age (years)	Objective	Type of intervention					
				Description	Duration (weeks)	Frequency (sessions)	Time (minutes)	Intensity	
(Alawna et al., 2021) (9)	11	18 / 55	To analyse the effects of aerobic exercise on immunological biomarkers	Cycling / walking	N/A	2 / 3	20 / 60	55% - 80% / 60% - 80% VO2max	It was shown that patients should follow a regular aerobic exercise programme.
(Bentlage et al., 2020) (10)	6	0 / 60 +	Recommending practices to maintain active lifestyles during pandemics	Moderate physical activity / Vigorous physical activity	7 / 7	1 / 1	150 / 75	Moderate / Vigorous	The exercises suggested by WHO and AHA are useful for the general population.
(Chaabene et al., 2021) (11)	17	65 / 83	Examining the effects of home-based exercise programmes on measures of fitness	Strength training	8 / 16	≤3 /> 3	≤ 30 /> 30	60% - 70% VO2max	Home-based exercise is an alternative to physical inactivity and to preserve/improve health and fitness.
Rooney et al., (2020) (12)	10	N/A	Comparing physical function and physical fitness in coronavirus-infected individuals	Aerobic and endurance training	6	2	60 / 90	60% - 70% VO2max	SARS-CoV patients were shown to have reduced levels of post-infection physical function and fitness compared to healthy controls.
Bohn et al., (2021) (13)	72	69 / 79	Observe the effects of home confinement on physical fitness.	Aerobic capacity, body strength	N/A	N/A	60 / 60	Moderate / Vigorous	There is evidence of a decrease in strength in both sexes, but not in aerobic capacity.
Brazo-saya et al., (2021) (14)	35	<60	Evaluating a multicomponent training programme	Multi-component training	11 / 11	2 / 3	150 / 75	60% - 70% VO2max	There were significant decreases in PA. In addition, there was a slight decrease in self-reported levels of disability.
Cataldi et al., (2021) (15)	30	18 / 18	Checking a CrossFit programme to mitigate fitness deficits	CrossFit Training	8 / 8	N/A	60 / 60	Moderate / Vigorous	Crossfit training could positively affect overall physical well-being and mental attitude.

Gao et al., (2020) (16)	105	<18	Exploring the impact of lifestyle and individual status on the acquisition of COVID-19	Moderate physical activity / Vigorous physical activity	8 / 8	5 / 5	N/A	Moderate / Vigorous	Lifestyle and health status can affect the occurrence of COVID-19.
McCarthy et al., (2021) (17)	5395	14 / 93	Explore patterns of activity tracked by smartphones	Physical activity	1 / 1	1 / 1	30	N/A	Tracked data suggest a significant drop in physical activity during the pandemic.

Study	Population		Characteristics					Results
	Total (items / persons)	Age (years)	Objective	Type of intervention				
				Description	Duration (weeks)	Frequency (sessions)	Time (minutes)	Intensity	
McGrath et al., (2020) (18)	209	27 / 90	Evaluating the "sheds for life" programme	Physical activity	10 / 10	5 / 5	30	N/A	Attention must be focused on those who are most vulnerable and in need of tailored interventions
Shaw et al., (2020) (19)	14	20 / 36	Cycle ergometry test until exhaustion	Test	1 / 1	1 / 1	N/A	Vigorous	No detrimental effect of wearing a non-disposable drape or surgical mask while exercising vigorously was found.
Berengüí et al., (2021) (20)	1019	35	To analyse commitment and feelings of insecurity related to the practice of sport.	Physical activity	N/A	2.88 ± 1.6	3.58 ± 2.7 h	Moderate	Supporting people to stay active should be seen as an integral part of pandemic-related activities.
Cheval et al., (2021) (21)	273	40 ± 18	To assess whether changes in physical activity and sedentary behaviour during the pandemic are associated with changes in physical and mental health.	Physical activity	2 / 2	1 / 1	150	Moderate / Vigorous	In the pandemic, less time in physical activity and more sedentary behaviour were identified, both associated with poorer physical health, mental health and subjective vitality.

Da Silveira et al., (2021) (22)	N/A	0 / 99	Analysing physical exercise as a tool to support the immune system against COVID-19	Aerobic exercise and strength	7 / 7	1 / 1	150	Moderate	Regular exercise at an appropriate intensity: for the immune system in infections such as COVID 19 includes increased immunosurveillance and improved immune competence.
Epstein et al., (2020) (23)	16	34 ± 4	Analyse returners to exercise who wear a mask during training.	Regular reactive aerobic activities	7 / 7	1 / 1	150 / 75	Moderate / Vigorous	In healthy subjects, aerobic exercise with a surgical mask is safe and feasible.

Study	Population		Characteristics					Results
	Total (items / persons)	Age (years)	Objetive	Type of intervention				
				Description	Duration (weeks)	Frequency (sessions)	Time (minutes)	Intensity	
Fernández et al., (2020) (24)	N/A	0 / 99	Inquiring about physical exercise as a multimodal tool for COVID-19	Physical exercise	7 / 7	1 / 1	60	60% - 80% VO2max	Training exerts immunoregulatory effects, controls viral entry gate, modulates inflammation
Franco et al., (2021) (25)	336	35 / 64	Establish the level of physical activity (PA), expressed as energy expenditure (MET-minutes/week).	Physical activity	7 / 7	1 / 1	150 / 75	Moderate / Vigorous	Isolation changed PA behaviours. The decrease in energy expenditure during confinement had a negative effect
Jiménez-Pavón et al., (2020) (26)	N/A	N/A	Showcase exercises that serve as therapy for older people during the pandemic.	Multi-component training	N/A	5 / 7	150 / 300	65% - 75% VO2max	Older adults can develop body weight exercises such as squats, sit-to-stand, stair climbing, weight lifting, walking at home, dancing and balancing.

Kirwan et al., (2020) (27)	N/A	60 / 90	Involve participants in exercise selection and programme design.	Resistance exercises	3	2 / 3	53	51% - 69% VO2max	Reductions in physical activity, disruption of normal eating habits, stress and altered sleep patterns will put older people at greater risk of sarcopenia.
Lakicevic et al., (2020) (28)	N/A	<65	Prescribing geriatric exercise in the COVID-19 pandemic	Physical activity	7 / 7	1 / 1	150 / 75	Moderate/ Vigorous	The purpose of home exercises is to maintain and improve overall health and promote functional independence
Lesser et al., (2020) (29)	1366	<19	Describing the impact of covid-19 on physical activity	Physical activity	7 / 7	1 / 1	150 / 75	Moderate/ Vigorous	Health promotion measures aimed at increasing levels of physical activity in inactive people should be generated in order to increase their sense of well-being.
Maertl et al., (2021) (30)	1034	18 / 74	Analysing PA in adults during total confinement	Physical activity	7 / 7	1 / 1	150 / 75	Moderate/ Vigorous	Tailored intervention strategies should be targeted, as they were significantly less likely to be physically active during the pandemic situation.

Study	Population			Characteristics					Results
	Total (items / persons)	Age (years)	Objetive	Type of intervention					
				Description	Duration (weeks)	Frequency (sessions)	Time (minutes)	Intensity	
Nienhuis et al., (2020) (31)	1098	<19	Assess whether there are gender differences in physical activity.	Physical activity	7 / 7	1 / 1	150 / 75	Moderate/ Vigorous	Women were less active than men and experience more anxiety. It is imperative to advocate for and provide environmental opportunities and support for physical activity to reduce the mental duress women may be experiencing.

Nyenhuis et al., (2020) (32)	N/A	N/A	Creating an exercise and fitness guide for people with asthma	Circuit training	N/A	3 / 5	15 / 25	Moderate/ Vigorous	Circuit training like this provides strength training benefits.
Quinn et al., (2020) (33)	27	66	To describe a physical activity training programme for newly diagnosed people with PD (Parkinson's disease).	Aerobic exercise	8	2	3	Vigorous	Remotely delivered interventions can serve as a sustainable platform for physical activity training programmes for people with PD.
Schmidt et al., (2020) (34)	1711	4 / 17	Comparing physical activity and recreational screen time, before and during the most stringent time of the pandemic	Physical activity	7 / 7	1 / 1	150 / 75	Moderate/ Vigorous	Sports activity decreased while recreational screen time increased during strict quarantine.
Schwartz et al., (2021) (35)	30	>60	Designing an online physical activity protocol	Physical activity	5 / 8	1 / 4	45	Moderate/ Vigorous	The designed protocol was found to be safe, conducive to high adherence and satisfaction rates.
Suzuki et al., (2020) (36)	165	70 / 86	To assess how public health constraints impact the PA, subjective well-being and health-related quality of life of older adults living in the community.	Physical activity	7 / 7	1 / 1	150 / 75	Moderate / Vigorous	Older adults should be helped to integrate PA under public health restrictions in a safe, efficient, simple and unsupervised way, as the restrictions are affecting them.

Study	Population		Characteristics						Results
	Total (items / persons)	Age (years)	Objetive	Type of intervention					
				Description	Duration (weeks)	Frequency (sessions)	Time (minutes)	Intensity	
Tittlbach et al., (2021) (37)	22822	≥18	To examine whether adherence to the guidelines for MVPA and MSE is associated with a lower prevalence of overweight/obesity.	Physical activity	7 / 7	1 / 1	150 / 75	Moderate / Vigorous	Compliance with the guidelines was associated with a lower prevalence rate of overweight/obesity.
Wickersham et al., (2021) (38)	770	<18	Describing trajectories of physical activity after the onset of lock-in among students	Physical activity	N/A	N/A	N/A	N/A	We found an increase in the number of steps walked per week since the start of quarantine, but a decrease in the number of miles walked per week among students.
Yang et al., (2020) (39)	N/A	N/A	Describe different considerations regarding exercise, nutrition and medication during the medication during the pandemic	Resistance exercises	>5	2 / 3	200 / 400	Moderate/ Vigorous	Physical activities have the long-term positive effects of relieving stress, improving mood and promoting long-term mental health.
Yang et al., (2020) (40)	431	18 / 65	Investigating changes in the PA of U.S. residents during the pandemic	Physical activity	4	N/A	52 / 46	Moderate/ Vigorous	PA levels in US residents declined during the quarantine. The use of gamification may be useful to counteract this decline in practice.

DISCUSSION

Covid-19, being an unknown element that has a great impact on people's health, implied the need for research related to this disease; however, to date, most published research is associated with the negative effects that the disease has on people and the methods of intervention, treatment and rehabilitation of the same.

Nowadays, this phenomenon should not only occupy professionals in the interventive professionals in the interventional approach; that of prevention and health promotion must continue to be present, especially when talking about serious diseases or diseases that generate effects on the health of many people, hence the practice of physical activity and exercise become necessary tools to address and prevent the negative consequences of the disease and the measures taken to mitigate the contagion (40).

Additionally, it is necessary to highlight that covid-19 not only affected those infected with this disease; on the contrary, the health measures implemented could also affect the physical and mental health of people, increasing one of the public health problems that has been fought in one of the most extensive wars: sedentary lifestyles (34). Hence, identifying measures to mitigate the negative effects of the disease, but also those to decrease the conditions conducive to sedentary lifestyles that are associated with covid-19 are required. Children and young people have been negatively affected by having to change their active lifestyles, no longer walking to educational institutions and schools, no longer doing physical education, no longer participating in sports and school activities, and older adults have reduced their social life and activity levels and become more prone to chronic diseases.

The articles included in this systematic review shed light on the Covid-19 phenomenon and its relationship to physical activity and exercise. One of the articles provides practical recommendations for maintaining an active lifestyle during a pandemic or other period of isolation (10), highlighting among these that the focus should be on home-based programmes with constant supervision, for which portable technological means such as activity trackers via mobile phones and smart watches can be used, these programmes should be conducted in daylight and if possible outdoors, respecting distance and hygiene (11). If accompaniment is not possible, they suggest daily 50-minute walks at light to moderate intensities. Strength training and relaxation should also be included in these programmes in order to should also be included in these programmes to reduce the tensions caused by confinement. Likewise, programmes that are carried out with others, even virtually, are the most appropriate, as they allow people to maintain contact with others if they are far away and thus reduce the levels of anxiety due to loneliness (9, 20, 31).

For these programmes to be effective, the World Health Organisation (WHO), the American Heart Association (AHA) and the American College of Sports Medicine (ACSM) advise that physical activity should last 30 minutes a day for healthy adults and one hour a day for children. Activities such as dancing, playing active video games, strength and balance training with body weight and participating in online classes can be scheduled. Other activities such as standing, stair climbing and jumping rope are also proposed (9).

The design and implementation of strategies aimed at encouraging PA at home will be an important point in overcoming this health crisis, as well as in the period after the resolution of this (Antilao, 2020); that is why from simple activities at home, those that use technology and assistance through virtuality, to the practice of vigorous activities that include moderate intensity and strength exercises are required in periods of isolation. Likewise, when measures are made more flexible and it is possible to carry out activities outdoors and even attend places where people congregate, the use of a mask or face mask does not generate difficulties in carrying out the activity (19, 23).

Finally, it is important to note that an inadequate lifestyle that does not include regular physical activity and exercise can facilitate the conditions for becoming infected with Covid-19 or increase mortality after infection (16, 22, 24).

CONCLUSIONS

The articles reviewed show the importance of physical activity and how it has been an agent of prevention against the serious symptoms of covid-19, clarifying that it is not that it prevents people from getting it, but that its effects are not serious.

The home training that began to intensify during isolation is here to stay, many people no longer want to go to gyms and have adapted their homes to be able to do physical exercise in them, which is beginning to generate other fields of research, because, although some are being guided by trainers, others just follow pages where the principle of individualisation of training is being lost, which would be important to analyse. is being lost, which would be important to analyse further.

The articles reviewed in general, show multiple benefits of doing physical exercise, and these are framed not only from the physical health, but from the mental, allowing to understand that a person who performs planned and continuous physical exercise, can get to obtain a general welfare.

BIBLIOGRAPHIC REFERENCES

1. Andreu, E. (2020). Actividad física y efectos psicológicos del confinamiento por covid-19. Revista INFAD de Psicología. International Journal of Developmental and Educational Psychology., 2(1), 209-220

2. Warren, M.S., Skillman, S.W., (2020). Mobility changes in response to COVID-19. arXivpreprint arXiv:2003.14228.

3. Antilao, L. (2020). Actividad física y brote de Coronavirus ¿Qué medidas se adoptarán para el adulto mayor en Chile?. Revista médica de Chile, 148(2), 271-272

4. Qin, F., Song, Y., Nassis, G.P., Zhao, L., Cui, S., Lai, L., Wu, Z., Xu, M., Qu, C., Dong, Y., (2020). Prevalence of Insufficient Physical Activity, Sedentary Screen Time and Emotional Well-Being During the Early Days of the 2019 Novel Coronavirus (COVID-19) Outbreak in China: A National Cross-Sectional Study.

5. Roschel, H., Artioli, G.G. Gualano, B., (2020). Risk of increased physical inactivity during COVID-19 outbreak in older people: a call for actions. J. Am. Geriatr. Soc.

6. Bell, K., Von Allmen, M., Devries, M., Phillips, S., 2016. Muscle disuse as a pivotal problem in sarcopenia-related muscle loss and dysfunction. J. Frailty Aging 5, 33–41

7. Cunningham, C., R, O.S, Caserotti, P., Tully, M.A., 2020. Consequences of physical inactivity in older adults: a systematic review of reviews and meta-analyses. Scand. J. Med. Sci. Sports 30, 816–827.

8. De Sousa, R. A. L., Improta-Caria, A. C., Aras-Júnior, R., de Oliveira, E. M., Soci, Ú. P. R., & Cassilhas, R. C. (2021). Physical exercise effects on the brain during COVID-19 pandemic: links between mental and cardiovascular health. Neurological Sciences, 1-10. https://doi. org/10.1007/s10072-021-05082-9

9. Alawna, M., Amro, M., & Mohamed, A. A. (2021). Aerobic exercises recommendations and specifications for patients with COVID-19: A systematic review. European Review for Medical and Pharmacological Sciences. Verduci Editore s.r.l. https://doi.org/10.26355/ eurrev_202012_24211

10. Bentlage, E., Ammar, A., How, D., Ahmed, M., Trabelsi, K., Chtourou, H., & Brach, M. (2020, September 1). Practical recommendations for maintaining active lifestyle during the covid-19 pandemic: A systematic literature review. International Journal of Environmental Research and Public Health. MDPI AG. https://doi.org/10.3390/ijerph17176265

11. Chaabene, H., Prieske, O., Herz, M., Moran, J., Höhne, J., Kliegl, R., … Granacher, U. (2021, May 1). Home-based exercise programmes improve physical fitness of healthy older adults: A PRISMA-compliant systematic review and meta-analysis with relevance for COVID-19. Ageing Research Reviews. Elsevier Ireland Ltd. https://doi.org/10.1016/j. arr.2021.101265

12. Rooney, S., Webster, A., & Paul, L. (2020). Systematic review of changes and recovery in physical function and fitness after severe acute respiratory syndrome-related coronavirus infection: Implications for COVID-19 rehabilitation. Physical Therapy, 100(10), 1717–1729. https:// doi.org/10.1093/ptj/pzaa129

13. Bohn, L., Barros, D., Borges-Machado, F., Carrapatoso, S., Pizarro, A. N., & Carvalho, J. (2021). Active Older Adults Keep Aerobic Capacity and Experience Small Reductions in Body Strength During Confinement Due to COVID-19 Outbreak, Journal of Aging and Physical Activity, , 1-8. Retrieved Jun 11, 2021, from http://journals.humankinetics.com/view/ journals/japa/aop/article-10.1123-japa.2020-0395/article-10.1123- japa.2020-0395.xml

14. Brazo-Sayavera, J., López-Torres, O., Martos-Bermúdez, Á., Rodriguez-Garcia, L., González-Gross, M., & Guadalupe-Grau, A. (2021). Effects of Power Training on Physical Activity, Sitting Time, Disability, and Quality of Life in Older Patients With Type 2 Diabetes During the COVID-19 Confinement, Journal of Physical Activity and Health, 18(6), 660-668. Retrieved Jun 11, 2021, from http://journals.humankinetics.com/view/journals/jpah/18/6/article-p660.xml

15. Cataldi, S., Francavilla, V. C., Bonavolontà, V., De Florio, O., Carvutto, R., De Candia, M., ... & Fischetti, F. (2021). Proposal for a Fitness Program in the School Setting during the COVID 19 Pandemic: Effects of an 8-Week CrossFit Program on Psychophysical Well-Being in Healthy Adolescents. International Journal of

Environmental Research and Public Health, 18(6), 3141. https://doi.org/10.3390/ijerph18063141

16. Gao, C., Zhao, Z., Li, F., Liu, J. L., Xu, H., Zeng, Y., Guo, Q. (2020). The impact of individual lifestyle and status on the acquisition of COVID-19: A case-Control study. PLoS ONE, 15(11 November). https:// doi.org/10.1371/journal.pone.0241540

17. McCarthy, H., Potts, H. W. W., & Fisher, A. (2021). Physical activity behavior before, during, and after COVID-19 restrictions: Longitudinal smartphone-tracking study of adults in the United Kingdom. Journal of Medical Internet Research, 23(2). https://doi.org/10.2196/23701

18. McGrath, A., Murphy, N., & Richardson, N. (2020). The impact of the COVID-19 pandemic on the wellbeing of Irish Men's Shed members. Health Promotion International. https://doi.org/10.1093/heapro/daaa113

19. Shaw, K., Butcher, S., Ko, J., Zello, G. A., & Chilibeck, P. D. (2020). Wearing of cloth or disposable surgical face masks has no effect on vigorous exercise performance in healthy individuals. International Journal of Environmental Research and Public Health, 17(21), 1–9. https://doi.org/10.3390/ijerph17218110

20. Berengüí, R., López-Gullón, J. M., & Angosto, S. (2021). Physical sports activities and exercise addiction during lockdown in the Spanish population. International Journal of Environmental Research and Public Health, 18(6), 1–13. https://doi.org/10.3390/ijerph18063119

21. Cheval, B., Sivaramakrishnan, H., Maltagliati, S., Fessler, L., Forestier, C., Sarrazin, P., … Boisgontier, M. P. (2021). Relationships between changes in self-reported physical activity, sedentary behaviour and health during the coronavirus (COVID-19) pandemic in France and Switzerland. Journal of Sports Sciences, 39(6), 699–704. https://doi.org/10.1080/02640414.2020.1841396

22. Da Silveira, M. P., da Silva Fagundes, K. K., Bizuti, M. R., Starck, É., Rossi, R. C., & de Resende e Silva, D. T. (2021, February 1). Physical exercise as a tool to help the immune system against COVID-19: an integrative review of the current literature. Clinical and Experimental Medicine. Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s10238-020-00650-3

23. Epstein, D., Korytny, A., Isenberg, Y., Marcusohn, E., Zukermann, R., Bishop, B., … Miller, A. (2020). Return to training in the COVID-19 era: The physiological effects of face masks during exercise. Scandinavian Journal of Medicine and Science in Sports. https://doi.org/10.1111/ sms.13832

24. Fernández-Lázaro, D., González-Bernal, J. J., Sánchez-Serrano, N., Navascués, L. J., Del Río, A. A., & Mielgo-Ayuso, J. (2020, November 2). Physical exercise as a multimodal tool for COVID-19: Could it be used as a preventive strategy? International Journal of Environmental Research and Public Health. MDPI AG. https://doi.org/10.3390/ijerph17228496

25. Franco, E., Urosa, J., Barakat, R., & Refoyo, I. (2021). Physical activity and adherence to the mediterranean diet among spanish employees in a health-promotion program before and during the covid-19 pandemic: The sanitas-healthy cities challenge. International Journal of Environmental Research and Public Health, 18(5), 1–14. https://doi.org/10.3390/ ijerph18052735

26. Jiménez-Pavón, D., Carbonell-Baeza, A., & Lavie, C. J. (2020, May 1). Physical exercise as therapy to fight against the mental and physical consequences of COVID-19 quarantine: Special focus in older people. Progress in Cardiovascular Diseases. W.B. Saunders. https://doi. org/10.1016/j.pcad.2020.03.009

27. Kirwan, R., McCullough, D., Butler, T., Perez de Heredia, F., Davies, I. G., & Stewart, C. (2020). Sarcopenia during COVID-19 lockdown restrictions: long-term health effects of short-term muscle loss. GeroScience, 42(6), 1547–1578. https://doi.org/10.1007/s11357-020- 00272-3

28. Lakicevic, N., Moro, T., Paoli, A., Roklicer, R., Trivic, T., Cassar, S., & Drid, P. (2020, July 1). Stay fit, don't quit: Geriatric Exercise Prescription in COVID-19 Pandemic. Aging Clinical and Experimental Research. Springer. https://doi.org/10.1007/s40520-020-01588-y

29. Lesser, I. A., & Nienhuis, C. P. (2020). The impact of COVID-19 on physical activity behavior and well-being of canadians. International Journal of Environmental Research and Public Health, 17(11). https:// doi.org/10.3390/ijerph17113899

30. Maertl, T., De Bock, F., Huebl, L., Oberhauser, C., Coenen, M., & Jung-Sievers, C. (2021). Physical activity during COVID-19 in German adults: Analyses in the covid-19 snapshot monitoring study (cosmo). International Journal of Environmental Research and Public Health, 18(2), 1–16. https://doi.org/10.3390/ijerph18020507

31. Nienhuis, C. P., & Lesser, I. A. (2020). The impact of COVID-19 on women's physical activity behavior and mental well-being. International Journal of Environmental Research and Public Health, 17(23), 1–12. https://doi.org/10.3390/ijerph17239036

32. Nyenhuis, S. M., Greiwe, J., Zeiger, J. S., Nanda, A., & Cooke, A. (2020, July 1). Exercise and Fitness in the Age of Social Distancing During the COVID-19 Pandemic. Journal of Allergy and Clinical Immunology: In Practice. American Academy of Allergy, Asthma and Immunology. https:// doi.org/10.1016/j.jaip.2020.04.039

33. Quinn, L., MacPherson, C., Long, K., & Shah, H. (2020). Promoting physical activity via telehealth in people with parkinson disease: The path forward after the COVID-19 pandemic? Physical Therapy, 100(10), 1730–1736. https://doi.org/10.1093/ptj/pzaa128

34. Schmidt, S. C. E., Anedda, B., Burchartz, A., Eichsteller, A., Kolb, S., Nigg, C., … Woll, A. (2020). Physical activity and screen time of children and adolescents before and during the COVID-19 lockdown in Germany: a natural experiment. Scientific Reports, 10(1). https://doi.org/10.1038/ s41598-020-78438-4

35. Schwartz, H., Har-Nir, I., Wenhoda, T., & Halperin, I. (2021). Staying physically active during the COVID-19 quarantine: Exploring the feasibility of live, online, group training sessions among older adults. Translational Behavioral Medicine, 11(2), 314–322. https://doi.org/10.1093/tbm/ ibaa141

36. Suzuki, Y., Maeda, N., Hirado, D., Shirakawa, T., & Urabe, Y. (2020). Physical activity changes and its risk factors among community-dwelling Japanese older adults during the COVID-19 epidemic: Associations with subjective well-being and health-related quality of life. International Journal of Environmental Research and Public Health, 17(18), 1–12. https://doi.org/10.3390/ijerph17186591

37. Tittlbach, S. A., Hoffmann, S. W., & Bennie, J. A. (2021). Association of meeting both muscle strengthening and aerobic exercise guidelines with prevalent overweight and obesity classes - results from a nationally representative sample of German adults. European Journal of Sport Science. https://doi.org/10.1080/17461391.2020.1870161

38. Wickersham, A., Carr, E., Hunt, R., Davis, J. P., Hotopf, M., Fear, N. T., … Leightley, D. (2021). Changes in physical activity among united kingdom university students following the implementation of coronavirus lockdown measures. International Journal of Environmental Research and Public Health, 18(6), 1–11. https://doi.org/10.3390/ijerph18062792

39. Yang, Y. C., Chou, C. L., & Kao, C. L. (2020, November 1). Exercise, nutrition, and medication considerations in the light of the COVID pandemic, with specific focus on geriatric population: A literature review. Journal of the Chinese Medical Association. Wolters Kluwer Health. https://doi.org/10.1097/JCMA.0000000000000393

40. Yang, Y., & Koenigstorfer, J. (2020). Determinants of physical activity maintenance during the Covid-19 pandemic: A focus on fitness apps. Translational Behavioral Medicine, 10(4), 835–842. https://doi. org/10.1093/tbm/ibaa08