South African Journal for Research in Sport, Physical Education and Recreation, 2022, 44(2): 15-28.
ISBN: 0379-9069

IMPACT OF COVID-19 INFECTION CONTROL AND PREVENTION MEASURES ON PHYSICAL-SPORTS ACTIVITY AMONG ADOLESCENTS IN A RURAL POPULATION

Luis E. FERNÁNDEZ-ÁLVAREZ[1], Alejandro CARRIEDO[1], María SÁNCHEZ-ZAFRA[2], Carmen GONZÁLEZ[1]

[1] *Department of Education Sciences, University of Oviedo, Oviedo, Spain*
[2] *Department of Didactics of Musical, Plastic and Body Expression, University of Jaen, Jaen, Spain*

ABSTRACT

The aim of this study was to analyse the changes related to the practice of physical-sports activities (P-SA) in adolescents owing to COVID-19 infection control and prevention measures. A total of 259 students (mean age=13.98±1.61 years) from a high school gave information on their physical-sports habits during the first year of the pandemic. The results showed a clear association between P-SA prior to the establishment of the state of alarm with P-SA practised after, and during the new normality. Also, a sporting club's membership was positively related to P-SA. Logistic regression analyses indicated that the duration of official training was the factor that most explained P-SA levels after confinement and during the new normality. In relation to post-confinement P-SA, males were more likely to practise more P-SA than females, but during the new normality, this factor was no longer significant and living with a family member at risk and the practice of individual sports became more important. These findings show that membership of a sporting club and commitment to training mitigated the negative impact of these health measures. Guidelines to ensure the maintenance of P-SA in adolescents should be established if similar situations are repeated in the future.

***Keywords*:** Confinement; Health; Physical activity; Quarantine; Sport

INTRODUCTION

The COVID-19 pandemic has produced a radical change in the lifestyle of the worldwide population. In the last two decades, humans have been affected by three epidemics of animal coronaviruses (Quiroz *et al*., 2020). The first, in 2003, was severe acute respiratory syndrome-related coronavirus (SARS-CoV), and this was followed in 2012 by Middle East respiratory syndrome-related coronavirus (MERS-CoV). Currently, COVID-19 is globally active, and the first symptoms of SARS-CoV-2 severe acute respiratory syndrome were reported in mid-December 2019 in the Chinese city of Wuhan (Carrillo *et al*., 2020; Huang, 2020; Li *et al*., 2020). On 7 January 2020, the World Health Organization (WHO) officially identified the new coronavirus (WHO, 2020). A few days later, the WHO warned that the COVID-19 outbreak constituted a public health emergency. On 11 March 2020, it was officially declared a pandemic.

Person-to-person transmission has been found to occur during the incubation period of the virus (i.e., 2–10 days), and spread is facilitated through aerosols and contaminated hands and surfaces (Al Huraimel *et al*., 2020). Once the virus has entered the host cell, it initiates the replication process, which can lead to rapid progression of infection (Llaveta & Guzman, 2020). It appears that the key to interrupting the chain of transmission may consist of isolating infected persons and tracing those with whom they have interacted (Khanna *et al*., 2020). Thus, restrictive measures such as social distancing, confinement, case detection, isolation, contact tracing and quarantine of those exposed are considered the most efficient actions to control the spread of this disease.

On 14 March 2020, the Spanish Government decreed a state of alarm in order to implement a series of measures to try to reduce the spread of the virus. For example, people's freedom of movement was restricted. People could only be on public roads or in public spaces for justified reasons. Sports training and competitions were cancelled. Telematic classes replaced face-to-face classes, and, as a result, physical education in schools was moved to the home. The state of emergency was extended until 21 June 2020.

During this period, children were not allowed to leave their homes until the end of April 2020. In addition, walks and the non-professional practice of individual sports that did not require contact with third parties were not allowed until 30 April. This measure conditioned the practice of physical-sports activities (P-SA) that adolescents could do during the de-escalation. At the end of April 2020, a plan for transition to a new normality was approved, in which it was pointed out that children and adolescents were groups that had suffered little from the impact of the disease but had been the most affected by the confinement. However, training and sports competitions could not be resumed because social distancing measures were still necessary. In September 2020, the school year began with security measures (e.g., social distancing, lowering of ratios, compulsory masks, use of hydroalcoholic gel and natural ventilation), but training and sports competitions were still not resumed. On 25 October 2020, a new state of alarm was declared, which would be extended until 9 May 2021. This meant that young people and adolescents ended the year 2020 without the possibility of attending official training sessions and competitions.

One area of life significantly affected by the containment caused by the measures to prevent the spread of COVID-19 concerns physical activity (PA). The closure of gyms, restrictions on 'non-essential' trips for adults, and the suspension of sports training and competitions for children and adolescents may have led to a decrease in PA. Ding *et al*. (2020) consider that changing circumstances may modify automatic behaviour patterns through discontinuing habits.

The PA patterns of adolescents during the pandemic have been analysed in several studies. For example, a reduction in PA due to confinement has been observed (Dallolio *et al*., 2022), which could have negatively affected adolescents' physical fitness and health (López-Bueno *et al*., 2020; Wahl-Alexander & Camic, 2021). In this regard, it has been observed that a decrease in PA was more intense among children who used to participate in organised team sports (Yomoda & Kurita, 2021). Neville *et al*. (2022) conducted a systematic review and observed that most studies conducted on children and adolescents showed decreased PA during the

COVID-19 pandemic. Other researchers reported increased sedentary behaviour (Dunton *et al*., 2020).

In a study of an adolescent population in Croatia, Sekulic *et al*. (2020) observed differences in PA levels between sexes. The authors of this paper suggest that the changes may have been because levels among boys were mainly related to participation in organised sports. In this sense, we cannot ignore that adherence to physical exercise is conditioned by the individual's motivation, because it determines the initiation, maintenance and abandonment of a behaviour and the implementation of active lifestyles that are maintained over time (Pino & Alonso, 2017).

As mentioned previously, health restrictions have affected adolescents' lifestyles and, as a consequence, their physical and sporting habits, an aspect that could affect them physically, mentally and emotionally. A researcher pointed out that a sedentary lifestyle leads to a loss of muscle mass, a decrease in flexibility and strength, and the appearance of chronic non-communicable diseases such as obesity, diabetes and cardiovascular diseases (Arocha Rodulfo, 2019).

Thus, the purpose of this study was twofold. Firstly, we aimed to examine the incidence of changes in P-SA in adolescents in a rural setting. Secondly, we aimed to analyse the factors that could explain the levels of P-SA that students performed after confinement and during the new normality.

METHODS

Participants

In this study, 259 (141 males and 118 females) students in compulsory secondary and baccalaureate education from a public school located in the rural north of Spain participated. Participants were aged between 11 and 17 years (M=13.98, SD=1.61; males: M=13.9, SD=1.65; females: M=14.02, SD=1.56). The students belonged to the first year of compulsory secondary education (n=56), second year (n=55), third year (n=43), fourth year (n=49), and first year of baccalaureate (n=56).

Procedure

First, approval was obtained from the university's ethics committee where the study was conducted. Subsequently, the researchers developed a questionnaire that could be completed in 5–8 minutes. Permission was then requested from a school selected for convenience and informed consent was obtained from the families of all participants. The questionnaire was distributed via the school's educational platform. All students were informed that their responses would be anonymous, and that the information would be treated confidentially. They were also informed that their participation was voluntary. The data were collected in the third week of November 2020, a time when PA and sports were regulated by the authorities and some activities were not allowed (e.g., sports competitions). Participants were asked about their P-SA before the declaration of the state of alarm (March 2020), after the end of house confinement (from May to August 2020), and during the first period of the 'new normality' (November 2020).

Measuring instruments and variables

An ad hoc questionnaire was developed, which included, in addition to sociodemographic information, aspects related to the physical-sports habits carried out before and after the declaration of the state of alarm. Likewise, participants were also asked about the P-SA carried out during the first stage of the new normality in Spain. This questionnaire was developed by experts with more than 10 years of experience conducting studies and developing scales in PA sciences, sports, psychology and education. For this purpose, the questions were selected following the requirements proposed by Skjong and Wentworth (2000). The questionnaire was piloted among adolescents from another high school who were not included in the main study.

Physical-sports habits. A questionnaire was designed to analyse P-SA patterns with different questions. The first question asked whether participants practised regular P-SA (at least twice a week, e.g., running, swimming, paddle tennis, aerobics, bodybuilding, sports such as football, basketball, etc.). Participants were also asked about the duration of their participation in P-SA per week at three different times: (1) before the home confinement that occurred from March to May 2020; (2) after the end of the alarm state, i.e., after the period of home confinement (from May to September 2020); and (3) during the first term of the 2020–2021 academic year (i.e., at the time of data collection, November 2020). Participants responded using an ordinal scale that indicated the number of hours per week of PA (0 = 0 hours; 1 = <1 hour; 2 = 1–3 hours; 3 = 3–5 hours; 4 = 5–7 hours; 5 = >7 hours). These variables were recoded into two categories differentiating students who performed a low level of weekly PA (<3 hours per week) or sufficient weekly PA (>3 hours per week). Similar classification criteria have been found in previous studies that have been conducted with a population confined because of COVID-19 and that have taken WHO and American College of Sports Medicine recommendations as a reference (García-Tascón *et al*., 2020). Finally, participants were asked whether they belonged to a sports club before the confinement and whether they still belonged to such a club. They included information on the sport they played, whether and when they returned to training, and the time per week they spent practising sport.

Other measures. Other measures included in the questionnaire were gender, age, membership of a sports club before (Yes, No) and after the alarm state (Yes, No), living with a family member at risk (Yes, No), type of sport (None = 0, Individual = 1, Collective = 2), training time (in hours/week) and days of training since training was resumed.

Data analysis

Data were analysed using the statistical package SPSS version 24.0 (IBM Co. LTD, Chicago, IL, USA). Descriptive analyses were performed, and different chi-square tests (×2) were run to test the assumption of independence between P-SA habits before the alarm state and after, and during the new normality, with a significance level of $p<.05$. The odds ratio (OR) was also calculated to determine an estimate of the relationships between the variables. Finally, two binary logistic regression models were run using the proposed multi-factor input method (i.e., type of sport [none = 0, individual = 1, collective = 2]; age; gender [male = 1, female = 2]; membership of a sports club after confinement [no = 0, yes = 1]; living with a family member at risk [no = 0, yes = 1]; duration of training; and days of training since resumption) to analyse the factors explaining P-SA levels (insufficient vs. sufficient) after confinement and during the new normality.

RESULTS

Descriptive analyses

Eighty-three percent of the participants indicated that they used to perform P-SA for at least 2 days a week before the alarm state was declared. However, only 131 participants (50.6%) reported being involved in higher PA levels before the lockdown (i.e., more than 3 hours per week). This percentage (i.e., 50.6%) was reduced to 33.2% and 31.3% after the confinement and during the new normality, respectively (see Table 1). Also, as can be observed, 58.3% (n=151) of the participants belonged to a sports club before the COVID-19 confinement measures. However, after the home confinement, that percentage (i.e., 58.3%) was reduced to 45.9% (n=119). There were fewer athletes involved in individual (37.8%) than in collective sports (59.7%) after the lockdown measures, and 47.9% of these athletes would have been training after the home confinement on an average of 35.08 (*SD*=44.12) days from the end of the home confinement (individual sports: *M*=57.42, *SD*=46.33; collective sports: *M*=22.22, *SD*=37.23). The average duration of these trainings was 1.71 (*SD*=2.71) hours per week (individual sports: *M*=2.11, *SD*=2.51; collective sports: *M*=1.48, *SD*=2.85). Finally, 22% of participants (*n*=57) reported living with someone with a health risk condition related to COVID-19.

Table 1. **DISTRIBUTION OF PHYSICAL-SPORTS ACTIVITIES PARTICIPATION BEFORE AND AFTER THE STATE OF ALARM, AND DURING THE NEW NORMALITY**

	Before (%)	After (%)	New normality (%)
Physical-sports activities practice per week			
0 hours	6.2	9.7	10.8
<1 hour	10.0	19.7	18.5
1–3 hours	33.2	37.5	39.4
3–5 hours	25.5	19.3	19.7
5–7 hours	15.1	6.2	8.5
>7 hours	10.0	7.7	3.1
Belonging to a sports club			
Yes	58.3	45.9	
No	41.7	54.1	

Analysis of changes in physical-sport activity

A relationship between P-SA prior to the alarm state and after the end of home confinement was observed ($\chi^2[1, n = 259]=32.198$, $p<.001$, OR=5.02), and during the new normality ($\chi^2[1, n=259]=23.364$, $p<.001$, OR=3.94) indicating that participants who did not practise P-SA before confinement were five and four times more likely to develop low PA levels after confinement and during the new normality period, respectively. Of the participants, 41.3% reported low levels of PA before and after confinement, whereas 25.5% of the participants were active before and drastically reduced their levels after confinement. Analysing the results by

group, 50.4% of the students who were active before confinement reduced their levels drastically, whereas the other 49.6% were able to maintain a level of PA higher than 3 hours per week. Of the students with low levels of activity, 83.6% maintained similar levels of P-SA. Likewise, the percentages observed during the new normality were very similar − 82.8% persisted in maintaining insufficient P-SA levels; almost 5% more students (i.e., 55%) reduced their P-SA drastically whereas 45% remained at sufficient levels during the new normality.

According to gender, a higher probability of maintaining low levels of P-SA after confinement was observed among women who did not achieve sufficient levels of P-SA before confinement (89.2%, χ^2[1, n=118]=20.287, p<.001, OR=7.53) compared with men (75.9%, χ^2[1, n=141]=9.716, p=.002, OR=3.23). Very similar results were found for P-SA performed during the new normality for females (82.4%, χ^2[1, n=118]=15.676, p<.001, OR=5.14) and males (83.3%, χ^2[1, n=141]=9.365, p=.002, OR=3.53). Finally, a higher proportion of females reduced their P-SA after confinement (52.3%) compared with males (49.4%). However, during the new normality, a greater reduction was observed among males (58.6%) compared with females (47.7%).

Analysis of physical-sport activity and membership of a sports club

Membership of a sports club prior to the establishment of the alarm state was found to be related to post-confinement P-SA (χ^2[1, n=259]=6.963, p=.008, OR=2.08), and club membership during the new normality was also positively associated with P-SA (χ^2[1, n=259]=13.742, p<.001, OR=2.75). Thus, the likelihood of maintaining low levels of P-SA after confinement was twice as high among students who did not belong to a sports club (75.9% compared with 60.3% of those who did belong to a club). Similar results were observed in relation to sports club membership during the new normality and P-SA (i.e., 78.6% of those who did not belong to a club performed insufficient P-SA compared with 57.1% of those who did belong to a club).

However, when analysing the association between P-SA practised before and during the phases after the alarm state, it was observed that the most drastic changes occurred in students who after confinement did not belong to any sports club (Yes: χ^2[1, n=119]=11.189, p<.001; No: χ^2[1, n=140]=9.333, p=.002). Sixty percent of students who maintained high levels of P-SA and did not belong to a sports club significantly reduced their activity (OR=0.28) compared with 46.2% of students who maintained high levels of P-SA and did belong to a sports club (OR=0.18). That is, the likelihood of reduced P-SA was lower among students who belonged to a sports club after confinement. Similarly, during the new normality, similar results were observed, with 5% more non-club students reducing their PA (i.e., 65%) and 4.3% (i.e., 50.5%) in the club group (Yes: χ^2[1, n=119]=6.86, p=.009, OR=3.59; No: χ^2[1, n=140]=6.12, p=.013, OR=2.83). Finally, whether persisting in sports club membership was related to these variables was controlled for and a partial association was observed only in those students who remained in their clubs (i.e., did not drop out) (χ^2[1, n=116]=5.480, p=.019, OR=3.18). Thus, persisting in sports club membership after the alarm state appeared to have an impact on the association between pre-alarm state P-SA and during the new normality (48.9% persisted in maintaining sufficient levels of P-SA), whereas there appeared to be no association between pre-alarm state P-SA and during the new normality among students who disenrolled. Thus, of the participants who remained in their sports club, students with low P-SA levels during the new normality were three times more likely to be found among those with low P-SA levels prior to

confinement. There does not seem to be an association for those who unsubscribed, with most students having low P-SA levels regardless of the P-SA they had previously performed.

Factors explaining physical-sport activity levels

Two binary logistic regression models were run. Results from the first model indicated that the data fit the model adequately (χ^2[8, n=259]=48.201, p<.001). Approximately 24% of the variance in post-confinement PA levels was explained by the factors included in the model (Nagelkerke R^2=0.238). Table 2 shows the regression coefficients that were significant for each factor. As can be seen, students who spent more hours in official club training were more likely to perform more P-SA after confinement (p=.002, OR=1.37, 95% CI: 1.118–1.684). In addition, those participants who had been training for more days were also more likely to perform more P-SA (p=.046, OR=1.00, 95% CI: 1.00–1.018). Finally, it was observed that males were more likely to perform more P-SA after confinement than females (p=.020, OR=2.21, 95% CI: 1.132–4.337).

Table 2. **ORDINAL LOGISTIC REGRESSION ANALYSIS OF FACTORS EXPLAINING PHYSICAL-SPORTS ACTIVITY LEVELS SINCE RESUMING TRAINING AFTER CONFINEMENT**

	Estimate	**Std. error**	**Wald**	**Sig. (*p*)**	**95% CI**
Training duration (hrs/week)	0.316	0.104	9.161	.002	1.118–1.684
Gender					
Male	1				
Female	0.795	0.343	5.388	.020	1.132–4.337
Return training days	0.009	0.471	3.983	.046	1–1.018

Note. Only significant variables are included in the table.

The second model also showed that the data fit the model well (χ^2(8, n=259)=42.726, p<.001). Approximately 22% of the variance of PA levels during the new normality was explained by the factors included in the model (Nagelkerke R^2=0.216). Table 3 shows the regression coefficients that were significant for each factor. Some differences from the previous model can be observed. On this occasion, students who devoted more hours to official club training were again more likely to perform more P-SA during the new normality (p=.007, OR=1.28, 95% CI: 1.070–1.521). However, an association was also detected with living with a family member at risk of COVID-19 (p=.010, OR=2.46%, CI: 1.240–4.870). Those who cohabited with a person at risk were more likely to participate in more P-SA during the new normality. Finally, an association was also observed according to the type of sport. Those who practised an individual modality were more likely to do more P-SA than those who practised a collective modality, during the new normality (p=.049, OR=2.49, 95% CI: 1.002–6.164).

Table 3. **ORDINAL LOGISTIC REGRESSION ANALYSIS OF FACTORS EXPLAINING PHYSICAL-SPORTS ACTIVITY LEVELS PERFORMED DURING THE NEW NORMALITY**

	Estimate	**Std. Error**	**Wald**	**Sig. (*p*)**	**95% CI**
Training duration (hrs/week)	0.243	0.09	7.349	.007	1.070-1.521
Living with a family member at risk					
No	0.902	0.348	6.713	.010	1.240-4.870
Yes	1				
Type of sport					
None	0.462	0.629	0.541	.462	0.463-5.442
Individual	0.911	0.463	3.862	.049	1.002-6.164
Collective	1				

Note. Only significant variables are included in the table.

DISCUSSION

The purpose of this study was twofold. Firstly, we aimed to examine the incidence of changes in P-SA in adolescents in a rural setting. Secondly, we aimed to analyse the factors that could explain the levels of P-SA performed by students after confinement and during the new normality. The results of this study show that students who did not practise P-SA before confinement were more likely to develop low levels of PA after confinement and during the new normality period. During the confinement, leaving one's home was not allowed and therefore it was not possible to participate in P-SA in teams and at clubs. Different studies have shown that this led to a considerable reduction in PA (Ammar *et al*., 2020; Constandt *et al*., 2020; Dunton *et al*., 2020; Stockwell *et al*., 2021). After the end of home confinement, P-SA levels increased, although not to levels before the state of alarm, as Romero-Blanco *et al*. (2020) indicated. In this regard, Ding *et al*. (2020) point out that changes in routines can modify automatic behavioural patterns, as is the case of P-SA. However, in this study, participants who were inactive before confinement did not increase their P-SA levels afterwards.

It is important to keep in mind that physical inactivity can lead to alterations in both metabolic and body systems, loss of bone mineral density and a reduction in aerobic capacity (Capelli *et al*., 2006; Márquez, 2020). Hence, guidelines should be established to encourage adolescents to practise P-SA so that they participate in PA as part of their daily routine.

Factors that could explain the levels of P-SA practised by participants after confinement and during the new normality were also analysed in this study. According to gender, a higher likelihood of maintaining low levels of P-SA after confinement was observed among females who did not achieve sufficient levels of P-SA before confinement. A higher proportion of females reduced their P-SA after confinement than men. However, a greater reduction was observed among males compared with females during the new normality. In this regard, the present study's results contrast with the findings of previous studies that point to a higher

affinity towards body health in females (Mora, 2018), which could mitigate the decline in P-SA. Another factor to take into account is the time spent on training. In the present study, it was observed that adolescents who spent more hours on P-SA were more likely to perform more P-SA after confinement. Similarly, those training for more days were also more likely to perform more P-SA. Some factors have been found associated with the likelihood of being physically active during adolescence, for instance, fun, improved social relations and friendships, and the weekly frequency of being with friends after school (Wold, 1995). As noted above, all of these circumstances were altered by confinement and suspension from sports training and competitions. It was also found that those who practised an individual modality were more likely to practise more P-SA than those who practised a collective modality during the new normality. Persisting in belonging to a sports club after the state of alarm seems to have had an impact on the association between P-SA prior to the state of alarm and during the new normality.

According to Escribano *et al*. (2017), there is a positive and significant association between participants who have a high self-perception of motor competence and are federated. Likewise, as self-perceived motor competence increases, the level of habitual voluntary, school and leisure-time PA increases. Among participants who remained in their sports club, students with low levels of P-SA during the new normality are more likely to be found among those with low levels of P-SA before confinement. It has been suggested that among people who have been exercising longer, social bonding and affiliation motives may be associated with greater motivation towards social membership and interaction (Mora, 2018). Thus, people who belong to a sports club may be more intrinsically motivated and task-oriented than those who do not (Sanmartín *et al*., 2018).

Finally, a factor that may be surprising is living with a person at risk. In the present study it was observed that adolescents in this situation were more likely to practise more P-SA during the new normality. This was not the case after confinement. A possible explanation could be related to the stressful and worrying situation experienced that had been softened by the return to school and some normality. This issue could be explored in future studies. Parrado-González and León-Jariego (2020) found that the Spanish population living with people at risk and anticipating economic problems from the socio-health crisis had increased emotional distress and psychological morbidity during confinement. In this sense, Cabrera (2020) points out that children absorb the emotional climate transmitted by their parents at home and that these youngsters will have problems in emotional and behavioural regulation as they are in the midst of development and suffer from a deprivation of movement, street play and social interaction.

The study's results have to be interpreted against some limitations experienced. On the one hand, the data were collected cross-sectionally. Although much literature related to COVID-19 and PA has followed a similar procedure and used ad hoc questionnaires, it would be advisable to use a longitudinal approach with validated instruments in future studies. On the other hand, it would be interesting to have more sociodemographic and more detailed information about the confinement and how the participants experienced it in terms such as lockdown patterns, housing characteristics, number of people in each household. It should also be noted that when using retrospective questions, the ability of participants to accurately recall their behaviours may be questionable. Instruments that measure the intensity and duration of P-SA more accurately, such as accelerometers, could be included. Furthermore, it should be considered

that the sample of this study is representative of the adolescent population of a rural population located in a province in the north of Spain. Finally, similar studies could confirm or discover different patterns among adolescents in other contexts and/or in other age groups.

CONCLUSIONS

The results of this study demonstrated reductions in PA levels during the COVID-19 pandemic. Possibly the most important finding was that membership of a sports club increased the likelihood of being physically active after confinement and during the new normality, which is consistent with the importance of motor competence, motivation, having fun, improving social relationships and spending more time per week with friends (Mora, 2018). This implies that it is necessary to consider the importance of providing P-SA in both school and leisure time to improve the concerning physical inactivity levels in adolescence. Hence it could be said that people have been living with another pandemic related to physical inactivity, a situation that has been shown to aggravate the symptoms and problems associated with COVID-19 (Sallis *et al*., 2021). According to the results of this study, this problem could be mitigated in the event of a similar situation recurring in the future if adolescents were to engage in P-SA through membership in a club or sports team, as they have been found to be less likely to develop low levels of PA during periods when social distancing measures are in place. Thus, public authorities and organisations should propose effective solutions to encourage and sports clubs or association membership.

Data availability statement
Data are available for research. Any further inquiries can be directed to the authors.

Conflict of interest
The authors declare no conflict of interest

REFERENCES

AL HURAIMEL, K.; ALHOSANI, M.; KUNHABDULLA, S. & STIETIYA, M.H. (2020). SARS-CoV-2 in the environment: Modes of transmission, early detection and potential role of pollutions. *Science of the Total Environment*, 744: 140946. https://doi.org/10.1016/j.scitotenv.2020.140946

AMMAR, A.; BRACH, M.; TRABELSI, K.; CHTOUROU, H.; BOUKHRIS, O.; MASMOUDI, L.;... & HOEKELMANN, A. (2020). Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. *Nutrients*, 12(6): 1583. https://doi.org/10.37473/dac/10.1101/2020.05.04.20072447

AROCHA RODULFO, J.I. (2019) Sedentarismo, la enfermedad del siglo XXI. *Clínica e Investigación en Arteriosclerosis*, 31(5): 233-240. https://doi.org/10.1016/j.arteri.2019.04.004

CABRERA, E.A. (2020). Actividad física y efectos psicológicos del confinamiento por covid-19. *International Journal of Developmental and Educational Psychology, 2(1):* 209-220. https://doi.org/10.17060/ijodaep.2020.n1.v2.1828

CAPELLI, C.; ANTONUTTO, G.; KENFACK, M.A.; CAUTERO, M.; LADOR, F.; MOIA, C.; TAM, E. & FERRETTI, G. (2006). Factors determining the time course of VO2(max) decay during bedrest: implications for VO2(max) limitation. *European Journal of Applied Physiology*, 98(2): 152-160. https://doi.org/10.1007/s00421-006-0252-3

CARRILLO, C.G.; PAREJA-CRUZ, A.; VALENCIA-AYALA, E.; ENRIQUEZ-VALENCIA, Y.P.; DE LEON-DELGADO, J. & AGUILAR-RAMIREZ, P. (2020). Un nuevo coronavirus, una nueva enfermedad: COVID-19. *Horizonte Médico (Lima)*, 20(2): e1208. https://doi.org/10.24265/horizmed.2020.v20n2.11

CONSTANDT, B.; THIBAUT, E.; DE BOSSCHER, V.; SCHEERDER, J.; RICOUR, M. & WILLEM, A. (2020). 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*, 17(11): 4144. https://doi.org/10.3390/ijerph17114144

DALLOLIO, L.; MARINI, S.; MASINI, A.; TOSELLI, S.; STAGNI, R.; BISI, M.C.; GORI, D.; TESSARI, A.; SANSAVINI, A.; LANARI, M.; BRAGONZONI, L.; CECILIANI, A. (2022). The impact of COVID-19 on physical activity behaviour in Italian primary school children: a comparison before and during pandemic considering gender differences. *BMC Public Health*, 22(1): 1-8. https://doi.org/10.1186/s12889-021-12483-0

DING, D.; DEL POZO-CRUZ, B.; GREEN, M.A. & BAUMAN, A.E. (2020). Is the COVID-19 lockdown nudging people to be more active: a big data analysis. *British Journal of Sports Medicine*, 54(20): 1183-1184. https://doi.org/10.1136/bjsports-2020-102575

DUNTON, G.F.; DO, B.; WANG, S. (2020). Early Effects of the COVID-19 Pandemic on Physical Activity and Sedentary Behavior in U.S. Children. *BMC Public Health*, 20:1351. https://doi.org/10.1186/s12889-020-09429-3

ESCRIBANO, L.G.; CASAS, A.G.; FERNÁNDEZ-MARCOTE, A.E.; LÓPEZ, P.J.T. & MARCOS, M.L.T. (2017). Revisión y análisis de los motivos de abandono de práctica de actividad física y autopercepción de competencia motriz. *Journal of Negative and No Positive Results*, 2(2): 56-61.

GARCÍA-TASCÓN, M.; SAHELICES-PINTO, C.; MENDAÑA-CUERVO, C. & MAGAZ-GONZÁLEZ, A.M. (2020). 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*, 17(19): 6961. https://doi.org/10.3390/ijerph17196961

HUANG, C.; WANG, Y.; LI, X., REN, L.; ZHAO, J.; HU, Y.; ... & CAO, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*, 395(10223): 497-506. https://doi.org/10.1016/s0140-6736(20)30183-5

KHANNA, R.C.; CICINELLI, M. V.; GILBERT, S.S.; HONAVAR, S.G. & MURTHY, G.V. (2020). COVID-19 pandemic: Lessons learned and future directions. *Indian Journal of Ophthalmology*, 68(5): 703. https://doi.org/10.4103/ijo.ijo_843_20

LI, G.; FAN, Y.; LAI, Y.; HAN, T.; LI, Z.; ZHOU, P.; PAN, P.; WANG, W.; HU, D.; LIU, X.; ZHANG, Q.; WU, J. (2020). Coronavirus infections and immune responses. *Journal of Medical Virology*, 92(4): 424-432. https://doi.org/10.1002/jmv.25685

LLAVETA, G. A. & GUZMÁN, J.A. (2020). SARS-CoV-2: estructura, replicación y mecanismos fisiopatológicos relacionados con COVID-19. *Gaceta Médica Boliviana*, 43(2): 172-178. https://doi.org/10.47993/gmb.v43i2.85

LÓPEZ-BUENO, R.; LÓPEZ-SÁNCHEZ, G.F.; CASAJÚS, J.A.; CALATAYUD, J.; GIL-SALMERÓN, A.; GRABOVAC, I.; Tully, M.; SMITH, L. (2022). Health-related behaviors among school-aged children and adolescents during the Spanish Covid-19 confinement. *Frontiers in Pediatrics*, 8: 573. https://doi.org/10.3389/fped.2020.00573

MÁRQUEZ. J. (2020). Inactividad física, ejercicio y pandemia COVID-19. *VIREF Revista De Educación Física*, 9(2): 43-56.

MORA, C. (2018). Comparación entre los motivos para la práctica de actividad física según el género y el tiempo de práctica en un grupo de estudiantes. *MHSalud: Movimiento Humano y Salud*, 14(2): 1. https://doi.org/10.15359/mhs.14-2.1

NEVILLE, R. D.; LAKES, K. D.; HOPKINS, W.G.; TARANTINO, G.; DRAPER, C.E.; BECK, R. & MADIGAN, S. (2022). Global changes in child and adolescent physical activity during the COVID-19 pandemic: a systematic review and meta-analysis. *JAMA Pediatrics*, 176(9): 886-894. https://doi.org/10.1001/jamapediatrics.2022.2313

PARRADO-GONZÁLEZ, A. & LEÓN-JARIEGO, J.C. (2020). COVID-19: Factores asociados al malestar emocional y morbilidad psíquica en población española. *Revista Española de Salud Pública*, 94(8): 1-16.

PINO, I. P. & ALONSO, J.D. (2017). Motivación percibida por los adolescentes gallegos en la práctica del ejercicio. *Revista de Estudios e Investigación en Psicología y Educación*, 14: 117-121. https://doi.org/10.17979/reipe.2017.0.14.2518

QUIROZ, C.; PAREJA, A.; VALENCIA, E.; ENRIQUEZ, Y.; DE LEON-DELGADO, J. & AGUILAR, P. (2020). Un nuevo coronavirus, una nueva enfermedad: COVID-19. *Horizonte Médico (Lima)*, 20(2): e1208. https://doi.org/10.24265/horizmed.2020.v20n2.11

ROMERO-BLANCO, C.; RODRÍGUEZ-ALMAGRO, J.; ONIEVA-ZAFRA, M.D.; PARRA-FERNÁNDEZ, M.L.; PRADO-LAGUNA, M.D. & HERNÁNDEZ-MARTÍNEZ, A. (2020). Physical activity and sedentary lifestyle in university students: Changes during confinement due to the Covid-19 pandemic. *International Journal of Environmental Research and Public Health*, 17(18): 6567. https://doi.org/10.3390/ijerph17186567

SALLIS, R.; YOUNG, D.R.; TARTOF, S.Y.; SALLIS, J.F.; SALL, J.; LI, Q.; SMITH, G. & COHEN, D. A. (2021). Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *British Journal of Sports Medicine*, 55(19): 1099-1105. https://doi.org/10.1136/bjsports-2021-104080

SANMARTÍN, M.G.; MIGUEL, J.M.T. & CALATAYUD, P. (2018). Determinantes de la práctica deportiva de los adolescentes en horario extraescolar. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte*, 13(1): 91-100. https://doi.org/10.24310/riccafd.2020.v9i2.9080

SEKULIC, D.; BLAZEVIC, M.; GILIC, B.; KVESIC, I. & ZENIC, N. (2020). Prospective analysis of levels and correlates of physical activity during COVID-19 pandemic and imposed rules of social distancing; gender specific study among adolescents from Southern Croatia. *Sustainability*, 12(10): 4072. https://doi.org/10.3390/su12104072

SKJONG, R. & WENTWORTH, B. (2000). "Expert judgement and risk perception." Available online: [http://research.dnv.com/skj/Papers/SkjWen.pdf] Retrieved on 30 March 2021.

STOCKWELL, S.; TROTT, M.; TULLY, M.; SHIN, J.; BARNETT, Y.; BUTLER, L.; MCDERMOTT, D.; SCHUCH, F. & SMITH, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ Open Sport & Exercise Medicine,* 7(1): e000960. https://doi.org/10.1136/bmjsem-2020-000960

YOMODA, K. & KURITA, S. (2021). Influence of social distancing during the COVID-19 pandemic on physical activity in children: A scoping review of the literature. *Journal of Exercise Science & Fitness*, 19(3): 195-203. https://doi.org/10.1016/j.jesf.2021.04.002

WAHL-ALEXANDER, Z. & CAMIC, C.L. (2021). Impact of COVID-19 on school-aged male and female health-related fitness markers. *Pediatric Exercise Science,* 33(2): 61-64. https://doi.org/10.1123/pes.2020-0208

WOLD, B. (1995). Health behavior in school children: A WHO cross national survey. Resource Package of Questions 1993-94, Norway: University of Bergen.

WORLD HEALTH ORGANIZATION (2020) Novel Coronavirus (2019-nCoV) situation reports [Internet]. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus2019/situation-reports. Retrieved on April 15th 2021

Corresponding author: Dr A. Carriedo; **Email:** carriedoalejandro@uniovi.es

(Subject Editor: A/Prof. Jeanne Grace)