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Balance performance analysis after the COVID-19 quarantine in children aged between 8 and 12 years old: Longitudinal study

Vicenta Martínez-Córcoles [a,1], Pilar Nieto-Gil [b,*,2], Laura Ramos-Petersen [c,d,3], Javier Ferrer-Torregrosa [e,4]

[a] Doctorate School, Valencia Catholic University "San Vicente Mártir", Valencia, Spain
[b] Department of Nursing and Podiatry, University of Valencia, 46010 Valencia, Spain
[c] Department of Podiatry, Faculty of Health Sciences, Universidad Católica San An tonio de Murcia, Campus de Los Jerónimos, Guadalupe, 30107 Murcia, Spain
[d] Research Team PODUMA University of Malaga, Spain
[e] Department of Podiatry, Faculty of Medicine and Health Sciences, Valencia Catholic University "San Vicente Mártir", Valencia, Spain

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ABSTRACT

Background: Corona Virus Disease 2019 (COVID-19) has caused great changes in daily activities, especially in children. In Spain, to avoid infections, a home quarantine was declared, which caused a drastic reduction in daily or weekly physical activity in children.

Objective: to analyse the balance performance after the COVID-19-induced quarantine on children's balance, through the use of balance tests, considering the type of sport practiced.

Methods: an observational and longitudinal study was carried out with a sample size of 150 healthy children (69 boys and 81 girls) with a mean age of 10.02 ± 1.15 years. Postural control was evaluated under different equilibrium conditions before and after the quarantine period. Two data collections using the Gyko system were compared, with a difference of 8 months between them. In addition, the influence of foot type and physical activity was analysed.

Results: After the quarantine, statistically significant differences were found in terms of balance results, which were worse than before ($p < 0.05$). Postural control was not influenced by the type of sport practiced (i.e., individual, collective and / or not practicing sport), nor by the surface which the test was performed ($p > 0.05$). Physically active children (i.e., individual and / or collective sport) presented worse results than physically inactive children. A statistically significant impairment in terms of balance was demonstrated in children who performed high and moderate physical activity ($p < 0.05$).

Conclusions: After the quarantine period, a significant reduction in balance performance was found in children. The findings suggest that regular physical activity benefits postural control. Loss of balance does not differ in postural stability by the type of sport practised. Postural stability is not influenced by the type of footprint after the period of physical inactivity. Postural control is influenced in children with a great level of physical activity.

1. Introduction

According to World Health Organisation (WHO), daily physical activity is essential for adults, teenagers and children [1]. However, the impact of Corona Virus Disease 2019 (COVID-19) on life has caused drastic changes in daily activities [2]. On 11th March 2020, the WHO declared COVID-19′s global pandemic status which is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and it was described for the first time in Wuhan China in 2019 [3,4]. For this reason, WHO advised social distancing in order prevent the rapid spread

* Correspondence to: Facultad de Enfermería y Podología, Universidad de Valencia, Menéndez y Pelayo, 19, 46010 Valencia, Spain.
E-mail addresses: vicenta.martinez@mail.ucv.es (V. Martínez-Córcoles), pilar.nieto@uv.es (P. Nieto-Gil), lrpetersen@ucam.edu (L. Ramos-Petersen), javier.ferrer@ucv.es (J. Ferrer-Torregrosa).
[1] First Author: Vicenta Martínez-Córcoles, Doctorate School
[2] ORCID: 0000-0002-4629-3094
[3] ORCID: 0000-0002-9349-7751
[4] ORCID:0000-0002-4617-7659

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of the disease in the population. This was also to avoid the collapse in world health systems and prevent the death of many. [5]. Consequently, the COVID-19-induced quarantine caused a drastic reduction in levels of physical activity in adults and children as well. Which in turn may cause a detriment in health due to the sedentary activities [3]. In order to prevent sedentary behaviour, WHO recommends, at least 60 min of moderate physical activity for children and teenagers [6,7].

It is well known that regular physical activity is essential for an adequate postural control [8], as well as to prevent pathologies [9]. However, during the COVID-19 pandemic, a global reduction in physical activity has been observed, in both professional and amateur level young athlete [10]. Several studies have concluded that after the pandemic a significant decrease in daily physical activity in children was shown [11, 12]. Physical activity improves abilities such as emotional control, memory and the ability to adapt to different tasks and environments that are necessary for optical, psychological and physical development [13, 14]. Postural control is defined as the ability of an individual to maintain her/his centre of gravity on the base of support and against gravity [15].

Physical activity regularly practised in adults promotes better postural control compared to physically inactive adults, and also compared to those who have been previously physically active, but not anymore [16]. In addition, it is theorised that muscle weakness and hypotonia impair general health and the ability to perform daily activities [17].

Previous studies have shown that balance improves with age as postural oscillations decrease from childhood to adulthood [18–20]. During early childhood (between 8 and 12 years of age) postural control is developed [21] and it is continually improving, due to the experience and the constant growth of the body, with improvements in the agonist and antagonist muscles, to be in balance by keeping the centre of forces steady and therefore, the centre of gravity [22–24]. Hence the importance of balance in childhood and in physical activity. This manuscript studies the physical inactivity period on balance performance.

However, due to the COVID-19-induced quarantine during 2020, a deeper understanding about the effect that this condition may have caused on postural control is necessary.

Therefore, the main aim of this study was to analyse the balance performance after the COVID-19-induced quarantine in children aged between 8 and 12 years old, through the use of balance tests, considering the type of sport practised. We hypothesise that depending on the type of sport practised, a different influence on postural balance will be shown, as they require different training. In addition, the secondary objective was to analyse the balance performance after the COVID-19-induced quarantine in children considering the foot type (i.e., cavus, flat or normal foot) to demonstrate a relationship between the type of foot and postural control.We hypothesised that participants with neutral feet will present a better postural stability than participants with supinated or pronated feet. We hypothesised that the reduced physical activity in children due to the quarantine, will have negative impact on the balance of healthy children.

2. Materials and methods

The present study was an observational and longitudinal study that recruited children aged between 8 and 12 years from two schools in the provinces of Albacete and Alicante, from November 2019 to July 2020, after 8 months from the initial data collection.

2.1. Participants

A total sample of 150 children were included in the present study. The sample size was comprised of 69 (46%) boys and 81 (54%) girls. The age, height and mass of the sample were 10.02 $\pm$ 1.15 years, 144.44 $\pm$ 10.81 cm and 40.08 $\pm$ 10.45 kg, respectively. A random sample was selected among those children that were born between 2006 and 2010. Mass was measured using calibrated Digital Pegasus Scales and height was measured to the nearest millimetre using SECO 7710 calibrated portable apparatus.

The criteria for inclusion were: asymptomatic and symmetrical feet, without evident joint deformities and being born between 2006 and 2010.

The exclusion criteria were: (a) children under some pharmacological treatment, (b) be using orthopaedic treatment, (c) play sports 48 h before the test, (d) have some type of vestibular, neurological, muscular, psychological condition or visual alteration or (e) pathology that may affect the results of the balance tests.

The legal representatives were informed about the study and asked to provide signed consent to confirm the participation of their children. Therefore, the participants had to appear at their school with the authorisation of the legal representative for data collection.

The sample size was calculated using the G*Power 3.1 software (Heinrich-Heine-Universitat Düsseldorf, Düsseldorf, Germany; http://www.gpower.hhu.de/). The result indicated that a total of 84 participants were necessary to show changes of the same magnitude in the final score of the statokinesiogram surface, proposing a statistical power of 0.95 and a significance level of 0.05.

2.2. Method

To assess the balance performance, participants were set with the anthropometric position from the protocol proposed by the International Society for the Advancement of Kinanthropometry (ISAK): participants placed their head on the Frankfort plane; with their upper limbs in a relaxed position with their palms facing forward, and thumbs separated from the rest of fingers; participants were stood bare foot, with their feet externally rotated by f 30 degrees and with a 4 cm distance between both heels [25].

To collect the balance data (i.e., Ellipse area (EA): length and surface in cm2) a Gyko inertial sensor system was used (dimensions: 50×70×20mm; mass: 35 g; Microgate Srl, Bolzano, Italy) [26]. The sensor contains three-axis accelerometer, gyroscope and magnetometer, which records (full scale range: 8 g) at a sample frequency of 500 Hz. During the assessment, the accelerometer and gyroscope signals are transferred via Bluetooth to a computer (HP Pavilion DV6, 15.6-inch, i7–3610QM 3rd gen., 2.3 GHz, 4 GB RAM) and are stored using the proprietary software (Gyko Re-Power Software). The software automatically calculated length and surface projection, speed projection and the frequency of oscillations. Gyko system offers high reliability in the measurement of postural control compared to other measurement systems [26]. Previous research reports have shown that this protocol had moderate to strong evidence of validity and reliability [27].

The device was placed with a support system to be attached to the body (Fig. 1). The participant maintained a visual reference point at eye level located 3 m away. Once the device was placed, the balance assessment was carried out following the next sequence [28]:

- The participant remained in an anthropometric position for 60 s
- Data was obtained consecutively with, open eyes, closed eyes, standing on a rubber surface and standing on a stable surface. A total of 4 measurements were taken for each participant: Ellipse Area Open Eyes ($OpenEyes_{EA}$), Ellipse Area Closed Eyes ($ClosedEyes_{EA}$), Ellipse Area Open Eyes on a rubber surface ($OpenEyesRS_{EA}$), Ellipse Area Closed Eyes on a rubber surface ($ClosedEyesRS_{EA}$).
- In the case that the Gyko system did not record a valid test, a new measurement was re-recorded.

There was 1 familiarisation episode and then the data-acquisition was conducted 3 times. Tests were performed barefoot and wearing sport style clothing. The same researcher assessed the participants before and after quarantine. Moreover, she explained to the participants how to perform the tests. A rubber surface was used to assess the participants during the balance test. The rubber surface was the model

Fig. 1. Placement of the Gyko inertial sensor system on a participant.

Balance Pand_Elite®, with the following characteristics: 50 × 41×6 cm dimension, 0.7 kg mass and 55 kg/m density. The characteristics of this rubber are a nominal density of 40 kg/m^3 and resistance to vertical compression of 0.45 N/mm^2.

The Physical Activity Questionnaire for Children (PAQ-C) [29] was the validated questionnaire used to analyse sports practice. This questionnaire provides a score based on the physical activity performed by the participants. The physical activity levels are classified as follows: Very Low Activity, Low Activity, Moderate Activity, High Activity, and Very High Activity.

The Hernandez-Corvo method was the outcome to assess the footprint type. It is obtained using the image of the footprint of each foot through the Tecniwork Pedrograph. The child placed both feet on the edge of the pedigraph, in a bipedal position. The method classifies the foot type in six different categories, from severe pes cavus to severe pes planus [30,31].

To avoid risk of bias, the data collection was carried out during school hours, in a room with moderate light.

The stabilometric data obtained the greater the area of the ellipse per cm^2, the less stabilometry the participants presented. For the analysis of the plantar footprint, the patients were divided into three groups. Our study classified the foot type into three considering the following percentages: 0–36.5% flat, 36.5–57.5% normal and 57.5–100% cavus [31, 32].

2.3. Statistical analysis

All variables were expressed as mean and standard deviation (SD) and/or standard error (SE). All variables met the normality assumption (i.e., Kormogorov-Smirnov test). Correlations between pre and post measurements of balance were tested by the Pearson's product moment correlation coefficient (r) and coefficient of determination (R^2). An analysis of covariance (ANCOVA) was conducted to evaluate the effect of the quarantine period regarding the type of sport practiced (i.e., individual, team sport or sedentary), considering the pre-intervention measurements as a covariate on each of the balance test (i.e., OpenEyes$_{EA}$, ClosedEyes$_{EA}$, OpenEyesRS$_{EA}$ and ClosedEyesRS$_{EA}$**)**. When a significant main effect was observed, post hoc t-test with Bonferroni corrections were used to identify the source and reported as mean differences with 95% of confidents intervals ($CI_{95\%}$). The effect size (ES) was calculated using Cohen's d formula. The qualitative assessment of ES was defined as: null (<0.20), low (0.20–0.59), moderate (0.60–1.19), large (1.20–1.99) or very large (> 2.00) [33]. The level of significance was set at $p < 0.05$. All analyses were performed using statistical analysis software (JASP v 0.15, The Netherlands).

2.4. Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the UCV Ethics Committee (Ref.UCV/2017–2018/113) "*Control postural e integración sensorial en niños de 8 a 12 años en función de la práctica deportiva*". The children participated in the study voluntarily and written informed consent was obtained from their parents or legal guardians.

3. Results

A total of 150 children participated in the present study. Results showed that the balance performance (i.e., OpenEyes$_{EA}$, ClosedEyes$_{EA}$, OpenEyesRS$_{EA}$ and ClosedEyesRS$_{EA}$) was statistically significantly worse after the quarantine due to COVID-19 (see Table 1). All the variables showed statistically significant differences ($p < 0.05$) in comparison between sex.

Pearson correlation coefficient between before/after quarantine period were $r = 0.62$, $r = 0.62$, $r = 0.66$ and $r = 0.68$ for the variables OpenEyes$_{EA}$, ClosedEyes$_{EA}$, OpenEyesRS$_{EA}$ and ClosedEyesRS$_{EA}$ respectively, all above $p < 0.05$.

3.1. Type of sport practised

There were significant differences for all stabilometric conditions after quarantine, increasing the ellipse area, which is correlated with a detriment in balance. Postural control was not influenced by the type of sport practiced.

Results from ANCOVA showed statistically significant differences in the main effect of time om OpenEyes$_{EA}$ ($F_{[1144]}$= 20.65, $p < 0.001$, $n^2_p = 0.13$), ClosedEyes$_{EA}$ ($F_{[1144]}$= 22.19, $p < 0.001$, $n^2_p = 0.13$), OpenEyesRS$_{EA}$ ($F_{[1144]}$= 30.77, $p < 0.001$, $n^2_p = 0.18$) and ClosedEyesRS$_{EA}$ conditions ($F_{[1144]}$= 35.74, $p < 0.001$, $n^2_p = 0.20$) (see Fig. 2).

However, statistically significant differences were not found regarding interaction effect of the type of sport x OpenEyes$_{EA}$ ($F_{[2144]}$= 2.51, $p = 0.085$, $n^2_p = 0.03$), type of sport x ClosedEyes$_{EA}$ ($F_{[2144]}$= 1.46, $p = 0.235$, $n^2_p = 0.02$), type of sport x OpenEyesRS$_{EA}$ ($F_{[2144]}$= 0.99, $p = 0.374$, $n^2_p = 0.01$) and type of sport x ClosedEyesRS$_{EA}$ ($F_{[2144]}$= 0.62, $p = 0.542$, $n^2_p = 0.01$). Information about mean, SE, p-value and ES can be found in Table 2.

3.2. Footprint type

Footprint type was not influenced by the quarantine period. Results from ANCOVA showed statistically significant differences in the main effect of OpenEyes$_{EA}$ ($F_{[1144]}$= 82.04, $p < 0.001$, $n^2_p = 0.36$), ClosedEyes$_{EA}$ ($F_{[1144]}$= 81.09, $p < 0.001$, $n^2_p = 0.36$), OpenEyesRS$_{EA}$ ($F_{[1144]}$= 109, $p < 0.001$, $n^2_p = 0.43$) and EA_RCE ($F_{[1144]}$= 117, $p < 0.001$, $n^2_p = 0.45$). However, no statistically significant differences were found regarding the footprint type and OpenEyes$_{EA}$ ($F_{[2144]}$= 0.34, $p = 0.712$, $n^2_p = 0.01$), footprint type and ClosedEyes$_{EA}$ ($F_{[2144]}$= 0.28, $p = 0.754$, $n^2_p = 0.01$), footprint type and OpenEyesRS$_{EA}$ ($F_{[2144]}$= 0.55, $p = 0.576$, $n^2_p = 0.01$) and footprint type and ClosedEyesRS$_{EA}$ ($F_{[2144]}$= 2.36, $p = 0.098$, $n^2_p = 0.03$). Post Hoc comparison can be found in Table 3.

3.3. PAQ-C

Children who performed intensive and moderate physical activity

Table 1
Mean and standard deviation (SD) of the dependent variables (i.e., $OpenEyes_{EA}$, $ClosedEyes_{EA}$, $OpenEyesRS_{EA}$ and $ClosedEyesRS_{EA}$) before and after quarantine period.

		$OpenEyes_{EA}$ (cm^2)		$ClosedEyes_{EA}$ (cm^2)		$OpenEyesRS_{EA}$ (cm^2)		$ClosedEyesRS_{EA}$ (cm^2)	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Male	**Mean (SD)**	53.59 (36.01)	75.43 (34.22)	62.84 (35.69)	88.09 (36.31)	81.41 (45.11)	103.99 (39.48)	102.78 (50.30)	123.14 (57.40)
Female	**Mean (SD)**	35.44 (21.55)	59.64 (30.78)	45.33 (29.05)	74.15 (33.60)	59.83 (35.95)	89.25 (40.40)	77.33 (48.01)	106.88 (51.74)

Note= all the variables showed statistically significant differences ($p < 0.05$) in comparison between sex. Ellipse Area Open Eyes ($OpenEyes_{EA}$), Ellipse Area Closed Eyes ($ClosedEyes_{EA}$), Ellipse Area Open Eyes on a rubber surface ($OpenEyesRS_{EA}$) and Ellipse Area Closed Eyes on a rubber surface ($ClosedEyesRS_{EA}$).

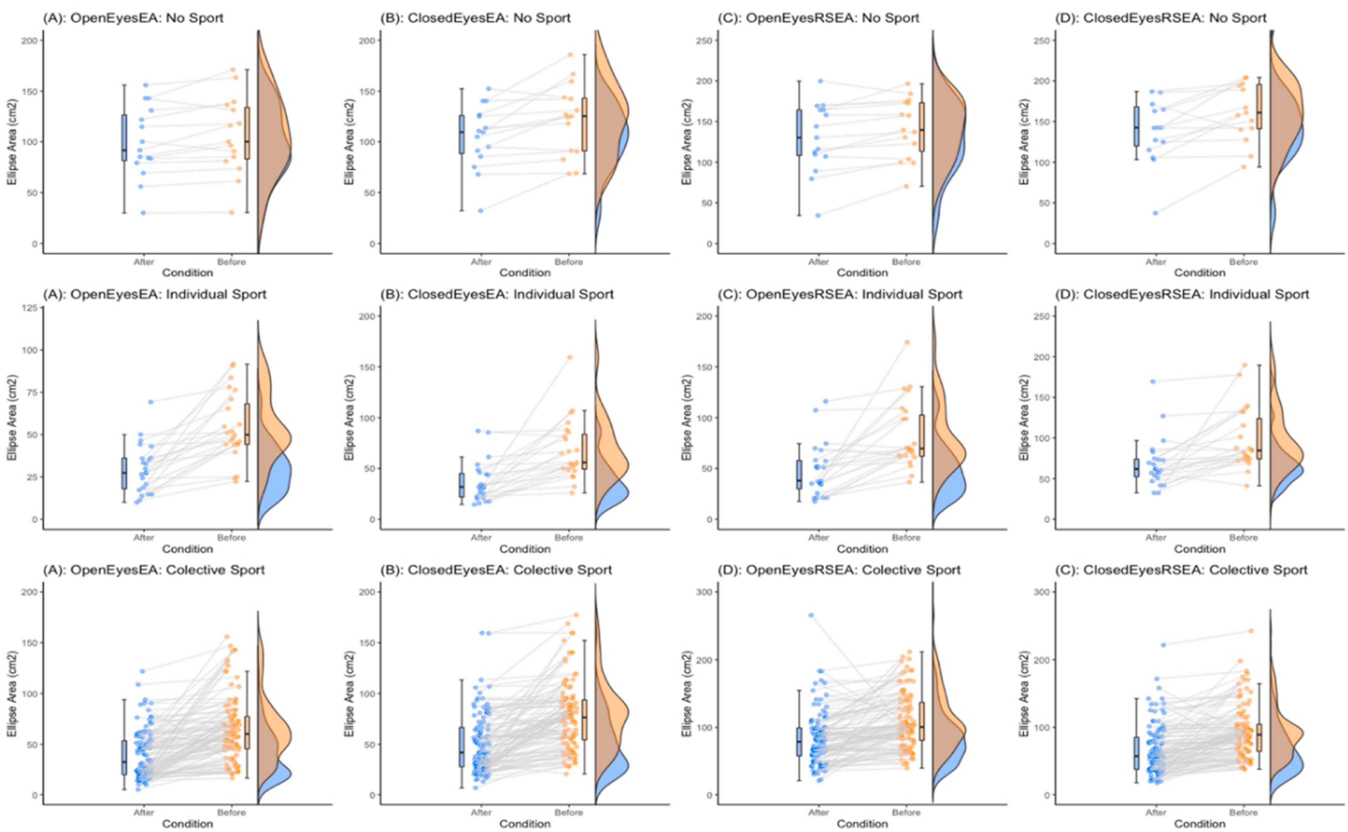

Fig. 2. Main effect for all stabilometric conditions after quarantine (Ellipse Area Open Eyes [$OpenEyes_{EA}$], Ellipse Area Closed Eyes [$ClosedEyes_{EA}$], Ellipse Area Open Eyes on a rubber surface [$OpenEyesRS_{EA}$] and Ellipse Area Closed Eyes on a rubber surface [$ClosedEyesRS_{EA}$]) in terms of type of sport (i.e., no sport, individual sport and collective sport). Circles represent individuals data points. In addition, boxplot and density distribution at each condition (i.e., after and before) where plot at the right side of each subplot.

before quarantine, showed deteriorated balance after low physical inactivity due to confinement, with both open eyes and closed eyes.

Results from ANCOVA revealed statistically significant differences in main effect of $OpenEyes_{EA}$ ($F_{[1144]}$= 45.43, $p < 0.001$, $n^2_p = 0.25$), $ClosedEyes_{EA}$ ($F_{[1144]}$= 40.96, $p < 0.001$, $n^2_p = 0.23$), $OpenEyesRS_{EA}$ ($F_{[1144]}$= 54.12, $p < 0.001$, $n^2_p = 0.28$) and $ClosedEyesRS_{EA}$ ($F_{[1144]}$= 35.17, $p < 0.001$, $n^2_p = 0.20$).

On the other hand, statistically significant differences were found in the interaction effect of the physical activity and $ClosedEyes_{EA}$ ($F_{[2144]}$= 3.36, $p = 0.012$, $n^2_p = 0.08$) and physical activity and $OpenEyes_{EA}$ ($F_{[2144]}$= 6.18, $p = 0.001$, $n^2_p = 0.15$), measured by the PAQ-C questionnaire. However, statistically significant differences were not found regarding the interaction of physical activity and $OpenEyesRS_{EA}$ ($F_{[2144]}$= 1.15, $p = 0.221$, $n^2_p = 0.04$), neither physical activity and $ClosedEyesRS_{EA}$ ($F_{[2144]}$= 0.91, $p = 0.460$, $n^2_p = 0.03$). Post Hoc comparison can be found in Table 4.

4. Discussion

The main objective of this study was to analyse the balance performance previous and after the COVID-19 quarantine period in children, taking into account the type of sport practised. Furthermore, to analyse the balance performance after the COVID-19 quarantine period in children considering the type of foot (eg, pes cavus, flat or normal), as well as the influence of the level of daily physical activity in children. The main result showed that children's balance was affected after the COVID-19 quarantine, due to a detriment observed in all stabilometric conditions. Our data showed that the lack or low physical activity meant a disadvantage in terms of the postural capacity to perform activities, as the previous study of Eid et al. (2017) demonstrated [17]. Another previous study concluded that children who did not regularly practice physical activities obtain a detriment of their postural control [16].

The type of sport practised (ie, individual, collective and/or non-sports practitioner), was not influenced by the COVID-19 quarantine. Previous studies suggested the existence of stabilometric differences depending on the type of sport practised; Golomer et al., (1998) carried out studies in different sports disciplines (dance, soccer, windsurfing and acrobatics) and untrained participants, obtaining better stabilometric results for those who performed sports [34]. It should be considered in future studies to be analysed by sports disciplines or even within the

Table 2
Mean Differences (MD), Standard Error (SE) and Effect Size (ES) of post Hoc tests regarding type of sport (i.e., no sport, individual sport and collective sport).

$OpenEyes_{EA}$	MD (SE)	p-value	ES	Descriptor
No sport vs. Collective sport	-11.42 (14.91)	0.724	-0.40	Low
No sport vs. Individual sport	-18.21 (13.05)	0.345	-0.57	Low
Collective sport vs. Individual sport	-6.80 (8.03)	0.675	-0.23	Low
$ClosedEyes_{EA}$				
No sport vs. Collective sport	0.41 (16.07)	1.000	0.01	Null
No sport vs. Individual sport	−5.93 (14.38)	0.911	-0.42	Low
Collective sport vs. Individual sport	-6.34 (8.10)	0.714	-0.20	Low
$OpenEyesRS_{EA}$				
No sport vs. Collective sport	1.62 (16.25)	0.995	0.05	Null
No sport vs. Individual sport	-2.30 (14.21)	0.986	-0.06	Null
Collective sport vs. Individual sport	-3.92 (8.91)	0.899	-0.10	Null
$ClosedEyesRS_{EA}$				
No sport vs. Collective sport	15.00 (16.95)	0.651	0.35	Low
No sport vs. Individual sport	10.16 (14.60)	0.767	0.21	Low
Collective sport vs. Individual sport	-4.85 (9.92)	0.877	0.87	Moderate

Note: MD = mean difference, SE = standard error, ES= Effect size. Ellipse Area Open Eyes ($OpenEyes_{EA}$), Ellipse Area Closed Eyes ($ClosedEyes_{EA}$), Ellipse Area Open Eyes on a rubber surface ($OpenEyesRS_{EA}$) and Ellipse Area Closed Eyes on a rubber surface ($ClosedEyesRS_{EA}$).

Table 3
Mean Difference (MD), Standard Error (SE) and Effect Size (ES) of post Hoc tests in terms of foot type (i.e., cavus, flat or normal foot).

$OpenEyes_{EA}$	MD (SE)	p-value	ES	Descriptor
Flat foot vs. Normal foot	-4.09 (5.49)	0.737	-0.12	Null
Flat foot vs. Cavus foot	0.05 (5.21)	1.000	0.00	Null
Normal foot vs. Cavus foot	4.15 (6.01)	0.769	0.13	Null
$ClosedEyes_{EA}$				
Flat foot vs. Normal foot	-1.01 (5.81)	0.984	-0.03	Null
Flat foot vs. Cavus foot	3.40 (5.60)	0.817	0.10	Null
Normal foot vs. Cavus foot	4.40 (6.38)	0.770	0.13	Null
$OpenEyesRS_{EA}$				
Flat foot vs. Normal foot	-5.51 (6.31)	0.658	-0.13	Null
Flat foot vs. Cavus foot	0.37 (6.11)	0.060	0.01	Null
Normal foot vs. Cavus foot	5.87 (6.94)	0.847	0.15	Null
$ClosedEyesRS_{EA}$				
Flat foot vs. Normal foot	-3.67 (7.36)	0.872	-0.07	Null
Flat foot vs. Cavus foot	1.20 (7.24)	0.985	0.03	Null
Normal foot vs. Cavus foot	4.87 (8.12)	0.820	0.09	Null

Note: MD = mean difference, SE = standard error, ES= Effect size. Ellipse Area Open Eyes ($OpenEyes_{EA}$), Ellipse Area Closed Eyes ($ClosedEyes_{EA}$), Ellipse Area Open Eyes on a rubber surface ($OpenEyesRS_{EA}$) and Ellipse Area Closed Eyes on a rubber surface ($ClosedEyesRS_{EA}$).

same sports discipline. However, those children who regularly engaged in physical activity (ie, collective and/or individual) before quarantine, showed worse results than non-active children, without statistically significant differences. This could be due to the number of hours of training.

Footprint type did not show any effect on children's balance performance. There are previous studies in adults that showed worse stabilometric results in flat and pronated feet [35,36]. As other authors did not find significant differences, this discrepancy could be due to the method of measuring the plantar footprint [37].

Finally, it was shown that the previous physical activity carried out by the children (assessed with the PAQ-C questionnaire) affected the results of the stabilometric tests. Children who had great levels of physical activity showed worse results than children who had very low levels of physical activity after the COVID-19 quarantine period.

The COVID-19-induced quarantine led to a decline in physical activity levels along with a sedentary lifestyle. This fact could cause the

Table 4
Mean Difference (MD), Standard Error (SE) and Effect Size (ES) of post Hoc tests in terms of the PAQ-C questionnaire.

$OpenEyes_{EA}$	MD (SE)	p-value	ES	Descriptor
Very low vs. Low	-7.26 (15.33)	0.990	-0.23	Low
Very low vs. Normal	-9.54 (8.71)	0.808	-0.29	Low
Very low vs. High	-27.16 (10.64)	0.085	-0.83	Moderate
Very low vs. Very high	-60.37 (14.94)	**0.001****	-1.54	Large
Low vs. Normal	-2.28 (14.27)	1.000	-0.11	Null
Low vs. High	-18.90 (15.53)	0.703	-0.76	Moderate
Low vs. Very high	-53.11 (18.74)	**0.041***	-1.70	Large
Normal vs. High	-17.62 (9.04)	0.296	-0.64	Moderate
Normal vs. Very high	-50.83 (13.84)	**0.003****	-1.56	Large
High vs. Very high	-33.21 (15.14)	0.188	-1.02	Moderate
$ClosedEyes_{EA}$				
Very low vs. Low	7.57 (14.41)	0.985	0.23	Low
Very low vs. Normal	-4.37 (10.56)	0.994	-0.15	Null
Very low vs. High	-16.65 (12.78)	0.690	-0.48	Low
Very low vs. Very high	-48.96 (16.32)	**0.025***	-1.27	Large
Low vs. Normal	-11.94 (12.24)	0.866	-0.56	Low
Low vs. High	-24.22 (12.20)	0.434	-0.79	Moderate
Low vs. Very high	-56.55 (14.20	**0.012***	-1.72	Large
Normal vs. High	-12.29 (10.27)	0.753	-0.42	Low
Normal vs. Very high	-44.62 (14.34)	**0.019***	-1.47	Large
High vs. Very high	-32.33 (16.04)	0.264	-0.93	Moderate
$OpenEyesRS_{EA}$				
Very low vs. Low	7.58 (13.47)	0.980	0.19	Null
Very low vs. Normal	-4.01 (10.64)	0.996	-0.11	Null
Very low vs. High	-11.91 (12.44)	0.874	-0.30	Low
Very low vs. Very high	-33.94 (13.15)	0.079	-0.77	Moderate
Low vs. Normal	-11.59 (11.50)	0.851	-0.43	Low
Low vs. High	-19.49 (13.18)	0.578	-0.56	Low
Low vs. Very high	-41.52 (13.85)	**0.026***	-1.09	Moderate
Normal vs. High	-7.90 (10.27)	0.939	-0.25	Low
Normal vs. Very high	-29.93 (11.11)	0.060	-0.88	Moderate
High vs. Very high	-22.03 (12.85)	0.428	-0.57	Low
$ClosedEyesRS_{EA}$				
Very low vs. Low	0.77 (14.37)	1.000	0.01	Null
Very low vs. Normal	11.95 (0.81)	0.805	0.24	Low
Very low vs. High	8.27 (12.28)	0.961	0.16	Null
Very low vs. Very high	-15.39 (13.87)	0.802	-0.26	Low
Low vs. Normal	11.17 (13.19)	0.915	0.41	Low
Low vs. High	7.50 (13.32)	0.985	0.20	Low
Low vs. Very high	-16.16 (15.78)	0.844	-0.40	Low
Normal vs. High	-3.68 (10.77)	0.997	-0.11	Low
Normal vs. Very high	-27.35 (7.62)	0.201	-0.75	Moderate
High vs. Very high	-23.66 (13.84)	0.430	-0.56	Low

Note: MD = mean difference, SE = standard error, ES= Effect size. Ellipse Area Open Eyes ($OpenEyes_{EA}$), Ellipse Area Closed Eyes ($ClosedEyes_{EA}$), Ellipse Area Open Eyes on a rubber surface ($OpenEyesRS_{EA}$) and Ellipse Area Closed Eyes on a rubber surface ($ClosedEyesRS_{EA}$).

development of some chronic diseases with serious consequences on the health status of the population. It is necessary to prevent this sedentary behaviour, motivate the population to practice sports and remind them to stay active [12]. The WHO has established a guideline with standards on physical activity and sedentary behaviour in children to help and reduce physical inactivity caused by COVID-19 to be carried out in 2030 [7]. The present study suggests that the decrease in physical activity caused by quarantine affects the balance in the OpenEyesEA, ClosedEyesEA, OpenEyesRSEA and ClosedEyesRSEA conditions, being more evident in children with a lot of physical activity compared to children who practiced little or no activity [8].

Many countries are affected by the pandemic, so the impact that COVID-19 has had on physical activity and sedentary lifestyle must be evaluated [11,12,33].

Previous studies proposed some initiatives to avoid the decrease in physical activity levels caused by COVID-19 and therefore avoid a stabilometric detriment, achieving good childhood development [38].

The benefits of practicing physical activity in terms of balance are mainly observed when postural control is affected by different conditions such as the interruption of the information provided by the visual, somatosensory and vestibular systems [38–40]. The present study shows statistically significant differences in terms of the level of physical activity, an exception of the condition of the vestibular system (ROSC) isolating the rest of systems.

4.1. Study limitations

There are several limitations to this study that should be taken into consideration when interpreting the results obtained. The first aspect to consider is that the physical activity of the children has not been evaluated or monitored during the quarantine period. For this reason, the results are from two specific dates. Furthermore, no biases have been considered that may have also influenced the results, such as an assessment of muscle mass loss due to lack of physical activity as well as the physical activity done during quarantine period in side home. Finally, we did not measured any reliability coefficients of the outcomes. However, as one of the main factor that affect to reliability is the assessor, we use the same researcher both in pre and post measurements. In addition, previous studies reported that previous research demonstrated that this protocol had moderate to strong evidence of validity and reliability. Also, it was not controlled if the participants tested positive for COVID-19, developed another condition or modifications in their BMI, which could have modified the results.

4.2. Future research

The results of the present study guide the following future research: similar studies may be carried out using another device to assess the balance to compare the results. Dividing the sample size in terms of age, sex and type of sport could show statistically significant differences in future studies. Also, to study the relationship of balance and loss of strength after quarantine.

5. Conclusions

After the quarantine period, a significant reduction in balance performance was found in children. The findings suggest that regular physical activity benefits postural control. Loss of balance does not differ in postural stability by the type of sport practised. Postural stability is not influenced by the type of footprint after the period of physical inactivity. Postural control is influenced in children with a great level of physical activity.

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CRediT authorship contribution statement

All authors contributed to the conception and design of the study. VM-C organised the database and wrote the first draft of the manuscript. VM-C and JF-T performed the statistical analysis. All authors wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

Declaration of Competing Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the UCV Ethics Committee (Ref.UCV/2017–2018/113) "*Control postural e integración sensorial en niños de 8 a 12 años en función de la práctica deportiva". The children participated in the study voluntarily and written informed consent was obtained from their parents or legal guardians.*

Data Availability

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

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Consent for publication

The patients gave their oral and written informed consent to the publication of their anonymous and clustered data and anonymous pictures.

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