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Effects of Physical Exercise on the Body Composition and Conditional Physical Capacities of School Children During Confinement by COVID-19

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Abstract

As a result of the COVID-19 pandemic, most of the countries announced the temporary closure of schools, opting to continue classes virtually, affecting children's lifestyles, primarily by reducing the practice of physical activity and sport, which becomes a risk factor for the development of obesity and overweight. The objective of the present study was to determine the effects of physical exercise on body composition in a sample of school-age children during confinement by COVID-19. A quantitative approach study and quasi-experimental design with pre-test and post-test. The sample consisted of 70 school-age children from 8 to 12 years old who were randomly assigned to 2 groups: the experimental group (GE: 35), who received an aerobic and anaerobic physical exercise program 3 times a day. With a duration of 60 minutes for 10 weeks in a virtual way and a control group (CG: 35) that received only the physical education class. Although the pre-test post measurements showed favorable changes in body composition, weight, and conditional capacities (speed and jumping), these were not statistically significant ($P < .05$). A structured physical exercise program through virtuality for schoolchildren can be a strategy to control overweight and obesity in children during confinement and improve their conditional physical capacities (speed, jumping).

Keywords

physical exercise, obesity, overweight, involuntary confinement, COVID-19

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Introduction

As evidence, physical activity in schoolchildren generates numerous benefits, among which are better socialization, perception of general well-being, self-esteem, better performance in executive functions and cognitive processes in childhood[1] and the establishment of healthy habits that provide the bases for maintaining a good quality of life and preventing chronic diseases that are increasingly common at an early age, such as for overweight and obesity.[2]

These health conditions can occur at any stage of life, affecting millions of children without any discrimination; Among the leading causes are sedentary lifestyle, physical inactivity, and poor eating habits that are considered a public health problem worldwide.[3]

The COVID-19 pandemic radically changed children's lifestyles,[4] taking into account that education was carried out virtually. As a result, their physical and recreational activities, including extracurricular activities, were restricted, causing a sedentary lifestyle to increase in children, negatively impacting physical, emotional, and psychosocial well-being.[5]

It has been found that physically, the main affectations are reflected in children's body composition and motor skills. Consequently, generating "weaker, slower and heavier children in comparison to them before the

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start of the health situation" has been associated with the Pediatric Inactivity Triad (PIT) characterized by exercise deficit disorder, pediatric dynapenia, and illiteracy physical.[6]

During the development of mandatory confinements in the pandemic, some studies showed worrying figures of increased BMI, overweight, and obesity in the child population. The study of Mulugeta and Hoque[7] reports these same conditions, disproportionately affecting subpopulations disadvantaged (Spanish speakers).

According to Medrano et al [8] the prevalence of children who worsened their lifestyle behaviors during confinement due to COVID-19 in Spain was 95.2% for physical activity, 69.8% for screen time, and 31.4% for adherence to the Mediterranean diet.

During confinement, strategies were implemented to promote physical activity through information and communication technologies (ICT)[9] turning virtual physical education into a tool to contribute to the quality of life of people in isolation and distancing conditions social.

Currently, in Latin America, there are no published studies that identify the impact of strategies to counteract the effects of confinement in children, such as implementing exercise and physical activity strategies virtually.

In this sense, the objective of this study was to determine the effects of physical exercise on the body composition and conditional physical capacities of school children during confinement due to COVID-19.

Methodology

Study Design

Quantitative approach study and quasi-experimental design with pre-test and post-test.[10] The sample consisted of 70 children from 8 to 12 years old. Who randomly were assigned to 2 groups: the experimental group (EG: 35) who received an aerobic and anaerobic physical exercise program 3 times per week with a duration of 60 minutes for 10 weeks virtually and a control group (CG: 35) that received only the physical education class.

Population and Recruitment

The study population consisted of 200 boys and girls from a public educational institution in Colombia. An intentional probabilistic sample of 70 overweight and obese boys and girls between 8 and 12 years old who met the criteria was selected. Inclusion: being enrolled in the institution, being overweight and obese, not having a primary pathology that prevents physical activity and exercise, having a computer and internet connection for the development of the program, accepting the participation of the study by signing the consent and virtually informed assent.

The following were established as exclusion criteria: boys and girls who did not complete the programed exercise plan.

The boys and girls were randomly assigned to 2 groups: an experimental group (n = 35) who received the physical exercise program and a control group (n = 35) who received the regular physical education class.

Procedures

The research project was socialized to the directives and parents of the educational institution through virtual meetings on the google meet digital platform where the benefits of physical exercise on the body composition and conditional physical capacities of school children were related during confinement COVID-19. The parents of the participants provided their informed consent and the children their assent.

The children in the experimental and control group were evaluated before and after applying the intervention defined for each group through virtual meetings by google meet with each participant together with the parent or guardian.

The physical exercise program was developed through virtual meetings 3 times a week for 60 minutes during 10 weeks.

Data Collection

Sociodemographic characterization was carried out through Google forms and telephone calls with questions such as age in years; sex of the participant, socioeconomic stratum defined by Colombia with values of 1: low-low stratum; 2: for low stratum; 3: for medium-low stratum; 4: for middle stratum; 5: for high stratum; and 6: for high-high stratum and health regimen. Moreover, a questionnaire of open and closed questions was applied with response options on the habits and lifestyle of the children such as daily cell phone use, tablet use, computer, watch television, and practice physical activity according to days, time in minutes.

Anthropometric Measures

The anthropometric measurements followed the guidelines of Resolution 2465 of 2016 of the Ministry of Health and Social Protection of Colombia. With the adoption of the anthropometric indicators, reference standards, and cut-off points to carry out the anthropometric classification of the nutritional status of children

and adolescents under 18 years of age. Under the growth patterns published in 2006 and 2007 by the World Health Organization.[11]

Additionally, the parents were asked their weight and height at the beginning and the end of the project. The parents were advised to take the weighing; they needed to verify that the scale was on a flat and firm surface and at 0, as well as the child should be in light clothing and without shoes. In the same way, for height measurement, the measuring tape should be on a flat surface and against a wall and the child in an upright position with the heels together and knees straight.

Fitness Assessment

The physical condition evaluation was carried out through virtual encounters. The parents received an explanation of the characteristics of each test and the materials needed for each test. Plate tapping was applied to measure the segmental speed of the upper limb, speed ten by 5 m to measure the speed of movement and agility, horizontal jump to determine the power of legs and abdominals in 30 seconds to determine the resistance strength of the abdominal muscles. Belonging to the Eurofit[12] battery for this study, it was not possible to apply the complete battery taking into account the locative conditions of each child.

Intervention Protocol

A physical exercise program was designed based on theoretical background and was subjected to expert judgment by 2 physiotherapists specializing in physical activity and sport. After this, the physical exercise program was applied to the experimental group through virtual meetings developed 3 times a week with a duration of 60 minutes for 10 weeks. The intervention consisted of aerobic and anaerobic exercises, 15 minutes for the warm-up phase, 30 minutes of moderate and high-intensity physical activity, and finally, 15 minutes of relaxation and stretching. During week 1 to week 3 the objective was to promote aerobic capacity and endurance, with a slight intensity, with a frequency of 3 times a week and a time of 60 minutes, through an aerobic circuit that included rope jumping and displacements. During week 4 to week 6 was to promote aerobic capacity, endurance, flexibility and enhance muscular strength with moderate-intensity workouts. With a frequency of 3 times a week and a time of 60 minutes, the aerobic circuit includes jumps (Jumping jacks), lateral movements, and squats (classic, juice, stride). Furthermore, the objective for weeks 7 to 10 was to maintain aerobic capacity, endurance, promote flexibility, and enhance muscular strength with High intensity. With a frequency of 3 times a week and a time of 60 minutes, the circuit aerobic included jumps (Jumping jacks), lateral movements, squats (classic, juice, stride), and isometric exercises for the upper body and lower body.

It is proven that the combination of both helps reduce overweight and obesity and improves schoolchildren's physical condition and motor development.[13]

Ethical Considerations

The present study follows the ethical principles of the Declaration of Helsinki of the World Medical Association[14] and resolution 8430 of 1993 of the Ministry of Health in the minimal risk category according to article 11.[15] Project approved in call 856 of Minciencias (Ministry of Science, Technology, and Innovation) of young researchers and innovators from Huila with ethical endorsement granted by the María Cano University Foundation, Medellín Colombia in session the 2 of October the October 9 2020 and assignment of code # 013008047-2020-311.

Statistic Analysis

The data were incorporated into a matrix created in Microsoft Excel and processed in the statistical program (SPSS) version 26, where frequencies of all the variables were generated for each group.

Before performing the hypothesis test, whether the quantitative variables have a normal distribution with the Shapiro-Wilk test was checked. To compare the quantitative parametric variables between the 2 groups, the Student's *t*-test was used. In the case of comparison of non-parametric variables, the Wilcoxon test was used. In all cases, a level of statistical significance was taken into account when the *P*-value $<.05$.

Results

A total of 70 overweight and obese boys and girls were recruited, 40 (57%) female and 30 (43%) between 9 and 12 years old, with a mean age of 9 years belonging to socioeconomic stratum 2 (65%) low.

The experimental group obtained significant numerical changes in body composition variables (weight, BMI) and conditional physical capacities. The positive changes brought in speed and jumping stand out (see Table 1; Figure 1). However, these results did not show statistically significant differences ($P < .05$) when comparing the mean range of the related samples in all the variables of the control and experimental groups.

The median and interquartile ranges show better results in the experimental group's variable weight than the control group in the pre-test and post-test (Figure 2).

Table 1. Changes in Anthropometric Variables and Physical Condition After the Intervention.

	Control group		Experimental group		
Variables	Pretest	Postest	Pretest	Postest	*P*
Weight	39.77 ± 6.52	40.29 ± 6.55	40.78 ± 5.31	38.97 ± 5.1	.42
BMI	20.59 ± 1.46	20.88 ± 1.49	20.91 ± 1.78	19.98 ± 1.72	.41
Tapping	21.48 ± 5.67	21.49 ± 4.26	21.65 ± 5.13	19.09 ± 4.20	.69
Speed	30.86 ± 4.65	31.88 ± 5.91	34.79 ± 5.82	27.65 ± 5.44	.63
Jump	109.11 ± 20.31	106.51 ± 18.63	87.94 ± 23.48	110.71 ± 22.57	.41
ABS	11.29 ± 3.10	10.89 ± 2.22	9.63 ± 2.39	12.74 ± 2.21	.9

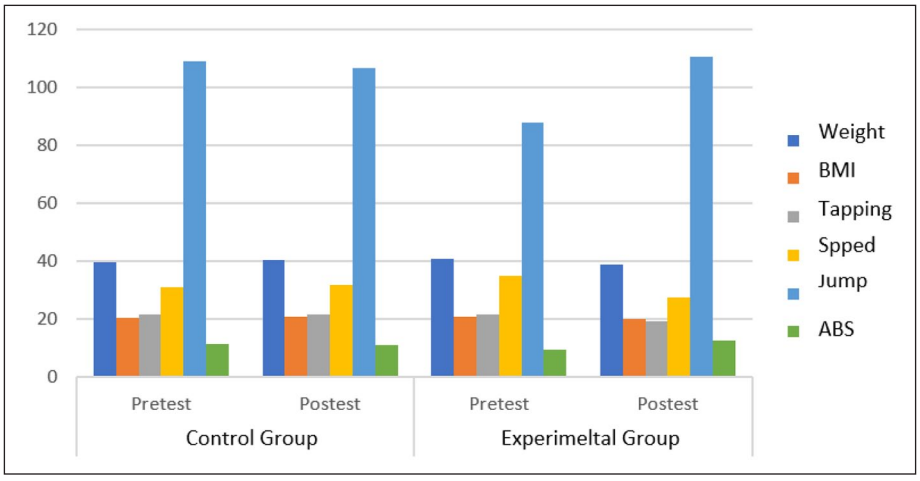

Figure 1. Changes in anthropometric variables and physical condition after the intervention.

The median and interquartile ranges show better results in the experimental group's BMI variable than the control group in the pre-test and post-test (Figure 3).

Discussion

Childhood overweight and obesity continue to be a public health problem worldwide. However, it has been shown that it can be prevented and treated through regular physical exercise. In the present study, the effects of a physical exercise program on overweight and obesity in school children were determined through virtuality during confinement by COVID-19. The results show positive effects on weight and Body Mass Index between the experimental and control groups.

The results did not show statistically significant differences ($P < .05$). However, the experimental group obtained significant changes, demonstrating that a structured physical exercise program positively affects weight, speed, and jumping. Similar studies such as the one developed by Romero et al[16] conclude that a program of moderate-intensity physical exercise twice a week in overweight children presents changes in weight, height, and body self-image. Likewise, Alves and Alves[17] found that a regular physical exercise program for overweight children is effective, without dietary interventions, in reducing weight gain and BMI.

The findings show a numerical difference between the pre-test and post-test results regarding the Body Mass Index variable. The current study's findings are consistent with Pumar et al,[18] who observed that a physical activity program carried out during recess in schoolchildren produces improvements in BMI values and physical condition in children between 9 and 11 years old. Other authors have used dance to treat childhood obesity, finding results in a significant reduction in the *z* score of the BMI and the waist/height ratio. Such de Monteiro et al[19] or like Lavelle et al[20] who report that there is increasing evidence that school interventions containing a physical activity component can be effective in helping to reduce BMI in children.

Authors such as Aguilar Cordero et al[13] affirm that the most effective physical activity program in overweight and obese adolescents is the one that combines aerobic and anaerobic exercises. Therefore, this study confirms that the virtual physical exercise program applied to the

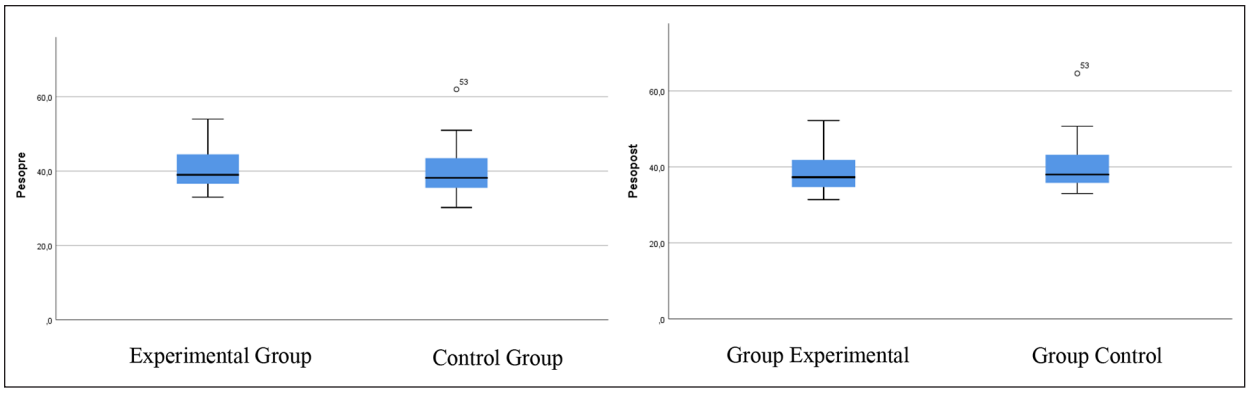

Figure 2. Distribution of the control and experimental group, according to weight before and after the intervention.

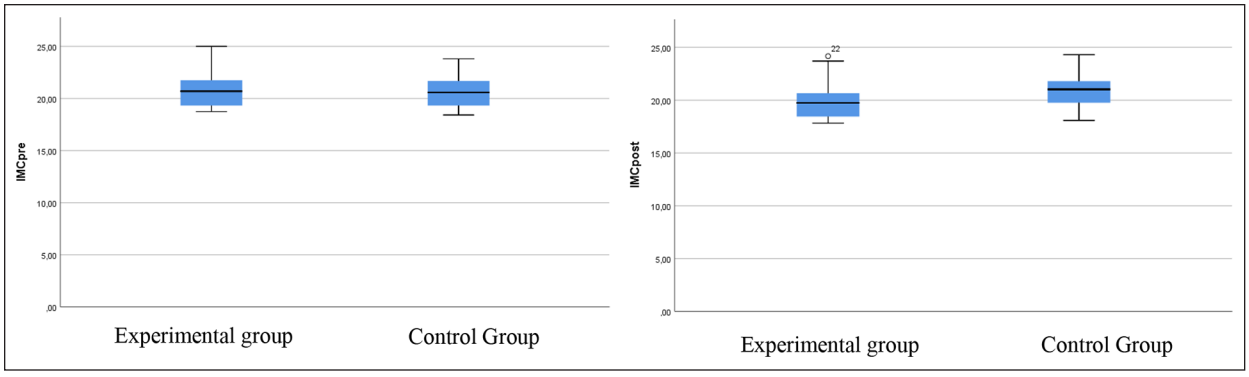

Figure 3. Distribution of the control and experimental group, according to the BMI before and after the intervention.

experimental group it was designed with aerobic and anaerobic exercises with moderate and vigorous intensity.

The jumping variable observed improvements in the post-test, indicating that the explosive force in the lower limbs improved after the intervention. In the same way, the variable tapping that measures the segmental speed of the upper limb. The previous results coincide with those observed in the study by Gelabert et al[21] who found effects on the increase in upper body strength and explosive strength of the lower body, analyzed through the horizontal jump, through the application of games of short duration, following an interval structuring with a duration 20 minutes and with a moderate-vigorous intensity.

On the other hand, in the present study, the EUROFIT battery was used to assess the physical condition of children due to its frequent usefulness, reliability, and validity. Authors such as Corredor et al[22] performed 5 integrated tests within the EUROFIT battery in their study to determine the relationship between physical condition, birth weight, and breastfeeding in adolescents from a rural town in Spain. Additionally, other authors such as Falzon et al[23] used it to measure physical condition in children with cystic fibrosis, and Ranson et al[24] used it to measure physical fitness, flexibility, speed, endurance, and strength schoolchildren. The preceding accounts for the scientific evidence that the EUROFIT battery has in assessing physical condition in children.

The present study produced a positive impact on the children who were in confinement due to COVID-19, since they presented weight gain related to the sanitary measures established worldwide, as demonstrated by Arévalo et al[4] in their results where they refer that the mandatory isolation period produced that 75.2% of the children did not manage to add the recommended minutes of physical activity, that 82.8% exceeded the time of 60 minutes a day in front of electronic devices and that 44% increased from the weight.

Equally important, authors such as Andreu et al[25] refer that this type of compulsory confinement produces temporary and permanent psychological damage. In the child population, the restriction of movement will cause anger, crying, fear, specific hyperactivity, and eating disorders such as obesity. Since feeding and looking for a remedy

against anxiety; Physical activity can mitigate these psychological effects, so it can be practiced without going to a gym. It has also generated a natural phenomenon in social networks and as a social response to the restriction of movement. There has been a sporting phenomenon never seen before: Physical activity at home, authors such as Carrillo[26] affirm that technological advances should be used to improve the comprehensive care of patients by maintaining physical exercise programs through virtual platforms and keep people active during confinement.[27]

For this reason, it is essential to make good use of technology. For example, video games allow physical interaction with the images on the screen, promoting and favoring physical fitness characteristics in children and young people at school.

Physiotherapists could recommend using active video games for therapeutic purposes focused on reducing sedentary lifestyle and obesity levels, thus supporting our research with the virtual physical program directed by a professional in physiotherapy.

Conclusion

A structured physical exercise program through virtuality can be a strategy to control overweight and obesity in children during confinement. Improvements in weight, BMI, and physical condition (jump, speed) were evidenced in school-age boys and girls.

Author Contributions

María Helena Audor González made a substantial contribution to the concept or design of the work; or acquisition, analysis or interpretation of data, drafted the article or revised it critically for important intellectual content, approved the version to be published. Piedad Rocio Lerma Castaño made a substantial contribution to the concept or design of the work; or acquisition, analysis or interpretation of data, drafted the article or revised it critically for important intellectual content, Approved the version to be published. Elizabeth Roldán González made a substantial contribution to the concept or design of the work; or acquisition, analysis or interpretation of data, drafted the article or revised it critically for important intellectual content, approved the version to be published.

Declaration of Conflicting Interests

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