EFFECTS OF CROSSFIT LESSONS IN PHYSICAL EDUCATION ON THE AEROBIC CAPACITY OF YOUNG STUDENTS

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Abstract
Strength training in adolescents is one of the pending subjects of Physical Education. Habitually, improvements in physical condition are solely and exclusively related to training in aerobic resistance. The objective of this study was to assess the effects of the incorporation of Crossfit along with aerobic games on aerobic capacity over a period of 8 weeks in a group of teens during their physical education sessions at the school. The study examined 82 subjects between 16-18 years of age, who were high school students. 40 women and 42 men were distributed into two groups, experimental and control. The results indicate that the effect on aerobic capacity measured through the course navette test is significantly positive through the inclusion of crossfit methodology along with aerobic games in physical education sessions.

Key words: Aerobic capacity, adolescents, crossfit.

Introduction
The attainment of a good physical condition is the backbone of the subject of Physical Education and this objective must be carried out in a way that is entertaining and new, without losing sight of its purpose. We have to keep in mind that students spend many hours sitting and working on theoretical concepts individually. That is why we must take advantage of our material to work effectively and efficiently and at the same time achieve practical training in their academic performance and enable them to disconnect from the stress generated by their studies. Unfortunately, many centers use traditional training methodologies that discourage students as they are boring, repetitive, unrealistic, and above all provide few incentives that encourage students to practice sports. This is important not just in the classroom, but also because adherence to physical activity is key to the development of the student. We have in our hands as teachers, the opportunity to gain students' adherence to physical activity and to enable them to escape from a sedentary lifestyle.
Keep in mind that health problems are no longer the sole responsibility of the healthcare field. This new way of understanding health is an innovative approach that has come to school and is affecting the reconstruction of the curriculum of the area of Physical Education. Several agencies, such as the United States Department of Health, Centers for Disease Control and Prevention in the United States and the Australian Ministry of Health and the Third Age of Australia, Anzar & Webster (2), point out that children and adolescents need to perform at least 60 minutes (and up to several hours) of physical activity of moderate to vigorous intensity, all or most days of the week. As it is proven that these values are not achieved, we have to put into practice new models of fitness work that can provide different results that should be applied and analyzed to continue progression in a science such as Physical Education.

If the main objective of Physical Education is to promote health and train students for regular physical activity in their free time, to continue physical activity into adulthood and lead to the adoption of exercise habits which have a positive impact on health and quality of life, Physical Education professionals can not turn their backs on this problem. (16)

Patterns of physical activity in young people have important health implications, since with low levels of practice there may be an early onset of cardiopathy, osteoporosis or obesity in adulthood, (19). In the last three decades, the abundant epidemiological analysis of physical activity has reached very uniform conclusions about the benefits of its regular practice. However, the prevalence of sedentary lifestyles continues to increase, so physical intervention promotion interventions are necessary to achieve the goal of “accumulating at least 30 minutes of moderate intensity physical activity in almost all, or better all, the days of the week”.

The amount and quality of physical activity has been considerably reduced in today’s society. The imbalance that is produced in terms of food consumption that exceeds energy expenditure leads to an increase in body weight and, consequently, of obesity. There are several determinants of obesity, as well as its consequences. To treat an obese person, one must know, first of all, the agent triggering the illness. Teachers of Physical Education, together with the contributions of professionals from other areas of sports sciences, can be of vital importance to help children and adolescents with problems caused by being overweight (3).

In a recent study (13), the level of physical condition of adolescents, especially the aerobic capacity, with the levels of body fat is inversely related. Having a high level of obesity involves serious health problems as it increases the risk of coronary artery disease, high blood pressure, type 2 diabetes, etc. Unfortunately, obesity and being overweight are increasing alarmingly in Europe. The World Health Organization now recognizes physical inactivity as the fourth risk factor for global mortality in noncommunicable diseases. In a few years, some countries have doubled their obesity rates and the epidemic, far from referring, threatens to continue increasing. According to a study (15), the prevalence of weight increase and obesity in children and adolescents in Spain is still very high (about 40%). The obesity rate in the Spanish adult population (25-60 years) is 14.5% while being overweight is 38.5% (16).

**Crossfit and aerobics**

Crossfit is a novel, comprehensive, general and inclusive method based on multi-articular or functional movements that combines weight-bearing exercises or basic gymnastics, weight-lifting and metabolic conditioning activities, performed at high intensity, (18).

According to the principles of this sport modality, Crossfit is based on the improvement of the 10 domains of fitness, which would be precision, agility, balance, coordination, cardiovascular and pulmonary resistance, flexibility, power, speed, general resistance or endurance and strength, (18).

CrossFit has been one of the best fitness training methods in the fitness industry since its inception in 2000. This popularity could be derived from two main factors: physiological changes in training and psychological benefits. There are two factors that have influenced the success of this modality. One is the little time necessary to practice it because it is a high intensity training or HIIT and the other is that it improves physical and physiological abilities, (18). Although in
Physical Education, the levels of practice are lower than in extracurricular activity (6). P.E. Classes are very important in achieving the motivation that will make these students intend to be physically active later. Likewise, strength training at an early age should be incorporated progressively and be part of a wider global physical conditioning program. For this reason, force training at the adolescent stage should be presented in similar formats with these ages, in order to avoid boredom and to foster compliance (14).

Benefits of Crossfit school interventions

Fortunately crossfit, along with aerobic gaming activities, would be considered an ideal way to reduce the weight increase and obesity of children and adolescents as shown by a recent study (1). According to these authors, the most effective physical activity program is the one that combines aerobic and anaerobic exercises. There is consensus on the need to accumulate more than 180 minutes a week dedicated to these ends, with 3 sessions of 60 minutes; each one of physical exercise of a moderate intensity. This could be enough to execute a physical exercise program for those children, teens or adults who present this problem of being overweight or obese.

The following study was conducted to investigate the physiological and psychological benefits of CrossFit training in a population of healthy adults subjected to their first contact with the training method. The CrossFit program was conducted for 8 weeks by Certified CrossFit trainers at a local gym. After the 8-week training, the participants were evaluated again using the same measures. In conclusion, this study suggests that CrossFit training may be beneficial for improving body composition and at the same time changing certain motivational factors to continue participating in physical activity (17).

Another study, in this case with obese children (5), evaluated the hypothesis that strength training is beneficial for obese children with a controlled diet compared to the acquisition of lean mass and bone mineral The children in the training group showed a significantly greater increase in lean body mass and overall bone mineral content compared to control group subjects. Therefore, in pre-existing children with obesity / excessive weight who perform a controlled diet, participating in an exercise program with emphasis on strength training resulted in improvements in lean mass and in the aggregation of bone minerals.

In another study, in which the intensity of the exercise is the same as that proposed in the didactic unit, the effect of a program of 8-week high intensity aerobic training, developed during Physical Education classes, on the aerobic capacity of adolescents aged 15 to 18. The training program consisted in the practice of aerobic physical activity with an intensity equivalent to 75-80% of the VO2max. In conclusion, a high intensity aerobic training program of 8 weeks, 2 days per week, improves the aerobic capacity of the students.

According to Sánchez et al, (15) the practice of Crossfit encourages the motivation of the students due to being a new activity and also increases the perception of fun, learning and level of intensity of Physical Education classes. That is why all time spent on Crossfit at the school will encourage students to continue practicing out of school. Hence the value of seeding at the center an effective and fun work methodology that will allow the student to enjoy and at the same time learn theory and practice of training. It will be, therefore, the school that sets the necessary precedent so that the student can continue practicing outside and throughout life. The objective of this study is to assess the effects on aerobic capacity, the incorporation of Crossfit along with aerobic games for 8 weeks in a group of teens in their physical education sessions at the school.

Materials and Methods

Part of the study comprised 82 subjects between 16-18 years of age, high school students. 40 women and 42 men were distributed in two groups, experimental and control.
Table 1. Descriptive characteristics from the sample

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Intervention group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>N</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>82</td>
<td>17,2</td>
<td>45</td>
</tr>
<tr>
<td>Gender %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>82</td>
<td>51,2%</td>
<td>45</td>
</tr>
<tr>
<td>BMI Kg/cm²</td>
<td>82</td>
<td>19,8</td>
<td>45</td>
</tr>
</tbody>
</table>

To measure the aerobic capacity, and establish indirectly the VO2Max at the initial and the final stage of the Didactic Unit, both control and intervention groups where tested.

It has been decided to use the Course Navette Test. This test evaluates the maximum aerobic capacity from an indirect-incremental field test-20m. maximum return, using the equations proposed by Léger et al, (10) to estimate the maximum oxygen consumption (VO2max ). The reliability and validity of this test to predict VO2max in children and adolescents have been sufficiently demonstrated.

The school intervention will consist of the completion of eight weeks in which a first part of work will be carried out for high intensity and short physical activity High intensity interval training (HIIT) stations, which will be formed by eight stations in which there will be Crossfit exercises and other simpler exercises, as there will be adaptations for adolescents, although the dynamics of multi-art exercises will be the same.

The circuit will last between 16 and 24 minutes, during which the students will do two laps of the circuit and the latter will be equipped with music, which will motivate more students. There will also be a time dictating when the students have to change their stage and when they have to start the exercise.

The other part will be formed by cooperative and collaborative-opposition games, in which there will be an inclusion and exclusion criterion that will give sense to the work of aerobic resistance. The basic premise of the game is to make the greatest number of students move, and thus increase motor commitment and make the activity more effective and efficient. The intention is to change the habit of the student who does not practice physical activity outside the classroom and get him or her to adhere to a program of physical activity either in a gym, in the street or with the practice of a sport circuit training. This will be useful as the students will know what muscles work in each exercise, to what intensity and what benefits this activity entails.

Results

The T test was done to compare related samples concerning the effects of the intervention on the increase of the VO2max thanks to the work of the Didactic Unit (DU).

We can see in table 2 how the results of the experimental group change significantly after the crossfit intervention in the physical education sessions.

In the control group there are no differences in the two moments in which the sample has been analyzed.

Table 2. Values of aerobic capacity (Vo2max/Ml/Kg/min) in both control and intervention groups, before and after the Physical Education intervention.

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention Vo2max</th>
<th>Post-intervention Vo2max</th>
<th>t'</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>34,04</td>
<td>36,96</td>
<td>-3,02</td>
<td>0,004*</td>
</tr>
<tr>
<td>Control</td>
<td>35,88</td>
<td>35,85</td>
<td>0,66</td>
<td>.948</td>
</tr>
</tbody>
</table>

The results indicate that the effect on aerobic capacity measured through the course navette test has been significantly positive through the inclusion in the physical education sessions of the crossfit methodology along with aerobic games.
Discussion

The main objective of this study was to assess whether a didactic pedagogical crossfit unit and aerobic game with music could be a more suitable way of improving condition compared to traditional physical condition work.

The results showed that students who practice pedagogical crossfit and aerobics, have a greater degree of fun compared to traditional physical condition and significant improvements in aerobic capacity (VO2max), which indicates that they are the most intensive activities convenient for the work on physical condition in school.

All the knowledge can be transferred to a gym or the street, and therefore health is promoted and the training of students for a regular physical activity in their free time, which remains into adult age and that is tied to the adoption of physical exercise habits that positively affect health and quality of life since physical education professionals can not turn their backs on this problem (16). There would be a congruence between our conclusions and the present study.

The pedagogical Crossfit aims to motivate and enhance the practice of physical exercise since, according to the results, the values of satisfaction are higher than those of the traditional physical condition. This motivation would be an incentive for students to practice physical activity outside school as well, because according to a recent study (11), adolescents do not reach the minimum recommendations established by international organizations and the levels of practice are greater during extracurricular or leisure hours, than during PE classes.

In addition, the high levels we have obtained of fun amongst the students are of vital importance, although in Physical Education, the levels of practice are lower than in the extracurricular activity, according to a Cuevas et al, (6) classes are very important to achieving the motivation that will make these students later intend to be physically active. Therefore, it would be interesting to apply this type of physical condition workout because the results with regard to the effects are significatively positive.

The results show a significant improvement in the VO2max and these effects would also be positive at the psychological level. In another study (4), 226 girls participated from the bachelor of the Murcia institutes. Here, physical activity was related to anxiety and depression. The results indicated that girls who practiced some physical activity had lower levels of both depression and anxiety. It was also possible to determine that those who practiced physical activity more frequently had even lower levels of anxiety and depression. On the other hand, girls who practiced low intensity physical activity had higher levels of anxiety and depression. Therefore, it was a case-effect study since increasing the physical activity variable decreased depression.

On the other hand, crossfit pedagogical and aerobic games are activities that are practiced in groups. This has a number of benefits thanks to the social component of physical activity; one of its main effects would be to prevent mental illnesses such as depression. This is shown by a case-effect study (20). These researchers carried out an analysis of several factors associated with those of anxiety, social phobia and depression. The work allowed researchers to determine that social anxiety and the depression increase if sport activities are not realized, they do not have intimate friendly relations nor is there friendly interaction. It was found that people who do not perform any of these activities present social anxiety and depression greater than those that do them.

Improving physical condition would make it possible for students to prevent illness, as demonstrated by a study from Ortega et al, (13) that inversely relates the level of physical condition of adolescents, especially the aerobic capacity, with levels of body fat. Having a high level of obesity involves serious health problems as it increases the risk of coronary artery disease, high blood pressure, and type 2 diabetes.

The pedagogical crossfit is formed by multiarticular exercises. Regular participation in physical conditioning and sports programs that include multi-articulation exercises with moderate to high intensity overload (CrossFit) can help
optimize the accumulation of bone mineral density during childhood and adolescence.

Also, several studies have shown that children performing strength training using multi-art exercises and even similar to those of Olympic upsurge or jumps as a training complement to regular sporting activities (set games, combat sports, athletics, etc.) tend to significantly reduce the incidence of injuries (7).

We have been able to observe that the physical state of teens is low; our results are congruent with the Ortega, BF, et al. (12), in which the results indicate the need to improve the level of physical condition of Spanish adolescents.

This study presents some limitations. One of them is that it has only been possible for two months. This fact means that it is difficult to extrapolate, since perhaps in a work of 10-12 weeks the results would be more evident. Another was not to have taken into account the socioeconomic level of the centers, which would have allowed other comparisons.

The practice of the didactic unit: the effects of pedagogical crossfit combined with aerobic games could be the best indications of working on physical condition for results regarding including satisfaction, fun, and improvement of VO2max.

We have also verified that the practice of the didactic unit is motivating and this could lead to changes in the sedentary habits that unfortunately many students have in the center. These results imply that it would be convenient and very effective to work on the physical condition through this didactic unit since the component of diversion and satisfaction would be greater. Also, that the activities worked on can be easily taken out of the classroom and finally that the improvement of the cardiovascular capacity would be significant. We should not forget that Physical Education is a science and there must be constant reassessment by teaching staff and adaptation of the new training trends in the classroom.

**BIBLIOGRAPHY**


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