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# Effect of Supplemental Ascorbic Acid on Aerobic Capacity in Children

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***Abstract***

***Introduction***

Ascorbic acid is a water-soluble vitamin solved in water that acts as a helper of some the enzymes in the reactions of energy metabolism. Thus, the study aims to investigate the use of supplemental ascorbic acid on the aerobic and anaerobic capacity of the children.

***Materials and Methods***

Participants of this quasi-experimental study were 18 children in Esfahan who were randomly selected and divided into 9 groups in pair (Aerobic exercise group and the control group). For 10 days before the start of the main trial, the participants in the control group received placebo and the experimental group received ascorbic acid. The average aerobic capacity was measured before and after 10 days of the use of ascorbic acid. The results were analyzed by SPSS version 18.

***Results***

Before and after 10 days of the use of ascorbic acid, the mean and standard deviation of the aerobic capacity of the experimental group were respectively (3.59± 0.38) and (4.23 ± 0.77) and of the control group, were (3.7 ± 0.40) and (3.7± 0.53) respectively. Therefore, there was a significant relationship between the use of ascorbic acid and placebo in terms of aerobic capacity ($p \leq 0.05$).

***Conclusion***

Results of the study indicated that the use of supplemental ascorbic acid would lead to increase the children's aerobic capacity. Therefore, the footballer children with no prior planning and no appropriate physical fitness who had to be involved in a heavy physical activity could use the results in order to decrease the consequences of a sudden involvement in a heavy physical activity.

***Keywords***: Aerobic capacity, Ascorbic acid, Children.

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## Introduction

Today, the use of supplemental drugs to improve physical and mental strength is inevitable in all groups of sport as a serious manifestation. In this respect, the provision of false physical force by different supplemental drugs has been attracted not only the coaches and athletes' attention but also the researchers attention as the driving factors of force (1). Vitamins are organic materials of the body that are essential to help release carbohydrates and fat, regulate the proper functioning of the nervous system, and guarantee the good performance of the energy boost systems (2). Water-soluble vitamins act as coenzymes for biochemical reactions. Ascorbic acid is a water-soluble vitamin and the effects of additional use of it have been demonstrated on the intensity of the performance of human and animal cells (1). Excess intake of this vitamin may be in part due to the solubility in water and or due to its rapid digestion and excretion (3). However, the important point is that as a result of continuous and heavy work, such as exercise, the body needs a considerable amount of different vitamins so that the increased need for B vitamins and ascorbic acid are more tangible (4). On the other hand, some studies have demonstrated that exercise as a stressful factor can reduce the amount of ascorbic acid and active people need a higher daily ascorbic acid (5, 6).

Aerobic capacity is closely associated with the performance of activities in children and in many sports, the ability to absorb and use oxygen help people to have optimal performance in the intended sports because proper aerobic fitness prevents fatigue in the intense and prolonged training and competition. Therefore, since most children lose their energy in the first minutes of the game, they are less able to continue their activities (7). Research on the aerobic capacity and the role of the excess ascorbic acid has been shown on the development of aerobic exercise that excessive intake of ascorbic acid caused a significant increase in the maximum aerobic power (8). On the other hand, there have been statements that the biochemical deficiency of ascorbic acid was related with reduced aerobic capacity (6, 9).

There were a few studies conducted on ascorbic acid and the use of its supplemental on the aerobic capacity of children that shows the importance of doing such research. Therefore, as the sport of football among children has many enthusiasts and it is possible to develop the sport due to physical properties and high potential and talent of this part of the world; the researcher attempted to gain information of its effects.

## Materials and Methods

In a quasi-experimental study, 18 footballer children aged 8.83 ± 0.5 years old, non-smoker, no endocrine disorders, diabetes, heart disease, and chronic diseases were invited to participate in the study after the explanation of conditions and a targeted written informed consent. They randomly divided into two groups (experimental group and control group).

The limitations of the study included the impossibility of the motivation control and of the participants and a lack of control of the latent diseases. In order to achieve the purpose of the study, the parents of the participants were asked to follow from normal sleep patterns (at least 8 hours of sleep) and patterns of daily activities during the study before conducting the test and avoid any vigorous physical activity, dietary supplements, medications, consumption of coffee, tobacco, cocoa for 48 hours before the test.

Initially, both the experimental and control groups performed the Strand step test to estimate aerobic capacity that is described below. The participants were explained about how to scroll up and down the stairs

in order to perform the test. According to the song that was playing from the metronome device, the participants went up and down the stairs to determine the pressure and a regular rhythm. Armin Strand nomogram was used in the Strand step test to measure aerobic capacity according to heart rate after training and body weight. When testing, the participants went up and down stairs in 5 minutes and 22.5 times per minute. The step height was 40-cm. Heart rate of the participants was counted by the number of pulse rate between 15-30 seconds after the workout, then 4 multiplied the heart rate and the participants' beats were calculated per minute. The aerobic capacity was estimated by putting the heart rate in the left column of nomogram and the participant's weight in the right column and connecting the two specified points for each (10). After the Strand step test, the participants in the control group received placebo for 10 days (every day, one capsule of 250 mg containing Malto-dextrin) and the participants in the experimental group received ascorbic acid (capsules of 250 mg ascorbic acid per day). Then, again after 10 days of placebo and ascorbic acid, their aerobic capacity was measured by the Strand step test.
Data analysis was run by spss version 18. According to the normality of data,the analysis independent and dependent t-test was used to analyse data and compare the means at different stages of the test. In addition, a confidence level of 0,95 % was considered for all tests.

## Results

Mean and standard deviation of age, height, and weight of the participants were respectively 8.83 ± 0.5 years, 1.3± 0.1 cm, and 34.1± 2.8 kg. Before and after the use of ascorbic acid for 10 days, the aerobic capacity in the experimental group respectively was 3.59±0.38, 4.23± 0.77 and in the control group 3.7±0.40 and 3.7 ±0.53 (Table.1).

**Table 1:** Mean Scores of the Aerobic Capacity of Children in the Primary and Final Tests of both Experimental and Control Groups

| Group | | The primary test Mean± SD | The final group Mean± SD |
|---|---|---|---|
| Experimental | Aerobic capacity (kg/ms) | 3.59±0.38 | 4.23±0.77 |
| Control | Aerobic capacity (kg/ms) | 3.7±0.40 | 3.7±0.53 |

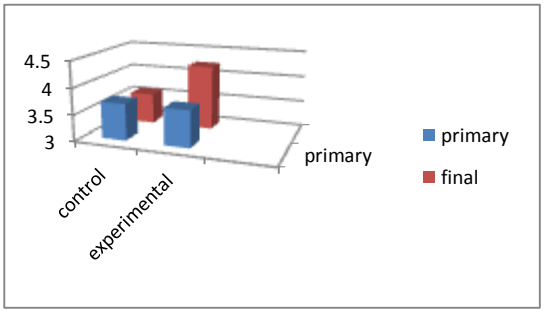


**Figure 1:** The comparison of the mean aerobic capacity in the primary tests of both experimental and control group

According to (Table.2) there was a significant difference between the mean of the preliminary and final aerobic capacity in the experimental group, because t calculated (4.67) was greater than the t critical (3.250) but there was no significant difference in other cases. Therefore, the use of ascorbic acid increased the aerobic capacity of children.

**Table2:** The Comparison of the Differences in the Use of Supplemental Ascorbic Acid on the Mean Aerobic Capacity in the Primary and Final Tests of both Experimental and Control Group

| Variable | Group | Calculated-t | Calculated-t in two-directional test | df | p-value |
|---|---|---|---|---|---|
| Aerobic capacity | The primary and final in the experimental group | 4.67 | 3.250 | 9 | 0.01 |
| Aerobic capacity | The primary and final in the control group | 0 | 3.250 | 9 | 0.01 |
| Aerobic capacity | The primary in the experimental and control group | -0.5901 | 2.878 | 18 | 0.01 |
| Aerobic capacity | The final in the experimental and control group | 1.398 | 2.878 | 18 | 0.01 |

## Discussion

The aim of this study was to evaluate the effect of supplemental ascorbic acid on the aerobic capacity of footballer children. Results showed that excess ascorbic acid intake increased aerobic capacity in children. Although, it was tried to control the factors that influence and interfere with the study as much as possible, one of the inevitable limitations of the study was the small size of the participants. This is the case reported by Zhobbi et al. (2006). In interpretation of the results, they showed no effect of vitamin intake in some of the dependent variables, a result that was indicated in the present study (11).

Vapstin (1980) studied the impact of excess ascorbic acid intake on the development of aerobic exercise in individuals of low mobility. He observed a significant increase in the maximum aerobic capacity. Bazin et al. (1982) conducted a study on the students aged 12-15 years and showed similar results on the effect of this vitamin on the maximum aerobic capacity (12). Sabotikank et al. (1984) investigated the effect of additional ascorbic acid on physical activity capacity of 49 young boys. Their results showed that ascorbic acid caused a significant increase in the maximum aerobic capacity (13). Samantha and Bis Vass (1985) examined the use of supplemental ascorbic acid on endurance capacity of 16 adult women. They found that the additional intake of this vitamin could significantly affect women's endurance capacity (14). Chetard et al. (1998) mentioned the excessive use of ascorbic acid as the only characteristic to define aerobic capacity (15). As seen, the results of the above-cited research are compatible with the present findings. This agreement may be caused by reasons such as, the participants' needs, the effects of the intake of supplemental ascorbic acid on respiratory system and energy, including mitochondria and cytochrome, the effect on the enzymatic reactions such as, electron transmitter, contribution to the release of energy, iron uptake, and decrease lactic acid formation. All of these need more research. Ascorbic acid may be involved in the process of respiratory chain of mitochondria and act against the harmful effects of chemical activators called free radicals. Moreover, its role has been known in the prevention of cardiovascular disease and cancer, lower blood pressure, and rise in high-density lipoproteins (good cholesterol), maintenance of epithelial tissues, bones, teeth and cartilage, collagen synthesis and norepinephrine hormone, some enzymatic reactions such as, electron transport, storage of capillaries, reduction in muscle damage, strengthening the immune system, iron absorption, and reduced lactic acid formation

## Conclusion

The results of the study indicated that the use of supplemental ascorbic acid would lead to increase the children's aerobic capacity. Therefore, the footballer children with no prior planning and no appropriate physical fitness who had to be involved in a heavy physical activity could use the results in order to decrease the consequences of a sudden involvement in a heavy physical activity.

## Conflict of Interest

The authors declare that they have no competing interests.

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