



Effect of *Aloe vera* on some indicators of cell damage after a period of aerobic exercise in male athletes

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ABSTRACT

Introduction: *Aloe vera* is a medicinal plant with antioxidant activity. The purpose of this study was to determine the effect of *Aloe vera* on some indicators of cell damage after a period of aerobic exercise in male athletes of 15-18 years old.

Methods: In this clinical trial study, 20 male students with average weight of 64.85 ± 51 and height of 172.05 ± 6.4 were randomly assigned to 2 groups of *Aloe vera* supplement ($n=10$) and placebo ($n=10$). Then aerobic training was conducted for 4 weeks. The supplemented group took 3 capsules, each capsule contains 2 g of dried *Aloe vera* and placebo group took 3 capsules/day containing dextran after every meal. To determine the index of cell injury markers creatine kinase (CK), lactate dehydrogenase (LDH) and reactive protein C (CRP) were determined and blood samples were collected 24 hours before and after each test. The data were analyzed using ANOVA and independent t test. Significance level was considered as $P \leq .05$.

Results: The use of *Aloe vera* during aerobic exercise significantly reduced LDH ($P = .006$) in the supplement group (15% reduction) compared to placebo group and CRP with 11% reduction in the supplement group compared to placebo ($P = .008$). There was no significant reduction in CK.

Conclusion: The findings of this study showed that *Aloe vera* reduces cell damage and inflammation indicators. This result may reflect the role of *Aloe vera* as anti-inflammatory and antioxidant agent.

Implication for health policy/practice/research/medical education:

Aloe vera can be taken to alleviate the capacity of the antioxidant defense system and might improve athlete's performance.

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Introduction

Using of herbs as medicines and food supplements allocated special situation to improve overall health and treat illnesses (1,2). The skill levels of athletes have been developed in various disciplines. Each factor that can make little chance for developing the success has special importance that among them, dietary supplements have most important situation (3,4).

High levels of free radicals and depletion of antioxidants can lead to cellular dysfunction and oxidative damage to membrane lipids and other organelles (4,5). Reactive oxygen species (ROS) are produced in prolongs and intense exercises that may cause cell damage (4). It seems that using the antioxidant supplements can decrease the oxidative stress of exercises (4,6,7). The antioxidant supplements that are introduced to the athletes are mainly

synthetic chemical compounds. But today, attention has been paid to the herbal supplements with antioxidant activity (1,4,8,9). Basically, natural supplements have less harms than artificial supplements and against artificial supplements. *Aloe vera* is rich in vitamin C and E with antioxidant activity and enhances the resistance of the body against free radicals (1,8). *Aloe vera* works by inhibiting the production of interleukin (IL) 6 and 8 and decreasing leukocyte adhesion (10,11). It also increases the level of interleukin 10 and reduces the levels of tumor necrosis factor-alpha (TNF α), inhabiting the inflammatory reactions (10,12,13). This study was designed to determine the effect of *Aloe vera* on some indicators of cell damage after a period of aerobic exercise in male athletes of 15-18 years old. The factors evaluated were lactate dehydrogenase (LDH), creatine kinase (CK),

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and reactive protein C (CRP).

Materials and Methods

This study was a quasi-experimental trial. The population included male athletes of 15 to 18 years old from Imam Ali Industrial and Physical Education School of Shahrekord, Iran. Twenty volunteers were divided into 2 groups of *Aloe vera* supplementation (n = 10) and placebo (n = 10) groups. The criteria for entering the research included having general physical and mental health and being athlete. The criteria of eliminating the research were cardiovascular disease, surgery, hormonal disorders, smoking and any intervention affecting on the experimental results. Before the intervention, in order to homogenize 2 groups, the age, height, weight and body mass index (BMI) were matched among them (Table 1). All participants were given written information about research and after studying their parents' consents were gotten.

This research was conducted by a sport physiologist the subjects did not have any history of cardiovascular diseases, high blood pressure, diabetes, kidney and liver diseases affecting the measured variables. Subjects became familiar with the manner of exercise, for decreasing some of the confounding and bias factors which might affect the results. The subjects were asked to avoid the use of anti-inflammatory drugs during the exercises. Students' Cooper tests were done to confirm that they were athletes. All subjects were healthy and did not have any clear diseases. Blood specimens of subjects were collected in 4 steps as follows: 24 hours before Cooper test (first step), 24 hours after Cooper test (second step), 24 hours before second Cooper test (third step), and 24 hours after Cooper test (forth step). Two groups participated in the exercise protocol. The intensity of the exercise was increasing once during 4 weeks from simple to hard. Each group had 12 sections for 1 hour and 2 groups had 15 minutes exercise for warming up, 35 minutes for running with 65%-75% of maximum of heartbeats and 10 minutes for cooling off. Also relating to the intense of exercise, this work was done by determining the subjects' heartbeats before exercising, during it and after doing activity in each section. The weight of the athletes was measured by scale with 0.1 kg accuracy. BMI was obtained by weight (kg) divided to square of height (m). Each of bloodletting was done at 16:00 PM in the supine situation for determining the amount of creatine kinase, lactate dehydrogenase and CRP. It is worth noting that the level of CRP was measured by CJKC method of ELISA kits (Pars Making test). The blood samples were centrifuge for 5 minutes in 4000 rpm and the serum was separated. The obtained data were presented as frequency, mean and standard deviation for each variable (Table 1). Kolmogorov-Smirnov test was used to determine the homogeneity of the data. Independent *t* test was used for comparing the variables of two groups and IFN Boone to separate mean comparison. The statistical calculation was done by SPSS version 16

and the $P \leq .05$ was considered significant.

Results

The demographic characteristics of the subjects including the age, height, weight and BMI are summarized in Table 1. There were no differences for the above-mentioned variables between 2 groups.

The results of repeated measure analysis of variance (ANOVA) for comparison internal of group variables in different steps of exercises are presented in Table 2.

The real effects of exercise on the amount of creatine kinase are shown in the second row of Table 2. This variable shows that creatine kinase in the group which got *Aloe vera* was 63% less than that of control group. The real effects of exercises on the amount of CRP in *Aloe vera* group was 64% less than the variance in control group. To compare the indicators of cell damage in *Aloe vera* and placebo groups independent *t* test was done and the results are shown in Table 3.

Regarding the results of Table 3, independent *t* test showed that was significant ($P \leq .05$). So, the using of *Aloe vera* caused to decrease the level of CRP.

Discussion

The goal of doing this research was determining the effect of using the *Aloe vera* on cellular damages indices after a course of aerobic exercise among male athletes of 15-18 years old. The obtained results of research showed that there were no significant differences in the amount of LDH and CRP after doing the exercise protocol. But there was not any significant difference in the amount of CK among groups. The obtained results are in agreement with the results of others (14,15). In these researches antioxidant supplement caused significant decrease in CK in supplemented groups which represents a reduction of oxidative stress during exercise in athletes. But, in

Table 1. Homogeneity of the demographic characteristics of the subjects before the exercise

| Variables | Supplementation group | Placebo group | P value |
|--------------------------|-----------------------|---------------|---------|
| Age (y) | 17 ± 0.65 | 17 ± 0.94 | 1 |
| Weight (kg) | 64.80 ± 5.26 | 64.90 ± 9.75 | .97 |
| Height (cm) | 173.3 ± 5.05 | 171.06 ± 6.80 | .53 |
| BMI (kg/m ²) | 21.73 ± 1.84 | 22.22 ± 3.12 | .67 |

Abbreviation: BMI, body mass index.

Table 2. Comparison of the effects of inter-group LDH, CK and CRP variables in different steps following the use of *Aloe vera*

| Statistic test | Freedom rate | F coefficient | P value |
|----------------|--------------|---------------|---------|
| LDH | 3 | 6.086 | .001 |
| CK | 3 | 4.012 | .01 |
| CRP | 3 | 3.05 | .03 |

Abbreviations: CK, creatine kinase; LDH, lactate dehydrogenase; CRP, reactive protein C.

Table 3. Comparison of LDH, CK and CRP in supplement and placebo groups

| Variable | Steps | Subjects | | P value ^a |
|----------|---|----------------------------|-------------------------|----------------------|
| | | Supplement group M ± SD | Placebo group M ± SD | |
| LDH | Before the Cooper test | 357.60 ± 40.61 | 376.10 ± 44.77 | .34 |
| | After the Cooper test | 394.90 ± 80.48 | 380.20 ± 32.88 | .59 |
| | After one month, before the Copper test | 427.60 ± 94.64 | 599.80 ± 14.53 | .006 ^b |
| | After the second Cooper test | 495.70 ± 59.138 | 624.70 ± 59.138 | .01 ^b |
| CK | Before the Cooper test | 258.70 ± 125.626 | 190.60 ± 46.126 | .1 |
| | After the Cooper test | 279.90 ± 152.581 | 205 ± 57.941 | .2 |
| | After one month, before the Copper test | 326.80 ± 157.64 | 340 ± 121.112 | .8 |
| | After the second Cooper test | 439.80 ± 160.785 | 453.60 ± 88.781 | .8 |
| CRP | Before the Cooper test | 3.90 ± 0.99 | 4.60 ± 0.84 | .17 |
| | After the Cooper test | 4.20 ± 1.13 | 4.90 ± 1.19 | .19 |
| | After one month, before the Copper test | 5 ± 1.15 | 6.50 ± 1.08 | .008 ^b |
| | After the second Cooper test | 5.80 ± 0.91 | 6.90 ± 1.101 | .02 ^b |

Abbreviations: CK, creatine kinase; LDH, lactate dehydrogenase; CRP, reactive protein C.

^a The results of Independent t test.

^b Statistically significant.

this research there were not any significant effects on CK. In 2 studies, antioxidant supplements decreased the muscles damage during the endurance exercise courses (4,10). There were not significant changes in CK among supplemented and placebo groups.

Intense exercise courses such as aerobics or endurance marathon are important factors in the production of free radicals and also production of destructive factors in membrane. The Cooper test which was used in this research showed that cellular damage indexes such as LDH, CK and CRP increased after 24 hours that in comparison between supplemented and placebo groups was significant. The results showed decrease in LDH and CRP which are in agreement with the results of others (1,4,6,11). In a study the cellular inflammation index in *Aloe vera* group significantly reduced in comparison to placebo group. As seen, there are different results about the effects of *Aloe vera* in cellular indexes of damages and aerobic exercises in researches.

The number of participants and duration of supplementation to achieve corollary results are important issues. The results of some researches are different following using of *Aloe vera* supplement.

The level of the readiness and the kind of exercise programs were so effective on the results of it. In this research all the subjects were male athletes 15-18 years old and the exercise was aerobic exercise with certain intense that all subjects in 2 groups did for 4 weeks in 3 courses. *Aloe vera* effect on CRP was not effective on male athletes 15-18 years old after 1 course.

In short, the results of statistical analysis of present research showed that using *Aloe vera* has positive effect on the antioxidant defense system and also causes a decrease in the free radical during the endurance. So the sport can be considered as a profit in intense exercise.

Authors' contributions

All the authors wrote the manuscript equally.

Conflict of interests

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the authors. This trial's protocol and procedures were approved by Ethics Committee of Hamadan University of Medical Sciences, Iran. Then, this trial was registered at <http://www.irct.ir> website. The registration number of this trial is IRCT2015040521614N1.

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