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# Efficacy of Beetroot Juice Consumption on the Lipid Profile of Female Soccer Players

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## ABSTRACT

**Background and Objective:** It is desirable for athletes, especially female soccer players, to consume beetroot beverage during training as a way of improving both health and performance .. Therefore, the objective of this study was to assess the effect of beetroot juice intake on lipid profile in female soccer players.

**Methods:** Young and well-trained female soccer players (N=20) were included in a randomized placebo-controlled crossover study. They were categorized into two groups: experimental (beetroot beverage, n=10, age: 23.20±0.91 years, BMI: 22.57±1.54(kg/m$^2$)) and control (placebo, n=10, age: 23±0.81 years, BMI: 23.13±0.58(kg/m$^2$)). Subjects drank either 200 ml concentrated beetroot beverage or an equal amount of placebo 2 hours prior to their trainings for six weeks (18 session). Blood samples were taken 24 hours before and after trials. All data were compared in pretest and posttest via paired sample t-test and independent sample t-test. All statistical analyses were performed at (P≤0.05) by SPSS (version22).

**Results:** Beetroot juice intake increased plasma high density lipoprotein (t= -60.88, P<0.05). Triglyceride, total cholesterol, and low density lipoprotein were reduced (P<0.05). Compared with placebo, beetroot juice reduced the concentrations of triglyceride, total cholesterol, and low density lipoprotein (P<0.05).

**Conclusion:** Regular beetroot juice intake has significant effects on lipid profile in female soccer players, hence its suggestion for preventing diseases such as hypercholesterolemia and hypertension in female soccer players.

**Key words:** Soccer, Training, Dietary Supplements, Lipids.

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## INTRODUCTION

Unhealthy life style leads to myriad undesirable consequences ranging from obesity, hypercholesterolemia, and hypertension to cardiovascular diseases (1). Hypercholesterolemia is a risk factor for atherosclerosis and cardiovascular disease which are among the major causes of mortality worldwide (2). Hypertension is also the reason behind approximately 5% of mortal diseases . Several studies have revealed the direct relationship between hypertension and increased levels of TC, TG, and LDL (3). Some studies have shown that high cholesterol induces oxidative stress through reducing the potential of antioxidant enzymes in tissues and generating free radicals (superoxide anions); this leads to the expansion of cardiovascular and degenerative nervous system diseases (4-6). Over the recent years, several studies have been conducted on the relationship between plasma lipoprotein levels and physical activity to prevent CVD diseases (7, 8). Regular exercise is known to diminish the danger of cardiovascular diseases; however, it has been evidenced that exercise has a minor impact on TC, LDL, and HDL (9, 10). It is necessary to better understand the physical exercise mechanisms involved in lipid profile (11). Athletes, soccer players in particular, need a powerful cardiovascular system to supply the oxygen and ATP for the muscles. Evidence suggests that vegetables and plants such as beetroot, in addition to their lipid reduction potential, are able to reduce reactive oxygen species and increase plasma lipoprotein resistance to oxidation, preventing diseases such as atherosclerosis (12-14). Flavonoids and phenolic amides in beetroot have a positive effect on the prevention of cardiovascular diseases (15). El Dosari (2011) examined the effects of beetroot extract on cholesterol levels in mice receiving a diet rich in cholesterol. Their results showed that high-cholesterol diet only increased their cholesterol and triglyceride concentrations and reduced HDL levels. Studies have revealed a reduction in cholesterol and triglyceride and an increase in HDL levels following the consumption of different doses of beetroot juice. This finding showed that higher doses of beetroot extract more affected the levels of cholesterol in the mice, indicating the lipid-reducing potentials of beetroot (2). There is no study on the effects of beetroot juice intake on the lipid profile in female soccer players. Therefore, the objective of the present study was to evaluate the impact of beetroot juice intake on lipid profile in female soccer players

## MATERIALS AND METHODS

Twenty young female soccer players (23.13±0.77) were recruited. All subjects had been engaged in regular soccer training (>3 ×/week) for several years. After being informed of the aim and potential risks of the study, the subjects provided written informed consent. This study and its processes were approved by the Ethics Committee of Kermanshah University of Medical Sciences, Kermanshah, Iran (Ethical code: IR.KUMS.REC.1397.655).

Inclusion criteria were:

- No special diseases such as cancer, diabetes, asthma, kidney stone, and kidney disorders.
- No muscle injuries.
- No addiction.

Subjects were excluded if they had beetroot allergy or experienced vomiting and diarrhea during the study.

This study was designed to determine whether or not beetroot juice intake (200 ml) for six weeks can improve lipid profile in female soccer players. None of the participants had any known food allergies or cardiovascular diseases. They were advised to not consume supplementations, energetic beverages, oil seeds, and drugs(such as Atorvastatin, Fluvastatin , Lovastatin, Pitavastatin, Pravastatin, Rosuvastatin calcium, and Simvastatin) as they affect the lipid profile. Subjects lived in a dormitory and had the same diet. They consumed the food provided by the central canteen of Razi University. Subjects were asked to continue their routine training programs throughout the study. In the first session, anthropometry assessment (height, weight, BMI) was performed (Table 1). Twenty-four hours prior to the trial, blood samples (10ml) were collected and transferred to the laboratory. Next, subjects were randomly categorized into two groups (experimental and control)(n=10) and consumed a dose of concentrated beetroot beverage (200 ml) or an equal amount of placebo (red carmoisine food color and a slight

dose of stevia dissolved in 200 mL of water) two hours before training (16).

Twenty-four hours after the last training session, blood samples were collected once again, and the lipid profile (TG, TC, HDL, LDL) in the pretest and posttest was investigated.

Routine training programs were conducted on even days. Female players performed general and special warm-ups, including forward and backward running, dribbling between obstacles, pass, and shoot. Next, they performed offensive and defensive trainings supervised by the coach. The cool down was done at the end of the training session. Blood samples (10 ml) were taken from subjects, placed in test tubes, and transferred to the laboratory by a laboratory specialist to measure the lipid profile (TG, TC, HDL, LDL). The samples were placed in a centrifuge with 3000 rpm for 15 min. TG, TC, HDL, and LDL levels were compared between pretest and posttest.

Analyses were carried out using SPSS (version 22). For comparisons within groups in the pretest and posttest, paired sample T-test was utilized. For between-group comparisons, we used student t-test. Data analyses were done at ($P \leq 0.05$) significant level. Physiological characteristics are shown in Table 1. Tables 2 and 3 further show the changes in the lipid profile (TG, TC, HDL, and LDL) .

**Table 1- Anthropometry assessment (Weight, Height, BMI) (Mean ± SD)**

| Variable | Experimental | Control |
|---|---|---|
| Age (year) | 23.20±0.91 | 23±0.81 |
| Weight(kg) | 58.56±4.88 | 61.18±2.48 |
| Height(cm) | 161.05±5.10 | 162.60±1.89 |
| BMI (kg/m$^2$) | 22.57±1.54 | 23.13±0.58 |

### 3.1. Changes in lipid profile (TG, TC, HDL, and LDL)

**Table 2-Triglyceride, Total Cholesterol, HDL and LDL values in pretest and posttest in the groups (mean± SD)**

| | TG(mg/dl) | | TC(mg/dl) | |
|---|---|---|---|---|
| | Exp | Ctl | Exp | Ctl |
| pre | 97.6±45.62 | 99.80±2.82 | 121.90±12.54 | 125±1.82 |
| post | 86.8±45.59 | 99.60±3.65 | 113±13.67 | 124.40±1.71 |
| t | 33.06 | 0.45 | 9.88 | 1.76 |
| p-value | 0.0001 | 0.66 | 0.0001 | 0.11 |
| | HDL(mg/dl) | | LDL(mg/dl) | |
| | Exp | Ctl | Exp | Ctl |
| pre | 46.7±3.26 | 48.30±4.21 | 66.9±8.04 | 65.70±13.19 |
| post | 56±3.39 | 48.10±4.53 | 55.5±8.11 | 65.5±13.81 |
| t | -60.88 | 0.61 | 69.81 | 0.30 |
| p-value | 0.0001 | 0.55 | 0.0001 | 0.76 |

**†Abbreviations: TG= triglyceride, TC= total cholesterol, HDL=high density lipoprotein, LDL=low density lipoprotein, Exp=Experimental, Ctl=Control.**

**Table3- Comparison of lipid profile scores between experimental and control groups**

| | TG(mg/dl) | TC(mg/dl) | HDL(mg/dl) | LDL(mg/dl) |
|---|---|---|---|---|
| Experimental | -10.80±1.03 | -8.90±2.84 | 9.30±0.48 | -11.40±0.51 |
| Control | -0.20± 1.39 | -0.60±1.07 | -0.20±1.03 | -0.20±2.04 |
| t | -19.28 | -8.62 | 26.34 | -16.80 |
| P-value | 0.0001 | 0.0001 | 0.0001 | 0.0001 |

## DISCUSSION

Our findings revealed that six-week chronic beetroot juice intake reduced triglyceride, total cholesterol, and LDL and increased HDL levels in female soccer players. There is no research investigating the effects of beetroot intake on the lipid profiles of female soccer players. However, in similar studies, the impact of beetroot juice intake on the lipid profiles of healthy individuals was studied and similar results were obtained. For instance, Brown et al. investigated the influence of beetroot juice intake on the lipid profiles of healthy individuals for one session. Their research results showed that one session of beetroot juice consumption significantly reduced TG, TC and LDL, which is consistent with the results of this study. Contrary to the present study, HDL levels were reduced (17). Singh investigated the effect of beetroot intake on the lipid profile of active individuals. They reported that beetroot juice reduced triglyceride, cholesterol, and LDL while increasing HDL levels, which is in line with the current results (18). Kumar examined the anti-lipid activity of various beetroot extracts in mice. They found that different beetroot extracts resulted in reduced levels of cholesterol, triglyceride, LDL and increased levels of HDL in the studied mice. This finding has theoretical implications regarding the treatment of diseases associated with lipid metabolism. Their findings are in accordance with the results of the present study (19). Furthermore, the present findings are consistent with the study performed by Rabeh who claimed that beetroot fiber diet reduced the cholesterol levels by 30% and the serum levels of triglyceride by 40%. HDL levels also significantly increased in male wistar rats (20). Researchers believe that HDL and LDL are hardly affected by exercise, especially the levels of HDL affected by exercise intensity (21), unless a diet containing ingredients such as beetroot is considered. In comparison with the control group, beetroot, with its anti-lipid effects, significantly reduced triglyceride, total cholesterol, and LDL and increased HDL. In the current study, lipid profile levels (triglycerides, cholesterol, HDL and LDL) were normal in subjects in the pretest.

## CONCLUSION

It can be proposed that regular intake of beetroot juice is beneficial for the well-being of female soccer players. It should be incorporated as part of their daily diet and used as a nutritional therapy. Daily consumption of beetroot juice is able to provide nutrients for the body and be used as a natural herbaceous beverage for preventing hypercholesterolemia and hypertension.

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## CONFLICT OF INTEREST

None to declare.

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