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**RESPONSES OF OXIDATIVE STRESS INDICES TO RESISTANCE EXERCISE
AFTER BLACKBERRY EXTRACT SUPPLEMENTATION**

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ABSTRACT

The present study was conducted to investigate the effect of blackberry extract supplementation on plasma total antioxidant capacity and lipid peroxidation in obese men after a single bout of resistance exercise. In a double-blind study, 20 obese men were randomly assigned to either the placebo group or supplement group. Supplement group received daily supplementation of 100 mg blackberry extract for seven days and the placebo group received the same amount of placebo. Two groups of participants participated in a session of 9 moves resistance exercise with 60% 1 - RM intensity and their venous blood samples were collected in the three stages: before supplementation (1 week before activity), before and 24 hours after resistance exercise to determine the concentration of Malondialdehyde (a marker of lipid peroxidation), and total antioxidant capacity of plasma. The results showed that the biomarker concentrations of Malondialdehyde in the placebo group significantly increased ($P < 0.05$) compared to the group receiving blackberry extract supplementation after resistance exercise. However, no significant differences ($P > 0.05$) in plasma total antioxidant capacity was shown in both groups before and 24 hours after exercise. The results of this study indicate that despite increased levels of malondialdehyde in obese individuals after a single bout of resistance exercise, blackberry extract as antioxidant supplement can have a positive influence on lipid peroxidation in cell membranes and prevents the damaging effects of free radicals.

Keywords: Oxidative Stress, Resistance Exercise, Blackberry Extract

INTRODUCTION

Today, the global prevalence of obesity is a major challenge in the field of social and health care (Forsythe *et al.*, 2009) and several studies have shown that obesity is the major risk factor for many common diseases including diabetes, cardiovascular disease, hypertension, metabolic disorders and various types of cancer (Parisi & Goodman, 2008).

Also, the available evidence suggests that obesity is associated with increased oxidative stress and reduced antioxidant capacity (Ozata *et al.*, 2002; Vassalle *et al.*, 2009). It has become clear that obesity increases rates of myocardial oxidative stress (Vincent *et al.*, 1999) and increases lipid peroxidation (Dobrian *et al.*, 2000). In addition, increased oxidative stress is a major factor in the metabolic syndrome associated with obesity and may play a fundamental role in the pathophysiology of various diseases such as diabetes type 2 (Nojima *et al.*, 2008). However, results of some studies suggest that regular participation in physical activity can be a good way to prevent diseases caused by complications of obesity (Calderon *et al.*, 2005). Despite the fact that regular physical activity is associated with several physiological compliances and has several health advantages such as preventing diabetes, cardiovascular disease,

obesity, and various types of cancer (Thirumalai *et al.*, 2011), but some reports indicate that a single bout of intense exercise generates free radicals, can cause cell damage and subsequent injuries by oxidative stress (Belviran & Gokbel, 2006), because oxidative stress and free radical production could be affected by any factor that may lead to further increases in oxygen consumption. during Severe sporting activity, oxygen consumption is increased to the utmost levels and this is one of the factors that can increase the production of free radicals (Didani *et al.*, 2012). McBride and colleagues (2000) showed that a single bout of intense resistance exercise significantly increased plasma malondialdehyde concentrations as a marker of oxidative stress in trained men. It also has been reported that resistance exercise, especially eccentric contractions cause muscle damage and subsequent inflammatory processes and eventually began to produce oxygen free radicals and lipid peroxidation (Atashak *et al.*, 2012).

In addition, since one of the main sources of free radicals and oxidative stress markers such as malondialdehyde is body fat, And obese men and women have more fat mass than those with normal weight, it is likely that obese individuals have higher rates of production of reactive oxygen species and

free radicals than other people during exercise. In this regard, it has been reported that oxidative stress after exercise in obese men and women further increases compared with normal weight individuals, because plasma lipids is oxidized rapidly and much more in obese individuals compared to normal weight individuals (Vincent *et al.*, 2004).

However, one of the appropriate measures to protect the adverse effects of oxidative stress caused by intense exercise can be utilization of dietary factors and the use of antioxidant supplements (Atashak, *et al.*, 2012; Jafari and *et al.*, 2011). So, in recent years a growing attention has been generated based on the effectiveness of herbal supplements and natural supplements, primarily in countering damages caused by free radicals (Ghasemi *et al.*, 2012; Jafari *et al.*, 2011).

In this regard, given the sheer volume of the BlackBerry antioxidant substances, beneficial effects of cranberry juice can undoubtedly be noted as an antioxidant that would strengthen the antioxidant system and avoid the adverse effects of oxidative stress (Imran *et al.*, 2010).

Conducted research proves that blackberry extracts is full of Flanoid compounds (AntoSysanyns) that inhibits many oxidation reactions caused by free radicals And lead to lose or delay of damage to cells

and tissues (Fukumoto & Mazza, 2000; Pergola *et al.*, 2006; Srivastave *et al.*, 2010).

Therefore, with regard to the fact that extreme sports activities may cause or exacerbate oxidative stress in obese individuals and on the other hand, according to limited and contradictory studies on supplementation of BlackBerry extract and its products to the oxidative stress, especially after physical activities, the present study was to investigate the effect of short term black berry juice consumption on concentration of Malondialdehyde as a marker of lipid peroxidation and plasma total antioxidant capacity in men after a single bout of resistance exercise.

MATERIALS AND METHODS

In a double-blind trial 20 overweight male students aged 20 to 30 years were chosen, and randomly divided into two groups of blackberry extract supplementation (n = 10) and placebo (n = 10) after complete description of the subject, objectives, research methods, damages resulting from the activity and obtaining informed consent form and health questionnaire.

None of the subjects were taking any supplements or medications in the past six months. Furthermore, they had no history of chronic health problems and various diseases such as respiratory, metabolic, cardiovascular, kidney and liver diseases. In

order to determine the body density and body fat percent, skin thickness gauge and three-point formula of American Sports Medicine School (triceps skin fold thickness, abdomen and pelvis above right) was used.

Preparation Supplements

Blackberry fruit was collected from the mountains of the North West Iran and 100 ml of water was added per 100 g of blackberry and boiled for 10 minutes and then cooled brewed placed in sealed containers. Those in a bout of resistance exercise and consuming blackberry group received 100 ml blackberry daily for 7 days one week before the resistance exercise test.

It must be mentioned that dose selection was completed according to earlier research. Placebo group was administered in the same way. All subjects of the two groups were asked to follow their usual diet during the study, And not to change their physical activity not to participate in other sports or activities. In addition, using 24-hour dietary questionnaires during the feeding study, subjects were monitored to record and remove the annoying effects.

Training Program

At first, In order to familiarize participants with the motions and devices used On exercise of resistance and to Obtain one repetition maximum (1 - RM) in each of the movements, two weeks prior to the study

protocol The subjects were called to the university gym. Brzycki formula with less than 10 iterations was used to determine one repetition maximum (1 - RM). Then a week after supplementation, subjects in both groups did a single bout of intense resistance exercise, % 60 1 - RM which involved performing 3 sets of 10 reps of each arm flexion movements, triceps, sit-ups, 90 degrees squat, back thigh, bench press, front thigh, shoulder presses and shovel in fixed position which involved all the big muscles of the body. All movements were controlled by the researcher and his colleagues at the gym.

Blood Samples

In order to investigate the effect of resistance exercise on the BlackBerry consumption malondialdehyde concentration and total antioxidant capacity of all subjects, blood samples were collected in three stages. The first blood sample was collected from fasting subjects the day before supplementation at 8am. In this phase, all subjects were told to avoid any vigorous exercise two days before sampling. The subjects dealt with a week of supplementation and subsequent blood samples were collected immediately before exercise and 24 h after resistance exercise. In order to assess the level of serum malondialdehyde, as the main indicator of lipid peroxidation, thiobarbituric acid and

spectrometry tests were used. In addition, total antioxidant capacity of plasma was measured using the FRAP¹ (Benzie & Strain, 1996).

Statistical Analysis

In order to analyze the data, the KS test was used to check the normality of data distribution. ANOVA with repeated measures was used to observe the difference between the sample and between groups, and then bonferroni post hoc test was used. All statistical calculations were performed on the significance level and using SPSS 18.

RESULTS

Mean and standard deviation of the general characteristics of the subjects are presented in separate groups in **Table 1**. The information in this table indicates that no significant differences in body mass index (BMI), body fat, age, height and weight were observed between the two groups, and the groups were homogeneous. The results indicate that the concentration of serum malondialdehyde (MDA) in both groups increases 24 h after a single bout of resistance exercise. However, the variation pattern was different in the two groups. So that the variation range of malondialdehyde concentrations in the group receiving supplements of blackberry extract was not significant ($P=0/241$), while in the placebo group it was significantly increased ($P =$

$0/007$). Furthermore, the results using ANOVA with repeated measures with the intra group factor showed that effects of MDA is significant in different time periods ($P < 0/001$).

Therefore, given the significant differences observed at different times, the results of bonferroni post hoc test showed higher concentrations of 8-iso-PGF₂a at 24 hours after exercise in the placebo group than Blackberry extract supplemented group ($P=0/007$). In addition, the results of concentration changes of total antioxidant capacity of plasma (FRAP) showed no significant differences between groups in mean changes in different time periods and after one resistance exercise session ($P > 0/05$) (**Figure 2**). In other words, blackberry extract supplementation and resistance exercise has no significant effect on serum FRAP variations.

Table1: Body composition and physical indicators of the two groups of subjects

Group\variable	BlackBerry extract	placebo	P
Number	10	10	0
Age (year)	25.30±3.30	24.90±4.25	0.631
Weight(kg)	98.80±6.87	100.01±4.13	0.461
Height (m)	1.73±0.04	1.67±6.15	0.181
BMI(kg/m)	33.04±2.10	33.49±1.14	0.534
Body fat %	38.01±1.24	38.36±2.28	0.490
no significant differences between groups. (P> 0/05)			

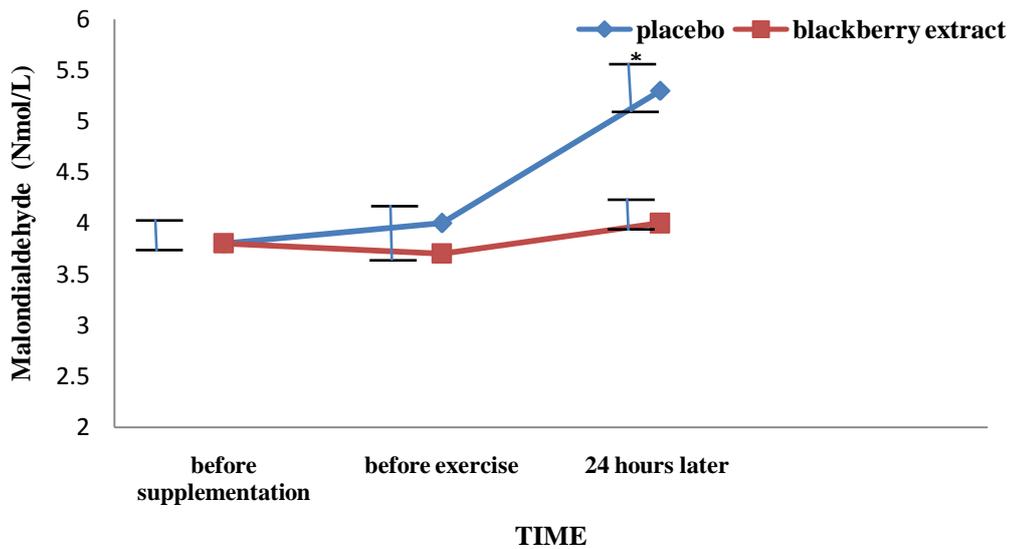


Figure 1: Changes in malondialdehyde concentration in the supplement and placebo groups after supplementation and resistance exercise

NOTE: * Significant differences with before exercise and supplementation. (P< 0/05)

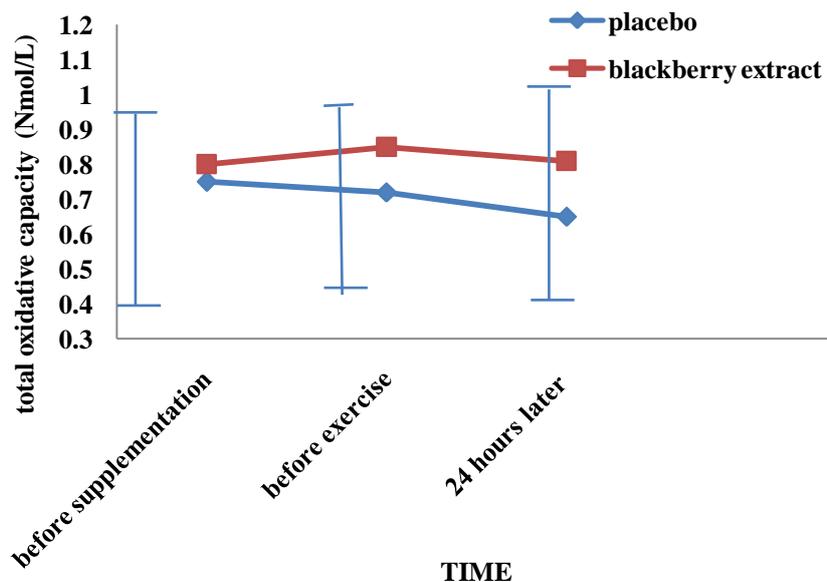


Figure 2: Changes in serum total antioxidant capacity (FRAP) in both groups after resistance exercise

DISCUSSION

Although most studies have shown that regular and long-term exercise has beneficial effect on public health, especially in obese individuals (**Atashak et al., 2011**), but direct evidence and indirect evidence suggests that heavy physical activity may increase production of free radicals and oxidative stress in muscles and other body tissues (**William et al., 2000**), so this fact has been well documented that oxidants are produced by increasing metabolic activity caused by muscle contractions (**Didani et al, 2012**). As a result, despite the numerous health benefits of long-term exercise for obese people, heavy exercise may exacerbate complications of obesity such as diabetes and nephropathy.

Therefore, to identify and provide appropriate solutions capable of preventing oxidative stress indices during intense physical activity, especially in obese and overweight people can be of very important applications.

The results of this study showed that a single bout of resistance exercise significantly increased the concentration of malondialdehyde (MDA), as an indicator of lipid peroxidation, in the placebo group, while reducing total antioxidant capacity in the two groups was not significant.

In line with recent research findings, **Cardoso et al., (2012)**, showed that lipid

peroxidation (TBARS) and protein carbonyl in middle-aged women will be increased following resistance exercise. In addition, Vincent and colleagues (2004) reported that concentrations of malondialdehyde (MDA) after both aerobic and resistance exercise protocol in both obese and normal weight people were significantly increased, with the explanation that the amount of increase was higher in obese subjects.

Deminice et al., (2010) also found similar findings and found that a single bout of resistance exercise in male athletes increase the plasma oxidative stress markers. In addition, other researchers have reported that resistance exercise can lead to oxidative stress through the mechanism of theory of "ischemic-re-injury," (**McBride et al., 1998**). This suggests that during resistance exercise, severe muscle contractions cause a temporary decrease in blood flow and oxygen availability and thus ischemia, which followed by expansion of muscle and blood injected makes abundant supply of oxygen, and thus production of free oxygen radicals. The next mechanism and Hypothesis that can be used to increase oxidative stress following resistance activities is mechanical stress (**Viitala et al., 2004**). Based on this mechanism resistance exercise causes muscle damage and subsequent initiation of inflammatory

processes and eventually free oxygen radical production and lipid peroxidation.

However, **Dixon et al., (2006)** observed no significant changes of serum malondialdehyde concentration in athlete and non-athlete students, after a single bout of resistance exercise protocol with 8 reps of 10 ternary sports movement. Perhaps one reason for the contradictory findings of these researchers is physical activity and fitness levels and subjects; because, as noted earlier, unlike Dixon and colleagues the subjects in the present study were obese and had lower fitness level.

The present findings are in contrast with the results of other previous studies (**Mcanulty et al., 2005; Gur et al., 1999**), and it is perhaps due to different factors such as age, sex, type of exercise protocol, and subjects. On the other hand, several studies have investigated the role of nutritional interventions in reducing oxidative response after exercise.

Also considering the likely effects of chemical additives, research has been done on herbal and natural supplements, the effects of WHICH can be clearly useful in modulating oxidative stress induced by physical activity.

The results of this study also showed that short-term consumption of blackberry extract can significantly increase malondialdehyde concentrations in obese

subjects following a single bout of resistance exercise. In this regard, **Cho and colleagues (2012)** found that administration of blackberry extract caused lipid peroxidation in mice. It also has been reported that the blackberry extract could have powerful antioxidant effects through inhibition and clean-up of free radicals and increasing the activity of antioxidant enzymes (**Dai et al., 2007; Cotelle, 2001**).

In line with recent research findings, in a study that used green tea as an herbal supplement on oxidative stress parameters in male weightlifters, it was observed that green tea prevents significant increase of GSH and MDA induced by exercise in Weightlifting (**Panza et al., 2008**). **McLeay et al (2012)** also showed that short-term use of cranberry juice before and after eccentric resistance exercise boosts recovery and avoids increased oxidative stress markers in healthy women.

In addition, another study reported that supplementation with grape seed extract can prevent the oxidative stress induced by exercise by preventing lipid peroxidation and increasing antioxidant enzyme activities (**Belviranl et al., 2012**). **Morillas - Ruiz (2004)** have also achieved similar results in a study on 30 male athletes and found that taking natural polyphenolic antioxidant supplements instead of sports drinks can prevent lipid peroxidation and carbonated

Protein index and cellular damage to the athletes.

CONCLUSIONS

The results of this study and similar studies can contain important scientific concepts and applications associated with natural supplements rich in antioxidants. In order to maintain health and prevent oxidative stress damage induced by exercise in athletes, especially obese individuals. However, determining the actual impact of this fruit juice as a supplement and possible mechanisms involved requires more comprehensive research.

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