The Acute Effects of "Red Bull Energy Drink" On Blood Lactate Levels and Performance in Active Male

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Abstract: Background: energy drink consumption by athletes has become increasingly popular. Athletes believe that energy drinks can be used to enhance their performance during training and competition due to their potentially ergogenic ingredients. Therefore, the purpose of this study was to determine the effectiveness of the acute ingestion of an energy drink on Wingate cycle performance, muscle strength and blood lactate levels in a sample of 19 male active students from Mazandaran University. **Method**: this research was conducted on two separately sessions by four days rest in between. At first session, all of subjects were participated in Wingate test and handgrip strength test after having standard breakfast, and after the blood taking. In second session, subjects were divided three groups (Red bull, placebo and no drink groups) by systematically random design. Immediately after having breakfast (forty five minutes prior to test beginning), each group received 6 ml/kg.bw of related beverages. **Results**: in Red bull group, total work and mean power were increased and blood lactate after the test, was decreased. Changes observed in other measured factors in three groups were not significant. **Conclusion**: Red Bull can enhance anaerobic power in recreationally active people but not strength and blood lactate levels.
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Introduction

Nowadays, excessive exercise do not considered as a key factor for achieving to best performance and the target. There are different factors which may affect athlete's peak performance and abilities in different sport disciplines, such as psychological, physiological, biomechanical and nutritional factors (Zawila, 2003). Improving knowledge about nutrition, betterment nutritional habits and having healthy and sufficient regime are necessary for optimal performance in professional athletes and recreationally active population (Littie, 2002). Recently, energy drinks have received much attention by athletes prior to competition to improve performance (Ferreira, 2006).

The makers of Red Bull drink claim that it ''gives you wings,'' by improving performance, concentration and reaction speed, vigilance, emotional status, and stimulating metabolism (Astorino, 2012). Red Bull containing 80 mg of caffeine per serving as well as taurine and carbohydrate (Woojae, 2003), that claimed have beneficial psychological (Alford, 2001; Warburton, 2001) and physiological effects (Alford, 2001; Warburton, 2001; Horne, 2001).Caffeine is completely absorbed within the stomach and the small intestine 45 min after ingestion, and its half-life in the body is 3–4 h (Astorino and Roberson 2010). It has been reported that, caffeine reduces fatigue and increase wakefulness and alertness (Hewlett and Smith 2007). Due to these statements, caffeine is frequently used by recreationally active individuals and athletes as an ergogenic aid. Investigations about energy drinks reported conflicting results. Some studies reported no positive effects of energy drinks on performance, Bichler et al (2006) have been reported that, the combination of caffeine and taurine, in concentrations equivalent to those found in one 250 ml serving of the Red Bull energy drink, does not improve performance on tasks requiring short term recall of simple facts but does modulate cardiovascular physiology. Also, Forbes et al (2007), in the investigation on young men and women reported that, Red Bull had no effect on peak or mean power, but improved bench press performance. In the other hand, some studies reported positive effects of Red Bull energy drink (Ivy et al. 2009). For example, Rahnama et al (2010) noted that, two caffeine and taurine-containing energy drinks have ergogenic effects on indices of maximal cardio respiratory fitness in male athletes. Forbes et al (2007), in the investigation on young men and women reported that, Red Bull had no effect on peak or mean power. However, to our knowledge, the effects of lower caffeine doses, as found in Red Bull, on anaerobic power, strength and lactate levels have yet to be investigated. In view of these considerations, we evaluated acute effects of "Red Bull energy drink" on Blood lactate levels and performance to understanding that, this energy drink how can influence on performance and blood lactate levels in active male.

Method

Nineteen male physical education students (see TABLE 1) volunteered as subjects for the study. All subjects must have some considerations for participating in this study, such as: 1) at least 30 min training a day, four days per week with at least 3 month experience, 2) hadn't used any energy drink beverages, 3) maximum amount of tea or coffee

consumption was 2 cups per day, and 4) hadn't any physiological and psychological problems. Subjects provided written informed consent. All experimental procedures were approved by the University Institutional Review Board.

TABLE 1.Descriptive characteristics of the subjects.

Descriptive characteristics	Red Bull group (n =7)	Placebo group (n=7)	C group (n=5)
Height (Cm)	173.21 ± 4.80	175.92 ± 5.36	176.20 ± 6.53
Weight (Kg)	68.90 ± 6.05	71.21 ± 6.66	71.38 ± 7.64
Age (year)	22.14 ± 1.06	22.28 ± 0.75	22.8 ± 0.83

Design

After describing the aim of study and methodology, one week before starting pre-tests (first session), familiarization with performing tests were conduct and subjects were instructed to exercise maximally during bouts. Subjects had not any vigorous exercise within 48 hours prior to the test and change in nutritional regime. In pre-test session, after having standard breakfast (including 395 kcal energy: 50g carbohydrate, 18g fat and 8g protein), height and weight were measured by standard methods. After assessment of blood lactate with lactometer, participants completed a 3-5min dynamic warm up and then performed handgrip test with dynamometer in three times with 1 min rest interval, then Maximal anaerobic power was assessed by 30 seconds of leg cycling (Wingate test). The Wingate test consisted of a 30-s supramaximal cycling against a resistance load. Each test was performed on a Monark cycle ergometer (Model 894-E) and the load was calculated as 0.090 kg ·kg-1 body mass for each participant. The subjects were requested to pedal as fast as possible to preserve maximal pedaling speed until the end of the 30 second test period. After end of test, peak power, mean power and Fatigue index was noted.

Drink

Second session (post-test) was performed similar to first session with different that after having standard breakfast, all participants performed three randomly assigned exercise experimental conditions: a) Red Bull energy drink; b) placebo drink; and c). Controls (without drink). In post-test session and in a randomized, placebo controlled, counterbalanced and double-blind design, participants were consumed 6 ml/kg body weight Red Bull energy drink, placebo drink or no drink, 45 minutes before exercise test.

A researcher co-worker watched each subject consume all of the drinks.

Blood sampling and measurement of lactate levels

Venous blood samples were taken at both sessions (before tests and 2 min after end of test). Lactate concentrations were measured using by enzymatic method.

Statistical analysis

General characteristics of the participants were presented as means and standard deviations. Statistical significance was assessed using 3 × 2 (drinks vs. sessions) repeated measures analysis of variance (ANOVA). The least significant difference (LSD) test was performed for post-hoc analyses. The statistical package SPSS version 16 was used for statistical analysis. Level of significance was accepted at $p<0.05$.

In addition, percentage changes (Δ%) were computed in order to detect potential tendencies in the data. The statistic Δ% allows for a comparison of pre- and post-test scores relative to their baseline values, and was computed as follows(Vincent, 1999):[(post-test mean – pre-test mean) / pre-test mean] x 100.

Results

Descriptive statistics (Mean ± SD) for variables of two sessions in three groups (Table 2) and percentage changes (Δ %) for variables of two sessions in three groups (Table 3) were recorded.

LSD test indicated a significant difference between mean power in Red Bull energy drink and placebo drink (p = 0.016), Red Bull energy drink and controls (p = 0.031) and no significant difference in placebo drink and controls (p=0.925).Furthermore, a significant difference between low power in Red Bull energy drink and placebo (p=0.009), Red Bull energy drink and controls (p = 0.022) and no significant difference in placebo drink and controls (p=0.872) was observed. Also, no significant difference between fatigue index in three groups (p=0.384) was observed. Finally, no significant difference between muscular strength in three groups (p=0.384) was observed.

The ANOVA did not show significant interactions (i.e., pre- to post test) in blood lactate 2 min before tests (p=0.357) and 2 min after end tests (p=0.920, F=0.084) (see figure1).

Shown in Table 3, energy drink consumption revealed a trend towards an improvement in mean power and low power compared to the placebo and control experimental conditions. In the case of the mean power and low power, there was a tendency towards an increased score between the pre-test and

Post-test in the energy drink (Δ = 8.85, Δ = 18.26%) conditions. In addition, there was tendency towards reduction in the energy drink (Δ = – 6.37%) and placebo (Δ = – 1.20%) conditions for the fatigue index and Blood lactate 2 min before the test (Δ = – 2.842) in the group energy drink.

Discussion

It has been suggested that the consumption of an energy drink improves psychological, aerobic and anaerobic performance(Alford ,2001).The purpose of this study was to examine the acute effects of "Red

Bull energy drink" on Blood lactate levels and performance in active male.

Figure1. Lactact changes in 3 study group (mmol.l)

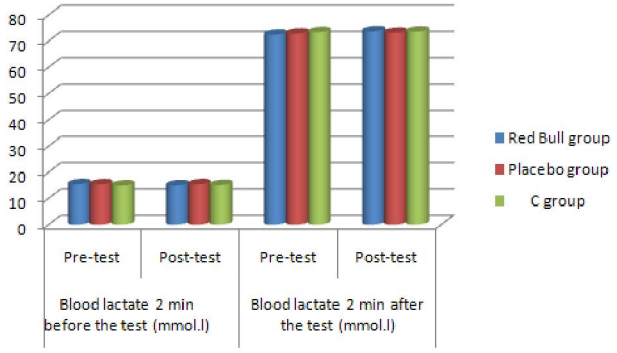

TABLE 2.Descriptive statistics (Mean ± SD) for variables of two sessions in three groups.

Variables		Red Bull group	Placebo group	C group
Mean power (w/s)	Pre-test Post-test	682.85±128.84* 743.28±156.15	715.28±91.45 727.85±99.69	696.00±113.31 707.40±106.41
Low power (w/s)	Pre-test Post-test	286.28±21.80* 338.57±37.49	294.42±18.30 298.00±17.03	285.20±33.22 287.40±31.02
Fatigue index (w/s)	Pre-test Post-test	42.85±7.27 40.12±7.42	43.85±7.59 43.32±5.61	42.90±4.93 43.36±4.34
Muscular strength kg)	Pre-test Post-test	51.35±5.32 52.95±6.61	49.74±3.88 50.35±4.22	56.56±8.87 56.76±7.79
Blood lactate 2 min Befor the test (mmol.l)	Pre-test Post-test	15.485±1.64 15.04±1.32	15.45±1.00 15.47±1.10	15.00±0.70 15.18±0.76
Blood lactate 2 min after the test (mmol.l)	Pre-test Post-test	72.42±10.11 73.71±8.93	72.85±7.35 73.14±7.40	73.40±8.04 73.60±8.82

*Indicate significant difference

TABLE 3.Δ% for variables of two sessions in three groups.

Variables	Red Bull group	Placebo group	C group
Mean power (w/s)	8.851*	1.757	1.638
Low power (w/s)	18.26*	1.216	0.771
Fatigue index (w/s)	-6.371	-1.209	1.072
Muscular strength (kg)	3.116	1.226	0.354
Blood lactate 2 min before the test (mmol.l)	-2.842	0.129	1.200
Blood lactate 2 min after the test (mmol.l)	1.781	0.398	0.272

*Indicate significant difference

Alford et al. (2001) found that the energy drink Red Bull improved anaerobic performance in 24% when compared to a placebo. Results indicated that intake of one serving of Red Bull can affect on mean and low power, but we did not find significant changes in Muscular strength, Fatigue index and blood lactate when athletes consumed an energy drink, a placebo or when athletes did not drink at all (i.e., control). Further, strength and Fatigue index improved from pre to post-test measurements regardless of the beverage consumed (see TABLE 2). This could be interpreted as a learning effect; however, the research design used in this study allowed for the minimising of that effect due to the randomisation of the subjects to the experimental conditions and also to the fact that the subjects and investigators were blind to the experimental conditions (Kerlinger & Lee, 2000). Nevertheless, the potential mechanism responsible for the improvements in strength unknown.

Some investigations have been reported that caffeine can enhance physical performance capacity, including endurance and muscle strength (Umaña-Alvarado, 2005; Alford, 2001). Results of this study indicate that no significant differences between groups in strength. There is less support for ergogenic effects of caffeine on strength (Astorino and Roberson 2010; Davis and Green 2010), but not about aerobic power (Alford, 2001).

In this study it was found that Red Bull cannot affect blood lactate levels. This findings in agreement with results of Bishop et al(2004) and Rahnama et al (2010). Possibly, because of no significant change between groups, Red Bull energy drink does not affect blood lactate levels. This may be due to increase in anaerobic power that mentioned above.

This study finding are same whit result of Alford (2001) and Umaña-Alvarado (2004) and are different with finding of Beck (2006) and Bichler(2006) researches. The reasons of differentiation in findings are dependent on some factors. In this study, result demonstrated that the preparation of a placebo condition can be a limitation for this line of study. Active placebos, as opposed to pure placebos, have been used in most studies; meaning that a low concentration of the same ingredients found in energy drinks (e.g., caffeine, taurine) has been used, which makes it almost impossible to compare the effects of these beverages across studies. Only Seidl et al. (2000) formulated, in our opinion, a reasonable placebo condition (wheat-bran capsules and water), which we tried to mimic in the present study (wheat-flour and blue-colored water). Therefore, before any conclusion regarding the effect of energy drinks is made, it is necessary to standardise placebos in order to discard any placebo effect.

In other studies (Umaña Alvarado 2004; Warburton et al., 2001), a specific volume (e.g., 150 – 250 ml) has been administered to the participants. Again, the exact dose of the active ingredients of the energy drink is unknown, which does not allow drawing valid comparisons between studies. In the

study by Umaña-Alvarado (2004) and in the present study, the energy drink volume was standardized to 6 ml / kg of body weight. In this way, all the subjects received the same amount of active ingredients, allowing for the higher internal consistency of the study (Kerlinger & Lee, 2000). Finally, the sample sizes and the diversity of compositions (e.g., male, female, athletes, nonathletes) have varied in previous studies (Alford et al., 2001; Seidl et al., 2000; Umaña-Alvarado, 2004; Warburton et al., 2001). In the present study 19 male active students participated in a within subjects design. This design has been shown to be more appropriate to study variability within a subject compared to the between-subjects designs where a subject only completes one of the experimental conditions and is compared against others (Kerlinger & Lee, 2000). Only Baum and Weiß (2001), and Umaña-Alvarado (2004) have used repeated measures designs, with samples sizes of 13, 15 and 11 participants, respectively. In spite of these reports, more research is needed before any statements are issued regarding the safety and efficacy of these beverages in the athletic population.

In conclusion, Red Bull energy drink can enhance anaerobic power in recreationally active people but not strength and blood lactate levels. It seems that, Red Bull energy drink can improve anaerobic power in recreationally active people.

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