Energy Bars with Curcumin Content Increase Human Performance

Hamidie Ronald Daniel Ray[1], Abdullah Firmansah[2] and Rita Patriasih[1]
[1]*Universitas Pendidikan Indonesia, Jln. Dr. Setiabudhi No. 229 Bandung, Indonesia*
[2]*Medical Nutrition Department, Faculty of Medical, Universitas Padjadjaran*
hamidieronald@upi.edu

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Abstract: An ergogenic aid is any method, mechanical devices, nutritional practice, pharmacological approach or psychological technique that can improve exercise performance capacity. Our previous study showed that curcumin have ability to increase mitochondrial biogenesis through increasing cAMP. However, the effect of curcumin to increase human performance remains unknown. Methods. Eighteen men (aged 19± 1 yr.) volunteered to participate in the present study during their 6 weeks aerobic exercise. The participants were randomly divided into three groups: the control groups (n=6) were only eat daily diet's without added the energy bars, the energy bars without curcumin content groups (EB; n=6) and groups with added the energy bars with curcumin content (EBC; n=6). All participants were assigned to vigorous (75% VO_2R). Intensity during exercise was controlled by having the subjects maintain target HR based on HR reserve. Exercise volume (and thus energy expenditure) was controlled across the three training groups by varying duration and frequency. Fifty-five subjects completed a 6-wk training protocol on a stationary bicycle ergometer and pre- and post-testing. During the final 4 weeks, the vigorous-intensity group exercised for 40 min, 4 days/weeks.

1 INTRODUCTION

Sport performance is depended with many factors included on genetic in athletes with morphologic, psychologic, physiologic and metabolic traits specific to performance characteristics to their sports (Horpkins, W.G. 1999). On the other way, athletes must also receive optimal training to increase physical capacity, enhance mental strength, and provide a mechanical advantage. In order for that some athletes often attempt to go beyond training and use substances and techniques which known as ergogenic aids. An ergogenic aid is any method, mechanical devices, nutritional practice, pharmacological approach or psychological technique that can improve exercise performance capacity and/or training adaptations (Kreider et al., 2010). In the past, many athletes have been used such as anabolic steroids and amphetamines to increase their performance but nowadays, athletes have led to the establishment of anti-doping legislation and effective testing protocols to help deter their use. Based on that reason, many athletes have preferred to choose dietary strategies, including the use of various supplements (sports supplements), which they presume to be effective, safe and legal.

Energy balance is an important factor in sustaining training load and maintaining high performance during exercise (Tanskanen et al., 2012) because of that, maintaining the energy intake is the best way to increase performance based on that activity has been found to have an influence on physical activity especially to boosting the high-energy intake when exercise. Energy bars are supplemental bars containing high energy foods targeted at people who require quick energy. Nowadays, this product be the target marketing for several industries to increase their selling product. A lot of athlete put in this product on their diet's because it's can be travel easily, provide a quick snack and readily available in most stores (Manore, 2006). Indeed, based on the characteristics of energy bars which have high-energy especially carbohydrate, this product is potentially to increase human performance.

Curcumin is the naturally herbal product which consumed by several people on the Asia countries especially Indonesia. Curcumin content the polyphenol which have been reported by previous study have ability to increase human performance

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(Gaffey et al., 2015, Nicol et al., 2015). Furthermore our previous study showed that curcumin have ability to increase mitochondrial biogenesis through increasing cAMP (Ray Hamidie et al., 2015). However, the effect of curcumin to increase human performance remains unknown. We hypothesize that energy bars conceive curcumin potentially to increase supply high-energy instantly and extend the duration of exercise on sport endurance.

2 METHODS

2.1 Participants

Eighteen men (aged 19± 1 yr.) volunteered to participate in the present study during their 6 weeks aerobic exercise. they had no more than one risk factor for coronary heart disease, they had. no signs or symptoms of cardiovascular disease, and they did not have known cardiovascular, pulmonary, or metabolic disease. The participants were randomly divided into three groups: the control groups (n=6) were only eat daily diet's without added the energy bars, the energy bars without curcumin content groups (EB; n=6) and groups with added the energy bars with curcumin content (EBC; n=6) (Waksberg, 1978).

2.2 Energy Bars Preparation

Energy bar that is meant in this research is a kind of snack based on rice krispi and chocolate. In this product formula is added complementary material that improves the quality of the energy bar and is also enriched with curcumin (Nielsen, 2009).
Ingredients:

- Chocolate: Chocolate used is a type of white compound chocolate that melts at a temperature 40-45ºC.
- Rice Crispy: Rice crispy is one of the main ingredients that contribute energy and gives crispy texture to the product. The types of rice krispi used are those that have a fresh and not sweet.
- Shortening: shortening is used using a vegetable-based known as margarine.
- The sugar syrup: used is derived from corn starch. This sugar syrup in addition serves to provide a sweet taste as well to improve the quality of the dough when it is formed.
- Dried fruits are additional ingredients that serve to raise the nutritional value and taste of the snack bar. The dried fruits used are raisin and orange peel.
- Lime juice used to enhance the taste and color quality of the product.
- Curcumin added to this formula in the form of a powder that has been removed its water content.

Percentage of material composition:

- Melted chocolate 56%, rice crispy 17%,
- shortening 4%, corn syrup 2%, dry fruit 15%, lime juice 1%, curcumin 1%.

2.3 Manufacturing Procedure

In general, materials used for energy-making bar are ready to serve material so that the processing procedure is done using the mixing method.

Mixing on the process of making the food bar works all the ingredients, getting the perfect hydration. For more clearly the following described step step making energy bar in the following picture:

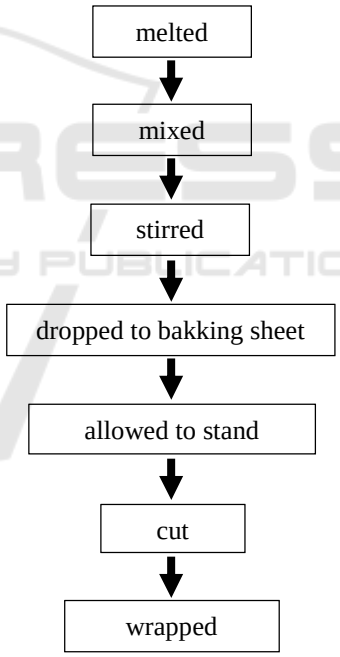

Figure 1 : Step by step making energy bar.

2.4 Aerobic Exercise Treatment

All participants were assigned to vigorous (75% VO2R). Intensity during exercise was controlled by having the subjects maintain target HR based on HR reserve. Exercise volume (and thus energy expenditure) was controlled across the three training groups by varying duration and frequency. Fifty-five

subjects completed a 6-wk training protocol on a stationary bicycle ergometer and pre- and post-testing. During the final 4 weeks, the vigorous-intensity group exercised for 40 min, 4 days/weeks (Gormley et al., 2008).

Table 1: Six weeks training program.

Week	Aerobic exercise
Week 1	50% HRR, 30 minutes, 3 days, 45 ATU
Week 2	75% HRR, 40 minutes, 3 days, 90 ATU
Weeks 3-6	75% HRR, 40 minutes, 4 days, 120 ATU
	ATU = intensity (% HRR or % VO2R) x duration x frequency; equivalent to energy expenditure of X number of minutes per week spent at VO2 max

2.5 Statistical Analysis

Statistical analysis was performed by one-way ANOVA to assed the main effect of energy bars to increase VO2 max and lactate threshold (pretest vs posttest). The Tukey post-hoc test was used for analysis to identify of difference between pretest and posttest result on every groups. All data were expressed as mean ± standard deviation (SD). The level of significance was established at $p < 0.05$.

3 RESULTS AND DISCUSSION

Table 2: Subject characteristic.

Group	Age (year)	Height (cm)	Mass (kg)	BMI ($kg.m^{-2}$)
Control Pre-test Post-test	19±1	162±4,3	58±4,9 58±4,9	23±1 22±1,2
EB Pre-test Post-test	19±1	163±4,1	60±3,3 58±3,2	22±0,6 21±0,7
EBC Pre-test Post-test	19±1	165±4,1	60±3,9 58±3,3	22±0,7 21±0,7

The baseline descriptive characteristic of the subject is presented in Table 2. There were significant differences observed at baseline between any of the groups for age, height, mass, BMI, or percent body fat.

Table 3: Change in VO2max (mL.min-1.kg-1) after the 6-wk training protocol.

Group	Initial VO2 max	Final VO2 max	Net Change in VO2 max
Control	35,2±0,7	38,2±0,7	2,9±1,1
EB	34,5±1,3	39,2±1,3	3,8±1,5
EBC	35±1,4	40,5±1,2	5,7±0,4

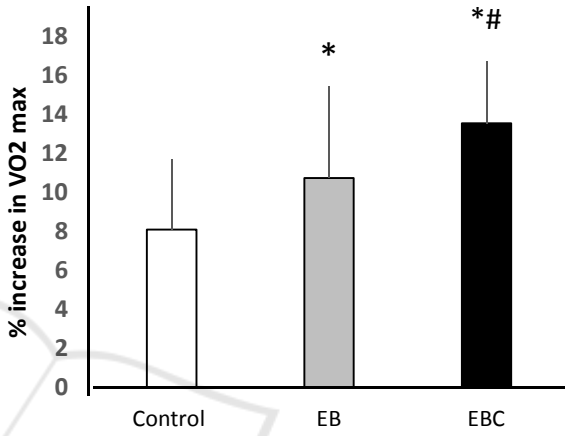

Figure 2: Percent changes (mean ± SD) in VO2 max after training.
* significantly different from control ($P<0.005$). # significantly difference from EB ($P<0.005$)

4 CONCLUSIONS

VO2 max significantly increased in all three exercise groups, as seen in Table 3. To control for baselines values, percent changes in VO2 max were analysed by one-way ANOVA. As shown in Figure 1, there were significant percent increases between pre-test and post-test in the control group (8 %), the EB group (10 %) and EBC group (17%). Furthermore, group with added energy bars significantly difference with control and interestingly that Energy Bars with curcumin (EBC) group significantly difference with Energy bars only without curcumin content.

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