

## The Effect of Different Beverage Consumption (Dough, Non-Alcoholic Beer, Carbohydrated Replacement Drink) on Performance, Lipids Profile, Inflammatory Biomarkers After Running-Based Anaerobic Sprint Test in Taekwondo Players

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### ABSTRACT

**Background:** After exercise, recovery is very essential in professional sport. Athletes use sport beverages to enhance endurance and physical performance. The purpose of this study was to examine the effects of Dough versus non-alcoholic beer and carbohydrate (CHO) fluid on performance, lipids profile, inflammatory biomarkers after Running-based Anaerobic Sprint Test (R.A.S.T) in Taekwondo players.

**Methods:** This study was conducted as repeated measures crossover design with 22 men Taekwondo player. Subjects completed standard protocol R.A.S.T so that immediately and 1 h posterior R.A.S.T protocol received number 1 beverage. Subjects spend 2 h recovery periods. Second and third sessions trial were similar to prior trial, separated by at least 4 days, instead of number 1 beverage, participants received number 2 and number 3 beverage.

**Results:** Data showed that average pre- and post-recovery in C-reactive protein (CRP) or Dough significantly decreased ( $P < 0.05$ ), while for CHO drink and non-alcoholic beer, were not statistically significant. Moreover, the mean pre- and post-recovery in  $VO_2$  max for Dough and non-alcoholic beer significantly increased, but for other beverages, there was no significant difference ( $P > 0.05$ ). About mean pre- and post-recovery in low density lipoprotein (LDL) and high density lipoprotein (HDL) there were no significant differences in all three beverages. Besides, amount of CRP was significant between three beverages ( $P < 0.05$ ). There were no other within-subject differences for any of the other variables measured, including HDL, LDL, and  $VO_{2max}$ . In addition, no significant different ( $P > 0.05$ ) in dietary intake were observed between three treatment periods.

**Conclusions:** Dough was effective in reducing LDL and reducing inflammatory biomarkers including CRP with little effect on performance in subjects.

**Keywords:** Beverage, C-reactive protein lipids profile, performance, post-exercise

### INTRODUCTION

After exercise, recovery is very essential in professional sport,

especially in competitions. Professionals athlete must exercise at high intensity with restricted rest times between attempts; thus recovery methods in sport can aid athletes to improve performance in competitions.<sup>[1]</sup> In order to enhancement function, a kind of post-exercise recovery interventions are frequently utilized to improve recovery from training time.<sup>[2]</sup> The composition and timing of nutrient intake can considerably impact recovery from severe exercise.<sup>[3-6]</sup> Some appearance of recovery, including reduced muscle damage and boosted performance can be magnified by nutritional intervention, carbohydrate (CHO)-electrolyte drink beverage intake.<sup>[7]</sup> The beverages are generally utilized throughout and after exercise, ranging from bottled water to CHO-electrolyte replacement drinks.<sup>[8]</sup> Beverages can aid in quick restoration of performance, blood sugar and muscle glycogen if used instantly after exercise. Post-exercise recovery drink have underlined on timing, type of beverage, macro- and micro-nutrient content (calories, CHO and protein (PRO), mineral, and vitamins).<sup>[9-14]</sup> Recent research suggests that a CHO-PRO) beverage consumed after exercise may satisfyingly affect the exercise recovery.<sup>[6,15,16]</sup> Therefore, composition of PRO to CHO in beverages can enhance performance and recovery between exercise sessions with a short recovery period.<sup>[7]</sup> Chocolate milk is as a popular and easily available drink among children and adults and is proposed to be effective. Thomas *et al.*<sup>[17]</sup> and Karp *et al.*<sup>[18]</sup> have shown that chocolate milk is an effective recovery drink after exercise in comparison with CHO replacement drink and fluid replacement drink. Another study,<sup>[19]</sup> reported that post-exercise chocolate milk consumption is as effective as a CHO beverage. Lunn *et al.*<sup>[20]</sup> examined effects of chocolate milk consumption on markers of PRO turnover, muscle glycogen, and performance during recovery from endurance exercise, and observed beneficial effects of chocolate milk compared to the CHO only beverage.

Dough, a yogurt-based, salty drink popular<sup>[21]</sup> and non-alcoholic beer are two other famous drinks in Iranian diet. Dough is a low-CHO high-PRO drink, which has a high amount of electrolytes like sodium (usually 0.8-1 g/100 g) and high calcium while non-alcoholic beer is a high-CHO low-PRO with vitamin B, C, and mineral. Although these beverages are highly consumed by professional athletes, their effect on post-exercise recovery is not assessed yet. In present study, we tried to evaluate

the effects of different beverage consumption on recovery time, Performance, lipids profile, inflammatory biomarkers after RAST test in Iranian professional Taekwondo athletes.

## METHODS

This study was conducted as repeated measures crossover design with 22 men Taekwondo player (mean  $\pm$  SD: Age 23.8  $\pm$  2.7 years; Stature 173.7 $\pm$ 4.3 cm; BMI 24.02 $\pm$ 0.92). These athletes were involved in professional sports. Before beginning the study, all subjects were informed of all procedures of the study and signed an informed consent. Participants were asked to refrain from exercise 24 h before trial initiation and to sustain their customary physical activity and dietary patterns. Participants were asked to fill a "food recall" for 1 day before intervention. Afterwards, venous blood samples were obtained from all participants. Subjects completed standard protocol running-based anaerobic sprint test (R.A.S.T), after a self-determined warm-up for 10 min. Participants concluded after protocol blood lactate was determined by lactometer (Scout) so that immediately and 1 h posterior R.A.S.T protocol received no.1 beverage. Subjects spend 2 h recovery periods. Finally, after 2 h recovery time, blood sample were obtained. Second and third sessions trial were similar to prior trial, separated by at least 4 days, instead of no. 1 beverage, participants received no.2 and no.3 beverages. The subjects were also asked to replicate their diet and activity in during study period. Dietary analyses were performed using nutritionist IV software. The indirect  $VO_{2max}$  was used by Harvard Step Test.

### Statistical analysis

Means and standard errors of the mean were calculated for each variable. Experimental trial data were analyzed using a simple repeated-measures analysis of variance (ANOVA). Simple contrasts were planned *a priori* in the case of a significant main effect, and Dough was the reference category. Within group comparisons were done using paired samples *t*-test. Significance was set at  $\alpha < 0.05$  for all analyses. Analyses were performed with the SPSS version 16 (SPSS Inc, Chicago, IL) statistical package.

## RESULTS

Results showed that average pre- and post-recovery

in CRP for Dough has significantly decreased ( $P < 0.05$ ), while for CHO drink and non-alcoholic beer were not statistically significant. Moreover, the mean pre- and post-recovery in  $VO_{2max}$  for Dough and non-alcoholic beer significantly increased, but for other beverages, there was no significant difference ( $P > 0.05$ ). About mean pre- and post-recovery in LDL and HDL were no significant differences in all three beverages. Beside, amount CRP was significant between three beverage ( $P < 0.05$ ). However, there were no other within-subject differences for any of the other variables measured, including HDL, LDL,  $VO_{2max}$  [Table 1].

In addition, no significant different ( $P > 0.05$ ) in dietary intake (Kcal, CHO, PRO, Fat) were observed between three treatment periods [Table 2].

## DISCUSSION

The aim of this study was to assess the effects of three beverages consumed during recovery from RAST test on inflammatory biomarkers, lipids profile and performance in Iranian professional Taekwondo player athletes. In this study, the serum CRP levels in Dough treatment was reduced more than non-alcoholic beer, whereas, in CHO fluid treatment was increased. However, there was

no difference in lipids profile, among groups. On the other hand,  $VO_{2max}$  increased in Dough and non-alcoholic beer treatments, but not in CHO fluid group.

On the one hand, in a study carried out by Agerbaek *et al.*<sup>[22]</sup> On a total of 58 healthy, non-fat men, it was concluded that 6-week intervention with fermentative product of milk caused a significant decrease in LDL; however, HDL in the both groups of Placebo and intervention showed no changes. On the other hand, in a time-frame study carried out by Demosthenes *et al.*,<sup>[23]</sup> on a total of 1514 men and 1528 women who use dairy products including milk, cheese, and yogurt, it was figured out that the diet containing dairy products has no relation to the level of HDL. Furthermore, in another study,<sup>[24]</sup> 34 women were using yogurt or fermentative milk during 4 weeks and the results showed that dairy products cause a decrease in the level of LDL. In fact, the observations were parallel with the results of the current study and it showed that using yogurt drink causes a significant decrease in the level of LDL. Out of the possible reasons for the resemblance in these results, it can be pointed that there was no differences in the ingredients of yogurt and yogurt drink of which calcium and vitamin D cause a decrease in LDL. Whereas, other studies showed different results; for

**Table 1:** Plasma concentrations of inflammatory, profile lipids and performance markers before and after ingestion of beverage

Variable	Dough	Non-alcoholic beer	Carbohydrate drink	P value
CRP mg/dl				
Pre-recovery	1.47±0.09	1.41±0.17	1.40±0.09	0.021*
Post-recovery	1.07±0.24	1.36±0.24	1.50±0.24	
P value	0.025*	0.35	0.24	
$VO_{2max}$ ml/min/kg				
Pre-recovery	71.30±4.05	71.97±2.7	72.36±2.51	0.60
Post-recovery	73.08±3.1	76.13±3.4	73.08±3.1	
P value	0.001*	0.003*	0.08	
HDL mg/dl				
Pre-recovery	63.26±6.44	61.68±7.21	61.77±7.90	0.27
Post-recovery	64.81±7.81	62.05±7.84	60.09±7.11	
P value	0.09	0.42	0.22	
LDL mg/dl				
Pre-recovery	85.63±7.96	83.86±7.75	81.36±7.15	0.39
Post-recovery	83.72±6.77	82.95±6.23	82.03±5.52	
P value	0.07	0.27	0.19	

Data reported are mean±SEM, \*Significantly greater than baseline ( $P < 0.05$ ),  $VO_{2max}$  =  $VO_{2max}$ , HDL=High density lipoprotein, LDL=Low density lipoprotein, CRP=C-reactive protein

**Table 2:** Mean composition of subjects diets (total kilo-calories), for the 24-h period prior to each trial

Dietary content	Mean 24-h intake (prior to testing day)			P value
	Dough	Non-alcoholic	Carbohydrate drink	
Energy (kcal)	2609±134	2554±118	2588±126	0.21
Carbohydrate (gr)	389±22.3	377±22.6	388±23.9	0.08
Protein (gr)	98±2.72	104.5±2.78	100.3±3.02	0.32
Fat (gr)	73.5±4.43	69.86±2.30	70.5±2.47	0.14

Data reported are mean±SEM, \*Significantly greater than baseline ( $P<0.05$ )

instance, in a cross 3-period, 7-week study done upon 29 healthy women, intervention with yogurt caused an increase in HDL but upon LDL no impact was noticed.<sup>[25]</sup> In another study carried out by McNamara *et al.*,<sup>[26]</sup> the 3-week effect of yogurt intervention on 18 men were investigated and the results showed that yogurt had no effect on lipids profile. The period of study and the subjects were the possible reasons for conflicting results of above mentioned studies with the current study.

In cross-sectional study done on 3042 men and women using dairy products, the results showed that dairy intake causes a significant decrease in the level of CRP.<sup>[23]</sup> The study had the same results as those of the present study and its possible reasons are: the presence of PRO of high-quality, riboflavin, genjoged linolenic acid<sup>[26,27]</sup> that might be effective on Biomarkers. Whereas, in a study, Van Meijl investigated the impact of dairy intake on 35 fat or overweight volunteers during 8 weeks, and he noticed no impacts upon the prominent factors. Supplementation with drinking milk during 12 weeks had no significant impacts on CRP and IL-6 in those suffering from high blood pressure.<sup>[28]</sup> It must be taken into account that these studies have not been planned to show the effect of dairy products on prominent Biomarkers.<sup>[29]</sup>

In a study done by Jimenez-Flores on 35 athletic university students, the effects of two supplements namely milk of high-PRO and trade supplement of high-CHO were compared and the results showed that the athletic performance of those using milk supplement is more than that of those using CHO supplement.<sup>[30]</sup> In another study, cacao milk intake by 9 athletes in 2 competitions as far as 1 week caused significant decrease in their athletic performance and recovery.<sup>[20]</sup>

In a cross-sectional study done by Choi on 9948 subjects, it was figured out that CHO has a reverse relation with the amount of HDL Plasma without taking fat intake and energy into account.<sup>[31]</sup> Additionally, in another cross-sectional study upon 2157 American teenagers, the reverse relation of CHO with the level of HDL and the positive relation with the level of plasma were not seen.<sup>[32]</sup> In a study done by Aeberli *et al.*, the results obtained from a 6-period, 3 week interference upon 29 volunteers showed that cocas sweeten cause an increase in LDL plasma.<sup>[33]</sup> These results are different from the findings of the current study and the period of study and ingredients present in non-alcoholic beer containing vitamin B are effective upon the results.

McBrier *et al.* studied seven athletic persons and no differences was seen in the level of CRP plasma between two groups using CHO drink and coca based PRO drink after their exercises.<sup>[34]</sup> In another study done upon 18 healthy non-sports men, the results obtained from two groups using placebo and CHO showed no changes in the level of CRP.<sup>[35]</sup> However, in another study<sup>[33]</sup> the levels of CRP during using coca sweeten showed a significant increase.

In a study done by Fallowfield upon 12 athletic men and 4 athletic women, the group using electrolyte-CHO solution noticed a significant progress in its performance during 4 h after recovery.<sup>[36]</sup> In another study done upon 18 athletic men and athletic women during 2 weeks, the solution containing CHO and sodium showed a more significant increase in their performance during the activity of resisting exercise than the other solutions selected by athletes themselves.<sup>[37]</sup> Concerning the results of abovementioned studies, the similar ingredients present in non-alcoholic beer, the period as well as the plan of study, and the subjects might have been effective on the sameness of the results. However, in a study done by Price and Cripps, 9 athletic men used glucose, bicarbonate sodium and placebo and no differences in their athletic performance was seen.<sup>[38-40]</sup>

This study suggests that Dough was effective in reducing LDL and reducing inflammatory biomarkers including CRP with little effect on performance in subjects. These findings further support the effectiveness of Dough as a potential recovery aid for athletes between intense workouts.

The strength of this study is since no study has been conducted on the effects Dough consumption. On the other hand, in this study, all of the beverages were isocaloric and isovolumetric amount.

The limitation of this study is not measuring other factors especially electrolyte and mineral contents. One another limitation of this study was as a result, further research is needed to clarify these findings.

## CONCLUSION

This study suggests that Dough was effective in reducing LDL and reducing inflammatory biomarkers including CRP with little effect on performance in subjects. These findings further support the effectiveness of Dough as a potential recovery aid for athletes between intense workouts.

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