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Effect of sodium bicarbonate supplementation different loading along with exhaustive activity on physiological variable associated with fatigue in the soldiers

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ABSTRACT

The design objective of research was to investigate comparison between the effects of sodium bicarbonate $[NaHCO_3]$ different loading in high intensity intermittent activity on fatigue parameters of soldger. 30 s soldger s acccomplishment wingate test in two situations: $NaHCO_3[SB]$ consumption and placebo. The SB $[0.3 \text{ g}\cdot\text{kg}^{-1} \text{ of body}]$ mass] or the placebo was ingested 60 min before the training in Solution 250ml . before and After wingate test, blood sample was collected. All parameters were compared using two-way repeated measures ANOVA, followed by Tukey post-hoc test , significantly level was set at 5%. The $[La^-]$ in wingate test after SB $[17.93 \pm 3.8 \text{ mmol}\cdot l^-]$ supplementation was significantly higher than placebo $[La^-]$ $[15.67 \pm 3.29 \text{ mmol}\cdot l^-]$ [P<0.05]. No difference was found between SB and placebo for hr number. In conclusion, NaHCO₃ did improve performance in soldgers, with enhance the glycolytic source without alteration of fatigue index.

Keywords: Soldger; Sodium Bicarbonate Supplementation; lactate; Exercise.

INTRODUCTION

The achievement to success in intensity drilling training is dependent on activity type and effort recovery relationship that consists of increases both aerobic and anaerobic components [1,2, 3,4]. People participating in Daily events, sports, amateur and professional sports and the search results are ranked higher during the tournament [5,6]. So they try to show their best performance . they can prevent the occurrence of several factors. Intracellular Ph in intense muscular activity may be changed, so that in the beginning, because the catabolism of creatine phosphate, alkaline created and further intensification of glycolysis, the prevailing acidic environment And the continued rise in glycolysis, the ruling acid [7]. The findings in the expression and location of the causes of fatigue, such as energy devices [Atp-pc, glycolysis and aerobic oxidation], the accumulation of by products of metabolism, nervous system, and impaired contractile mechanisms have focused It has been suggested that the maximum activity, increased lactic acid itself can be a cause of fatigue But lactic acid is decomposed and converted to lactate and hydrogen ions, leading to aggregation and loss of muscle cell ph [8]. Incremental increase in hydrogen ions decreases in intracellular PH that can contribute to fatigue in most sports [9]. Increased proton buffering can delay fatigue by improved utilization of energy substrates and the work done to preserve muscle contraction.

When compared to continuous training of the same energy expenditure, intensity activity need to carbohydrate and lactate metabolism [5,6]. increase carbohyrate metabolism induce production of lactic acid and the dissociation into hydrogen ions $[H^+]$ and lactate, coincide decreasing the pH of the blood [7,8,9]. the effect of reduced pH are the encumbrance of calcium ions deliveried from the sarcoplasmic reticulum, the coupling of actin and myosin, and of the activity of phosphofructokinase. There factors lead to downfall force production during performance [10-13].

The consumption of sodium bicarbonate supplement can approaching for dilation fatigue during drilling efforts [2,14-16] by relieving the reduce of pH [16,17]. Thus, regardless some anomalous findings [3,18-21] about the ergogenic effects of NaHCO3, it has been used to increase performance in several sports [22]. Lindh et al. [14] affirm that supplementation consumption of 300 mg·kg-1 of NaHCO3 amelioration the performance of 200 m in exprinces swimmers due to the increase in buffering capacity. The advantageous of NaHCO3 on intensity exercise were recently indicted. Findings by Siegler and Gleadall-Siddall [21] suggest a consumption of NaHCO3 in rigorous drilling sessions for swimmers who want to improve the quality of their drilling performance.

If NaHCO3 help the maintenance or even mollification the forfeiture in important parameters during the sessions of intensity drilling training, it would be reasonable to conclude that the Soldgers would benefit from this nutritional strategy. However, to our knowledge, no study assessed the effects of NaHCO3 on the changes in the parameters of Soldger activity together with the performance of the Soldger s. Thus, the aim of the present study was to evaluate the effect of supplementation of NaHCO3 on the Chemical and mechanical parameters of Soldger, physiological responses and performance of high-level Soldger.

MATERIALS AND METHODS

Participants

Thirty solider voluntarily participated in this study. The participants were recruited from sanandaj Garrison Prior to testing, subjects were randomly assigned into one of two groups, placebo and treatment. The physical characteristics of the participants were have shown in table 1.

The participants were instructed to avoid any high-intensity exercise during the testing sessions and to continue their nutritional habits. Prior to participation in the study, each subject provided written informed consent and completed medical screening. individuals who have health problems and disorders of the cardiovascular and respiratory are, eliminated of research processes.

Sodium Bicarbonate Supplement ingestion

Sodium bicarbonate supplement [alkalosis] in the form of white powder was produced from pars azmoon company [tehran,Iran]. Sodium bicarbonate supplement was used with dosage of 0/03 grams per kilogram of body weight in two different loading [18, 19], 30 minutes before the performance test.Placebo was tab water[250 ml]that ingested, 30 minutes prior to the performance test . the volunteers had not eaten or drunk for 12 hours before the test [10].

Chronic Supplementation

Chronic supplementation involved a four day loading period with SB. Following acute supplementation, After ten days of acute loading, chronic loading Began that this period is entitled wash out. each subsequent day of the chronic loading period involved supplementation with 0.3g/kg BM each day. On Day 5, subjects ingested no supplement and carried out the performance test. Previous studies have shown that the 5 day loading period followed by no supplementation on the day of the performance test may induce pre-exercise alkalosis sufficiently while also allowing time for any gastrointestinal discomfort that may affect performance to be alleviated.

Performance Test:

The performance test was a high-intensity test on a 'Monark 824E' cycle ergometer [Monark Exercise, farberg, Sweden]. The cycle ergometer recorded various forms of power output and was automatically calibrated by the patented self-regulating braking system. Wingate test was set at a resistance 7.5% BM¹ for each subject.

¹ - bady mass

. mean power output [MPO] were recorded for all participation. MPO were also expressed relative to body mass [relative MPO]. Total work was calculated as a product of the sum of the MPO for each wingate and the duration of the wingate [10s]. Fatigue index was also calculated for each participation as the MPO minus the minimum power output, expressed as a percentage of the MPO [13].

Blood Sampling

There were two blood sampling phases : before test,5 min and 60 minuts after test [bn]. In both loading, the blood samples were poured into lab tubes containing heparin. The blood samples were immediately sent to a laboratory for analysis.

Biochemical Measurements

5ml of blood were obtained from the Vein of forearm. lactate was measured with enzymatically method by lactate kit[pars azmoon, tehran, iran], Bicarbonate were measured enzymatically by bicarbonate kit[ABL5 Radiometer, Copenhagen, Denmark]. pH was measured by PH meter instrument[I-STAT Abbott Labora-tories, USA].

Heart rate

Heart rate was measured throughout each test and recorded at similar intervals to pretest, posttest and after one hour performing test. Heart rate was recorded using a wireless Polar heart rate monitor [Polar Vantage NVTM Polar, Port Washington, NY].

Statistical Analysis

Statistical analysis was performed using SPSS 16 for window. Data were tested for normal distribution using the Kolmogorov–Smirnov test . Data were normally distributed. Data are presented as means \pm SD. one-way repeated measures ANOVAs were used to investigate the differences in all the dependent variables at all time points. Where a difference was found, this was investigated using a LSD post hoc test. The level of significance was set at p <0.05.

RESULTS

Bicarbonate Concentration

In supplement group blood bicarbonate concentration significantly were greater than placebo group at all time points. The peak blood [HCO3 $^{-}$] [30.3 mmol/L] and the greatest change in [HCO3 $^{-}$] from baseline [6.6 mmol/L] were recorded after ingestion commenced. StdHCO3 - levels were significantly greater with chronic SB supplementation for all time points post-ingestion when compared to all control [p=0.000].

PH:

Following ingestion, blood pH was found to be significantly higher at all time points for chronic SB supplementation when compared to control [p<0.05].

Lactate

Baseline lactate levels were identified as lying within the normal ranges prior to supplementation for all subjects [0.8-1.8 mmol/L] with no significant differences between the groups [p = 1.000]. Following chronic SB supplementation, blood lactate concentrations were found to be significantly greater than the other supplementation protocols after the wingate only. Following the wingate, chronic SB ingestion resulted in a mean blood lactate concentration of 12.71 } 4.11 mmol/L, which was significantly greater than control [8.6 }.

Mean power output

Mean power output [MPO] was analysed for each wingate using each of the experimental supplementation protocols with significant differences observed between protocols in wingate test. The greatest MPO for each supplementation protocol was observed during Wingate in chronic supplement loading [p<0/05].

fatigue index:

No significant differences between supplementation protocols were found for fatigue index over the wingates [p=1.000]. Fatigue index was calculated as $\{27.2 \pm 2.2\}$, $\{27.5 \pm 1.65\}$ for control, chronic SB, respectively.

Heart rate:

No significant differences between supplementation protocols were found for HR number over the wingates [p>0/05]. HR number was calculated as $\{173\}$, $\{177\}$ for chronic SB, PLA, respectively. heart rate number One after of wingate test, no different among all group.

DISCUSSION

The primary finding was that NaHCO3 supplementation had ergogenic effect on the Soldger performance of wingate test. NaHCO3 supplementation lead to baffering capacity increase in the last effort without a change in hr number.

Although NaHCO3 possess an ergogenic effect on activate that lasting 1 to 10 min [14,19], the present study showed improvement in the performance of wingate test in the SB loading. The increase in performance during the wingate test was better in SB conditions. These findings are in agreement with Lindh and colleagues [14] reported a single effort of 200 m performance improvement in elite athletes, They also seem to present greater anaerobic capacity that allows for a higher level of acidosis and, therefore, benefit from NaHCO3 more than non-elite athletes.

Siegler and Gleadall-Siddall [21] reported on the effect of NaHCO3 supplement consuption in trained swimmers following eight sets of 25 m with a 5-sec pause, and detect a reduction in the total time of the performance [placebo: 163.2 ± 25.6 sec, SB: 159.4 ± 25.4 sec]. Thus, the elimination of noisome components could have influenced the subjects' improvement in performance. In the present study, significantly difference seen in SB was found in performing test, and, same with results by Siegler and Gleadall-Siddall [21] and Lindh and colleagues [14], the technical and competitive level of the subjects may have influenced their performance and, therefore, the turn may have diluted the improvement in SB.

Although the present study did analyze pH alterations, chronic SB loading was used in other studies [18,24,30] and showed to be effective in changing pH and the concentration of bicarbonate ion. The lactate concentration was significantly higher at the end of the last 100 m effort [placebo: 15.67 ± 3.29 mmol·l-1 and SB: 17.93 ± 3.80 mmol·l-1; P<0.05].

The increase in lactate concentration was reported by several studies [6,18,27]. Some hypotheses may explain the higher values of lactate concentration on SB. The first one is related to the fact that the elimination of lactate is increased when the extracellular pH increases, lactate depletion from muscle increased with the NaHCO3 supplementation [12,15]. The second relates to the higher glycolytic activity and anaerobic energy production due to a better internal environment, which would increase performance. However as to this hypothesis, in the present study, it was confirmed since there was significant difference seen the wingate test in SB. Notwithstanding, the protocol used in the present study consisted of wingate test for improvement in the tolerance to acidosis, so SB, besides achieving the goal of training, allowed for a higher production of [La-] without a decrease in the performance of the subject.

The MPO was used to estimate performance improvement during exercise. This approach is due to the close relationship between MPO and physiological markers related to intensity [such as heart rate and blood lactate] [9,17]. The present study found significant difference between the values of MPO in SB. Yamanaka et al. [26] did find any difference in MPO when studying the legs, with higher lactate concentration in SB after a set of intense exercise, which is in agreement with the present study. Numerous studies have shown elevated lactate concentration after NaHCO3 supplementation [6,18,27]. So, it seems that despite the change in MPO, SB increased the production capacity and the lactate tolerance. Therefore, the ergogenic effect may be beneficial in training that is aimed at increasing tolerance and/or [La-] production.

As to the effect of SB on HR number, no differences were found. Although the majority of the research involving SB supplementation demonstrates fluctuation in the acid-base balance inducing a state of alkalosis, this condition does not always translate into an enhanced performance. Horswill et al., [1988] found no significant improvement in the total work performed in a 2 minute cycling sprint with SB supplementation. No improvements were recorded, either for work performed or power output, following 90 seconds of maximal cycling exercise by untrained males [13]. The lack of significant findings in certain studies may also be as a result of factors such as sample size, subject characteristics, SB doses and insufficient durations and/or intensities of exercise. The exact reasons for these

conflicting results are unclear but may in part be due to inadequate exploitation of the maximum buffering capacity through insufficient duration or intensity of exercise, thereby limiting the ergogenic benefits [11]. In addition, there appears to be a highly individual response to SB ingestion, which may be partially accounted for by the gastrointestinal side effects associated with SB ingestion. Another explanation for the lack of performance enhancement with SB supplementation found in some previous studies may be the use of untrained subjects. Plasma pH and [HCO₃] measured before the test in the present study was comparable to those reported by Lindh et al[2008]. From these results it appears that 0.3g/kg BM of SB was sufficient to induce metabolic alkalosis in soldger. In support of this data, previous research has exhibited a significantly higher alkalinity in trained males [16] and elite female athletes [5]. This finding is widely supported in the research, particularly in investigations involving high intensity exercise with a heavy reliance on anaerobic metabolism [10,13,17,18] An increase in the activity of the lactate/H⁺ contransporter, promoting an increased efflux of lactate from the muscle cells, is purported to be the mechanism underpinning the increased post-exercise lactate concentrations observed with SB ingestion in chronic loading [10,16]. However, the sample size utilised in the current study was higher than the average of 8 ± 2 subjects observed in a review of research involving SB ingestion [11]. Sodium bicarbonate loading may have additional buffering effects in more subject's with enhanced intracellular buffering mechanisms [20]. In relation to performance, acute SB ingestion resulted in no significant difference between trials for subjects. However, significant differences in performance in chronic loading were observed. Previous studies have reported improved short-duration high-intensity cycling performance after chronic loading of NaHCO3 [8,16,18].

CONCLUSION

We conclude that the NaHCO3 supplementation does improve performance and it,s parameters after supplemention consumption. This thinking may change with performance solder where NaHCO3 may help to improve performance due to better solder performance and technical skills.

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variable	Sodium bicarbonate	Placebo
Age [years]	20.58±3.25	20.35±3.65
Height [cm]	175.33±2.48	175.42±2.35
Weight [kg]	64.43±1.34	64.53±1.23
BMI[kg/m2]	21.57±2.67	21.61±2.74

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