

Carbohydrate mouth rinse does not improve repeated sprint performance

Enxágue bucal com carboidrato não melhora o desempenho em sprints repetidos

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Abstract – The objective of this study was to evaluate the effect of a carbohydrate mouth rinse on the repeated sprint ability (RSA) of young soccer players. Nine youth soccer players (15.0 ± 1.5 years; 60.7 ± 4.84 kg; 1.72 ± 0.05 m; 20.5 ± 1.25 kg/m²) were selected. The athletes were submitted to an RSA test consisting of six sprints of 40 m (going/return = 20 m + 20 m), separated by 20 s of passive recovery, under three experimental conditions: carbohydrate mouth rinse (CHO) or placebo (PLA) and control (CON). The mouth rinses containing CHO or PLA were administered 5 min and immediately before the beginning of the test in doses of 100 mL. The best sprint time (RSAbest), mean sprint time (RSAmeyn), and drop-off in sprint performance (fatigue index) were determined for the different treatments. One-way ANOVA for repeated measures did not identify significant differences ($P > 0.05$) in RSAbest (CHO = 7.30 ± 0.31 s; PLA = 7.30 ± 0.30 s; CON = 7.26 ± 0.16 s), RSAmeyn (CHO = 7.71 ± 0.30 s; PLA = 7.71 ± 0.25 s; CON = 7.66 ± 0.24 s), or fatigue index (CHO = 5.58 ± 2.16%; PLA = 5.77 ± 3.04%; CON = 5.55 ± 3.72%). The results suggest that a carbohydrate mouth rinse does not improve the repeated sprint performance of young soccer players.

Key words: Athletic performance; Endurance; Nutritional ergogenic aid; Soccer.

Resumo – O objetivo deste trabalho foi analisar os efeitos do enxágue bucal com carboidrato sobre o desempenho, durante sprints repetidos (RSA), de jovens jogadores de futebol. Nove atletas de futebol da categoria infantil (15,0 ± 1,5 anos; 60,7 ± 4,84 kg; 1,72 ± 0,05 m; 20,5 ± 1,25 kg/m²) foram submetidos ao teste de RSA. O teste foi composto por seis sprints de 40 m (ida/volta = 20 m + 20 m), separados por 20 s de recuperação passiva com três condições experimentais: enxágue bucal com carboidrato (CHO) ou placebo (PLA) e controle (CON). O enxágue bucal com CHO ou PLA foi conduzido 5 min antes e imediatamente antes do início dos testes em doses de 100 mL. O tempo do melhor sprint (RSAbest), a média de tempo dos sprints (RSAmeyn) e o índice de fadiga (IF) foram determinados nas diferentes condições experimentais. ANOVA one-way para medidas repetidas não identificou diferenças significantes ($P > 0,05$) para RSAbest (CHO = 7,30 ± 0,31 s; PLA = 7,30 ± 0,30 s; CON = 7,26 ± 0,16 s), RSAmeyn (CHO = 7,71 ± 0,30 s; PLA = 7,71 ± 0,25 s; CON = 7,66 ± 0,24 s) e IF (CHO = 5,58 ± 2,16%; PLA = 5,77 ± 3,04%; CON = 5,55 ± 3,72%). Os resultados sugerem que o enxágue bucal com CHO não parece capaz de melhorar o desempenho, sobre sprints repetidos, de jovens jogadores de futebol.

Palavras-chave: Desempenho Atlético; Ergogênico nutricional, Futebol, Resistência.

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INTRODUCTION

Rinsing the mouth with a carbohydrate (CHO) solution has recently been proposed as a strategy that apparently shows beneficial effects on high-intensity exercise performance ($>75\% \text{VO}_{2\text{max}}$)^{1,2}. The mechanisms of action of CHO mouth rinse are probably related to the activation of brain regions responsible for motivation by the simple presence of CHO in the mouth^{3,4}. Therefore, a CHO mouth rinse may be used to improve athletic performance during training and matches in different sport disciplines (individual and collective).

Soccer is a discipline that may benefit from CHO mouth rinses since it is characterized by high- and low-intensity intermittent exercises. Although low-intensity exercises predominate in this sport, a greater efficiency of anaerobic metabolism would contribute decisively to athletic performance⁵. Within this context, repeated sprint ability (RSA), defined as the ability to perform short-duration sprints^{6,7}, shows a close relationship with the distances run at high-intensity ($>19.8 \text{ km}\cdot\text{h}^{-1}$) during matches⁸. In addition, this variable is able to discriminate between different competitive levels and different tactical positions, particularly in soccer⁹. Some tests have been proposed for the evaluation of RSA¹⁰ and specific sprint trainings have been recommended to improve RSA by increasing the systemic physiological load^{11,12}.

In view of the above considerations, we believe that CHO mouth rinse can improve performance in a specific soccer test through the activation of brain regions related to motivation and reward and may be of fundamental importance under conditions of training and during competitions. Therefore, the objective of the present study was to evaluate the effect of a CHO mouth rinse on the performance of young soccer players in a repeated sprint test. The main hypothesis was that the CHO mouth rinse improves performance variables in this type of test.

METHODOLOGICAL PROCEDURES

Subjects

The initial sample consisted of 12 athletes from an under-15 soccer team participating in state and national competitions. Criteria for inclusion in the study were experience of at least 2 years in the discipline and no use of anabolic steroids or nutritional supplements (this information was obtained by interview). During data collection, three athletes did not attend one of the sessions and were therefore excluded from the analysis. The final sample consisted of nine athletes (15.0 ± 1.5 years; 60.7 ± 4.84 kg; 1.72 ± 0.05 m; $20.5 \pm 1.25 \text{ kg}/\text{m}^2$).

The analyses were performed at the end of the pre-season, a period characterized by a predominance of physical training. All subjects received detailed information about the objective and procedures of the study and signed the free informed consent form together with their legal guardian.

The study was approved by the Ethics Committee of Universidade Estadual de Londrina (Protocol No. 242/09) and was conducted according to the guidelines on research involving humans of Resolution 196/96 of the National Health Council.

Study design

Four visits to the site of data collection were performed. Anthropometric measurements (body weight and height) were obtained during the first visit. On the subsequent visits, RSA tests were applied randomly under three different conditions: mouth rinse with a carbohydrate drink (CHO) or placebo (PLA) and control (CON). The subjects were assigned randomly in a double-blind fashion to receive the mouth rinse. The drinks were prepared by one of the researchers, who was also responsible for randomization of each subject to the treatments. The tests were performed at a minimum interval of 72 h.

Each subject underwent the tests under the three experimental conditions, always at the same time of the day to avoid a possible influence of the circadian cycle. The subjects were asked not to consume caffeinated substances during the 24 h preceding each test session.

Repeated-sprint ability test

Prior to the beginning of the RSA test under each experimental condition, the athletes underwent a standard warm-up. Five minutes after the end of the warm-up, the subjects were submitted to six sprints of 40 m (going/return = 20 m + 20 m), separated by 20 s of passive recovery^{8,9}. For each sprint, the athletes were positioned behind an imaginary line delimited by a photocell (Multi Sprint, Hidrofit[®]) coupled to a computer. At the signal of the examiner, each subject sprinted 20 m, touched a line delimited at the end of these 20 m with his feet, and ran back to the starting line as fast as possible. The same procedure was repeated until the six sprints were completed. The best sprint time (RSAbest), mean sprint time (RSAmean), and drop-off in performance over the sprints (fatigue index, FI) were recorded. The FI was calculated using the following equation: $FI = ((RSA_{mean}/RSA_{best}) * 100) - 100$. All tests were carried out on the soccer field where the athletes usually trained.

Prior to the study, the subjects were familiarized with the experimental protocol in order to minimize the effects of learning and to guarantee reliability of the test. During all sessions, the subjects were encouraged to give their best performance.

Carbohydrate mouth rinse

For the mouth rinse, the participants received approximately 100 mL artificial grape juice (0 g CHO) with or without the addition of a CHO solution (6% maltodextrin). The CHO was dissolved only 5 min before the beginning of the test session (RSA test) and immediately before the first sprint. The subjects were asked to move the tongue while the drink remained in

the mouth (approximately 10 s) and then to spit out the solution. The three treatments (CHO, PLA, and CON) were tested randomly. The procedure was double-blind for the CHO and PLA treatments.

Statistical analysis

The data were stored and analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, version 17.0). Normality of the data was confirmed by the Shapiro-Wilk test. Variables that did not meet the sphericity assumption as indicated by Mauchly's test were adjusted by Greenhouse-Geisser correction. One-way analysis of variance (ANOVA) for repeated measures was used for comparison between the three experimental conditions. A level of significance of $P < 0.05$ was adopted.

To increase the precision of data analysis, the statistical power of the sample was calculated based on RSA_{mean} in the RSA test. The values reported by Buchheit et al.¹³ were used as comparison parameters. The statistical power of the present sample was 90%. In addition, magnitude-based inferences were analyzed¹⁴. For this purpose, the chance that an effect is beneficial or harmful was calculated. Thus, changes were assessed qualitatively as follows: <1% = most unlikely; 1-5% = very unlikely; 5-25% = unlikely; 25-75% = possibly; 75-95% = likely; 95-99% = very likely, and >99% = most likely. When the negative and positive values show results higher than 10%, the inference is inconclusive.

RESULTS

Table 1 shows the performance variables in the RSA test under the three experimental conditions. No significant difference in any of the three variables analyzed (RSA_{best}, RSA_{mean}, and FI) was observed between the three treatments ($P > 0.05$). Qualitative inference showed that the differences in the three variables between the CHO and PLA groups were irrelevant (Table 1).

Table 1. Performance in the repeated sprint ability test under the different experimental conditions (n = 9).

		Mean	SD	95% Confidence interval		Magnitude (positive/ irrelevant/ negative)	Qualitative inference
RSA _{best} (s)	CHO	7.308	0.3195	7.062	7.553	CHO vs. PLA	Inconclusive
	PLA	7.302	0.3019	7.070	7.534	26.4%/40.4%/33.1%	
	CON	7.261	0.1698	7.119	7.403		
RSA _{mean} (s)	CHO	7.713	0.3021	7.481	7.945	CHO vs. PLA	Inconclusive
	PLA	7.719	0.2574	7.521	7.917	30%/40.8%/29.2%	
	CON	7.662	0.2474	7.455	7.869		
FI (%)	CHO	5.586	2.1610	3.918	7.253	MRCHO vs. MRPLA	Inconclusive
	PLA	5.777	3.0468	3.435	8.119	45.8%/35.4%/29.6%	
	CON	5.557	3.7271	2.441	8.673		

RSA_{best} = best sprint time; RSA_{mean} = mean sprint time; FI = fatigue index; CHO = mouth rinse with carbohydrate; PLA = mouth rinse with placebo; CON = control. No significant difference was observed between the three experimental conditions ($P > 0.05$).

Figure 1 illustrates the mean sprint time in each of the six sprints in the RSA test under the three experimental conditions. Again, no significant difference was observed between treatments ($P > 0.05$).

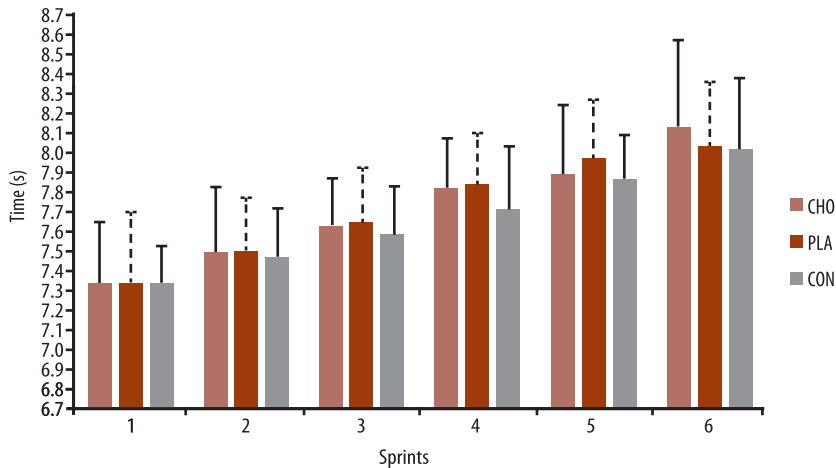


Figure 1. Mean sprint time in each of the six sprints in the repeated sprint ability test under the different experimental conditions (n = 9). There was no significant difference between the three treatments in any of the six sprints ($P > 0.05$). CHO = mouth rinse with carbohydrate; PLA = mouth rinse with placebo; CON = control.

DISCUSSION

Although our hypothesis was that a CHO mouth rinse would improve the performance of young soccer players in the RSA test, the present results did not confirm a possible ergogenic effect of this strategy on the variables analyzed. The present hypothesis was formulated based on the study of Gant et al.¹⁵ which demonstrated an increase in the frequency of motor evoked potentials due to increased cortical excitability after ingestion of a CHO solution. In this respect, the passage of CHO in the mouth would activate specific cortical areas (e.g., insular cortex) which increase the excitability of the motor cortex through integrated pathways, thus improving performance in some types of exercise^{3,4,13}. We believe that a CHO mouth rinse would be effective not only in aerobic events, but also in anaerobic events. However, little is known about the mechanisms underlying the improvement of performance induced by CHO mouth rinses^{3,4}.

The present results agree with previous studies that were also unable to identify improvement of performance in predominantly anaerobic, short-duration exercises such as maximal strength and strength endurance exercise¹⁶, or in a single sprint (30 s) effort on a cycle ergometer (maximum and mean power output)¹⁷ after administration of a CHO mouth rinse. Unfortunately, the design of the present study does not permit to infer on possible activation or not of cortical areas induced by CHO mouth rinse. However, variables such as the concentration of CHO and its route of administration were controlled in the present study as suggested in the literature for CHO mouth rinses¹, since this is one of the main limitations of most field studies. We found no study reporting that different CHO concentrations had been

tested in experiments on CHO mouth rinse, a fact that could generate different gustatory sensory information to the central nervous system.

More recently, Fares and Kayser¹⁸ investigated the effect of previous fasting and ingestion of a CHO-rich diet (6% maltodextrin) 3 h before CHO mouth rinse on the performance of non-athletes cycling on a cycle ergometer at a constant load (60% W_{max}) until exhaustion. The authors observed improvement of performance in the two conditions, particularly in the fasted state (~10%) when compared to the fed state (~3%).

Since the statistical methods usually employed for the analysis of athletic performance in different motor tasks are often not sufficiently sensitive to detect important changes, we used additional methods as proposed by Hopkins et al.¹⁴ which are based on the magnitude of the differences observed. However, qualitative inference of the variables of the RSA test was inconclusive for the different conditions investigated. It is important to note that the test used in this study is a specific test for soccer athletes, which is able to distinguish athletes of different training levels and playing positions⁹, as well as to predict the performance of soccer players^{6,7,19}. Although the present results indicate that a CHO mouth rinse does not seem to improve performance in the RSA test, probably because of its maximum characteristic (all-out) and of the short duration of the stimulus, the importance of CHO mouth rinse in soccer cannot be ruled out, particularly in situations that more closely resemble a competition. In this respect, controlled studies investigating the effect of CHO mouth rinse in small-sided games may provide important data on the relationship between this strategy and soccer. We emphasize the importance of better control of training load prior to the sessions, biological maturation (study of young people), and the use of food records for further studies.

CONCLUSION

The results of the present study suggest that a CHO mouth rinse does not improve the repeated sprint performance of young soccer players.

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