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Original Research Article

Pre-Exercise ORS Drink and Muscle Efficiency by Bicycle Ergography

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Abstract:

Introduction: The main issues observed during an extended exercise session are dehydration, substrate, and electrolyte depletion. Because oral rehydration solution (WHO) contains water, carbohydrates, and electrolytes that help postpone weariness, it can be quite beneficial for people participating in longer-term exercise programs. It has been discovered that skeletal muscle adaptations throughout an individual's exercise performance are mediated in part by nutrition. Water, electrolytes, and carbohydrates all contribute to better workout performance. Our study's objective is to measure the muscle efficiency metrics of male students who exercise on a bicycle ergometer until they become fatigued while receiving oral rehydration solution (WHO) prior to the exercise session.

Materials and Methodology: This cross-sectional investigation was carried out in the physiology department's research lab at Coimbatore Medical College in Coimbatore. In seven sessions, around fifty male adults engaged in cycling activity on a bicycle ergometer at 50, 75, and 100 watts of intensity, both with and without ORS consumption prior to the exercise. Energy expenditure, cycling distance and duration, and VO2max were among the parameters that were recorded.

Results: A master chart was created using the information gathered from the chosen subjects. The software SPSS 22 was used to calculate the mean, standard deviations, and 'p' values. ANOVA and the unpaired "t" test were employed to compare the parameters. The comparison of values before the start of cycling exercise with and without ORS consumption revealed a significant correlation.

Conclusion: According to bicycle ergometry, the current study shows that after ORS ingestion and exercise, the muscle efficiency metrics like RPP, METs, and VO2 max values rise. ORS works well as a water, electrolyte, and carbohydrate supplement, delaying the onset of muscle tiredness and boosting muscle function. In contrast to other commercial sports drinks, ORS is devoid of preservatives and can be made fresh. It is an affordable method of rehydrating before exercise to replenish electrolytes, carbohydrates, and water.

Keywords: Muscle Efficiency, Calories, Exercise.

Introduction

A structured, repetitive, and planned physical activity is called exercise. Enhancing or maintaining physical fitness is the ultimate or intermediate goal of exercise. [1] The maximum amount of oxygen that a person's body can consume while engaging in progressive activity is known as their aerobic power. This indicates a person's level of physical fitness.

The best measure of cardiovascular fitness and maximal aerobic power is thought to be VO2max. It involves a graded workout on a treadmill or cycle ergometer, where the intensity of the exercise is gradually increased while ventilation and the levels of oxygen and carbon dioxide in the air that is inhaled and exhaled are measured. [2] There is a natural connection between exercise and diet. Appropriate nutrition is the fundamental basis for physical performance. Although many people think that a well-balanced diet is enough to improve exercise performance, nutrients also give energy and regulate physiological processes related to exercise. Numerous studies have demonstrated the critical role that nutrition plays in mediating skeletal muscle adaptations during an individual's exercise performance. The primary substrates that drive the prolonged muscle contractions observed during endurance exercise are lipids and carbohydrates.

A person's aerobic capacity is one of the most accurate measures of his or her cardiorespiratory fitness. Appropriate cardiorespiratory function effects can be produced by an exercise program done 3-5 times a week, for 20-60 minutes per session, at an intensity of about 50 - 85% of VO_2 max. [3] The main issues that arise during an extended exercise session are dehydration,

substrate, and electrolyte depletion. In order to increase the storage, it is therefore imperative to replenish these chemicals before to activity. Oral rehydration solution (WHO) administration can be quite helpful for people who participate in longer-term exercise programs. Water, electrolytes like salt, potassium, and chloride, and carbohydrates like glucose are all present in ORS. [4] Our study's objectives are to measure muscle efficiency metrics by having male individuals exercise on a bicycle ergometer until they are exhausted while receiving oral rehydration solution (WHO) and to compare the Rate Pressure Product before activity with and without ORS ingestion. Also, to compare the VO2 max values without and with ORS ingestion before exercise.

Materials & Methodology

Over the course of a year, this cross-sectional study was conducted at the research laboratory of the department of physiology at Coimbatore Medical College. After gaining agreement to take part in the study, roughly fifty adult male subjects were enlisted. Before the study started, approval from the institute's ethical committee was acquired. The study comprised healthy guys between the ages of 18 and 25. Women, people with diabetes mellitus, smokers, anemia, and high blood pressure.

People using medications to treat any kind of ailment. Those who declined to participate in the study were not included. The results of the clinical examination were recorded and a thorough history was taken using a proforma. A pre-test questionnaire was supplied to the subjects in order to evaluate their cardiopulmonary profile and nutritional condition.

Every physical characteristic was noted. For at least two weeks before the trial, subjects are asked to refrain from using any dietary supplements or ergogenic aids. Additionally, during the trial, subjects are urged not to take any of the supplements. Six sessions were used to evaluate the subjects. Without consuming ORS, the subjects engaged in cycling exercises on a bicycle ergometer during the first session. Before they could continue cycling at a moderate range of Borg criteria, they exercised at 50 watts of power and 60 revolutions per minute. If the individuals had any problems, such as lightheadedness, trouble breathing, or excessive exhaustion, they were instructed to stop the exercise.

Additionally, the following parameters were noted. Energy use (c), total distance (in kilometers) traveled. The patients' cycling duration (measured in minutes) remained within the moderate range of the Modified Borg Criteria (110–130 beats per minute). Subsequent sessions III and IV used 75 watts, while sessions V and VI used 100 watts. The subjects were invited to attend the last session so that their VO2max could be recorded. The participants completed a sub-maximal test that lasted five to six minutes and a six-minute cycling exercise. Then the Astrand Ryhming Nomogram was used to plot the VO2max.

The watts were plotted against the maximal heart rate at which the person can cycle to maximum limit and the VO2max value was obtained from graph. SPSS version 22 was used for statistical analysis once all the data had been gathered and entered into a Microsoft Excel sheet. The 'p' values, mean, and standard deviations were computed. The mean values of cycling metrics, such as distance, time, and energy expenditure, were compared using the unpaired "t" test. VO2max was computed and mean values were obtained from the fundamental parameters. The correlation coefficient of Pearson was computed. A significant association was defined as one with a 'p' value less than 0.05.

Results

The study had 50 male participants in total. Their own controls were the subjects. Of these, four respondents were obese, twenty-one were overweight, and twenty-five males had a normal BMI.

The study population's average age was 21.58. The average height was 152.3 and the average weight was 59.16. The BMI was 25.56 on average. The average age of the 50 participants in the study was 21.58 years old. Their average height was 152.3 and their average weight was 59.16. They had a mean BMI of 25.56.

Table 1: Comparison of cycling distance

Sessions	Normal		Overweight		OBESE		p Value
	Mean	SD	Mean	SD	Mean	SD	
50 w without ORS	2.60	0.56	2.96	1.26	2.85	0.31	
50 w with ORS	2.95	0.53	3.03	0.70	3.30	0.37	0.047*
75 w without ORS	2.52	0.49	2.61	0.55	2.7	0.25	
75 w with ORS	2.67	0.45	2.82	0.48	2.87	0.33	0.000*
100 w without ORS	2.01	0.39	2.02	0.52	2.27	0.22	
100 w with ORS	2.35	0.45	2.24	0.46	2.5	0.21	0.000*

The cycling distances for 50 Watts sessions I (without ORS) and II (with ORS) differed significantly. The groups were therefore comparable. The riding distances for 75-watt sessions III (without ORS) and IV (with ORS) and 100-watt sessions V (without ORS) and VI (with ORS) differed significantly.

Table 2: Comparison of energy expenditure (in calories)

Sessions	Normal		Overweight		OBESE		p Value
	Mean	SD	Mean	SD	Mean	SD	
50 w without ORS	225.95	77.88	233.92	76.29	171.50	20.27	
50 w with ORS	250.10	75.25	250.92	78.45	195.75	32.98	0.047*
75 w without ORS	221.90	71.71	227.04	66.23	182	29.08	
75 w with ORS	233.19	70.35	232.52	69.03	204	32.58	0.001*
100 w without ORS	186.19	51.05	185.16	48.6	151.50	26.71	
100 w with ORS	200.67	53.25	197.4	46.54	167.75	26.76	0.000*

The energy expenditure for 50 Watt sessions I (without ORS) and II (with ORS) differed significantly. The groups were therefore comparable. Similarly, a substantial difference in energy expenditure was observed between 75 watt sessions III (without ORS) and IV (with ORS), as well as between 100 watt sessions V (without ORS) and VI (which included ORS).

Table 3: Comparison of cycling duration

Sessions	Normal		Overweight		OBESE		p Value
	Mean	SD	Mean	SD	Mean	SD	
50 w without ORS	11.90	3.59	13.56	4.84	13.50	1.91	
50 w with ORS	14.95	4.00	15.84	5.03	17.75	2.98	0.000*
75 w without ORS	13.62	3.59	13.96	3.92	15.75	2.98	
75 w with ORS	16.19	3.91	16.68	3.81	18.25	2.5	0.000*
100 w without ORS	11.10	3.53	11.20	2.82	12.25	2.5	
100 w with ORS	13.05	3.90	12.32	2.73	13.75	1.89	0.000*

There was significant difference in cycling duration between 50 Watts session I (without ORS) and session II (with ORS). Hence the groups were comparable. Similarly there was significant difference in cycling duration between 75 watts session III (without ORS) and session IV (with ORS) and 100 Watts session V (without ORS) and session VI (with ORS).

Table 4: Comparison of VO2max in session without ORS and with ORS

Sessions	Normal		Overweight		OBESE		
	Mean	SD	Mean	SD	Mean	SD	p Value
Without ORS	2.25	0.21	2.16	0.46	2.17	0.17	
With ORS	2.52	0.23	2.46	0.20	2.40	0.08	0.000*

The mean VO2max values between the cycling sessions without and withORS was statistically significant with a p value <0.001.

Discussion

The current study demonstrates the connection between the improvement in muscle efficiency at varying exercise intensities during cycling activity on a bicycle ergometer and the administration of oral rehydration solution. Compared to when exercise was performed without any prior ORS consumption, the energy expenditure, cycling duration, and distance cycled improved during the exercise session after ORS administration. Performance has improved as a result of the delay in muscle exhaustion, which has raised muscular efficiency. This results from the muscles absorbing more glucose and storing it as glycogen. Muscle tiredness can be postponed by using this glycogen during activity. The muscles used for exercise are oxidizing glucose at a higher rate. The study by Preetesh Parakh et al. [5] on male medical students who exercised on a bicycle ergometer in two sessions, separated by one week, is in good agreement with this one. Thirty minutes prior to exercising in the second session, the subjects drank a glucose drink. In both sessions, the amount of work completed, the time to tiredness, and the overall distance traveled were recorded. There was a significant difference in the time to fatigue with 12.09 ± 7.42 minutes, work done 6964.00 ± 4517.96 J, total distance travelled in the first session was 2.12 ± 1.54 km and in the second session with greater values than in the time to fatigue 7.09 ± 4.96 minutes, work done 4305.33 ± 3065.19 J, and total distance travelled was 3.55 ± 2.42 km in the first session with p values <0.001 which was highly significant. This

study showed that performance is better and time to fatigue is delayed in exercise performed after ingestion of glucose drink [6]. Studies by Ricardo G. Fritzche et al. examined the effects of consuming water and carbohydrates when participants rode a bicycle ergograph for extended periods of time and their Pmax—maximum neuromuscular power—was assessed. For 122 minutes, eight endurance-trained cyclists rode at 62% VO2max. This study supports my research, which found that consuming water and carbs prior to exercise has significant advantages. [7,8]

The mean values for VO2max during cycling without ORS administration among the normal group was 2.25 +/- 0.21 and in the cycling session with ORS administration was 2.52 +/- 0.23. This was found to be statistically significant with a p value < 0.01. This shows that there is an increase in the maximal oxygen uptake following cycling with ORS ingestion. The mean values for VO2max in the overweight group in session I (without ORS) was 2.16 +/- 0.46 and in session II (with ORS) was 2.46 +/- 0.20. This was also statistically significant with a p value < 0.01. The mean values for VO2max in obese subjects without ORS was 2.17 +/- 0.17 and in cycling session with ORS was 2.40 +/- 0.08. This was found to be statistically significant with p value < 0.01.

The increase in the VO2max values following ORS ingestion is due to the increase in the oxygen consumption by the exercising muscles, while performing the six minute submaximal cycling exercise protocol.

This finding is consistent with a study by Tarnopolsky, M.A., et al. that found that when volunteers consumed protein supplements that contained carbohydrates during recovery after an earlier session, they were able to cycle 55% longer at 85% VO2max compared to a sports drink that had only carbohydrates. When compared to the latter carbohydrate-only group 9, the participants in the former group exhibited 26% greater functional muscle glycogen.

Research by Mona Kharbanda et al., which evaluated the physical fitness of medical students who engaged in brief, limited-duration exercise on a bicycle ergograph using a Physical Activity Rating scale and VO2max, showed a strong correlation with the current study. There was a positive correlation between physical fitness score and normal BMI value. The study also showed that aerobic capacity of an individual improves with training [3].

This description of the subject's regular physical activity served as the basis for a subjective assessment of his degree of fitness. For well-trained, moderately-trained, and untrained participants, respectively, beginning work loads of 150W, 100W, and 75W at 50 pedal rotations per minute were employed. The nomogram was used to determine the expected VO2 max (I. Astrand, 1960). The VO2max values in the current investigation were 2.25 L/min without prior ORS administration and 2.52 L/min with prior ORS administration, respectively [10,11].

Conclusion

The statistically significant values of cycling duration, cycling distance, and energy expenditure demonstrate that there is an increase in muscle efficiency when an individual is properly hydrated and adequately nourished with carbohydrates and electrolytes before engaging in physical activity. After consuming ORS before cycling, the VO2max readings increased. This indicates an increase in aerobic capacity, or an increase in oxygen uptake as a result of the working muscles' enhanced efficiency. All of these results show that using an oral rehydration solution before engaging in cycling activity increases the muscles' absorption of glucose and electrolytes.

Additionally, the working muscles boost their oxidation of glucose. By preventing dehydration, the fluid consumed in conjunction with electrolytes and carbohydrates helps to postpone muscular exhaustion. As a result, ORS works well as a water, electrolyte, and carbohydrate supplement, delaying the onset of muscle tiredness and boosting muscle function. In contrast to other commercial sports drinks, ORS is devoid of preservatives and can be made fresh. It is an affordable method of rehydrating before exercise to replenish electrolytes, carbohydrates, and water.

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