

# Is Carbohydrate Mouth Rinsing a Novel Approach to Maintain Exercise Performance during Ramadan Fasting?

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## ABSTRACT

About a decade ago, carbohydrate mouth rinsing was shown to enhance endurance exercise performance. This improvement was more pronounced in a fasted compared to a fed state, suggesting that the ergogenic effect of carbohydrate mouth rinse is dependent on endogenous carbohydrate storage. Hence, indirectly highlights the potential use of carbohydrate mouth rinse as a potential strategy to mitigate the adverse effects of exercise during Ramadan fasting. To date, only one study has been carried out to explore the potential benefit of carbohydrate mouth rinse on exercise performance during Ramadan fasting. This single observation showed that a 10-km time trial performance was enhanced when performing mouth rinsing with either a carbohydrate or a placebo solution as compared with not performing mouth rinsing. While one study had acknowledged that the practice of mouth rinsing do have a positive effect on exercise performance during Ramadan fasting, future studies is warranted in order to have a better understanding on the underlying mechanisms associated with carbohydrate mouth rinsing during Ramadan fasting.

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## Introduction

During the Islamic holy month of Ramadan, healthy able-bodied Muslims perform the religious fasting ritual (i.e., Ramadan fasting) in which they refrain from drinking and eating from sunrise to sunset on a daily basis for 30 days. There is no doubt that the restriction of food and fluid intake from fasting during Ramadan, accompanied with alteration in sleeping pattern can be a real challenge for Muslim athletes to perform at their optimum level. Extensive research of the effect of Ramadan fasting on various aspects of exercise performance remains inconclusive. Performance of brief period of exercise such as 30-seconds repeated jump and 5 to 30-meter sprint has been shown to be not affected by Ramadan fasting (1). On the contrary, Ramadan fasting has been shown to cause detrimental effect on prolonged high intensity, submaximal aerobic exercise and progressive incremental exercise to exhaustion (2, 3). In order to minimize the negative effect of Ramadan fasting on exercise

performance, various strategies have been formulated which includes alteration in nutritional practices and changes in daily life style practices such as sleep pattern (1,4). In addition, rescheduling athlete's training session to early evening following the break of fast or even in the late afternoon, which is prior to the break of fasting is recommended to the athletes as a strategy allowing them to maintain their level of exercise capacity (5).

### ***Carbohydrate mouth rinsing***

In recent years, several review papers have highlighted the potential ergogenic benefit of carbohydrate mouth rinsing on endurance exercise performance (6, 7). It was the initial work of Carter and his colleagues (2004) that first explored the potential of carbohydrate mouth rinse in enhancing endurance exercise performance. In their study, Carter and colleagues (2004) observed an improvement in performance time during a 1-hr time trial when

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mouth rinsing a carbohydrate solution (6.4% Maltodextrin) compared with water. They then hypothesized that the improvement in exercise performance when mouth rinsing a carbohydrate solution was associated with the detection of carbohydrate by receptors in the oral cavity which triggered afferent neural signals to the brain that enhances sporting performance (8).

Many studies were carried out since then to explore the potential benefit of carbohydrate mouth rinsing with some reported a positive effect (9-12) while others did not observe any improvement in endurance performance (13,14).

The ergogenic effect of carbohydrate mouth rinse has previously been reportedly to be dependent on endogenous carbohydrate store in the form of liver and muscle glycogen (10,11).

This proposition was based on the observation that exercise performance was enhanced when performing carbohydrate mouth rinsing in a fasted compared to a fed state (11). In the study by Fares and Kayser (2011), a 7% improvement in the time to exhaustion was recorded when performing carbohydrate mouth rinsing during exercise in a preprandial state as compared to a 3% improvement when in a postprandial state. These two observations highlighted the ergogenic effect of carbohydrate mouth rinsing was more pronounced on an empty stomach. Hence, highlighting the potential of carbohydrate mouth rinsing intervention for athletes that train and compete during Ramadan fasting. While the practice of mouth rinsing in a training session during Ramadan fasting had been previously reported (4) as a way to relief the athletes from the stress of the exercise interventions, there was no direct investigation on the potential of carbohydrate mouth rinse practice in enhancing endurance exercise performance during Ramadan fasting.

To date the study by Che Muhamed et al (2014) was the only study that had examined the effect of carbohydrate mouth rinse on exercise performance during Ramadan fasting. In the study by Che Muhamed et al (2014), endurance exercise performance of trained male cyclists were tested during a 30 minutes submaximal exercise followed with a 10km time trial in a hot-humid environment. Two types of

solution used in this study were a 6% commercially available electrolyte beverage (Gatorade, PepsiCo, Chicago, ILL, USA) and an artificial sweetener (aspartame). This study was designed to address if carbohydrate mouth rinse was effective in improving or enhancing exercise performance in a hot-humid environment while undergoing a 10 hrs of fluid and food deprivation during a day in Ramadan. Che Muhamed and colleagues (2014) reported that the performance of the 10-km time trial was better when performing mouth rinsing, regardless of the type of solution as compared to when not performing mouth rinsing. It was interesting to note that cyclists in this study had also reported a reduced perception of effort in performing exercise in a fasting state when performing mouth rinsing. This observation supports the earlier finding by Chamber et al. (2009), that several areas of the brain that is associated with reward stimuli such as Anterior Cingulate Cortex and Orbitofrontal Cortex are activated when performing mouth rinsing.

The finding by Che Muhamed et al. (2014) demonstrated the potential use of mouth rinsing as a strategy to mitigate the adverse effects of Ramadan fasting during endurance exercise in particular when exposed to a heat stress environment. Currently, limited evidence is available to determine if carbohydrate mouth rinsing is as effective during exercise in the heat as previous been shown in temperate conditions of 20°C to 22°C (9-12). Only two studies to date had tested the effectiveness of carbohydrate mouth rinse in enhancing endurance exercise performance in the heat (14,15). Both these studies observed no ergogenic benefit of carbohydrate mouth rinse in enhancing endurance exercise performance when compared to rinsing a placebo solution (14,15). However, in the study of Che Muhamed et al. (2014), it was evident that the practice of mouth rinsing had a positive effect on endurance exercise performance regardless of the type of solution i.e a carbohydrate or a placebo solution.

More studies are needed to fully understand the potential benefit of mouth rinse during exercise. The study by Che Muhamed et al. (2014) did not compare the effect of carbohydrate mouth rinsing between fed state (prior to Ramadan) and fasting state during Ramadan). This comparison is recommended for

future studies, as it will enable us to determine if mouth rinsing is effective in the Ramadan fasting state. As for the application of mouth rinsing during Ramadan fasting, the current evidence suggest the potential benefit yet, a clear understanding on the mechanism of improving exercise performance needs further examination. In addition, the different belief of practicing mouth rinse during Ramadan is an issue that needs clarification from Religious scholars with some saying it is permitted while others ruling it as *Makruh* (meaning the practice is not recommended to perform during the fasting ritual in the holy month of Ramadan).

In conclusion, more studies will need to be carried out in order to explore the potential ergogenic effect of carbohydrate mouth rinsing on athletes performance during the Ramadan fasting.

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