

Effects of Highly Branched Cyclic Dextrin Supplementation on Exercise: A Narrative Review

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Abstract

Highly branched cyclic dextrin (HBCD) is a highly branched polysaccharide produced from waxy maize starch, being a glucose polymer with a molecular mass of between 160,000 and 400,000 g/mol. The purpose of oral supplementation with HBCD is to promote faster gastric emptying in order to perform strength and resistance exercise for longer. The aim of this review is to verify the efficacy of highly branched cyclic dextrin supplementation in exercise. HBCD intake was analyzed in different types of exercise such as resistance, strength and interval training. In conclusion, comment that the intake of HBCD has potentiating effects for the performance of exercise, favoring a greater performance in the time of exercise, as well as a decrease in perceived effort, a faster gastric emptying time, decreased fluid loss body, reducing the levels of proinflammatory cytokines and provides benefits on the immune system.

Keywords: glucose, endurance, rendimiento, carbohydrate.

Introduction

Highly branched cyclic dextrin (HBCD) is a carbohydrate with high molecular weight and low osmolality. HBCD is currently becoming the best performing carbohydrate nutritional supplement at the sports level for both recovery and performance goals. The HBCD is used before, during and after performing resistance and resistance exercise [1].

HBCD is a polysaccharide produced from waxy maize starch, being a glucose polymer that has a molecular mass between 160,000 and 400,000 g/mol highly branched and highly soluble in water [2].

In addition, HBCD has a low osmolality, specifically a 10% HBCD solution contains an osmotic pressure of 9

mOsm, while a 10% glucose solution has 646 mOsm, so it is advisable to use HBCD in sports drinks since it the low osmolality favors a faster gastric emptying time. In a study carried out on 10 subjects [5] showed how a 10% HBCD solution had a gastric emptying time of 26.7 minutes, while the 10% glucose solution showed a gastric emptying time of 39.9 minutes [1].

Currently, there are sports drinks that include HBCD as a carbohydrate source because the gastric emptying time is faster than other carbohydrates (Table 1), which favors that HBCD intake reduces the probability of gastrointestinal disorders during exercise.

The intake of 1.5 g/kg of body weight increases the capacity to perform resistance exercise [3].

Table 1. Gastric emptying time of the carbohydrates solutions.

Carbohydrate	% Solution	Gastric emptying time (min)
Glucose	10%	39.9
Maltose	10%	31.2
Sucrose	10%	24.4
HBCD	10%	26.7

Note. Extracted from Takii H et al. [5].

There are different types of carbohydrates (CHO) used in sports such as glucose, fructose, maltodextrin, sucrose, HBCD (Figure 1). Maltodextrin is widely used in sports drinks as a source of CHO with a sweet taste and relatively low osmolality [4].

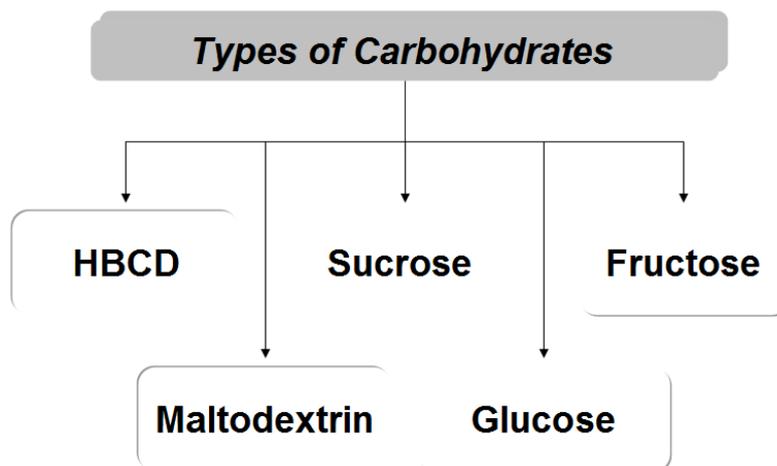


Figure 1. Types of carbohydrates used on exercise.

The objective of ingesting sports drinks is to replace the liquid lost through sweat, in addition to providing energy in the form of CHO, allowing rehydration where the gastric emptying time as well as intestinal absorption will determine its effectiveness [5].

The fatigue that occurs as a consequence of long-term exercise is related both to the decrease in glycogen stores and to dehydration greater than 2% of body weight. The intake of CHO both before and during exercise allows delaying fatigue and consequently improving performance. Therefore, a sports drink used during exercise must contain CHO that has rapid gastric emptying to provide the body with CHO and water quickly [5].

The aim of this review is to verify the efficacy of highly branched cyclic dextrin supplementation on exercise.

Material and Methods

A narrative review study has been carried out with the objective of answering the following research question: What are the beneficial effects of highly branched cyclic dextrin supplementation on exercise?

For this, a search was carried out in databases such as Pubmed and Google Scholar in December 2022. In order to find the largest number of articles possible, the following keywords were used: Highly Branched Cyclic Dextrin, exercise, sport, endurance, strength, athletes.

For the selection of articles, inclusion criteria were used such as: articles published in any country, articles published in English, articles on Highly Branched Cyclic Dextrin supplementation; The exclusion criteria were established: articles with supplementation other than Highly Branched Cyclic Dextrin, articles that do not refer to exercise.

Results

HBCD Supplementation on Endurance Exercise

Drinking an HBCD drink may help maintain fluid loss more effectively than a glucose drink, allowing for greater endurance exercise performance. This fact was confirmed by Chuychai et al. [2] in a study carried out with 13 marathon runners with a solution of 500 ml of water with 1.5 g/kg of body weight of HBCD or glucose running at the anaerobic threshold until exhaustion, those runners who ingested the solution with HBCD performed race time to exhaustion and had less body fluid loss than those who ingested the glucose solution.

Furuyashiki et al. [3] conducted a study comparing the effects of ingesting 15 grams of HBCD and maltodextrin respectively during resistance exercise, resulting in a decrease in the perceived exertion index 30 and 60 minutes after ingestion.

In a study carried out by Suzuki et al. [6] in 7 triathletes a duathlon race was

carried out (5 km run - 40 km bike - 5 km) and another duathlon race was carried out a month later. Of the 7 triathletes, the Control Group drank a drink with glucose and the Experimental Group a drink with HBCD (Experimental Group). Before and after the 2 duathlon races, urine and blood samples were taken. The results obtained showed that the subjects who ingested the beverage containing HBCD had lower levels of norepinephrine and cytokines IL-8, IL-10 and IL-12 after the duathlon tests performed with respect to the subjects who performed the ingestion of the drink with glucose.

In a study with mice [7] the effect of HBCD on endurance swimming in an adjustable current pool was investigated. They were dosed 10 minutes before, 10 or 30 minutes after the start of the swimming exercise with HBCD solution, glucose solution or water. Significant effects were found at a dose of 500mg/kg body weight. The mice that were administered 10 minutes after the start of the swimming exercise with the HBCD solution swam longer than the mice that were administered the glucose solution or water. The mice that were administered the HBCD solution 30 minutes after the start of the swimming exercise swam longer than the mice that were administered water. However the duration was similar in both the solution ingestion group with HBCD as in the glucose solution group. Therefore, the conclusions of the study were that the effects on the improvement of swimming time in the group of mice that were administered the solution with HBCD depended on the ability of the mice to supply glucose, as well as a response lower insulin, delaying fatigue.

In a study in which a 30-minute cycling test [8] was performed on healthy untrained subjects, subjects who drank a 10% HBCD sports drink 10 minutes prior to the test had a shorter time of gastric emptying after ingestion of the drink with respect to subjects who ingested a glucose drink [8].

HBCD Supplementation in Athletes and Interval-Training

The intake of HBCD allows a greater capacity for performance and/or resistance

in athletes with respect to other types of carbohydrates such as maltodextrin and glucose, especially when a subject's diet is low in carbohydrates. Beneficial effects of HBCD intake include decreased perceived exertion during strenuous activity as well as increased exercise time to exhaustion. The intake of HBCD can provide benefits on the immune system in endurance and ultra-endurance athletes, in swimmers [1].

Elite athletes can obtain improvements in performance or resistance to fatigue by taking HBCD. On the other hand, HBCD involves a high cost for amateur athletes who use other cheaper carbohydrates such as dextrose and maltodextrin [1].

In a study conducted by Shiraki et al. [4] HBCD, glucose, or water was administered to swimmers who completed 10 bouts of 5 minutes at 75% with 3 minutes of recovery plus 90% swim to exhaustion. Fatigue in the swimmers who ingested HBCD appeared 70% later than in the swimmers who ingested glucose and water. Swimmers who ate HBCD had higher blood glucose levels during the first bouts than swimmers who ate glucose or water. Therefore, the results show how HBCD improves resistance capacity.

HBCD Supplementation in Resistance Exercise

In a study conducted by Nishimura et al. [9] 10 healthy males ingested 75 grams of HBCD or glucose with 0.6 g/kg of fat-free mass of meat protein with 350 ml of water after a strength training session of all levels muscle groups.

The strength training session consisted of performing 2 upper body exercises performing 3 series of 8 repetitions at 70% of 1RM and 2 lower body exercises performing 3 series of 10 repetitions 10RM with a recovery between series and exercises of 2 minutes. It was determined that the ingestion of meat protein with HBCD did not increase the availability of postprandial amino acids or the myofibrillar fractional synthetic rate with respect to the group that ingested meat protein with glucose. However there was greater muscle signaling in the meat protein group with HBCD [9].

Conclusions and Future Directions

As conclusions of this review, it is highlighted that the intake of HBCD has beneficial effects for the performance of exercise, favoring a greater performance, especially in the performance of interval and endurance exercise. Not only is there a decrease in perceived exertion and a longer time spent exercising, but a faster gastric emptying time is produced, it also provides benefits for the immune system, decreases the loss of body fluids and reduces cytokine levels proinflammatory. The number of studies carried out with HBCD is very scarce in the scientific literature, so more studies are needed on the effects of HBCD on strength, speed, endurance, exercise time, as well as at different intensities.

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