

## **CARBOHYDRATE INTAKE**

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Carbohydrates are found in the diet in sugars, starches and dietary fibers. In fact, dietary fibers are not absorbed and so provide no energy value. Carbohydrates have several advantages compared with fats as the dietary sources:

- They are more rapidly absorbed.
- They maintain blood levels of glucose thereby sparing glycogen and protein from breakdown.
- They replenish glycogen stores in muscle and liver
- They are the only fuel that can be used by the glycolytic system.

## **HIGH CARBOHYDRATE DIETS**

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The diet where carbohydrates (in any form) contribute more than 50% of the total kcal is considered as high carbohydrate diet. If the energy intake of an individual is 2000 kcal, carbohydrate would be at least 1000 kcal, which is provided by 250 g of starch / sugar (carbohydrate yields 4 kcal/g) (~~Table 9.1~~). Athletes involved in endurance events may require much higher energy intakes.

## **EFFECTS OF DIETARY CARBOHYDRATE ON GLYCOGEN STORAGE**

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- For prolonged strenuous exercise, maintenance of muscle glycogen stores is essential. Dietary carbohydrate is necessary to replenish glycogen stores.
- Ingested carbohydrate is a source of blood glucose, from which glycogen is synthesized.
- Ingestion of carbohydrate increases insulin release too, which stimulates the pathway of glycogen synthesis.
- For these above reasons, high carbohydrate diets promote glycogen synthesis.
- Conversely, for rapid weight loss, intake of very low carbohydrate diets that are sometimes advocated popularly, leads to the depletion of glycogen stores in liver and muscle.
- Low levels of muscle glycogen diminish an individual's capacity to perform physical activities that rely heavily on glycogen stores, such as high-intensity exercises or long-duration exercises.

## **GLYCOGEN LOADING**

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The direct relationship between carbohydrate intake and glycogen storage is essential. The technique of glycogen loading or carbohydrate loading or super compensation is popularly used.

The underlying principle of carbohydrate loading is to deplete glycogen stores in the muscles that are most utilized in the activity and then to refill them with a greater amount of glycogen.

About a week before the event, the athlete consumes a low carbohydrate diet (e.g. 2 g of carbohydrate/Kg body weight) and performs high intensity exercise to exhaustion. A few days before the event, the athlete switches to a high carbohydrate diet (e.g. 10 g/kg) and dramatically reduces training intensity, in some cases, to no training on the day before the event.

Training is a necessary feature of this technique. Only those muscles that are trained during the regimen, exhibit enhancement of glycogen storage.

## **CARBOHYDRATE INTAKE BEFORE AND DURING EXERCISE**

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- Glycogen stores are depleted by fasting (including an overnight fast) and may therefore interfere the optimal performance of an individual. So a high carbohydrate meal should be eaten a few hours before an athletic event to replete glycogen stores.
- Within 30 minutes of the onset of physical activity, consumption of a high carbohydrate snack may diminish initial performance because of gastrointestinal distress or transient hypoglycemia, resulting glucose-stimulated insulin release.
- When the same amount of carbohydrate is consumed after the onset of exercise, hypoglycemia does not occur. Because the catecholamines that are released during exercise, suppress the release of insulin and therefore its effect on blood glucose.
- During exercise, muscle metabolizes glucose obtained from the breakdown of its glycogen stores and glucose that it takes up from the blood.
- Glucose is supplied to the blood by the liver through the breakdown of liver glycogen (glycogenolysis) and through the synthesis of glucose from noncarbohydrate sources (gluconeogenesis) as well as by the absorption of ingested carbohydrate from the gastrointestinal system.
- Thus, carbohydrate intake during exercise can mitigate the decline in blood glucose during prolonged activities and bring about a slower depletion of glycogen stores in liver and muscle.

## **POSTEXERCISE CARBOHYDRATE INTAKE**

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Carbohydrate intake is needed to replete liver and muscle glycogen stores. The period immediately after the exercise is optimal for glycogen synthesis, because:

- Blood flow and therefore glucose delivery of muscle is still high.
- Exercise-stimulated uptake of glucose is still high.
- The enzyme glycogen synthesis is more sensitive to insulin in the postexercise period than at other times.

For these reasons, the consumption of a given amount of glucose leads to the formation of more muscle glycogen in the postexercise state than in the resting state. Therefore, glycogen repletion is best served by the consumption of carbohydrate immediately after exercise.