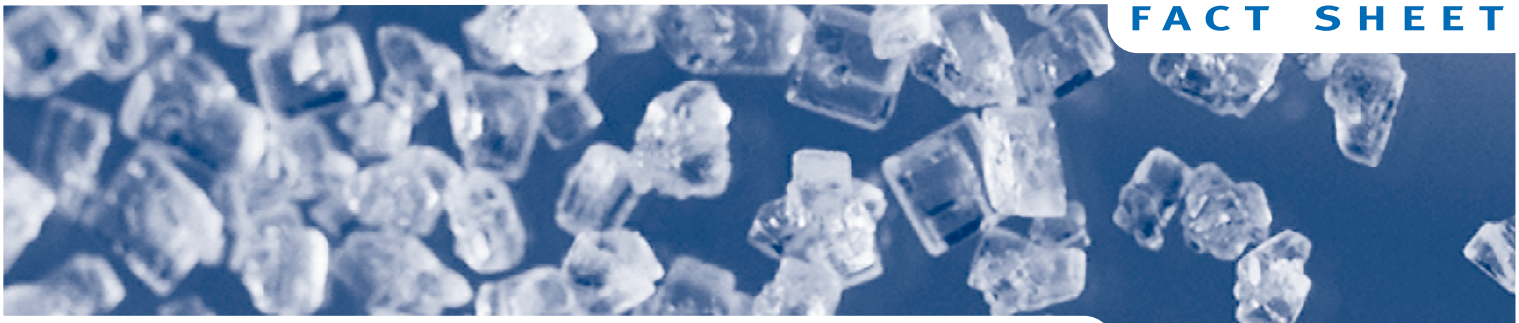

Sugar in the diet of sports people

The right diet is as important as the right amount of training for all sports people. There are benefits to be gained from paying attention to food and fluid intake, for both the serious athlete and those who participate in casual exercise. Diet and nutrition can significantly improve progress, performance and enjoyment during training and competition. Correct nutrition can also reduce the risk of injuries, fatigue and susceptibility to illness.

Dietary carbohydrates provide the major energy source in the diet of most people. For sports people, attention to quantity and composition of carbohydrate in the diet is particularly important. Carbohydrates are provided by a diverse range of foods and drinks and there is no universal system that can adequately describe the diverse metabolic, functional and nutritional features of these various foods. Athletes are encouraged to choose carbohydrate-rich foods and drinks that offer appropriate characteristics such as nutrient-density, glycaemic index, eating appeal and practicality according to the requirements of each sporting situation.[1]

This fact sheet provides an overview of the role of sugar in the diet of sports people. As with all dietary advice, the needs of individuals vary enormously and this is particularly so with sports people. The food and nutrition requirements of an endurance athlete who runs marathons will be quite different to the needs of someone who plays a high intensity sport, such as rugby.

If you are very serious about your sport or are simply feeling that you don't have the energy you need to really enjoy it, you could benefit from one-to-one advice. However, there are some basic principles that apply to everyone and these principles are outlined in this fact sheet.

For more information on sports nutrition visit the Australian Institute of Sport website at: www.ais.org.au, Sport and Recreation New Zealand, www.sparc.govt.nz, and the New Zealand Academy of Sport, www.nzas.org.nz. The New Zealand Dietetic Association (NZDA) has a Special Interest Group on Sports Nutrition which also may be of interest; visit www.dietitians.org.nz

WHERE DOES SUGAR FIT IN THE DIET?

When we exercise our body uses carbohydrates, fats and a small amount of protein as the fuel source. The recommendation for the normal New Zealand diet is that we consume 50–55% carbohydrate, 30–35% or less fat and the rest protein. It is generally recommended that the diet of sports people be made up of mainly carbohydrate, 20–25% from fats and the rest from protein, with the lower fat levels to allow for the increased carbohydrate that is needed.[2]

Carbohydrates can be broadly categorised into two groups; sugars and starches and dietary fibre, both of which are dealt with quite differently by the body.

Sugars and Starches

There are two types; simple sugars (mono and disaccharides) and complex carbohydrates (polysaccharides or starches). Both go through a complicated digestion process to ultimately produce glucose. Sugars include glucose, fructose, lactose, maltose and sucrose (the sugar we put in our sugar bowl). These sugars, and also starches, are found within carbohydrate foods such as breads, cereals, pastas, fruits and vegetables as well as many pre-prepared and ready to eat meals.

Dietary Fibre

Dietary fibre is classified as a non-digestible carbohydrate, however this can be misleading as some dietary fibre is digested. This takes place during fermentation by bacteria in the large intestine rather than in the stomach by normal digestive processes.

These carbohydrates move through the body's system relatively unchanged. Dietary fibre confers many benefits including slowing the release of energy from foods, stabilising blood glucose levels, as well as keeping our digestive tract healthy.

Digestion of Carbohydrate Foods

The digestion process breaks down the sugars and starches into glucose, which provides energy to our body – commonly called blood glucose. Excess glucose is stored in the muscles as glycogen, which is needed by the exercising muscles. If food energy intake is greater than requirements then the excess glucose will be stored as body fat.

The speed of the breakdown of carbohydrate foods into glucose and its subsequent effect on raising blood glucose varies greatly between individuals and is dependent on the overall composition of the food. For example a slice of bread may contain fibre, wheat starch and a small amount of sugar. The breakdown of all these components is interlinked.

Sugars are digestible, small and the least complicated of carbohydrates. Sugar can assist athletes in a number of ways. In particular, sugar is a rapid source of energy, which at certain times in an event or training can be important. Secondly, being an energy-dense food, sugar can be very useful in assisting athletes who have extremely high energy needs. For these athletes the sheer volume of food needed to meet energy and appetite needs can be physically difficult to consume without the use of energy dense foods such as sugar. For example, a female triathlete who has an active training programme might require as much as 4000 kcal per day, almost double an average woman's energy requirements.

An athlete who wants a quick burst of energy during an event might consume a sweet drink or even lollies, where the sugar is rapidly broken down and absorbed. In other cases, where energy is needed over a more extended time period, the sugar might be part of a mixed meal making breakdown and absorption of the sugar slower.

GLYCAEMIC INDEX

The Glycaemic Index (GI) was developed to help rank foods based on their immediate effect on blood glucose levels. The GI is a useful tool for athletes to work out what suits them best for their sport and personal choice. Generally nutritionists now divide foods into those that have a high GI (bread, potatoes, breakfast cereals, glucose-based sports drinks), a moderate GI (sugar, soft drinks, tropical fruit) or a low GI (dairy foods, lentils, legumes, oats

THE GI FACTOR OF COMMON FOODS[3]

HIGH GI>70		INTERMEDIATE GI 55–70		LOW GI<55	
*White Bread, 1 slice	70	Basmati Rice, boiled, 1 cup	58	Baked Beans in Tomato Sauce, 1 cup	48
Medium boiled potato, 1	88	Sucrose, 1 tsp	65	Orange Juice, 1 cup	46
Fruit Roll-up, 1	99	Digestive Biscuits, 2	59	Cooked White Spaghetti, 1 cup	41
Soda Crackers, 3	74	Weet-Bix, 2	69	Snickers Bar, 59g	41

* Note: Bread varies considerably in GI, some are close to 100 and it is difficult to buy bread with a low GI unless it is a wholegrain home-baked or specialty bakery product.

and cold climate fruits such as apples).
Because sugars and some foods tend to have a high GI they can be easily used by an athlete, as part of a balanced diet to help with their performance.
Athletes who need a quick release of energy from their food benefit from consuming high GI foods, while those who need a sustained release of food energy, such as endurance athletes, benefit from consuming low GI foods.
While GI is recognised as a useful tool for athletes, one of the most important things to consider is the total amount of carbohydrate in the diet. Remember, at least half an athelete's energy intake should be provided by carbohydrate foods.
Additionally, food may have low GI but be high in fat. This needs to be taken into consideration if included as a regular part of the diet.

BUILDING ENERGY STORES FOR EXERCISE

As mentioned, excess glucose is stored in the muscles as glycogen. Studies have shown that the amount of glycogen in the muscles at the start of exercise is proportional to the amount of time an athlete can perform before exhaustion or fatigue sets in. It is therefore particularly important for endurance athletes to eat adequately before, during and after exercise to ensure that optimal stores of muscle glycogen are achieved.
Carbohydrate loading for endurance athletes is a means of increasing muscle glycogen stores. It is a strategy that involves changes to training and nutrition patterns three to four days before an endurance event. Carbohydrate loading is appropriate for anyone exercising for 90 minutes or longer and it is estimated that it can improve performance over a set distance by 2–3%.
Muscle glycogen levels are normally in the range of 100–120mmol/kg ww (wet weight). Carbohydrate loading enables the muscle glycogen levels to be increased to around 150–200mmol/kg ww. As a general guide 10g carbohydrate/kg of body weight is used for carbohydrate loading. The extra supply of carbohydrate helps improve performance allowing the athlete to exercise for a longer period of time.
The athlete should reduce exercise levels three to four days prior to the event or competition to optimise the effects of carbo-loading. Many athletes don't achieve the results they have set, by failing to rest prior to competition. As well as rest, it is just as important to ensure they have enough carbohydrate and the right type of carbohydrate in the diet. Including food with higher sugar content allows the athlete to increase the carbohydrate content of the diet without feeling heavy with excessively bulky foods. Adding a little extra sugar to the morning cereal, having muffins without a high fat content and drinking low fat smoothies are all good ways of carbo-loading.
Specialist athletes wishing to achieve optimum results should also consider working with a sports dietitian who can prepare a carbo-loading plan to individual needs.

GETTING THE MOST FROM THE EVENT

Performance and enjoyment of an event will be enhanced if the athlete has the right fuel on board. The appropriate carbohydrate drink or food to consume generally depends on the athlete's previous experience, the type of event, gastrointestinal comfort and the need for fluid replacement. Again, a carbohydrate source of moderate – high GI is more sensible such as a glucose-based sports drink. During the event, the athlete should consume carbohydrate to supply additional fuel and enhance performance. A specially formulated sports drink is likely to be more effective than a standard juice or soft drink.[4]
Adequate hydration is very important as fluid delivers essential energy and electrolytes. Most sports drinks contain sodium (typically 10–30mmol/L), which is not only an important electrolyte replacement, but sodium also aids in the absorption of sugar. Regular top ups of sugar are better than consuming a large amount all at once as small, regular amounts promote hydration, replace glucose levels and enable the digestive system to work more freely.
When exercising or participating in an event over a period of time, say longer than 20 minutes, fluid and energy top ups are needed. Taking small sips of an electrolyte drink is generally most effective. The optimum concentration of carbohydrate will depend on individual circumstances, so trialling different types of sports drinks and foods prior to competing will allow the body to process the source without going into shock in such demanding circumstances.
Studies have shown that the ingestion of glucose during prolonged intense exercise will prevent the development of hypoglycaemia (low blood glucose) by maintaining or raising the circulating glucose concentration.[5]
Research by Williams (1992), cited in Christian and Greger,[6] has also indicated that an improvement in performance is linked to additional fuel during exercise. Studies showed the ingestion of glucose solutions by athletes, who could adjust the running speed on a treadmill while running, had the ability to run at a faster rate during the last 30 minutes of exercise. However, it did not allow the athlete to cover a greater distance.

REBUILDING ENERGY STORES AFTER THE EVENT

Refuelling after exercise or an event is as important as before and during activity. Recovery from exercise is not a passive process. Tissues undergo repair and reproduction, fluid balance is restored and glycogen stores are replaced. Carbohydrate replacement is one of the most important strategies as the muscle enzymes are receptive to glucose. It is essential to provide the enzymes with the ability to restock as soon as possible, but it can only be done if the appropriate source of carbohydrate is present e.g. high GI foods.
Failure to replenish energy stores will result in low muscle stores, which will lead to early fatigue and poor sports performance. Injuries and the onset of illness affect athletes who have low glycogen levels and can occur from 3–72 hours after prolonged exercise (greater than 90 minutes) when immune function may be reduced. To protect against this, having carbohydrate drinks (60g carbohydrate per hour) before, during and after exercise were shown to raise plasma glucose levels.[7]
For athletes who have several competitions in a row, carbohydrate replacement should be a priority. Spacing of carbohydrates is important to reduce the likelihood of gastrointestinal upsets when competing. This means reducing fibre intake by eating white breads and rice and low fibre cereals, as well as reducing fat intake and possibly having a liquid meal before competition.
Examples of high GI foods that could be eaten after an event include; sports drinks, some breakfast cereals, jam sandwiches and jellybeans.

CONCLUSION

To quote the New Zealand Dietetic Association; "It is important to understand there are no magic foods, combinations of foods, or special supplements which on their own promote sports performance or replace the need for a balanced and nutritionally sound diet."[8]
The clear message is that a balanced diet made up of a variety of foods can make a real difference to a sports person's performance and exercise enjoyment. An integral and valuable part of such a diet is sugar. As with all foods, the key message is variety and moderation.

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SRAS Sugar Research Advisory Service

The Sugar Research Advisory Service (SRAS) is a public information service funded by the New Zealand Sugar Company Limited. The SRAS is advised by a panel of independent health & nutrition experts whose role is to review all SRAS-produced information and guide the SRAS on issues of health and nutrition. Contact details are:

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