Here is a good read.

This fact sheet is based on AIS / National team athletes and is therefore specific to these athletes. Written by AIS Sports Nutrition.

Characteristics of the Sport

Distance runners compete over a variety of race lengths, most commonly 10km, 15km, half marathon (21.1km) and the marathon (42.2km). While there is a 10 000m track event, most distance running is done as road races or cross-country runs. 'Fun runs' of various lengths attract community participation, recreational runners joining with elite and club-level runners. Ultra-distance races such as 50 mile, 100km, 100 mile and 24 hour races are also becoming increasingly popular.

Training

Elite distance runners will typically train 6-7 days a week, often twice a day, with weekly training loads of up to 160-200km/week, depending on their phase of training and the events they are targeting e.g. 10km Vs marathon. Training may include speed/interval/threshold sessions, 1-2 longer runs, as well as easy/recovery runs. Some runners will also do strength/core work in the gym.

Competition

Elite runners will compete in a number of races of varying distances each year, with a few key races being chosen for full preparation and peaking. They may compete weekly over a season of road races (summer), or cross-country runs (winter), treating many of these as hard training sessions. Marathon runners are unlikely to compete more than once or twice in a year over this distance. Distance running is predominantly an aerobic activity, with elite male athletes running from well under 30 minutes for 10km, to just over two hours for the marathon.

Physical Characteristics

Most elite runners have low total body weights, being small in stature and lightly muscled, particularly in the upper body. These physical traits are important given they have to carry their body weight over many kilometres. Distance runners also typically carry very low body-fat levels.

Common Nutrition Issues

Fitting in the fuel

Many elite distance runners will combine full/part time work or study with their training commitments. This, combined with the large volume of training undertaken, can make it difficult for athletes to meet their daily fuel (carbohydrate) requirements. A poorly planned diet and/or one that places too much emphasis on protein rich or high fat food choices will result in inadequate repletion of muscle glycogen stores. This may have a negative

impact on training performance and recovery, especially if this period of inadequate refuelling goes on for long periods of time.
The runners carbohydrate intake should reflect their daily training load i.e. more for harder training days, less on easy/recovery days. A useful strategy is to establish a dietary routine which emphasises nutrient dense carbohydrate rich foods that meets the fuel demands on an easy training day. On heavier loading days, where fuel requirements are increased, additional carbohydrate rich foods can be orientated around training to enhance performance during or recovery after the session. For example, consuming sports drink/gels during a long run and a carbohydrate rich snack soon after finishing.

Optimising recovery

Running will not only challenge the runners carbohydrate stores, but also cause some damage to muscle fibres, which will delay recovery. Strategic intake of carbohydrate rich food soon after training will enhance the rate of muscle glycogen repletion and make it easier for athletes to consume enough carbohydrate before their next training session. This is especially important when they are undertaking two training sessions/day. Including a small serve of protein at this time may further enhance the recovery process, as well as promote more positive adaptations from the session. These recovery goals can be met by consuming a regular meal e.g. bowl of cereal, or if training/racing away from home, a portable, non perishable snack e.g. liquid meal supplement, can of creamed rice.

Fuelling early morning training

Many runners will train early in the morning, either out of habit or simply due to other commitments, making it difficult to consume any food/fluid prior to the session. The decision on whether to consume any carbohydrate rich food/fluid at this time should be guided by the type of training being undertaken. If doing a quality session e.g. intervals, the athlete should aim to maximize carbohydrate availability with intake of an easily digested carbohydrate rich snack e.g. toast with honey, or fluid before or consume carbohydrate e.g. sports drink/gel, during the session. If, however, the goal of the run is simply to put "miles in the legs", some water before and during may suffice, and may even enhance the physiological response from the session.

Iron Deficiency

Distance runners, particularly females, are at a high risk of low iron status secondary to both increased losses e.g. in sweat, from gastrointestinal bleeding, red blood cell damage, and/or poor intake of iron rich foods. The latter is particularly a concern for "fussy meat eaters" or those on an energy restricted diet. Unfortunately, it is becoming increasingly common for athletes to self prescribe iron supplements in the belief it may provide a performance edge or to counter the feelings of fatigue associated with the heavy training loads. However, athletes need to be aware that supplementation will only be of benefit when a recognized deficiency exists. Indeed, excess iron intake may compromise immune function and in susceptible individuals, lead to iron overload or haemochromatosis (See factsheet on Iron).

Gastrointestinal Problems

Many runners report gastrointestinal problems e.g. stomach cramps, diarrhoea, during hard runs, particularly races. The cause of these problems is largely unknown, but it seems to be related to the intensity of the running, the stress of competition, hydration status, or the type and volume of food consumed before the run. Often, it is best to run on an empty stomach, with the pre-race/training meals eaten well in advance. If this is not practical e.g. early morning session/race, a sports drink or gel taken before or during the run may be advisable. Choosing low fibre foods and/or replacing meals with liquid meal supplements the day before hard training sessions or important races may also help alleviate concerns.

Race day fluids and fuel

The goal of food and fluid intake prior to racing is to top up fuel stores and optimise hydration status. Therefore the foods and fluids consumed should be ones that are rich in carbohydrate and low in fat, fibre and protein. Some practical examples may include toast/plain muffins with jam or honey or pancakes/pikelets with maple syrup. Liquid meal supplements provide a compact and quickly digested alternative to solid food in situations where time is scarce or pre-race nerves are a problem.

Fuel and food requirements during the race will depend on a variety of factors including the race distance, the adequacy of the pre race meal, as well as the environmental conditions. For events up to the half marathon, provided the athlete consumed an adequate pre race meal, there is little benefit in consuming additional carbohydrate during the race. Race nutrition strategies need only focus minimising the level of dehydration. While elite runners will typically finish these races with a fluid deficit, they should still aim to minimise the extent of this by implementing an their own individualised hydration plan (See Hydration fact sheet).

For the marathon, athletes will need to be more aggressive with their intake of fuel and fluids, both in the lead up and during the race itself. In the two days before the race, they should undertake a carbohydrate load to help "super compensate" muscle glycogen stores (see Carbohydrate Loading fact sheet), as well consume a carbohydrate rich pre race meal. During the race, they should look to create opportunities to have regular access to fuel and fluids. Sports gels provide a compact source of carbohydrate that runners may easily carry with them while running or have at "special needs" stations located at various points along the race course. Sports drinks and cola also provide an opportunity to top up fuel stores, while simultaneously providing a fluid to help minimise the fluid deficit, which in a marathon can be substantial. It is important that athletes practice their fuel and fluid strategies in lead up races/hard training sessions to assess tolerance when consuming these products 'on the run'.

About carbs, let us understand some basics. The energy that is used for exercising is not the one made from the food we have currently. It comes from the glycogen or the carb energy stored in the body from our regular diet. The energy is stored in your muscles, liver & fat cells. This energy can help you do intense exercises for 1 to 2 hours or 3 - 4 hours of moderate exercises, without any fatigue.

Before carbohydrate is tucked away in your muscles and liver as glycogen, it enters your bloodstream in the form of glucose (also called blood sugar), a readily available source of energy that helps perk you up when you're feeling hungry and fatigued. If the glycogen stored in your muscles and liver is low, your body can rely on glucose for fuel; if you already have a fair amount of stored glycogen, your body will use the glucose as a secondary source of energy and spare the glycogen. "It means that you have two sources of fuel as opposed to one, so you can last a lot longer,"

What is carbohydrate loading?

Carbohydrate loading is a strategy involving changes to training and nutrition that can maximise muscle glycogen (carbohydrate) stores prior to endurance competition.

The technique was originally developed in the late 1960's and typically involved a 3-4 day 'depletion phase' involving 3-4 days of hard training plus a low carbohydrate diet. This depletion phase was thought to be necessary to stimulate the enzyme glycogen synthase. This was then followed immediately by a 3-4 day 'loading phase' involving rest combined with a high carbohydrate diet. The combination of the two phases was shown to boost muscle carbohydrate stores beyond their usual resting levels.

Ongoing research has allowed the method to be refined so that modern day carbohydrate loading is now more manageable for athletes. The depletion phase was demonstrated to be no longer necessary, which is a bonus for athletes as this phase was very difficult. Australian marathon runner, Steve Moneghetti has described the depletion phase as making him feel like "death warmed up". Today, 1-4 days of exercise taper while following a high carbohydrate diet (7-12g/kg body weight) is sufficient to elevate muscle glycogen levels.

Does carbohydrate loading improve performance?

Muscle glycogen levels are normally in the range of 100-120 mmol/kg ww (wet weight). Carbohydrate loading enables muscle glycogen levels to be increased to around 150-200 mmol/kg ww. This extra supply of carbohydrate has been demonstrated to improve endurance exercise by allowing athletes to exercise at their optimal pace for a longer time. It is estimated that carbohydrate loading can improve performance over a set distance by 2-3%.

Who should carbohydrate load?

Anyone exercising continuously at a moderate to high intensity for 90 minutes or longer is likely to benefit from carbohydrate loading. Typically, sports such as cycling, marathon running, longer distance triathlon, cross-country skiing and endurance swimming benefit from carbohydrate loading. Shorter-term exercise is unlikely to benefit as the body's usual carbohydrate stores are adequate. Carbohydrate loading is generally not practical to achieve in team sports where games are played every 3-4 days. Although it might be argued that players in football and AFL have heavy demands on their muscle fuel stores, it may not be possible to achieve a full carbohydrate loading protocol within the weekly schedule of training and games.

What does a high carbohydrate diet look like?

The following diet is suitable for a 70kg athlete aiming to carbohydrate load:

Breakfast 3 cups of low-fibre breakfast cereal with 11/2 cups of reduced fat milk
1 medium banana
250ml orange juice
Snack toasted muffin with honey
500ml sports drink
Lunch 2 sandwiches (4 slices of bread) with filling as desired
200g tub of low-fat fruit yoghurt
375ml can of soft drink
Snack banana smoothie made with low-fat milk, banana and honey
cereal bar
Dinner 1 cup of pasta sauce with 2 cups of cooked pasta
3 slices of garlic bread
2 glasses of cordial
Late Snack toasted muffin and jam
500ml sports drink
This sample plan provides ~ 14,800 kJ, 630 g carbohydrate, 125 g protein and 60 g fat.

Are there any special considerations for females?

Most studies of glycogen storage have been conducted on male athletes. However, some studies suggest that females may be less responsive to carbohydrate loading, especially during the follicular phase of the menstrual cycle. This appears to be, at least partly, because they have difficulty consuming the larger amounts of carbohydrate required for a complete CHO load. Further research needs to be conducted specifically on females.

What are the common mistakes made when carbohydrate loading?

Research indicates that many athletes who attempt to carbohydrate load, fail to achieve their goal. Common mistakes include:

- Carbohydrate loading requires an exercise taper. Athletes can find it difficult to back off training for 1-4 daysbefore competition. Failing to rest will compromise carbohydrate loading.
- Many athletes fail to eat enough carbohydrate. It seems athletes don't have a good understanding of the amount of food required to carbohydrate load. Working with a sports dietitian or using a carbohydrate counter can be useful.
- In order to consume the necessary amount of carbohydrate, it is necessary to cut back on fibre and make use of compact sources of carbohydrate such as sugar, cordial, soft drink, sports drink, jam, honey, jelly and tinned fruit. Athletes who include too many high fibre foods in their carbohydrate loading menu may suffer stomach upset or find the food too bulky to consume.
- Carbohydrate loading will most likely cause body mass to increase by approximately 2kg. This extra weight is due to extra muscle glycogen and water. For some athletes, a fear of weight gain may prevent them from carbohydrate loading adequately.

- Athletes commonly use carbohydrate loading as an excuse to eat everything and anything in sight. Consuming too many high fat foods will make it difficult to consume sufficient carbohydrate. It may also result in gain of body fat. It is important to stick to high-carbohydrate, low-fat foods while carbohydrate loading.

How can I check the amount of carbohydrate I eat each day?

The following chart provides information about the carbohydrate content of common foods. Each food portion provides 50 g of carbohydrate. Use this information to plan a daily menu, or specific pre-event meals and post-exercise recovery meals to meet the carbohydrate intake targets provided in Table 1. These carbohydrate-rich foods should form the basis of meals and snacks, with other nutrient-rich foods added to round out the meal.

Food Portions Providing 50 g of Carbohydrate

CEREAL

Wheat biscuit cereal (e.g. Weet Bix) 60g (5 biscuits)
'Light' breakfast cereal (e.g. Cornflakes) 60 g (2 cups)
'Muesli' flake breakfast cereal 65 g (1-1.5 cups)
Toasted muesli 90 g (1 cup)
Porridge - made with milk 350 g (1.3 cups)
Porridge - made with water 550 g (2.5 cups)
Rolled oats 90 g (1 cup)
Bread 100 g (4 slices white or 3 thick wholegrain)
Bread rolls 110 g (1 large or 2 medium)
Pita and lebanese bread 100 g (2 pita)
Chapati 150 g (2.5)
English muffin 120 g (2 full muffins)
Crumpet 2.5
Muesli bar 2.5
Rice cakes 6 thick or 10 thin
Crispbreads and dry biscuits 6 large or 15 small
Fruit filled biscuits 5
Plain sweet biscuits 8-10
Cream filled/chocolate biscuits 6
Cakestyle muffin 115 g (1 large or 2 medium)
Pancakes 150 g (2 medium)
Scones 125 g (3 medium)
Iced fruit bun 105 g (1.5)
Croissant 149 g (1.5 large or 2 medium)
Rice, boiled 180g (1 cup)
Pasta or noodles, boiled 200 g (1.3 cups)
Canned spaghetti 440 g (large can)

FRUIT
Fruit crumble 1 cup
Fruit packed in heavy syrup 280 g (1.3 cups)
Fruit stewed/canned in light syrup 520 g (2 cups)
Fresh fruit salad 500 g (2.5 cups)
Bananas 2 medium-large
Large fruit (mango, pear, grapefruit etc.) 2-3
Medium fruit (orange, apple etc.) 3-4
Small fruit (nectarine, apricot etc.) 12
Grapes 350 g (2 cups)
Melon 1,000 g (6 cups)
Strawberries 1,800 g (12 cups)
Sultanas and raisins 70 g (4 Tbsp)
Dried apricots 115 g (22 halves)

VEGETABLES
Potatoes 350 g (1 very large or 3 medium)
Sweet potato 350 g (2.5 cups)
Corn 300 g (1.2 cups creamed corn or 2 cobs)
Green Beans 1,800 g (14 cups)
Baked beans 440 g (1 large can)
Lentils 400 g (2 cups)
Soy beans and kidney beans 400 g (2 cups)
Tomato puree 1 litre (4 cups)
Pumpkin and peas 700 g (5 cups)

DAIRY PRODUCTS
Milk 1 litre
Flavoured milk 560 ml
Custard 300 g (1.3 cup or half 600 g carton)
'Diet' yoghurt and natural yoghurt 800 g (4 individual tubs)
Flavoured non-fat yoghurt 350 g (2 individual tubs)
Icecream 250 g (10 Tbsp)
Fromage frais 400 g (2 tubs)
Rice pudding/creamed rice 300 g (1.5 cups)

SUGARS and CONFECTIONERY
Sugar 50 g
Jam 3 Tbsp
Syrups 4 Tbsp
Honey 3 Tbsp
Chocolate 80 g
Mars Bar and other 50-60 g bars 1.5 bars
Jubes and jelly babies 60 g

MIXED DISHES
Pizza 200 g (medium -1/4 thick or 1/3 thin)
Hamburgers 1.3 Big Macs
Lasagne 400 g serve
Fried rice 200 g (1.3 cups)

DRINKS
Fruit juice - unsweetened 600 ml
Fruit juice - sweetened 500 ml
Cordial 800 ml
Soft drinks and flavored mineral water 500 ml
Fruit smoothie 250-300 ml

SPORTS FOODS
Sports drink 700 ml
Carbohydrate loader supplement 250 ml
Liquid meal supplement 250-300 ml
Sports bar 1-1.5 bars
Sports gels 2 sachets
Glucose polymer powder 60 g