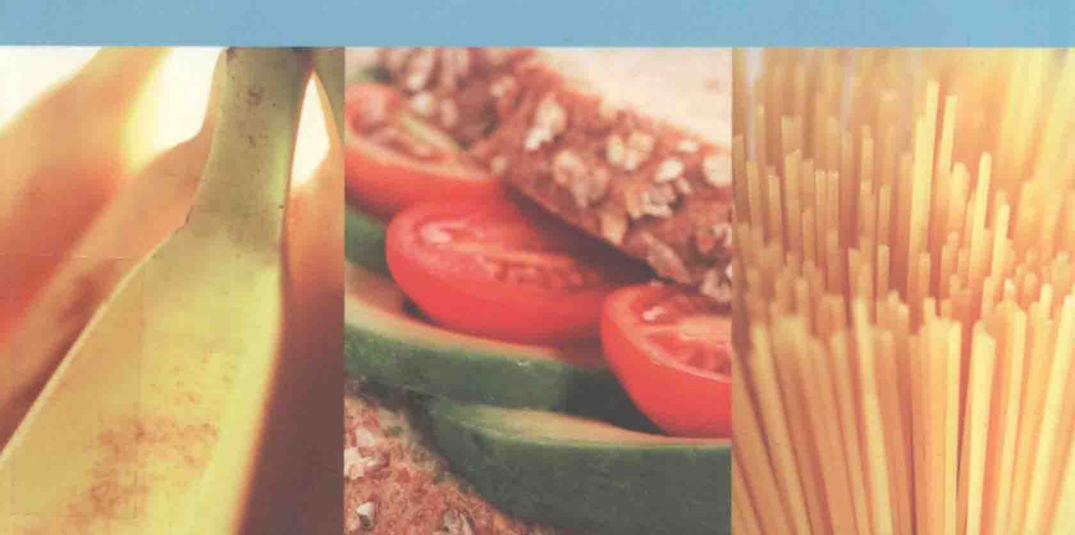
ANITA BEAN'S

sports nutrition FOR WOMEN

A PRACTICAL GUIDE FOR ACTIVE WOMEN



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INTRODUCTION

Why a book for female athletes? For the last 20 years or so I've been advising both male and female athletes on nutrition, and have realised that female athletes have different nutritional, weight and performance concerns compared with men. While men and women's basic nutritional needs may not be significantly different, female athletes often eat differently from male athletes in ways that may prevent them meeting their nutritional needs. Like women in general, female athletes are under social pressure to be thin, and this – combined with the physical and psychological demands of their sport – may lead to restrictive eating. Many attempt to achieve low body fat levels by unhealthy eating practices and compulsive exercise. While leanness is desirable for performance in many sports, it often comes at a price, and a large number of female athletes develop disordered eating and serious eating disorders such as anorexia nervosa.

Much research has focused on a condition known as the 'female athlete triad': disordered eating, amenorrhoea (the cessation of periods) and bone loss. These are often present simultaneously in female athletes who restrict their diets and undernourish their bodies due to negative body image. Disordered eating is typically the trigger of the triad. Low calorie intakes combined with intense or excessive training can cause a woman's body fat level to fall so low that the ovaries can no longer produce enough oestrogen. This hormone is needed for normal menstrual function and bone formation, and low levels of it result in menstrual dysfunction (irregular or absent periods). This, combined with under-nutrition, results in a loss of bone density, and increased risk of stress fractures and osteoporosis.

Many athletes may not have the extreme symptoms of the triad, but rather may have 'sub-clinical' stages of one or more of the conditions. For example, an athlete may show signs of restrictive eating, but not meet the clinical criteria for an eating disorder. Or she may experience menstrual disturbances, such as a change in menstrual cycle length, but not yet have developed amenorrhea. Likewise, she may be losing bone, but may not yet have dropped below her age-matched normal range for bone density.

In writing this book, I wanted to provide female athletes with the very latest information about the female athlete triad, and help them to make decisions and find support. In addition, I think that it's important to recognise that female athletes come in all shapes and sizes, even within the same sport, and that very low body fat is not necessarily desirable – it may have a negative impact on a female athlete's health. Chapter 3 will help you understand the consequences of achieving an optimal weight and body composition for your sport, and enable you to put into practice a healthy weight loss strategy.

If you are pregnant, or considering having a baby in the future, then you will find plenty of practical information on conception, nutrition and exercise during pregnancy in Chapter 5. It addresses the unique nutritional concerns of female athletes, and presents the consensus of medical opinion on safe exercising during pregnancy.

To help you put the nutritional advice in this book into practice, I have devised more than 40 delicious recipes (starting on page 99) that are easy to prepare, and good for you too. Each provides a nutritional breakdown so you know exactly what you are eating!

I hope that you will find this book informative and helpful, and that it will inspire you to make positive changes to the way you eat and train.

Yours in health,
Anita Bean

01

THE NUTRITIONAL NEEDS OF FEMALE ATHLETES

Planning what you eat before, during and after exercise is important. A healthy diet will increase your energy and endurance, reduce fatigue and maximise your fitness gains. After exercise, you need to give your body enough of the nutrients it needs for repair and recovery.

To help you make the right food choices, this chapter explains the basis of a good training diet, what each nutrient does, how much you need and how you can achieve your ideal intake.

How does my body produce energy?

In your body, energy is produced from carbohydrate, fat, protein and alcohol. Carbohydrates are the body's preferred fuel, although protein, fat and alcohol can also be converted into energy. Each nutrient provides different amounts of energy. For example, 1 g of the nutrients listed below provides the amount of energy indicated:

- carbohydrate 4 kcal (17 kJ)
- fat 9 kcal (38 kJ)
- protein 4 kcal (17 kJ)
- alcohol 7 kcal (29 kJ).

Each body cell has a small store of readily available energy in the form of a compound called adenosine triphosphate (ATP): the energy 'currency' of your body. ATP consists of an adenosine 'backbone' with three phosphate groups attached. When one of these phosphate groups splits off, then energy is produced (see fig. 1.1). Around one-quarter of this energy fuels work (such as muscular movement); the rest is given off as heat. ATP is continually being made and broken down to keep up with your body's requirements for energy.

Normally, you have enough ATP in your muscle cells to fuel a few seconds of exercise; after this your body breaks down glucose (from your blood or from stored glycogen in your muscles) and/or fat to make more ATP and therefore more energy.

$$\text{ATP} \rightleftharpoons \text{ADP} + \text{P} + \text{ENERGY}$$

Fig 1.1 The relationship between ATP and ADP

You may be wondering if the source of the calories is important. If you are only considering weight loss or gain, the answer is no, it is the total intake of calories that is important. However, if you are talking about nutrition and health, it definitely does matter where your food calories come from. Generally, carbohydrates and proteins are healthier sources of calories than fats or alcohol.

What are calories?

Calories are the units used to describe the amount of energy in food. In scientific terms, one calorie is defined as the amount of energy (heat) required to increase the temperature of 1 gram of water by 1°C. A kilocalorie (kcal) is equal to 1000 calories.

What's the difference between calories, kilocalories and kilojoules?

You'll see all these terms on food labels, which can be a bit confusing! One kilocalorie (kcal) is 1000 calories, and this is strictly what we mean when speaking about 'calories' in the everyday sense. The scientifically defined calorie is a very small energy unit, which would be inconvenient to use on food labels. An average serving of any food typically provides thousands of these calories. For example, a food label would declare a portion of food contains 100 kcal rather than 100,000 calories. However, in everyday language we would probably say '100 calories'.

You'll also see food energy measured in joules or kilojoules (kJ) on food labels, which is the SI (standard international) unit for energy, named after Sir Prescott Joule. One joule is the energy required to exert a force of one Newton for a distance of one metre. Again, a joule is not a large amount of energy, so kilojoules (1 kJ = 1000 J) are more often used. One kcal is equivalent to 4.2 kJ.

How can I work out how many calories I need?

Your calorie needs depend on many factors: your genetic make-up, age, weight, body composition and your daily activity. They will differ from one day to the next, depending on your level of activity, and as you grow older if your lifestyle changes. The average (sedentary) woman needs around 2000 calories a day and men around 2500. These are the guideline daily amounts (GDAs) for energy that you see on food labels.

The number of calories you burn daily depends on three main factors:

1 your basal metabolic rate (BMR)
2 your level of physical activity
3 thermogenesis.

Your *BMR* is the number of calories you burn at rest to keep your heart beating, your lungs breathing, to maintain your body temperature, and so on. It accounts for 60–75 per cent of the calories you burn daily. Generally, women have a lower BMR than men, due to their smaller body mass.

The second factor, *physical activity*, includes all activities, from doing the housework to walking and working out in the gym. The number of calories you burn in any activity depends on your weight, the type of activity and the duration of that activity.

The third factor, *thermogenesis*, is the process by which the body generates heat by increasing the metabolic rate above normal. This occurs after consuming food, and includes the extra energy involved in eating, digesting and processing food – it's called the 'thermic effect of food'. Typically it accounts for about 10 per cent of your total calorie expenditure. So, if you eat 2000 calories a day, you'll burn about 200 calories digesting that food.

So, your daily calorie requirement is the sum of these three factors: BMR, physical activity and thermogenesis. It is possible to measure your daily calorie output (and therefore your calorie needs) by two methods: **indirect calorimetry** and the **doubly labelled water technique.** Both require specialised equipment and are generally limited to universities and research organisations.

With indirect calorimetry, the amount of oxygen you consume and carbon dioxide you produce is measured in a metabolic chamber (a sealed room unit) or in a 'ventilation hood', mask or mouthpiece, over several hours or days. The amount of energy you have expended is then calculated using various equations.

With the doubly labelled water technique, the concentration of non-radioactive isotopes in your urine is measured after ingesting a sample of water that has been labelled with non-radioactive isotopes of hydrogen and oxygen. This gives a measure of the amount of carbon dioxide, and therefore energy, produced by your body.

However, these methods are mostly used in the realms of research and are not very accessible to the general public. Instead, you can estimate your calorie needs and basal metabolic rate using predictive equations that take account of your weight and daily activity level. However, it is worth bearing in mind that these equations are based on populations of sedentary people, rather than athletes, so you should use them simply as a guide to your calorie needs.

Step 1: Estimate your basal metabolic rate (BMR) using either of the following methods.

Quick method

As a rule of thumb, BMR uses 22 calories for every 1 kg of a woman's body weight.

$$\text{Women: BMR} = \text{weight in kg} \times 22$$

Example: BMR for a 60 kg woman = 60 × 22 = 1320 kcal.

Longer method

For a more accurate estimation of your BMR, use the Harris–Benedict equation:

BMR = 665 + (9.6 × W) + (1.8 × H) - (4.7 × age) = daily calorie needs
Where:
W = weight in kg
H = height in cm
Age = years

An example for a 30-year-old woman weighing 60 kg and measuring 168 cm (5 foot 6 inches) tall would be:

665 + (9.6 × 60) + (1.8 × 168) - (4.7 × 30)
665 + 576 + 302 - 141 = **1402** kcal per day

This equation will be accurate for most women except the extremely muscular (these women need more calories) and the extremely fat (these women need fewer calories), because it doesn't take into account the amount of lean body weight a person may have.

Step 2: Estimate your physical activity level (PAL)

Your physical activity level is the ratio of your overall daily energy expenditure to your BMR – a rough measure of your lifestyle activity.

Table 1.1 Working out PAL

Physical activity level (PAL)	Description	Examples
1	Inactive	Sleeping/lying down
1.2	Sedentary	Mainly sitting/desk job
1.5	Moderately active	Some walking
1.7	Active	Daily walking or gentle exercise
2.0	Very active	Moderate daily training or sport
2.2	Extremely active	Strenuous daily training or sport

Step 3: Multiply your BMR by your PAL

Daily calorie needs = BMR × PAL

So, the daily energy needs of a 30-year-old active 60 kg woman are:

1402 × 1.7 = 2383 kcal

This figure gives you an idea of your daily calorie requirement to maintain your weight. If you eat fewer calories, you will lose weight; if you eat more, you will gain weight.

Why do women need fewer calories than men?
Women generally have lower calorie requirements than men because they have less muscle tissue and, generally, weigh less. Muscle tissue burns more calories than fat. The more muscle mass you have, the more calories you will burn. And the heavier you are (whether that's muscle or fat), the higher your metabolic rate.

Do you need fewer calories as you get older?
As you get older, activity levels are often reduced, which causes a loss of muscle tissue, and so your energy requirements tend to decrease – but this isn't inevitable. Regular exercise (especially resistance training) can help reduce or prevent the 3.2 kg decline in muscle mass generally observed with each decade of ageing.

Is there a minimum calorie level I should have to stay healthy?
Severely restricting your calorie intake may lead to a drop in your performance as well as having serious health consequences. According to researchers at Ohio University in the USA, levels of female sex hormones fall and menstruation may become irregular or stop altogether (amenorrhoea – *see* Chapter 4). Studies with female athletes have shown that when calorie intake drops below a threshold of 30 kcal per kg of lean body weight per day, bone health is affected. There is increased bone loss, stress fractures and, in younger athletes, failure to achieve their peak bone mass.

It is thought that the combination of intense training, calorie restriction and the psychological pressure for extreme leanness may precipitate disordered eating and clinical eating disorders in some athletes. There is a fine line between dieting and obsessive eating behaviour, and many female athletes are under pressure to be thin and improve their performance. The warning signs and health consequences of eating disorders are discussed in Chapter 2.

Where do I get energy from during exercise?

Your muscles derive energy from carbohydrate, fat and protein during exercise, but the proportions of these fuels will depend on the type, intensity and duration of your activity, how well conditioned, or 'fit', you are, and what you have eaten beforehand.

During **anaerobic** activities, such as sprinting and weight lifting, virtually all the energy you burn comes from carbohydrates, or muscle glycogen (stored carbohydrate). On the other hand, during **aerobic** activities, such as running, swimming and cycling, energy is provided by a mixture of carbohydrates and fat. Protein may also fuel aerobic exercise – but its contribution becomes significant only when muscle glycogen stores become depleted.

The higher your exercise **intensity**, the greater the reliance on muscle glycogen. As a rule of thumb, during moderate exercise intensities (50–70 per cent of your maximal aerobic capacity) glycogen supplies around half your energy needs. At higher exercise intensities – above 70 per cent of your maximal aerobic capacity – it makes up around three-quarters of your energy supply.

The fuel mixture changes with exercise **duration**. As your muscle glycogen stores deplete, the muscles will use more fat, blood glucose and protein for energy. Generally, your muscles use a higher percentage of glycogen for fuel during the early stages of a workout, and a higher percentage of fat for fuel during the latter stages.

Aerobic conditioning (or 'fitness') affects the fuel mixture used during exercise. Regular aerobic training increases the levels of fat-burning enzymes in your muscle cells, which means your muscles learn to burn fat more readily and spare precious glycogen. This is clearly advantageous for endurance sports because the body's stores of fat energy are vastly greater than its store of glycogen energy (typically 400 g or 1600 kcal in a 70 kg person). In other words, the better conditioned you become, the more efficiently your muscles produce energy, and the longer you can continue exercising.

How much carbohydrate, fat and protein you burn during exercise also depends on your **pre-exercise diet**. Consuming carbohydrates during the two to four hours before exercise increases blood sugar and insulin levels, which encourages the muscles to favour carbohydrates for fuel. On the other hand, fasting or avoiding carbohydrates during the four-hour pre-exercise period encourages the muscles to burn a little more fat and less carbohydrate during exercise. The number of calories burned will not necessarily change, only the proportions of carbohydrate and fat.

What's the difference between liver and muscle glycogen?

The purpose of liver glycogen is to maintain steady blood sugar levels. When blood glucose dips, glycogen in the liver breaks down to release glucose into the bloodstream. Muscle glycogen, on the other hand, fuels physical activity. During exercise, glycogen in your muscles releases glucose, which is used for energy.

Eating and exercise: before, during and after

When and what should I eat before exercise?

Most of the energy needed for exercise is provided by whatever you have eaten several hours – indeed, days – before. A balanced diet that includes enough carbohydrate will produce high levels of glycogen in your muscles.

Ideally, you should have a light meal approximately two to four hours before exercising, according to researchers at the University of North Carolina. Leaving a longer interval between eating and exercising may reduce your endurance and result in earlier fatigue. They also recommend including moderately high amounts of carbohydrate and avoiding too much fat in your pre-exercise meal.

Opt for foods with a low glycaemic index (GI) – foods that produce a gradual rise in blood sugar levels. Researchers at the University of Sydney found that cyclists were able to exercise for 20 minutes longer after eating a low-GI meal (lentils) compared with a high-GI meal (potatoes). A 2006 study at the University of Loughborough found that runners who consumed a low-GI meal three hours before exercise were able to run on average eight minutes longer compared with those who

ate a high-GI pre-exercise meal. The slower release of energy helped maintain their blood sugar levels, reduced the rate at which muscle glycogen was burned and promoted fat burning. In other words, eating a low-GI meal will encourage your body to burn more fat and less glycogen during exercise, and will help to increase your endurance. Porridge, cereal with milk, a jacket potato with beans, or a light pasta dish would be suitable pre-workout meals.

If you plan to exercise for longer than one hour, having a low-GI pre-workout drink or snack 30–60 minutes before exercise may also benefit your performance. Try an apple, a few dried apricots, a handful of sultanas, a smoothie, a pot of yoghurt, 300 ml of diluted fruit juice (50/50) or even half a bar (25 g) of chocolate. The extra carbohydrates will help postpone fatigue.

PRE-EXERCISE SNACKS

- Fresh fruit
- Wholemeal toast with honey
- Cereal bar
- Fruit yoghurt
- Dried fruit
- Cereal with milk.