CONTENTS

NUTRIENTS IN FOOD AND HOW OUR BODY USES THEM .......................... 3
Abstract ........................................................................................................ 3
Carbohydrate .............................................................................................. 3
Fat .................................................................................................................. 3
Protein ............................................................................................................ 4
Vitamins ......................................................................................................... 5
Minerals ......................................................................................................... 6
Water ............................................................................................................... 6
Final message .................................................................................................. 7

THE ROLE OF PARENTS AND SCHOOLS IN PROMOTING HEALTHY DIETARY BEHAVIOURS ............................................................... 9
The role of parents .......................................................................................... 9
Parenting styles and feeding practices .......................................................... 10
Family food environment ............................................................................. 10
The role of schools ........................................................................................ 11
The role of schools ....................................................................................... 11
Conclusion .................................................................................................... 12
NUTRIENTS IN FOOD AND HOW OUR BODY USES THEM

By Karen Murphy, Senior Research Fellow, University of South Australia

Abstract
Good nutrition is important to nourish our bodies with vital nutrients to help with growth and to keep us alive and well. The human body has a remarkable ability to break down the food we eat into valuable energy and nutrients for our basic biological functions. To ensure the optimal function of our body’s systems including the cardiac, respiratory, digestive, kidney and liver systems, neural, muscular and vascular networks and healthy bones, a variety of foods are required to deliver energy and key nutrients. Key nutrients include carbohydrates, fat, protein, vitamins and minerals found in foods like cereals and grains, nuts, meat, poultry and fish, dairy foods, fruits, vegetables, nuts, seeds and legumes. There are also other components of foods including fibre as well as phytonutrients (‘small nutrients’) like antioxidants compounds such as flavonoids, carotenoids which often have health benefits above and beyond that of regular nutrients. This article provides a breakdown of our major dietary nutrients, discussing metabolism and use and subsequent health implications.

Carbohydrate
Our major contributor to energy intake (around 50-60% of total kilojoules) is carbohydrate. This nutrient is found in a range of foods including breads, cereals, grains, vegetables, fruits, legumes and dairy foods and is needed to supply our muscles and brain with energy to function. Based on the molecular structure of carbohydrates, they are classified as either simple carbohydrates (monosaccharides: glucose, fructose, galactose; disaccharides: maltose, sucrose, lactose) or complex carbohydrates (glycogen, starch, fibre). Glucose is the major source of energy for the body and we cannot function without it. Excess glucose is stored in the liver or muscles as glycogen, a complex carbohydrate, and can be broken down later on when energy is immediately required, such as in periods of endurance exercise. Once carbohydrate is broken down in the stomach, glucose is released into the bloodstream.

The level of glucose in the bloodstream or ‘blood sugar level’ is carefully regulated by the hormone insulin. However, in diseased states when our bodies have impaired function, glucose regulation can be compromised. This results in excess glucose stuck in the bloodstream, unable to be delivered to our organs or muscles or stored in the liver. Excess glucose can lead to Type 2 Diabetes Mellitus and is associated with higher risk of illness and death from cardiovascular disease and can affect blood circulation and eye function. Dietary guidelines around the world recommend that at least half of our intake of carbohydrate comes from wholegrain sources. Wholegrain carbohydrates release glucose into the bloodstream slowly helping the body manage blood glucose levels; keeps you fuller for longer; and are important sources of dietary fibre. Guidelines also recommend limiting refined carbohydrates which include white breads, confectionary, cakes and desserts and processed foods. These types of carbohydrates cause blood glucose levels to rise rapidly. A steady balance of glucose in the blood is desirable for the cells to function normally.

Message: don’t be frightened of carbs! Our bodies need carbohydrates as fuel. Choose wholegrain carbohydrates over refined e.g. choose wholegrain bread over white bread.

Fat
There is a negative perception that all fat is bad, however oils ain’t oils! It is true that some dietary fat is not as good as the others, but we all need some fat. Fat is required for our body for the make-up of our brain. Did you know our brain is made of at least 50% of fat? We also need fat for the structure and integrity of our body’s cells, for making neurotransmitters that send messages from our brain to our body and for hormone production.

There are different types of fats that are distinguishable by their chemical structure and as a result can have different benefits to our health. There are saturated fats (mainly from animal products and processed foods), monounsaturated fat (found in nuts, avocado and olive oil) and polyunsaturated fats (found in vegetable seed oils, walnuts and fish). There are two types of polyunsaturated fats; omega-6 which are found mainly in vegetable seed oils and omega-3 which are found in walnuts, linseed and oily fish like tuna, salmon and sardines. It is the omega-3 polyunsaturated fats which offer many benefits to our heart, eyes, brains, joints
and skin, and it is important to keep a balanced ratio of omega-6 to omega-3 fats in our diets.

Firstly, what happens to fat when we eat it? Digestion of fat begins in the mouth where enzymes called lipases start to break down the structure of fat. The stomach then physically churns the food and mixes it with more enzymes and water, breaking the fat down further. It then moves into the small intestine where bile is secreted from the gall bladder to emulsify the fat, or more simply to fully digest the fat. The digested fat is then packaged and transported in vehicles called lipoproteins and delivered around the body for immediate use or storage. Did you know that fat supplies around 60% of our body’s energy needs, which may increase when we are exercising? However, when we eat too much fat in our diets, the body has more fat than it needs and ends up storing the fat as adipose tissue.

Fat has twice as much energy as carbohydrate or protein, so eating large amounts of fat can lead to overweight particularly if an individual is not physically active.

Different types of fats have different health effects. Saturated fats are found in animal foods like meat, processed meats like sausages and bacon, dairy foods, butter, coconut, take-away foods, desserts, crisps, cakes, chocolate and many other discretionary foods. Too much saturated fat in the diet can raise blood cholesterol levels, clog the vessels that deliver blood to your brain and body, increase blood pressure and increase your risk of developing heart and having a heart attack.

Healthcare professionals for a healthy heart recommend replacing saturated fats with unsaturated fats like mono and polyunsaturated fats in the diet. Monounsaturated fats are healthy fats and found in avocado, nuts, olive oil and seeds. Research from Mediterranean countries like Spain, have shown dietary patterns that contain mainly monounsaturated fat live longer, have less heart disease and less cancers. Like monounsaturated fats, polyunsaturated fats are also considered particularly healthful lipids, particularly the omega-3s. Omega-3 fats are found in oily fish and help our blood flow through our blood vessels and around our body, reduce the fat in our blood, stop the blood clotting which is important in stroke and can help reduce our risk of death from heart disease. Omega-3s are also important during pregnancy for the growing babe and in eye and brain development in infants. Omega-6 fats are found mainly in vegetable seed oils like canola, safflower, sunflower oil and many processed foods that use these oils, mayonnaise, some nuts and salad dressings. Western populations like Australia eat too much omega-6 fats and not enough omega-3.

To optimize our intake and quality of fat in our diets, we should limit take-away and discretionary foods, replace saturated fats with monounsaturated fats, choose omega-3 fats over omega-6 fats and watch our portion sizes of food.

Message: Remember that all foods contain a mixture of different types of fats. Choose monounsaturated and omega-3 polyunsaturated fats over saturated fats.

Protein

When we talk about protein, we need to start with the building blocks of protein; the amino acids. There are 20 common amino acids, some are essential meaning our body cannot make them so we need to obtain them from our diet, and some are non-essential meaning our body can make them through a series of metabolic pathways. Proteins are made up of a sequence of amino acids linked together by bonds.

We get protein from both animal, meat, fish, dairy foods, eggs; and vegetable sources, legumes, nuts and soy. When we eat protein foods, they are broken down by chewing in the mouth and then mixed with acids in the stomach and then the
small intestine to break the protein down further to peptides and amino acids. These peptides and amino acids are then transported around the body.

Proteins are used for growth and maintenance of just about all of our body’s structure and functions. Proteins are important for our muscles, blood, skin, teeth and bones, replenishment of dead or damaged cells of our bodies and for the synthesis of enzymes and hormones. Protein has other roles including helping with maintaining our fluid-balance in our body, help transport other nutrients and molecules in the blood, form antibodies that fight disease and can also be a source of energy and glucose when there is a lack of carbohydrate or when the body is forced into starvation mode. On the other hand, proteins can contribute to weight gain as they can also be converted to and stored as fat when we exceed our energy and protein requirements.

Many countries around the world experience starvation and fail to obtain enough energy (kilojoules) and protein for daily needs. Conversely people in industrialized, western countries often exceed energy, unhealthy fat and protein requirements posing health risks such as obesity and chronic disease. Excess protein may contribute to heart disease, possibly through elevated homocysteine levels, a non-essential amino acid or through the contribution of saturated fat through animal based protein foods. How much protein do we need in adolescence? According to the Nutrient Reference Values for Australia and New Zealand, females (8-13 years) need ~45g/d or 0.77g of protein per kilogram of body weight per day; and males (8-13 years) need ~65g/d or 0.99g of protein per kilogram of body weight per day. Adequate protein can be obtained through an average healthy balanced diet by eating a combination of a range of plant and animal foods including breads, cereals, nuts, legumes (e.g. lentils, chickpeas, red kidney beans), dairy foods, eggs and meat, fish and poultry.

**Message:** Protein is an important nutrient in our diet. It is particularly good to have a mixture of vegetable and animal protein.

### Vitamins

Vitamins are essential nutrients that do not yield energy when digested and metabolized by the body. In fact they work with other compounds in the body such as enzymes to help break down carbohydrate, fat and protein, but they also have other roles including helping the body to fight colds, help the blood clot, assist with brain function, eye health and support reproduction and growth to name a few.

There are two types of vitamins: water-soluble vitamins and fat soluble vitamins, listed in the table below. The water soluble vitamins (vitamins B and C) are found in the watery components of foods like fruits, vegetables and also enriched breakfast cereals and breads, while the fat soluble vitamins (vitamins A D E K) are found in the fat component of foods like milk, nuts, vegetable oils and leafy green vegetables. Water soluble vitamins can move directly into the blood after being digested, whereas the fat soluble vitamins travel through the lymphatic system in a similar way to some dietary fats, firstly before they enter the blood.

All vitamins have a dietary recommendation of how much an individual needs for their health. These are called nutrient reference values or NRVs. These recommendations are set for males and females of all ages. When these recommendations are not met, individuals can suffer from vitamin deficiencies. Some deficiencies include scurvy with a lack of vitamin C and failure of the neural tube to form in babies during pregnancy (neural tube defect) with a lack of folate. Both of these deficiencies are less common in today’s world with our adequate food supply and availability of supplements during pregnancy. On the other hand, eating vitamins in excess can lead to toxicity, but this is less common with the water soluble vitamins as excess is usually passed in the urine.

The fat soluble vitamins have a wide range of functions. Vitamin A is important in vision, our skin and helps with reproduction and growth. Vitamin D is important for bone health and can be synthesized in the body with the help of sunlight and can be obtained through foods like dairy foods, meat and oily fish. Vitamin E’s major role in the body is an antioxidant, meaning it protects compounds like polyunsaturated fats from oxidation. Vitamin E is found in nuts, like walnuts, plant oils, whole grains and green leafy vegetables. Vitamin K plays a vital role in helping to make the proteins required for the blood to clot. It is found in mainly in leafy green vegetables but can also be made by the bacteria in our gut.

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<tr>
<th>Water soluble vitamins</th>
<th>Fat soluble vitamins</th>
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<tr>
<td><strong>B group vitamins</strong></td>
<td>Vitamin A</td>
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<td>Vitamin D</td>
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<td>Riboflavin</td>
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<td><strong>Non-B group vitamins</strong></td>
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The Nutrient Reference Values for Australia and New Zealand, females (8-13 years) need ~45g/d or 0.77g of protein per kilogram of body weight per day; and males (8-13 years) need ~65g/d or 0.99g of protein per kilogram of body weight per day. Adequate protein can be obtained through an average healthy balanced diet by eating a combination of a range of plant and animal foods including breads, cereals, nuts, legumes (e.g. lentils, chickpeas, red kidney beans), dairy foods, eggs and meat, fish and poultry.

**Message:** Protein is an important nutrient in our diet. It is particularly good to have a mixture of vegetable and animal protein.
Minerals

Minerals are vital in our diet and can be split into major and trace minerals. Major minerals include calcium, sodium, potassium, phosphorus, sulphur, chloride and magnesium, and are required in large amounts (>5g) in the human body. There are many trace minerals such as iron, zinc, copper, manganese, iodine and selenium, which are required in much smaller amounts than the major minerals in the body. Some minerals can be absorbed directly into the blood, whereas others require a carrier compound to help absorb and transport them around the body. Sodium, or salt, is an important major mineral in the body. It is probably one of the most commonly talked about minerals; particularly because in some individuals it can raise blood pressure (raised blood pressure or hypertension is a risk factor for heart disease). Sodium is found in the fluid outside of the body’s cells. It regulates the volume of this extracellular fluid; it is vital to nerve transmission and muscle contractions and it plays an important role in the acid-base balance (pH) of the body. The balance of sodium is tightly regulated by the kidneys. When too much sodium is ingested, the body signals for you to drink until the optimal ratio of sodium to water is reached. The kidneys are then able to excrete excess sodium and excess water. The western diet is rarely deficient in sodium. Sodium is found in processed foods, such as bread and breakfast cereals, processed meats, cheese, potato crisps, canned and packet soup mixes, condiments and sauces. Dietary guidelines in Australia include recommendations to limit our intake of processed foods and drinks that contain sodium.

Potassium is another important mineral as its major role is maintaining the fluid and electrolyte balance in the body. It is found inside the body’s cells and its concentration is tightly controlled. Interestingly, low potassium levels seem to raise blood pressure, however high potassium levels, coupled with low sodium levels seem to lower blood pressure.

Another vital mineral is calcium, the predominant mineral in the body. Nearly all of the calcium in the body is present in the bones and teeth. The regulation of steady calcium levels in the body is governed carefully by hormones and vitamin D. Calcium is delivered mainly through dairy foods as well as almonds, sardine bones and some green vegetables. The NRV for calcium changes throughout the lifespan, from around 1300mg per day for adolescents, to 1000mg for women over 50 years and men over 70 years, back up to 1300mg for older individuals to protect against bone loss and conditions like osteoporosis. In addition to bone health, research suggests that calcium may have an important role in disease prevention. Calcium may reduce blood pressure, reduce body fat and help with weight loss when used as part of a weight loss diet.

Message: Minerals are important for maintaining our fluid balance, healthy hearts and healthy bones. Sodium is plentiful in our diets and it is advisable to avoid excess sodium in processed foods and to eat plenty of foods containing potassium to achieve an optimal sodium/potassium ratio for healthy blood pressure. Adolescents (14-18 years) should aim to choose 3 ½ serves of low fat dairy foods each day to meet their calcium needs. This looks like: a cup of milk, 40g of cheese, a tub of yoghurt and a handful of almonds.

Water

Water is absolutely vital to life. It makes up over half of our body’s composition and is important in maintaining our blood pressure, fluid and electrolyte balance, body temperature, provides a medium for all our body’s reaction to occur in, plays a structural role in and around our body’s cells, and is important in our joints, brain, spinal cord, amniotic sac during pregnancy and in the eyes. Being well hydrated is important to also avoid constipation. It is important to stay well hydrated. We lose water through sweat as a means of regulating our body temperature, through urine and faeces and through our breath. Too little water leads to dehydration. If you are thirsty, this is an indicator that you are probably already a little dehydrated. Consuming too much water, whilst rare, can upset our body’s electrolyte (salt) levels and can cause confusion, convulsions and even death. It is difficult to set an exact recommendation for water consumption as it varies depending on our physical activity, dietary intake and temperature amongst other things. The common thought is that we need 8 glasses of water a day to stay hydrated, however this is in fact a myth from the mid 1900s. We obtain water from our foods and beverages that all contribute to our intake and hydration status. As a general guide to check how well hydrated you are, monitor the colour of your urine! If it is light or clear colour, you are adequately hydrated, if it is dark, you need to drink more.

Message: stay hydrated. If you are thirsty, you are probably already dehydrated. Check your urine colour, if it is light, you’re hydrated, if it is dark, drink more fluid.
Final message

Take the advice of dietary guidelines. Our guidelines are designed to promote health and wellbeing and enjoy a long healthy life. Enjoy a variety of foods from the five food groups: fruits, vegetables, grains, nuts, legumes, lean meat, poultry and fish, dairy foods and drink water. Choose foods like takeaway foods, desserts, biscuits, chips, lollies, etc. as sometime foods. Choose healthy oils like omega-3s and monounsaturated fats over saturated fats. Limit your intake of processed foods to reduce intakes of salt, saturated fat and added sugars and be mindful of your portion sizes.

Student activities:

1. Carbohydrates are a major source of energy in the diet. What is the better choice for carbohydrate… refined or wholegrain?
2. What is carbohydrate broken down to and released into our bloodstream and what is the hormone that regulates its blood level?
3. Please describe what the good fats are and where they are found in our food supply.
4. What are the two types of polyunsaturated fats called and what are their food sources?
5. The B group vitamins include (circle which is correct):
   a. niacin, thiamin, riboflavin
   b. vitamin A, niacin, vitamin C
   c. vitamin K, vitamin D, vitamin E
6. Name the fat soluble vitamins and list one dietary source of each.
7. Which vitamin can help you see in the dark?
8. Which mineral is important for bone health?
9. Name three of the major minerals and name three of the trace minerals and some of their food sources
10. Explain briefly why they are called major and trace minerals.
11. What is the recommendation for water consumption?
12. List three reasons why it is important to stay hydrated.
References and further reading:


Australian Dietary Guidelines. www.eatforhealth.gov.au

THE ROLE OF PARENTS AND SCHOOLS IN PROMOTING HEALTHY DIETARY BEHAVIOURS

Dr Natalie Parletta, Senior Research Fellow, University of South Australia

Today’s children and teenagers are experiencing a rapidly changing world that is having a major impact on their health and wellbeing. Unhealthy foods like sweets, cakes, doughnuts, soft drinks, takeaway burgers, chips and pizza that used to be eaten occasionally are now consumed on a regular basis. Only around half of Australians eat the recommended serves of fruit while less than one in ten eat enough vegetables (ABS, 2013).

Box 1: Obesogenic food environment

The obesogenic food environment has been defined as ‘the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations’. This includes all the environmental factors that encourage us to eat unhealthy food high in fat, sugar and calories, and be less active.

However, schools and parents can take action to influence children’s food choices in a positive way. Parents have their strongest influence in the early years, when children are forming their food tastes and preferences. However their influence is still important throughout the teenager years. Schools can also have a major impact on attitudes and exposure to healthy food, and positively influence children’s food choices.

The role of parents

It wasn’t always like this. Our ‘obesogenic’ food environment (see Box 1) has driven consumption and demand for non-nutritious food, and this is an important issue for governments and policy makers to address with regulation of food industry and related environmental influences.

Image 1: Unhealthy foods that used to be eaten on rare occasions have now become the norm for meal and snacks, and in large portion sizes

Changed dietary patterns have contributed to an alarming increase in overweight, obesity and chronic disease worldwide. In Australia, one in four children is overweight or obese, and already developing risk factors for chronic diseases like diabetes and heart disease which have a major impact on personal, social and financial quality of life.

Image 2: Eating home cooked family meals together can have a positive influence on food intake and preferences of children and teenagers.
Parenting styles and feeding practices

Different styles of parenting have been identified that can be applied to feeding practices and dietary influences. These parenting styles can be understood in terms of the level of responsiveness (being supportive and attuned to children’s needs) and demandingness (expectations of mature behaviour and being responsible).

The authoritarian parenting style is high on demandingness and low on responsiveness, and therefore tends to be domineering and controlling. In terms of feeding this type of parent is likely to take control over what the child eats, which doesn’t help to empower children to make healthy choices or learn to trust their own instincts.

This approach to feeding could lead to power struggles around food and pressuring children to eat or bribing with dessert. It is well established that these tactics don’t work, leading to poorer food intake and negative associations with food. Children will eat when they are hungry, and if they are forced to eat what is on their plate, they will learn to ignore their own feelings of fullness, and to eat when they are not hungry. If they are bribed with dessert they will perceive that to be the desired food rather than the vegetables they are being bribed to eat.

The permissive parent is high on responsiveness but low on demandingness, and is likely to let the child do what they want with very little control. Therefore they may let the child eat whatever they like and give in easily when children make demands.

This can lead to poor food choices. In a similar vein, these parents may give children food to entertain or soothe them, typically sweet food or processed snacks that will placate them. This type of parenting will likely lead to preferences for unhealthy food, lack of self-control and ‘fussy eating’. It is likely to result in ‘short-order cooking’ – cooking a different meal for different members of the family, and offering substitute food if the child refuses to eat what is on their plate and therefore reinforcing the poor food habits.

The authoritative parent is high on demandingness and responsiveness. This style is associated with better health outcomes and behaviours. An authoritative parent will allow children to make their own choices but within firm limits. In other words, the parent will provide healthy options and let the child choose what to eat from those options.

This is associated with the ‘division of responsibility’ in feeding, whereby the parent decides what, where and when children eat while the child decides whether and how much they eat – i.e. ‘parent provide, child decide’. This will help children to learn to trust their internal hunger and fullness cues, and feel empowered to choose what they want to eat from the healthy options that parents make available at structured meal and snack times.

Authoritative parents tend to be more engaged with children, providing consistent discipline with warmth. When they say ‘no’ they mean ‘no’ and will not give in to demands or cook special meals. By being responsive to children they will focus on creating a warm, positive family food environment which will lead to positive associations with food and healthier food choices.

Family food environment

![Image 3: Role modelling, involving children in shopping, gardening, preparing and serving food, and providing healthy options in the home can help to foster a positive attitude towards healthy food.](image)

The family food environment has a powerful influence on children’s food exposure and eating habits. Making healthy choices available and keeping the unhealthy food out of the house makes it easier for children to choose healthy food for snacks. Continued positive, non-pressuring exposure (up to 10-14 exposures or more) to healthy foods like vegetables increases familiarity, liking and likelihood to eat those foods.

Parents are important role models as children are more likely to eat food that they see their parents enjoying. Eating family meals together can be a particularly bonding and supportive environment for learning to enjoy home cooked food, i.e. parents eating with children rather than feeding them or letting them eat in front of the TV. One meal is cooked for all, and ideally dishes are placed on the table for everyone to help themselves. Family meals are associated with better eating patterns in children, including teenagers.
The role of schools

Image 4: As well as parents, schools can have a powerful influence on children’s nutrition knowledge, attitudes and preferences around healthy foods – and can be particularly important if parents have limited time, knowledge or resources.

Schools can also help to arm children and teenagers with the knowledge and ability to make healthy food choices, and in turn can benefit from healthy children who have better school attendance, are more alert and better behaved. This issue has been the focus of much public debate, with major organisations arguing that despite smaller budgets and greater curriculum demands on schools, effective education needs to include health and wellbeing as important contributors to academic success.

It is generally agreed that a whole of school approach is needed to be effective in promoting healthy eating. For instance, nutrition programs need to be implemented at every year level, starting from kindergarten. Concepts about health and nutrition can be integrated in a wide range of classes (e.g. using nutrition concepts as a basis for teaching interactive computer skills, science projects, English assignments, geography, history, etc.).

These concepts are most effective when they are consistent throughout the school, i.e. reflected in replacing sausage sizzles with healthy options like a range of creative salads, fund raising drives using healthy options or non-food items, and healthy food being provided by the school canteen. The Australian Government has developed National Healthy School Canteens Guidelines that provide a range of resources including guidelines for healthy foods and drinks supplied in school canteens, posters, fact sheets, quick pocket guides and training manuals for canteen staff.

Some schools have adopted some of these canteen guidelines to varying degrees (see Box 2 for a case study). Common obstacles to healthy school canteens include a lack of volunteers to help prepare food, a lack of nutrition awareness, a perception of needing to profit from canteen sale and a lack of school support. This research highlights the importance of engaging the wider community in nutrition messages, volunteer support in school activities and the school canteen, encouraging older students to be positive role models or ‘champions’, and support at all levels for including healthy canteens within a school-wide priority placed on health and nutrition.

Box 2: Healthy school canteen case study

One South Australian school reported at a conference an initiative to improve the quality of the food in the school canteen to make it healthier. Older students became ‘champions’ to drive the change. They devised a range of activities including taste testing of healthy snacks, lunches, drinks, smoothies etc. and getting students to vote on their favourite items. They designed and put out flyers and posters to promote the new menu, and acted as volunteers in the canteen. Not only did sales go up but the canteen started making a profit for the first time! This case study is a great example of how schools, teachers and students (i.e. stakeholders) taking ownership of an initiative can drive positive change successfully.

Some schools have gardens with vegetables, fruit and herbs, that children can help to plant and nurture and some even pick and cook them. Home economics classes could be brought back to teach children basic cooking skills, which an increasing number of people do not have these days. Stephanie Alexander founded the Kitchen Garden Foundation (www.kitchengardenfoundation.org.au) which is designed to teach Australian children positive food habits through fun activities that revolve around gardening, cooking and eating fresh food. An evaluation of the program reported positive changes in children’s attitudes, knowledge, skills and confidence around gardening and cooking healthy food.

The Australian government has published a resource kit for ‘Healthy and active school communities’ which includes examples of schools that have implemented healthy eating and/or physical activity, what they did and what worked. These can provide ideas for inspiration. For instance, some schools have successfully implemented regular activities such as ‘fruit’ days, which encourage children to bring fruit from home to cut up and share. School-based nutrition programs also need to be consistent with environmentally sustainable and financially viable food systems. These are complementary – for instance, growing and cooking...
homemade meals cuts down on food processing and packaging; a school can promote home-prepared food in brown paper bags or reusable containers as part of a focus on environmental awareness, which will also be consistent with encouraging children to bring whole food rather than packaged, processed food to school.

A number of organisations in different countries have implemented healthy school initiatives, including an excellent model that was developed in Berkeley, California (http://edibleschoolyard.org/). The project started 20 years ago with an idea to grow a garden in a barren, vacant block of land next to the school and build a teaching kitchen that could be used to enrich the school curriculum and life of the school community (http://edibleschoolyard.org/our-story). Now they connect educators around the world to develop and share an edible education curriculum. Any school can join up and take part. They offer free online lectures, ideas for lessons, and provide five days of onsite training for educators around the world each year.

**Conclusion**

Traditionally, food was a central part of family culture, with families often growing, cooking and eating food together at the table. It can be a wonderfully bonding social experience. Learning to enjoy real food, comprised of an abundance of plant foods such as vegetables, legumes, nuts, seeds, wholegrains, herbs and spices, enhanced with good quality extra virgin olive oil, moderate intake of fish and dairy, is one of life’s blessings. It does not need to focus on forcing ourselves to eat ‘healthy’ food because it is good for us; it is about enjoying food that is real, tastes good and makes us feel good. This is embodied in the modern Mediterranean diet pyramid that includes conviviality as part of the overall food culture (Bach-Faig et al., 2011).
**Student activities:**

1. List all the influences that you can think of that contribute to an 'obesogenic environment'. Draw a Venn diagram to represent them visually, flowing from the individual in the centre of the diagram to immediate then broader influences.

2. Have a look at this article: http://www.bbc.com/news/magazine-20898379. Design a project investigating traditional whole plant food based Mediterranean diets, the foods and recipes, culture, and research on the health benefits.

3. Summarise the ways in which parents and caregivers can promote healthy food choices in children and teenagers.

4. Summarise the ways in which schools can promote nutrition literacy and healthy food knowledge and choices in students.

5. Come up with a range of strategies that could be used to initiate a successful, healthy school canteen menu.

6. Investigate food sustainability and what it means for our health and the environment.

7. List and describe ways that nutrition, healthy food and food sustainability can be incorporated into each of your subjects in the school curriculum, satisfying the national learning goals for each subject.

8. List obstacles to a healthy family food environment and come up with a range of strategies to address these and foster a healthy family food environment.

9. Explore the edible school garden project (http://edibleschoolyard.org/) and summarise the key points of the program in its development, implementation and alignment with the school curriculum. Conclude with your thoughts on the benefits of such a program.

10. Why is a whole of school approach necessary to be successful in promoting healthy food choices in students? List all possible ways that this could be implemented.

**References**


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