Lesson 2

NUTRITION & OBESITY

AIM
Explain the relationship between nutrition and obesity.

WHY WE NEED FOOD

Food is essential to fuel or body's and provide us with energy to carry out everyday functions in life. Food is essential as it provides the building blocks of life. By this we are talking about the chemical elements provided in food are the same chemical elements which make up the cells and tissues of your body – approximately 96%. The remaining 4% of the human body is made of minerals – mostly calcium and phosphorus.

Food is complex; it is made up of around 50 different chemical compounds which are required to nourish the human body. The nutritional values of food vary between each one.

Nutrients from food are required for healthy growth and development during childhood and for sustaining a healthy body throughout life into adulthood. These nutrients are primarily fats, proteins, carbohydrates, vitamins and minerals. A healthy diet provides us with all the nutrients we need from a variety of food sources.

SOME COMMON TERMS IN NUTRITION

Recommended Dietary Intake (RDI): the average daily dietary intake level required to meet the nutrient requirements of individuals

Estimated Energy Requirement (EER): the average dietary energy intake required to maintain balance between food intake and physical activity. This also takes account of age, gender, weight and height.

Upper Intake Limit (UIL): Usual intakes above this level may place an individual at risk of adverse side effects of excessive intake.

Adequate Intake (AI): used when there is not enough information about a nutrient to determine an EER or an RDI.

Note: these terms are commonly used in Australia, in other countries this terminology may vary slightly

UNDERSTANDING DIGESTION AND ABSORPTION

How we process food

The food we eat travels through our digestive system in order to be broken down and, thus enabling the nutrients in food to enter the blood stream and be used by the body as required.

This mechanical breakdown process starts in the mouth as a result of chewing. Saliva containing mucus, which acts as a lubricant to swallow food, and the enzyme amylase is secreted from salivary glands which are found around mouth. The enzyme amylase begins the initial stages of food breakdown – digestion.

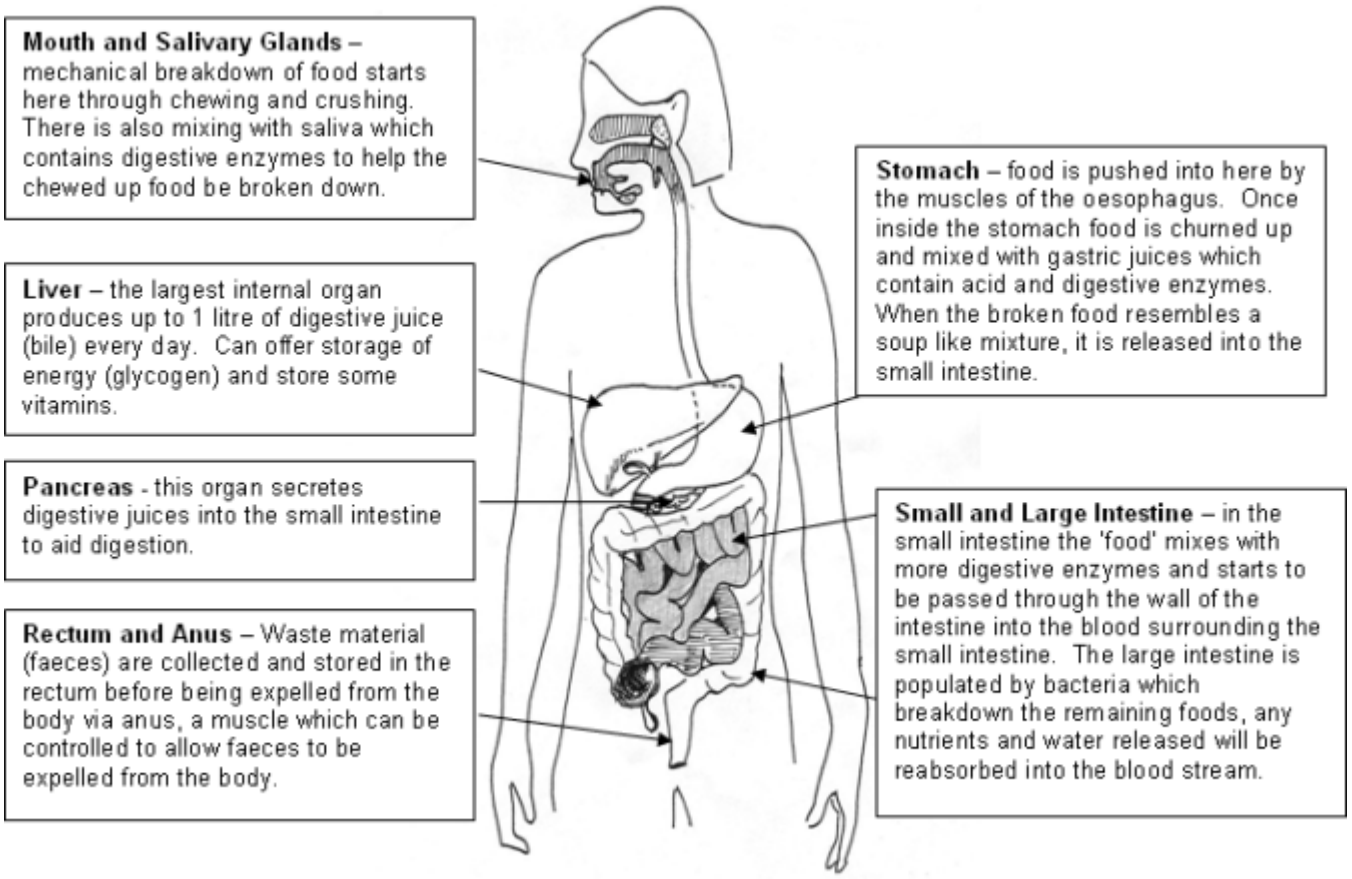
Food then reaches the stomach as a result of muscular contractions of the oesophagus pushing it along. Glands lining the stomach secrete hydrochloric acid that dissolves food particles and a digestive enzyme which is specifically designed to break down proteins – pepsin.

The final stages of digestion and almost all of the nutrient absorption occur in the small intestine. It is here that nutrients from food are absorbed by the body into the bloodstream through the intestinal wall. The pancreas (a large gland located behind the stomach) secretes further digestive enzymes and another fluid rich in to neutralise the acid from stomach, into the small intestine. The liver secretes bile into the small intestine. Bile contains ions to neutralise acid from the stomach and bile salts to help break down fats.

Undigested material is passed to the large intestine, where reabsorption of salts and water (and few nutrients) take place. Finally, contractions of rectum, the last part of large intestine, expel the faeces through the anus. Faeces are expelled from the body anything between one to three days after eating the food.

See the diagram below to locate the different organs of the digestive system.

Basic Roles of Major Digestive Organs



FOOD COMPOSITION

Carbohydrates

Carbohydrates contain carbon, hydrogen and oxygen. As a cheap source of energy, they are widely consumed, and form the basis of the diet of much of the human population.

- Complex carbohydrates (long chains of sugar molecules) – take longer to be broken down by the human body, and are found in foods such as bread, rice, pasta and potatoes.
- Simple carbohydrates (short chains or single molecules) – generally known as sugars, they are broken down more quickly in the body. They are found in foods such as honey, glucose syrup, dried fruits and soft drinks.
- Dietary Fibre – this is sometimes classified as a carbohydrate, and sometimes not. Dietary fibre comes from plant cells and is important for digestion. Fibre is found in wholegrain food products such as brown rice and wholemeal bread.

Proteins

Proteins are molecular compounds containing carbon, hydrogen, oxygen and nitrogen atoms; and often also sulphur and some phosphorus. Every cell in the body is partly composed of proteins. Protein is a structural material required for growth and repair, and replacement of damaged tissues. It is also required for the process of living, for glandular secretions, enzymes and hormones. Excess protein can be broken down and converted to variety metabolic products, and can be used to contribute to energy cycles in the body. When broken down efficiently, protein typically accounts for 10-15% of energy generated in cells. Nitrogen which is not used by the body during energy production is excreted (removed) from the body as a waste product in urine. It is for the reasons outlined above, that protein is important to athletes.

Plants manufacture their own protein, but humans cannot do this. People must be provided with ready made protein either in animal or plant foods. Protein is commonly divided up into plant and animal proteins. Foods high in protein include all meats, fish, peas, beans, legumes, egg, milk and cheese.

Proteins consist of a chain of hundreds or more amino acid units – amino acids are the building blocks of protein held together by bonds. There are only approximately 20 different amino acids found in food and body proteins. By being linked together in different combinations and proportions, an almost endless variety of different proteins can be formed.

The body has limited powers of converting one amino acid into another as the need arises. There are, however 8 amino acids which cannot be manufactured by the body in sufficient quantities, and these 8 are known as "essential amino acids". They must be provided in the diet of every adult human. The essential amino acids for adults are: Isoleucine; Leucine; Lysine; Methionine; Phenylalanine; Threonine; Tryptophan; and Valine.

The amount of protein required depends on both your level of exercise and your overall weight.

Fats

Fats are also compounds of carbon, hydrogen and oxygen but they contain less oxygen than carbohydrates. Fats are solid at room temperature, whereas oils are liquid. Humans convert excess carbohydrate into fat.

Fats have various roles in the body and are vital in maintaining human health through maintaining body temperature and promoting cell function. With regards to nutrition, fats do serve as an energy source for the body. As stated above, fats converted from carbohydrates or fat molecules can be directly stored in adipose (fat) tissue can be broken down in the body to release glycerol and fatty acids. The glycerol can be converted to glucose by the liver and therefore can be used as a source of energy.

Fatty acids (one of the components of fats), depending on their molecular structure, can be termed saturated, unsaturated, mono-saturated or polyunsaturated.

Most fats contain both saturated and unsaturated fatty acids but in widely varying proportions, e.g.

Butter	60% saturated	35% unsaturated fatty acids by weight
Soft margarine	31% saturated	66% unsaturated fatty acids by weight
Cheddar Cheese	60% saturated	35% unsaturated fatty acids by weight
Olive oil	14% saturated	81% unsaturated fatty acids by weight
Lamb (average)	48% saturated	43% unsaturated fatty acids by weight

Fats with a high percentage of unsaturated fatty acids are usually liquid at room temperature. Under controlled conditions unsaturated fatty acids can be converted to saturated fatty acids by a process known as hydrogenation. Hydrogenation is used in the manufacture of margarine, to turn liquid oil into a solid.

Fats are found in foods as visible fats, e.g. in butter, margarine, oils and the fat on meat as well as invisible fats in milk, nuts, lean meat, some fish etc.

Fibre

Fibre is essential for maintaining the health of the digestive system. Plants and plant products are the sources of fibre in the diet. There are two types of fibre – water soluble and insoluble fibre. Water soluble means the fibre can dissolve in water, whereas as insoluble means the fibre doesn't dissolve or breakdown in water. Why is this relevant?

Soluble fibre is needed to slow the breakdown of carbohydrates into simple sugars. By doing so, simple sugars are released into the blood stream more slowly and thus blood sugar levels are stabilised. Also, as this type of fibre moves through the digestive tract, it forms a thick gel-like mass on which cholesterol molecules bind. This therefore reduces the level of cholesterol entering the blood.

Insoluble fibre helps keep the digestive tract, specifically the colon, healthy by not being digested or absorbed by the body which means it moves through the colon encouraging regular bowel movements. This is important as a build up of faecal matter in the colon can lead to toxins entering the blood stream. This type of fibre also draws water in, making stools larger and easier to expel from the body.

The benefits of fibre are clear from the information outlined above; however, there is one extremely important reason why we should increase fibre consumption – cancer prevention. The bacteria which live in the colon can breakdown (digest) some fibre, by doing so they create an acidic environment inside the colon. Researchers have found that an acidic environment in the colon decreases the risk of colon (colorectal) cancer developing. This is currently a cancer which commonly leads to death.

The Need for Fluids

Every cell in the human body needs water. Water is vital for cellular functions and much more. It is needed to regulate body temperature and provide a means for nutrients to travel to cells and organs via the blood. Water also transports oxygen to cells, and removes waste from cells. In biological terms it is needed for most digestive, absorptive, circulatory and excretory functions.

There are so many different opinions stating how much water a person should drink each day. Often you may hear people say 6-8 glasses per day, but a glass is not a volumetric measure as all glasses are different sizes! Some other people recommend water intake based on the individuals weight - someone who weighs more needs more water. If we were to say what the recommended water intake should be, we suggest drinking between 2-3 litres every day. If the person is active, they should drink an additional litre for every half hour of vigorous exercise.

Water is lost from the body in many ways – perspiration (sweating), urinating, faeces and through exhalation. If someone does not drink enough water they may experience tiredness, headaches, dry eyes and mouth and experience a difficulty concentrating.

The Glycaemic Index (GI)

The Glycaemic Index (GI) represents the effect a particular food has upon the rate and increased concentration of sugar molecules in the blood, in other words, it classifies foods according to how fast they release glucose (sugar) into the bloodstream.

A high GI food, for example, a carbohydrate meal, will usually lead to a rapid rise in blood sugar levels, and usually within an hour. Apart from the carbohydrate content, the physical form of the food (small or large particles), and whether the food is raw or cooked will affect the glycaemic index. The glycaemic index of a given food may also vary between individuals.

Generally, foods high in simple carbohydrates have a high glycaemic index because they lead to a rapid rise in blood sugars. Some starchy foods also have the same properties. On the other hand, high fibre foods have a low glycaemic index. Fructose or fruit sugar actually has a low glycaemic index, and is used in sports drinks for this reason. The baseline is 100, which is the equivalent of eating pure glucose.

Foods with a high Glycaemic Index (>85)	**Foods with a medium Glycaemic Index (60-85)**	**Foods with a low Glycaemic Index (<60)**
Glucose	Banana	Fructose
Sucrose	Grapes	Apple
Honey	Orange juice	Cherries
Sugared lollies	Pasta	Kidney beans
Corn Flakes	Rice	Chick peas
Potatoes, carrots	Whole grain rye bread	Lentils
Raisins	Yams	Dates
White/whole wheat Bread	Corn	Figs
Potato Chips	Baked Beans	Ice cream
Plums, peaches	Beetroot	Milk
Sugared soft drinks or sports drinks	Shortbread	Yoghurt

CALCULATING ENERGY REQUIRMENTS

Protein, carbohydrates, fibre, vitamins and minerals, fats – how much does someone need?

Energy requirements change throughout life and are dependant on a multitude of factors. The most commonly recognised factors are age (whether or not someone is experiencing a growing phase),

gender and physical activity. People's energy requirements are also affected by pregnancy and breastfeeding, illness or infection, sleeping patterns, levels of stress or hormone levels, to name a few. To work out energy requirements it is important to take account of the many potential factors affecting a person's life at that time.

Energy in food is measured in kilojoules (kJ). This measurement used to be calories, but kilojoules are the metric unit for quantifying food energy now. You may still find calories on some food packaging, but use of this should be avoided where possible. One kilojoule is equal to 0.238 kilocalories.

People need to work out their kilojoule requirements based on their weight. Firstly, it should be noted that this varies enormously from person to person depending on what conditions they are under. One measure suggests that the average person requires each day 140 kilojoules of food intake for each 1kg of weight. Using this method if you weighed 80kg you would need 11,200 kJ to maintain your existing weight.

People trying to lose weight should aim to decrease the amount of kilojoules by 15-20% each day. So they should first work out the number of kilojoules needed to maintain their weight then deduct up to 20% to give a reasonable and achievable target for daily kilojoule intake.

FOOD PYRAMID AND RECOMMENDED DAILY INTAKE (RDI)

What is the recommended intake of nutrients?

There are many different authorities around the world that publish and promote recommendations. These recommendations can vary from one authority to the next. As new information comes to light, and our understanding of the human body grows, we find recommendations are continuously modified.

In the light of these considerations, you cannot be excessively strict in your adoption of recommendations; but you should always give serious consideration to recommendations made by enlightened and educated experts.

There are limitations of recommended daily intake population based nutrient recommendations which are outlined below. It is wise to become familiar with these to demonstrate your understanding that every individual is different and have specific needs which can't always be addressed by following population based dietary recommendations.

- Individuals have widely varying nutrient requirements - both from person-to-person and from day-to-day general dietary recommendations must, therefore, be used with caution in assessing an individual's diet.

- General dietary recommendations do not allow for illness, medications or the effects of major life stresses, smoking, and alcohol abuse.

- They do not allow for adaptation to high or low intakes of some nutrients (e.g. iron, calcium, energy) for the individual.

- They do not address the minor vitamins and trace elements (it is assumed that if the intake of the main nutrients is adequate, then the requirements for the others will automatically be covered).

POPULATION BASED NUTRIENT REQUIREMENTS

Another method of calculating daily energy requirement is to use average energy requirements for the general population. For example, the UK Department of Health has published estimated average requirements (EARs) of 1940 calories a day for women and 2550 for men. Average energy requirements can also be given by age range, gender and daily activity level . For example in Australia the estimated energy requirement (EER) for an 18 year old boy is has 4000KJ per day.

In addition to providing a daily energy prescription, population based nutrient recommendations are also useful in dietary planning by helping to show the amount of different nutrients required for good health.

There are limitations of recommended daily intake population based nutrient recommendations, however, and some of these are outlined below. It is wise to become familiar with these to demonstrate your understanding that every individual is different and have specific needs which can't always be addressed by following population based dietary recommendations.

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To help us achieve the recommended intake of nutrients pictorial guides have been developed to show the type and proportions of food the average person should eat on an average day to achieve good nutritional intake, this includes the food pyramid, originally developed in the US and the UK Eatwell plate. The Eatwell plate divides a plate like a pie, showing the size of each 'slice' of different kinds of food. Cereals and fruits and vegetables have the largest slices while two other categories: dairy foods, and meat, fish, eggs and beans are considerably smaller and foods high in sugars and fats have a very narrow purple-edged slice. The slices have a coloured rim to make the proportions of each food on the plate easy to see.

The US food pyramid follows the same principles as the Eatwell plate. In this instance different food groups are represented by different levels of the pyramid. The food group with the highest number of recommended daily servings (bread, cereal, and pasta group) form the base of the pyramid; the group with the lowest recommended number of servings (fats, oils, and sweets) form the apex of the pyramid. The food pyramid is used in a number of countries including Australia and New Zealand.

The United States Department of Agriculture (USDA) has recently turned their food pyramid on its side. It now shows a child walking up the stairs of the pyramid as a way to incorporate exercise into the nutritional eating habits of children. The pyramid also incorporates a new colour scheme. Released in April 2005, the new Dietary Guidelines from the USDA continues to reflect the tense interplay of science and the powerful food industry. Several of the new recommendations represent important steps in the right direction:

- The new guidelines emphasize the importance of controlling weight, which was not adequately addressed in previous versions. And they continue to stress the importance of physical activity.
- The recommendation on dietary fats makes a clear break from the past, when all fats were considered bad. The guidelines now emphasize that intake of trans-fats should be as low as possible and that saturated fat should be limited. There is no longer an artificially low cap on fat intake. The latest advice recommends getting between 20% and 35% of daily calories from fats and recognises the potential health benefits of monounsaturated and polyunsaturated fats.
- Shows the importance of fibre as opposed to simple sugars, urging an increase in wholegrain and limiting sugary sweets.

These changes which have been implemented have come about because research showed that American children and children in other countries have had a drastic increase in weight since the food pyramid had started decades ago. Also, the food pyramid was a one size fits all and now has altered

itself to include gender differences, age differences, as well as taking into account the amount of physical activity that the person exercises. The food pyramid is broken down into groups of foods. The basics of the food guide pyramid for servings are as follows:

- Fats, oils and sweets group - Limit servings
- Milk group - 2 servings
- Meat group - 2 servings
- Vegetable group - 3 servings
- Fruit group - 2 servings
- Grain group - 6 servings

As well as being a guideline for sources and groups the Food Pyramid and Eat well plate both convey the most important elements of a healthy diet:

- Proportion - simply by the shape of the food pyramid at a glance would indicate that fruits, vegetables and grains should make up a majority of a diet.
- Moderation - meat and dairy products, in moderate amounts, contribute to a healthy diet. The tip of the pyramid consists of fats, which is not omitted from healthy eating but is by far the smallest section on the food pyramid.
- Variety - choosing different foods from each food group every day will likely guarantee someone is consuming a greater variety of foods needed to maintain a healthy diet.

CHILDHOOD OBESITY

Increasingly, obesity is being documented in children, and even toddlers. This is unusual because of the natural propensity of toddlers and young children to be active and inquisitive. Most young children love to run, jump, move and play. However television, and with older children computer games are replacing physical activity as a favoured past time for children. This may be due to busy, stressed parents who have neither the time nor energy to play outdoors with their children, because parents are concerned for the safety of their children, and feel unable to supervise outdoor activities sufficiently, preferring children are indoors instead.

Lack of physical activity is not the only cause of childhood obesity. Diet is a very important factor. The availability of calorie dense, nutrient poor food, the often cheaper prices of such foods over fresh whole grains, organic products and quality meat cuts, marketing of junk food to children, and the reliance of fast-foods and take outs all contribute to the increasing prevalence of overweight and obesity in children. The problem has become so bad, that in some places that the percentage of overweight/obese children has more than doubled in as little as 10 or 15 years.

Other factors to consider include genetics, depression and family habits and cultural food preferences. Genetics is not usually a key factor in childhood obesity. It is true that in some families, there is a tendency to obesity, and children in such settings may be at increased risk of becoming obese, but with the exception of a handful of genetic diseases, genes are generally not the cause of obesity. Depression is an increasing problem in children and adolescents and can trigger comfort eating and dependence on food which in turns leads to weight gain. This is a vicious cycle where the increasing weight worsens self-image and self-worth, leading to increasing depression and a greater reliance on comfort foods.

Childhood obesity is complex in its causes, and yet, most can be approached simply and effectively to bring weight back within healthy limits or to ensure weight never increases to unhealthy levels in the first place. Simply increasing physical activity (60 minutes a day for children), removing calorie dense, nutrient poor foods from the diet, and maintaining good quantities of grains, fruits and vegetables along with quality lean meat and dairy can keep children at healthy weights, and also ensure good muscle strength, bone density and cardiovascular fitness. In the case of toddlers and very young children, excess weight may not be a major cause for concern. As activity levels increase and they experience growth spurts most toddlers, assuming they have a good diet and get plenty of opportunity to play will grow into their weight.

Obesity dramatically reduces a person's quality of life. For children it can leave them feeling isolated from their peers, prevent them participating in games and activities, make them the target of bullying and leave them susceptible to depression, anxiety and other mental health problems. They are often sick due to poor immune function, take longer to recovery from injury and to feel exhausted and suffer problems with concentration and behaviour. Greater awareness of the severity of medical conditions in obese children, and the impact obesity has on their physical and psychological well-being is important in combating childhood obesity and making those dealing with children more aware and responsible.

Obese children are at much higher risk of:

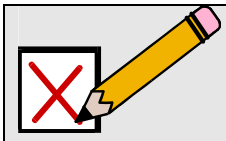
- Type II diabetes which in turn increases risk of micro vascular problems, fat accumulation on organs, and early development of atherosclerotic plaques (inflammation of the walls blood vessels arteries) and so on.

- Early entry into puberty which puts further stress on the child's body, which must now make additional hormones, provide not only energy but a full range of nutrients to fuel growth and maturation, and in girls increases iron requirements.

- Sleep apnoea (snoring). Children are often left tired and lethargic during the day and experience episodes of low blood oxygenation when their breathing is temporarily obstructed. They often perform at below their best at school, suffer headaches, may show behavioural problems and can often require surgery to remove the tonsils. Surgery is more risky in obese people.

- Cardiomyopathy and irregular heart beat/palpations. In obese children, the heart has to work much harder to pump blood effectively. Cardiomyopathy is a disease of the heart muscle that has several causes; one being the stress on the heart in obese people. Cardiomyopathy increases the risk of heart attack and arrhythmia (irregular heart beat). Nutrient deficiencies and toxicities can also affect heart function, particularly, high sodium intake and low potassium, magnesium and calcium intake.

- Nutrient deficiency or toxicity symptoms leads to chronic illness due to poor immune system, skin conditions such as dermatitis and eczema, lethargy, diarrhoea, constipation, poor hair and nail condition and so on.



SELF ASSESSMENT
Perform the self assessment test titled 'Self Assessment Test 2.'
If you answer incorrectly, review the notes and try the test again.

SET READING

Spend up to 1 hour reading over resources that you have access to, looking at anything that you can find which is relevant to the stated aim for this lesson.

These resources may include one or more of the following:

- Books in your possession
- Books you find in a library
- Brochures, plant catalogues etc.
- Web sites

SET TASK

Visit a supermarket (if you have accessibility problems undertake as much of this assignment as you can through a virtual visit on the internet). Observe the foods which are given prominence by the retailer (promoted more); and take note of the types of things people are purchasing. Given that many food products will list their contents on the packaging: study the packaging; determine the contents and consider the affect which different products might have upon nutrition and obesity management.

ASSIGNMENT
Download and do the assignment called ‘Lesson 2 Assignment’.