Unani Tibb Dietary Therapy Module

Learning objectives:

1. **To have an understanding of the principles of traditional Unani Tibb nutritional and dietary approaches**
2. **To develop the skills that would enable the student to apply a traditional Unani Tibb approach to nutrition in order to help effect optimal health and well-being in the client.**
3. **To have a comprehensive understanding of the Unani Tibb context of nutrition and dietary therapy as a means to maintaining good health, balanced humours and temperaments, and addressing disease.**
4. **To be able to advise on and modify diets appropriately.**
5. **To understand how diet, lifestyle and the environment may contribute to a toxic internal environment**
6. **To appreciate how diet, lifestyle and the environment may contribute to humoral imbalance and disease.**
7. **To understand the relationship between the health of an individual, humoral balance and diet and nutrition**
8. **To understand how diet and lifestyle affects temperament balance**

Year 1: Western Nutrition

1 Introduction

Welcome to the dietary therapy module. In this module you will learn about the Unani Tibb approach to dietary therapy and how diet can balance the temperaments and humours. You will also learn about the basics of Western nutrition so that you can easily explain to your clients how their current diet can be affecting their symptoms, both from a Western perspective and also from a Unani Tibb perspective.

We will start this module with a detailed look at Western nutrition: the macro nutrients of fats, carbohydrates and proteins and the micro nutrients of vitamins and minerals. Once you have learnt these basic principles we can then look at how foods affect us, both from a physical perspective, but also from an emotional perspective as well. Food affects our very nature; it determines who we are, it can influence our thought processes and decision making and our overall health. From a Unani perspective, this will not surprise you. We all have different natures which we know as the four temperaments. However, from a Western nutritional viewpoint, the fact that food can affect our nature and thought processes is a rather alien concept. Recent research suggests that the microbiome, our gut bacteria, will determine our food choices. This is interesting when we consider sweet cravings for example. Remember that Hippocrates said that all disease begins in the gut; unfriendly bacteria and yeasts will crave sweet foods/sugar and encourage the person to eat more sweet food, thus further imbalancing them. A yeast imbalance, namely candida, will generally result in a craving for sugary carbohydrates. This would be a phlegm imbalance in Unani Tibb. We will look at other correspondences between Unani and western medicine during the dietary therapy weekend and later in this module. It would seem that Western medicine with all of its research is finally catching up with the wisdom of Unani medicine.

Western nutrition reduces our food to the sum total of the chemical nutrients that it contains; namely carbohydrates, proteins and fats, vitamins and minerals. In recent years it has researched the biochemistry of 'phytonutrients' such as resveratrol found in grapes and red wine, or Proanthrocyanins which are found in a variety of plants. This has created the 'superfoods' industry with everyone eating blueberries with their breakfast or broccoli with their main meal. While these are good foods to eat we need to take a step back from this approach and look at the energetic composition of food, which is how food is viewed in Eastern medicine. Foods are matched to a person's energetic profile or temperament and we therefore truly start to use food as a medicine rather than 'playing around' with the biochemistry of food and eating foods because they contain a certain phytonutrient because it is the latest superfood. A total lack of understanding into what we should be eating has resulted from this reductionist approach leaving the dietary confusion of Western nutrition to the masses to pick through. The scientific approach has effectively squashed any instinctive knowledge that we used to use around our food choices.

In this module we will therefore have a look at the Western approach just so that you have an idea of the basic principles, and then we will concentrate on the Eastern approach to nutrition and in particular, the Unani Tibb approach to dietary therapy. You will see as you work through the first part of this module how the Western approach to nutrition reduces everything to its chemical components.

Your main course book for this module is *'Human Nutrition, A Holistic Approach'* by Rudolph Ballantine. Ballantine was a medical doctor who spent a lot of time in India, learning the Ayurvedic approach to diet and health. Although this book was written in the 1970's its naturopathic message is still very relevant today. There are numerous books written about nutrition which mainly approach this complex topic from a clinical, allopathic approach. Ballantine has a unique approach because he manages to weave together the Western nutritional approach with Eastern principles. Throughout this module you will be asked to read relevant chapters from this book to enhance your understanding about the topic being studied. You will need to have read the book to complete the assignment questions and the various self-assessment questions which are found at the end of each section, which have been added in so that you can check your understanding and knowledge of each separate area of study as you work your way through this module.

To start your journey into nutrition please read *Human Nutrition, A Holistic Approach* by Rudolph Ballantine, section 1 'The Ecology of Nutrition' and then answer the questions below. The answers are given at the end of the next section. Try to resist looking at the answers before attempting the questions first:

PLEASE READ 'HUMAN NUTRITION' BY BALLANTINE, CHAPTER 1, CHAPTER 2 AND CHAPTER 3. THESE 3 CHAPTERS COMPRISE THE FIRST SECTION 'THE ECOLOGY OF NUTRITION' AND INCLUDE 'EATING PATTERNS-ANCIENT AND MODERN'; 'NUTRITION AND THE SOIL'; AND 'NUTRITION AND THE CELL' P7-44

Self-Assessment Questions Introduction:

Q1: What is the significance of the action of humic acid in the soil?
Q2: What role does the fungi mycorrhiza play in the health or destruction of plants?
Q3: Although Ballantine was writing at the very beginning of the organic produce market, what are the two main benefits of organic produce?
Q4: In which part of the cell does heat originate?
Q5: Make a list of all the nutrients which are needed by the cell to produce energy
Q6: Explain the role of enzymes in cellular processes
Q7: What are enzymes made up of?

2: Carbohydrates

OBJECTIVES:

- **TO HAVE A BASIC UNDERSTANDING OF THE CHEMISTRY OF CARBOHYDRATES**
- **TO BE AWARE OF THE VARIOUS FOOD SOURCES OF CARBOHYDRATES**
- **TO UNDERSRAND THE DIFFERENCE BETWEEN REFINED AND UNREFINED CARBOHYDRATES, AND SOLUBLE AND INSOLUBLE FIBRE**

We will start with a look at the macro and micro nutrients. The macro nutrients are also known as the bulk nutrients and comprise carbohydrates, proteins and fats. The micro nutrients are the vitamins and minerals. Having a working knowledge of these will assist you in your practice and give you a base upon which to build additional nutritional knowledge should you decide to further your career and become a naturopath.

Macronutrients

In this section then we will look at the basics of carbohydrates, proteins and fats; their food sources and how the body breaks them down.

To start this section please do the following reading:

PLEASE READ 'HUMAN NUTRITION' BY BALLANTINE INTRODUCTION TO SECTION 2 'THE BIOCHEMISTRY OF NUTRITION' P46-48

Carbohydrates:

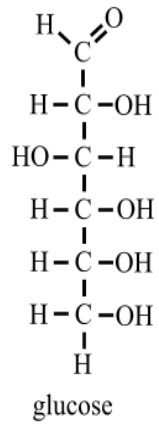
The history of carbohydrates is the history of civilised man. We introduced the grains into our diet approximately 10,000 years ago and at that point became farmers, tending the land and experimenting over the centuries with cross pollination to provide stronger, hardy varieties. In more recent years this has extended to using fertilisers, which have changed the composition of the soil and the vital nutrients within, and to pesticides, which have disturbed the immune system of the plant resulting in fewer nutrients available for us and a knock on effect to our immune systems. The nutrients are no longer in the soil. Even organic soil in the UK does not reach the nutrient value of that of soil in the 1930's. Pesticides have affected our detoxification systems resulting in compromisation of health and residual toxins placing an added load on liver detoxification. Wheat is a case in point. It has been modified so many times and sprayed with many fertilizers in the last 50 years that its composition is practically unrecognisable from how it was 50-100 years ago. The gluten (protein) content has increased and researchers are now suggesting that the human digestive system does not have the capacity to break it down. This has resulted in many people feeling a lot better when they eliminate it from their diet.

We will start this section with a look at the chemical composition of carbohydrates and then move on to see how they are broken down in the body and how the type of carbohydrates that we choose to eat in our diet can have a direct bearing on our overall health.

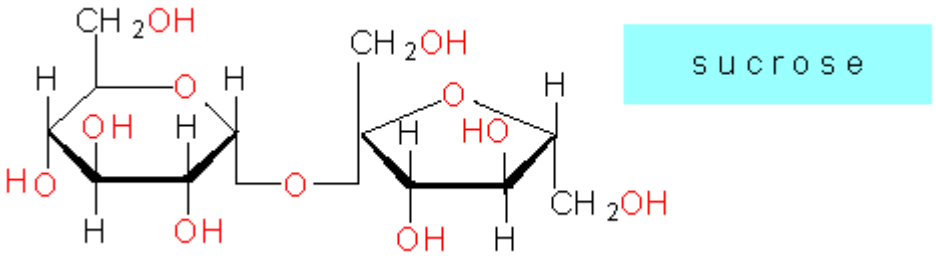
Carbohydrate chemistry

All carbohydrates are broken down in the body to their smallest components which are simple sugars. Simple sugars are categorised further into whether they have a chain of 5 carbons or a chain

of 6 carbons. For example, glucose, a simple sugar, contains 6 carbons. The chemical formula is C6 H12 06. Where 'C6' means 6 carbon molecules. The standard chemical formula for carbohydrates is CH2O; therefore if there are 6 carbons it follows that there will be 12 hydrogen molecules and 6 oxygen molecules. Have a look at the following chemical formula for glucose and note the 6 carbon atoms.

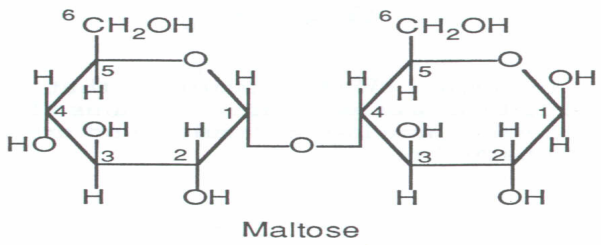


When two molecules of simple sugars are joined together, for example one molecule of glucose and one molecule of fructose, they are held by a glycosidic bond. Glycosidic bonds are very important in carbohydrate chemistry. They link together the two sugar units that make up cane or beet sugar (sucrose) and also hold together hundreds of sugar units that make up the molecules of starch or glycogen. There are only a few disaccharides that occur naturally. The most significant is sucrose, which is present in almost all plant tissue as a major source of energy.



Sucrose is made up of one molecule of glucose and one molecule of fructose joined together by a glycosidic bond. It is therefore known as a disaccharide.

Have a look at the next chemical formula which is of maltose. Maltose is made up of two units of glucose joined together by a glycosidic bond:



Monosaccharides, Disaccharides, Oligosaccharides, and Polysaccharides

From the chemistry you have learnt, a monosaccharide is the smallest unit that a carbohydrate can be. All carbohydrates are eventually broken down into monosaccharides. Therefore a monosaccharide is a single sugar.

Disaccharides are two single sugars joined together by a glycosidic bond. Examples are sucrose, trehalose, lactose and maltose.

Oligosaccharides comprise of a minimum of three simple sugars joined together, up to a maximum of ten. Examples are Raffinose and Stachyose which occur in soya beans and are noted for causing flatulence.

The following table gives the component monosaccharides for each oligosaccharide:

Oligosaccharides	**Combined monosaccharides**
Raffinose	Galactose+ Glucose+ Fructose
Stachyose	Galactose+ Galactose+ Glucose+ Fructose

Polysaccharides

The linkages from one monosaccharide to another may be repeated many times to form long chains. These are termed polysaccharides and always contain more than ten monosaccharides. Starch, glycogen and cellulose are all examples of polysaccharides.

Polysaccharides are generally divided into starch and non-starch polysaccharides. Non starch polysaccharides are also known as fibre. Starch is a plant storage polysaccharide which is deposited in the cells of leaves, tubers, roots and seeds.

Polysaccharides:

- Starch
- Fibre (cellulose)

Starch does not figure in animal metabolism except as a food source in edible plants. Animals and humans need digestive enzymes to break down the starch in food such as amylase and maltase.

Whereas plants store starch as their energy source, humans store glycogen as their energy reserves. Glycogen is stored in the muscles and liver. Mammals can draw on their carbohydrate stores (glycogen) during periods of food scarcity. However, it is only a short term reserve; the main long term reserve of energy is in the form of fat. Both muscles and the liver contain enzymes for breaking down glycogen.

Inulin

Starch is the main carbohydrate available found in foods. The main sources of starch are found in the grains, roots and tubers. There is also the polysaccharide inulin. Inulin is a 'fructan' meaning that it is composed entirely of fructose units. Inulin makes up the principle storage polysaccharide of chicory root and Jerusalem artichoke and also occurs in other vegetables to a lesser extent, such as asparagus. Inulin is particularly good for the bowel bacteria and acts as a prebiotic, feeding the beneficial bacteria and allowing them to proliferate and keep the bowel and immune system working well. Interestingly, Haris bin Kalda is quoted as saying *"pomegranate is the best fruit among all fruits, rose is the best essence among all essences and chicory is the best vegetable among all the vegetables*"[1]. In Tibetan medicine Pomegranate is revered for its healing properties. Research has shown that it stimulates detoxification and therefore pomegranate has been added to the ever growing list of superfoods alongside inulin.

Cellulose

Cellulose (also called fibre) is the other main polysaccharide found in plants. Plant foods contain a large amount of cellulose and it is the cellulose that gives the plant its strength to stand up straight, but cellulose does not provide us with much nourishment because we are unable to break it down. We do not have the capacity, or relevant enzymes to break down cellulose. However, fibre is of the utmost importance for the bowel bacteria. Friendly bacteria breakdown fibre and produce short chain fatty acids which help to keep the bowel wall healthy and guard against 'leaky gut'.

Q2.1 What does the body convert excess carbohydrate into?
Q2.2: What are known as the building blocks of the body?
Q2.3: When would we burn protein for energy instead of carbohydrate?
Q2.4: What is the smallest component that carbohydrates are broken down into?
Q2.5: What is the difference between a monosaccharide, disaccharide and oligosaccharide?
Q 2.6: What is a glycosidic bond?
Q2.7: Which sugars combine to make up sucrose, common table sugar?
Q2.8: What do all carbohydrates contain?
Q2.9: What is the chemical formula for carbohydrates?
Q2.10: How many sugars comprise oligosaccharides?
Q2.11: Where might you find raffinose and which sugars is it comprised of?
Q2.12: What are polysaccharides? How many monosaccharides are contained in a polysaccharide?
Q2.13: Where is starch found in a plant?
Q2.14: What is inulin and which monosaccharide is it made up of? What is inulin good for?
Q2.15: What is cellulose and where is it found?
Q2.16: What are the two categories that polysaccharides are divided into?
Q2.17: What food substance is of the utmost importance to the gut bacteria?

[1] Ibn Abi Usaiba. Uoyunal-Amba fi Tabqat al Atibba vol.1 (Urdu translation by CCRUM). New Delhi: Dept. of AYUSH, ministry of H & FW; 1990:74,75,97,138,220

Carbohydrate digestion

Carbohydrate digestion starts in the mouth with the secretion of **salivary amylase** (formerly called ptyalin). Hydrochloric acid in the stomach inhibits the action of salivary amylase. Messages are sent to the pancreas that food is in the stomach and the pancreas then starts to produce **pancreatic amylase**. This is the only carbohydrate digesting enzyme that is produced by the pancreas. Pancreatic amylase breaks down carbohydrates into monosaccharides, disaccharides, maltose and dextrose.

The enzymes made by the pancreas include:
Pancreatic proteases (such as trypsin and chymotrypsin) - which help to digest proteins.
Pancreatic amylase - which helps to digest sugars (carbohydrates).
Pancreatic lipase - which helps to digest fat.

We will continue our study of carbohydrates later when we study their effect upon blood glucose control. To complete this section please refer to Ballantine and then answer the questions below.

Fructose

Please note when reading this section of Ballantine's book that our knowledge of fructose has changed since Ballantine wrote his book. We now know that fructose goes straight to the liver and is implicated in fatty liver disease. There was a period at the end of the 20th century when fructose was added to diabetic jams and hailed as safe for diabetics because it by-passed insulin levels. What is now understood is that fructose affects liver function. Fructose is safe if eaten with fibre, as with eating fruit, but when it has been concentrated and taken on its own such as in fruit juices and high fructose corn syrup, it is considered very problematic.

PLEASE READ 'HUMAN NUTRITION' BY BALLANTINE CHAPTER 4 'CARBOHYDRATE, OUR SOURCE OF ENERGY' P49-90

To complete this unit we will explore gluten in a little more detail. Please choose one of the following books to read:

- **Dangerous Grains by Braly and Hoggan**
- **Wheat Belly by Dr William Davis, cardiologist**
- **Grain Brain by Dr David Perlmutter, neurologist**

Self-assessment questions: Carbohydrates

Q2.18: Explain carbohydrate digestion including the various enzymes involved.
Q2.19: Why are carbohydrates called 'energy foods'?
Q2.20: In very simple terms, explain blood sugar balance.
Q2.21: What is the difference between white sugar and molasses?
Q2.22: What is Gur (Jaggery)?
Q2.23: Explain why dental caries and diabetes did not appear in those who had eaten just sugar

cane for years
Q2.24: Explain nutrient debts
Q2.25: What are the 3 parts of grain?
Q2.26: What is the protein component of Wheat called?
Q2.27: According to Ballantine, what are the properties of wheat and why are some Indian physicians wary of it?
Q2.28: What is phytic acid and is it always considered to be a problem?
Q2.29: What are the drawbacks and benefits of refined flour?
Q2.30: Which nutrients are lost in the refining (polishing) of rice?
Q2.31: Which nutrients is corn particularly deficient in?
Q2.32: Buckwheat generally grows in cool moist climates. Why is it considered suited to the people who live in this type of climate?
Q2.33: Name the grains which contain gluten.

Answers to Self-assessment Question's from Introduction:

Q1: What is the significance of the action of humic acid in the soil?
A: Humic acid is able to chelate the trace elements and minerals in the soil and release them gradually as the plant requires them. Humic acid can also form insoluble complexes with calcium which help to hold the soil in place.
Q2: What role does the fungi mycorrhiza play in the health or destruction of plants?
A: fungi make and release chelating agents that bind to the minerals in humus and make them into a form which is easily absorbed into the plant root. In return the plant allows the fungi nourishment. If however the plant is growing in soil which is not correct for its species then the fungi will over power the plant and destroy it. As always with yeasts, it is a symbiotic relationship only until the other party shows weakness at which point it sets out to destroy its host.
Q3: Although Ballantine was writing at the very beginning of the organic produce market, what are the two main benefits of organic produce?
A: 1: better balance of minerals from the soil rather than artificial uptake of minerals and 2: no pesticides, artificial ripeners, waxing etc. sprayed on them. Due to inorganic minerals feeding direct into the plant there is no need for humus etc. which results in no buffering action of the soil. We thus end up with plants grown in deficient soil which are not as robust and therefore have to rely upon manmade pesticides, dying or waxing, or chemicals to increase ripening.
Q4: In which part of the cell does heat originate?
A: mitochondria
Q5: Make a list of all the nutrients which are needed by the cell to produce energy
A: your list should look something like this (Ballantine p40-41)

- Glucose
- Fructose
- Proteins (peptide chains: strings of amino acids)
- Amino acids
- Hormones e.g. thyroid or adrenal hormones
- Vitamins
- Minerals, especially calcium and potassium

Q6: Explain the role of enzymes in cellular processes
A: enzymes are required in the cells for all biochemical reactions. They break down old molecules and reassemble new ones. They combine oxygen with sugar for combustion, break down chains of

fatty acids and build new protein chains.
Q7: What are enzymes made up of?
A: enzymes are chains of proteins which allow them to fold, bend, grasp, hold and bring together other molecules.

3 Proteins

OBJECTIVES

- **TO HAVE A BASIC UNDERSTANDING OF THE CHEMISTRY OF PROTEINS**
- **TO BE AWARE OF THE ROLE THAT PROTEINS PLAY IN THE BODY**
- **TO UNDERSTAND THE DIGESTION OF PROTEINS**
- **TO BE AWARE OF THE VARIOUS FOOD SOURCES OF PROTEINS**
- **TO UNDERSTAND THE DIFFERENCE BETWEEN ESSENTIAL AND NON-ESSENTIAL AMINO ACIDS**
- **TO UNDERSTAND LIMITED AMINO ACIDS AND THE PROTEIN SCORE**
- **TO UNDERSTAND THE ROLE OF PROTEINS IN THE DIET FROM A NATUROPATHIC PERSPECTIVE**

Proteins are essential to life. They are the 'building blocks of nature'. Right down from the skeleton, muscles and hormone system to the very cells themselves, protein is essential. Without it life could not take place. Protein in food is essential for optimum health. Proteins provide amino acids and nitrogen which are important factors for the growth process of the body and tissue building.

Protein is found in various forms in the human body:

- Muscles
- Hormones
- Enzymes
- Skin
- Hair
- Organs

On a cellular level protein is crucial to both the structure and activities of living cells. Proteins comprise the enzymes that carry out almost every biochemical transformation within the cell. Protein is important for the structure of each and every cell and is found in the outer and inner membranes of the cell, the cytoskeleton of the cell, the cell nucleus, cytosol and the extracellular protein secretions that build tissue structures.

In the past protein has been placed on a pedestal and the amount of protein required by the human body debated (and is still being hotly debated). In the middle of the 20th century milk and meat were considered ideal sources of protein in the West and in the 1960's large shipments of dried milk were sent to areas of deprivation. Many of the receiving populations were not in the habit of consuming milk and were often intolerant to it anyway. There was an outmoded concept in the 1960's that underfed people just needed more protein. Proteins such as milk and meat were surrounded with

ideas of warmth, comfort and reassuring nourishment. Thus a great deal of resistance to giving up these foods, or just eating less of them, is due to the psychology attached to them.

It is important to remember that protein is essential to life however. It is the *balance* of protein that it is important.

We will study how protein is digested in this section: how proteins are broken down into peptides (strings of amino acids linked together) and then into amino acids, the smallest unit that protein is broken down into in order to be able to be absorbed.

The chemistry of proteins:

We will have a brief look at the underlying chemistry of proteins. This does not need to be understood in great detail at this introductory level to nutrition.

All proteins contain:

- Carbon
- Hydrogen
- Oxygen
- *Nitrogen*
- *Sulphur*

It is only the addition of nitrogen and sulphur which sets proteins apart from carbohydrates and fats (carbohydrates and fats contain carbon, hydrogen and oxygen).

These molecules are known as **AMINO ACIDS.**

Amino acids are the smallest component of proteins and all proteins are eventually broken down into amino acids.

The nature and structure of amino acids:

Amino acids are made up of a carboxyl group and an amine group:

Carboxyl group= **-COOH**
Amine group= **-NH2**

The peptide bond:

Similar to the glycosidic bond, the peptide bond holds amino acids together. The peptide bond links two amino acids together, making it a dipeptide. Peptides are strings of amino acids joined together by peptide bonds, from just two amino acids upwards, which are too small to be called proteins. Proteins are built up by a repetition of this linkage to form tripeptides, tetrapeptides and up to very large molecules with long chains. No one has defined how small the smallest protein is, however, insulin only has 51 amino acids and is an example of a very small protein.

Nature and structure of amino acids

Let us now look at the building blocks of protein, the amino acids. All proteins are broken down in to amino acids. All amino acids contain carbon, hydrogen, oxygen, nitrogen and occasionally sulphur.

As just mentioned, short sequences of amino acids are known as **'peptides'** and longer sequences/chains are termed **'polypeptides'**. They are held together with bonds known as **peptide bonds.** Polypeptides can be several hundred amino acids long and when combined together can make thousands of different proteins.

Peptides and polypeptides make up proteins. The amino acids are linked together in linear chains and can be any combination. Therefore a protein is a sequence of many chains of peptides and polypeptides. It is the sequence of the amino acids in the chains that determine the type of protein it is.

Protein molecules can be very small or very large indeed. It may only contain 50 amino acids (such as insulin which contains 51) or 500 or even 5000 amino acids or more. A protein may consist of just one chain of amino acids or of several chains bound together.

There are generally considered to be 20 different amino acids which comprise of 8 essential, 8 conditionally essential and 4 non-essential amino acids, although there is on-going debate as to those amino acids that fall into the conditionally essential group.

Recap:

1. Sequences of amino acids are known as PEPTIDES
2. Long chains of amino acids are known as POLYPEPTIDES
3. Bound together by peptide bonds

1. Protein molecules can be small or very large
2. May contain 50 amino acids (Insulin=51)
3. May contain 5000
4. Can be one chain or several chains bound together

Nitrogen and Ammonia:

All proteins contain nitrogen. It is partly this which differentiates them from carbohydrates. Nitrogen makes up 80% of the atmosphere. There are certain microbes in the soil (nitrogen fixing bacteria) which are able to take the nitrogen in the air and convert it into a form which can be used by plants. Thus, all amino acids (and therefore proteins) depend upon nitrogen from the air.

Nitrogen:

- 80% of atmosphere is nitrogen
- Nitrogen fixing bacteria in soil convert it to a usable form which is taken up by plants
- All amino acids depend upon nitrogen from the air
- Nitrogen containing compounds termed 'AMINES' (NH_2)
- When nitrogen breaks down it combines with hydrogen to form AMMONIA

Ammonia is extremely toxic, therefore the body has developed ways of ensuring its effective removal via the UREA CYCLE in the liver.

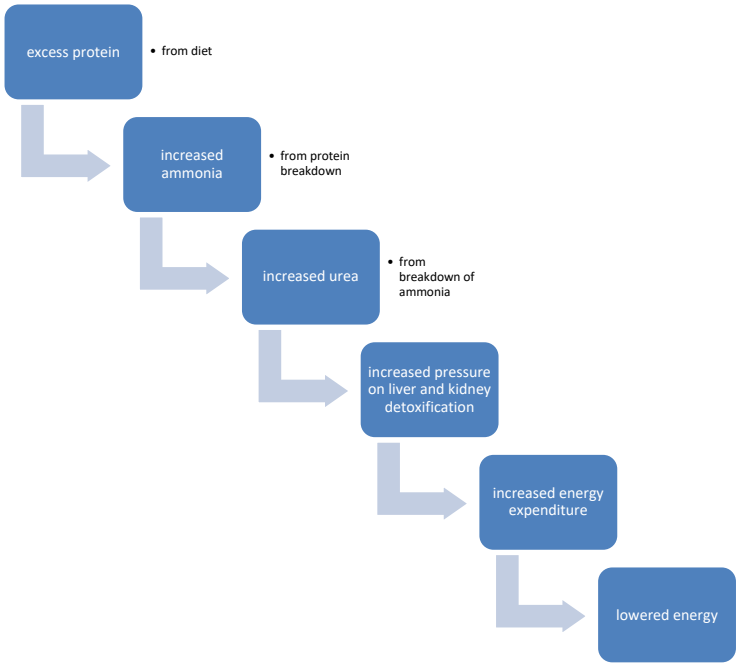
Breakdown of Ammonia:

During the breakdown of protein nitrogen is released as ammonia. This is converted to urea in the liver. As mentioned earlier, ammonia is extremely toxic and it is vital to eliminate it efficiently from the body. As you may well imagine this takes a lot of energy from the body. If we break it down to its biochemistry, (as is the way with Western nutrition) then we find that to eliminate ammonia in its converted form of Urea it takes 3 molecules of ATP (adenosine triphosphate which is our energy 'currency' which we produce inside the cells-this is the innate heat of Unani). It is not too difficult to take this a step further and understand that the more protein a person eats the more urea they will produce and therefore the more energy will be needed to excrete the resultant urea.

Have a look at the following points:

1. Nitrogen released as ammonia (very toxic)
2. Detoxification of ammonia essential
3. Converted to UREA in liver via the Urea cycle
4. Urea synthesised in the liver
5. Energy consuming process
6. 1 molecule of urea excreted for every 3 molecules of ATP
7. Increased protein = increased energy required to process it=reduced energy available for other bodily functions

Thus, from a naturopathic viewpoint, if you consume more protein than you need you will be using up valuable energy which could be used for healing the body.



The individual amino acids

In this section we will study the amino acids in a little more detail. There are approximately 20 different amino acids which are held in an amino acid 'pool' within the cells. Amino acids are not stored in the body therefore a turnover of amino acids is required from protein intake on a daily basis.

Amino acids can be

- Essential
- Conditionally essential
- Non-essential

Essential:

The term 'essential' means that these amino acids are *only* available through diet.

Conditionally essential:

These amino acids are not essential because they can be formed from one of the essential amino acids. However, if the body is diseased or out of balance or the diet deficient in the necessary *essential* amino acids, then these amino acids become essential and must be obtained via the diet. Thus they are conditionally reliant upon certain of the *essential* amino acids being *available.*

Non-essential:

This group of amino acids are readily available from our diet or we can readily make them from our stores of amino acids.

The essential amino acids are as follows:

Essential amino acids:

- **Tryptophan**
- **Threonine**
- **Phenylalanine**
- **Methionine**
- **Isoleucine**
- **Lysine**
- **Leucine**
- **Valine**
- **Histidine (in infants)**

Conditionally essential amino acids:

Sources disagree regarding the number of conditionally essential amino acids. The following list is in line with Mann and Truswell *'Essentials of Human Nutrition'*, which is a classical clinical nutrition textbook. The indecision stems from the fact that everyone's nutrient intake and absorption is

different and thus more amino acids are becoming classified as conditionally essential. 25 years ago there were only 4 amino acids that were thought to be conditionally essential which are marked below in **bold** type.

- **Arginine**
- Glutamine
- Glycine
- Asparagine
- Taurine
- **Cysteine**
- **Tyrosine**
- **Histidine** (in children)
- Proline

Non-essential amino acids (i.e. available easily from diet):

- Alanine
- Carnitine
- Glutamic acid
- Aspartic acid
- Serine

Recap

Amino acids can be:

- Essential-only available from diet
- Conditionally essential-become essential if a related essential amino becomes deficient
- Non-essential-can be formed in the body from the pool of amino acids

Proteins in Foods:

In this section we shall study the content of protein in foods. It is important to keep in mind that the best policy with regards to protein intake to promote optimum health is to provide full adequacy but to carefully avoid excess. It is therefore important to define 'full adequacy'. This is a policy that may not need to be followed by whole populations, but it is certainly a component of naturopathic treatment for the chronically ill.

We therefore need to know what the protein content of a certain food is. We also need to get away from the misconception that 'meat is protein'. For example 100g of meat does not equate to 100g of protein. The greater part of meat is water and a high percentage of the remainder is fat and non-protein constituents. As a result 20% is a common figure for the protein content of meat. Thus, eating 100g of fresh meat will result in an intake of 20g of protein.

The message to be learned here is not just weighing the foods that contain some protein but also knowing the protein content of each. In Western nutrition, again with its reductionist approach, food is dried to ascertain its constituents once the water has been removed. By doing this we can get a clear idea of how much of each nutrient is contained in the food item. This is

beyond the scope of this introduction to nutrition but is mentioned so that you are aware of the concept.

All foods contain some protein. Fruits contain very little protein. For example, melons contain 0.5% by weight. However, we must bear in mind that a melon is approximately 94% water. If we take this into account then the protein content of melons, based upon dry matter, is 8.3%. Similarly, fresh potatoes contain 2.1% but are 75.8% water. If we base our calculation upon the dry matter of potatoes then we arrive at 8.7% protein content. Fresh lettuces contain about 1% protein but are about 96% water, which gives them a protein content of 25%, based on their dry matter. Please don't worry about the calculations. 30 years ago these were done manually. Now we have computer programmes that work out all of the ratios and some nutritional therapists use these to prepare programmes for their client.

Proteins often appear at high levels in seeds because these naturally contain little moisture. Soya beans contain 34.1% protein, which is 37.9% protein when the adjustment for dry matter is made. Soya beans are therefore a rich source of protein, making them richer in protein than fresh beef. In fact, some of the highest protein contents are found in non-fatty fish: fresh lemon sole contains 81.2% water and 17.1% protein, which translates to 90.1% protein in terms of dry matter.

You will be able to see from the above examples that proteins are found in most foods. It is difficult to find a food that provides less than 8% protein on a dry matter basis. This means that generally a diet that delivers 500g of dry food matter in a day will also deliver us 40g of protein daily, which is close to being a safe amount. It is much easier to design a high protein diet than a low protein diet.

There are a few exceptions to the above generalisation. Bananas, for example, contain about 1.1% protein and about 71% moisture, so their dry matter only equates to 3.8% protein. Eating 500g of banana daily would only provide 19g of protein which is dangerously low. Similarly sweet potatoes and cassava (tapioca) are extremely low, with cassava being lowest of all containing only 2.89% protein in dry matter. It is extremely unlikely that you would find someone eating 500g of dry weight bananas in a day and this example just illustrates the narrow minded viewpoint of a Western clinical nutritional approach.

The concept of first and second class protein

'The Protein Score'

Egg protein (containing every nutrient for a baby chick to grow) has the maximum biological quality of any protein source for humans and is therefore valued at 100%. Egg protein is optimal because it contains all the essential amino acids and the ratio between the individual amino acids is also optimal. All other protein sources are compared to the balance of amino acids in eggs and allocated a score out of 100.

The dividing line between first and second class protein is above or below 70%.

If a protein source contains all essential amino acids in an ideal amount except for one, which is present at only half the amount, then the protein quality of that item is only 50%.

Similarly, in a protein source that contains 6 essential amino acids in ideal amount, but only 50% of one other amino acid and 75% of the last essential amino acid, the protein quality will be decided only by the single amino acid that is the most deficient. This is known as '*the limiting amino acid*'. The limiting amino acid is the one that is *most* deficient *relative* to an ideal standard composition (i.e. that of eggs).

Limiting amino acids in foods:

Food	Ile	Leu	Lys	Met	Phe	Thr	Trp	Val	Cys &Met	Tyr	score
FAO	270	306	270	144	180	180	90	270	270	280	100
Salmon	329	529	607	180	258	299	71*	360	251	221	79
White Rice	250	538	240*	135	317	260	84	375	240	260	89
Whole Wheat	227	450	172*	109	298	180	76	298	278	204	64
White Flour	265	481	133*	111	326	188	77	299	287	177	49
Sesame	300	500	159*	181	460	182	93	261	317	244	59
Lager	92*	156	219	62	125	156	375	156	188	156	34
Potato	262	387	357	101	274	244	92	327	182*	193	67
Kidney Bean	260	481	450	71	331	252	59	291	122*	161	45
Sweetcorn	229	792	168	120	320	229	40*	305	221	244	44
Egg	351	518	391	198	320	320	112	427	310	249	100

Notes:

- FAO stands for "Food and Agriculture Organisation of the United Nations" which from time to time sets up committees to advise upon the ideal mix and intakes of essential amino acids and human nutrition. The figures in the top line represent one such set of recommendations.
- Limited amino acids are identified by *
- Please note that the figures do not add up to 100, but the overall percentage of the amino acids, if in their correct quantities and ratios to one another, will equate to a score of 100. You will notice that egg protein has a 100% score, with all the amino acids present in more than adequate amounts.
- Salmon is an example of an animal protein which has a good score but it cannot equal that of egg.
- Rice protein is included to show an example of a good vegetable protein source, which is in excess of the protein score of some animal-derived foods (not shown).
- Notice that wheat is lysine deficient, white flour having a much lower protein score than whole wheat.

- Sesame is an excellent vegetable source of methionine, although deficient in other amino acids. There are very few vegetable sources which offer excess methionine over the FAO standard.
- Lager is included to show its exceptionally high level of tryptophan.
- Note that vegetable source proteins contain all the essential amino acids; they just don't contain the right amounts of them.

Study the next table and compare the levels of essential amino acids in each of the food sources. Note particularly that not all of the proteins that we think of as good protein sources actually meet the 100% guidelines. For example beef protein has a protein score of 83 whereas fish only reaches 70. Don't get confused between protein scores and grams of dried weight of protein per item which was what was discussed earlier. Note that the scores for eggs and rice are slightly different in this table. This is because the source of the information is different and when foods are analysed it depends on many different factors as to how much of each amino acid is present. Although an average is taken, different sources are always going to give varying amounts, similar but not identical. This is also a criticism of dietary analysis which analyses the amount of nutrients in a given diet. It is not possible to accurately analyse someone's diet because there are so many factors to take into consideration such as the quality of the soil, the freshness of the food eaten, the quality (e.g. organic, biodynamic or other) the individual nutrient value of the food eaten, and most importantly, the individual's capacity to digest the food and absorb its nutrients. There is not a computer programme that is able to do this.

With this in mind have a look at the next table and compare levels of amino acids for the various protein sources:

	Iso	Leu	Lys	Phe	Tyr	Met	Thr	Try	Val	Protein score
Cows milk	407	630	496	311	323	154	292	90	440	78
Eggs	428	565	396	368	274	196	310	106	460	100
Beef muscle	332	515	540	256	212	154	275	75	345	83
Fish	317	474	549	231	159	178	283	62	327	70
Oats	302	436	212	309	13	84	192	74	348	79
Rice	322	535	236	307	69	142	241	65	415	72
Maize	293	827	179	284	385	117	249	38	327	42
Millet	374	583	190	247	-	254	254	80	445	70
Soya flour	333	484	395	309	201	86	247	86	328	73
Sesame seed	300	500	159	460	244	181	182	93	216	59
Sunflower seed	296	402	195	275	149	95	209	78	313	72
Cassava	118	184	310	133	98	22	136	131	144	22
Wheat gluten	261	426	107	308	192	100	151	60	264	40
F.A.O. ref standard	**270**	**306**	**270**	**180**	**180**	**144**	**180**	**90**	**270**	**100**

NB: Cow's milk is lacking in total sulphur containing amino acids-only figures for methionine are shown on this table. The F.A.O. reference for total sulphur containing amino acids is 270 whereas cow's milk only provides 211.

Note the low level of protein in maize which is what you learnt about in the chapter about Carbohydrates in Ballantine's '*Human Nutrition'*.

Complementary proteins:

This is an important concept for you to understand when you are practicing with your clients as you may well see clients who have chosen to be vegetarian or vegan. You will need to explain this to them so that they can ensure they are receiving good quality vegan protein sources in their diet by combining certain food groups together. We have already touched on this subject earlier when we studied the food tables and levels of individual amino acids present in grains and pulses.

Vegetable proteins can vary in their mix of amino acids. Grains often have lysine as their limiting amino acid. Pulses, such as kidney beans are generally high in lysine, but lack other amino acids that the grains are high in. Therefore, if these two protein sources are combined they *complement* each other and can make up a better protein score than meat or fish.

Example; if kidney bean protein and sesame protein are added together in the ratio of two parts sesame protein to one part kidney bean protein the score comes up to 89-which is a lot better than salmon (if the ratio is 1:1 then the score is only 52). This example is given purely to show how proteins can be combined. However, it becomes too complicated to work out the amount of protein per food source and eat it in the correct ratio to one another.

In general the grains should be mixed with the pulses whereupon the low lysine levels in the grains are compensated for by the high lysine in the beans. It is considered necessary to have to eat these protein sources together at the same meal. Methionine is often the limiting amino acid in bean and grain combinations. Sesame and millet are high in methionine and can therefore be included in the diet of vegetarians and vegans.

Soya beans mixed with millet and sesame in the correct ratios that equalise the protein contributions from each will give a protein score of 89-which is a better protein score than many meat and fish proteins provide.

The following table shows figures for a combination of sesame seeds and red kidney beans. Their individual protein scores are 59 and 45 respectively. The simple average of these is only 52. When they are mixed together in the ratio of 2 parts sesame to 1 part red kidney beans the score comes up to a favourable 89 which is a lot better than salmon protein which gives 79. The protein content of sesame seeds is 18.2 and that of kidney beans is 22.1. Therefore to mix the proteins in a 2:1 ratio one would have to eat 24g of sesame with every 10g of kidney beans (probably not that palatable!).

FOOD	Lle	Leu	Met	Phe	Thr	Trp	Val	Cys+Met	Try	Lys	Score

Sesame and kidney bean mixture	287	494	144	417	205	82	241	252	216	256	89
FOA	270	306	144	180	180	90	270	270	280	270	100

By mixing soya beans (protein score of 73) with millet (70) or sesame seeds (59) in ratios that equalise the protein contributions from each, a mix with a protein score of 92 can be produced, which is higher than beef protein. These levels can only be achieved if the mixing is done correctly but it is hardly worth the effort and would be extremely complicated to work out all of the different combinations and ratios, resulting in a lack of creativity in preparing food!

Recap:

- Grains have lysine as limiting amino acid
- Pulses are high in lysine
- Combination of grains and pulses create a better protein score
- Methionine often deficient in grain/pulse combinations
- Millet and sesame high in methionine
- Correct legume, grain and seed combinations can produce higher protein scores than some meats and fish.

Naturopathic view of Protein

It has already been mentioned earlier that protein takes a lot of energy to break down, using up three molecules of ATP for every one molecule of urea broken down. If someone is eating a lot of protein they will be relying upon their stores of energy in order to break the protein down efficiently. Thus because the digestion of protein takes energy and because the disposal of surplus nitrogen takes energy in the urea cycle, consuming excess protein will result in an energy drain that detracts from other bodily activities.

Alternative medicine has completely different priorities from conventional medicine, from science and from conventional dieticians. The view of protein therefore takes on different priorities. For example, if someone had a serious chronic disease, the first priority, arising from naturopathic philosophy, is to lighten the patient's metabolic load, to encourage them to eliminate toxins, and to feed them the life giving minerals that will strengthen vitality. Lightening the metabolic load always means keeping the protein levels low for the following reasons:

1. It is well known among physiologists that taking protein into the body is harder work than taking in the other nutrients which mainly contain just calories. After a protein meal the heat production of the body rises as energy is used up in the process of digesting and assimilating it. There is no point in taking in more protein than you need because it just uses up energy wastefully and detracts from vitality.
2. Digestion from animal derived proteins foods is harder work than from vegetable protein foods. This is partly due to the modern factory farming methods of producing meat. Animal

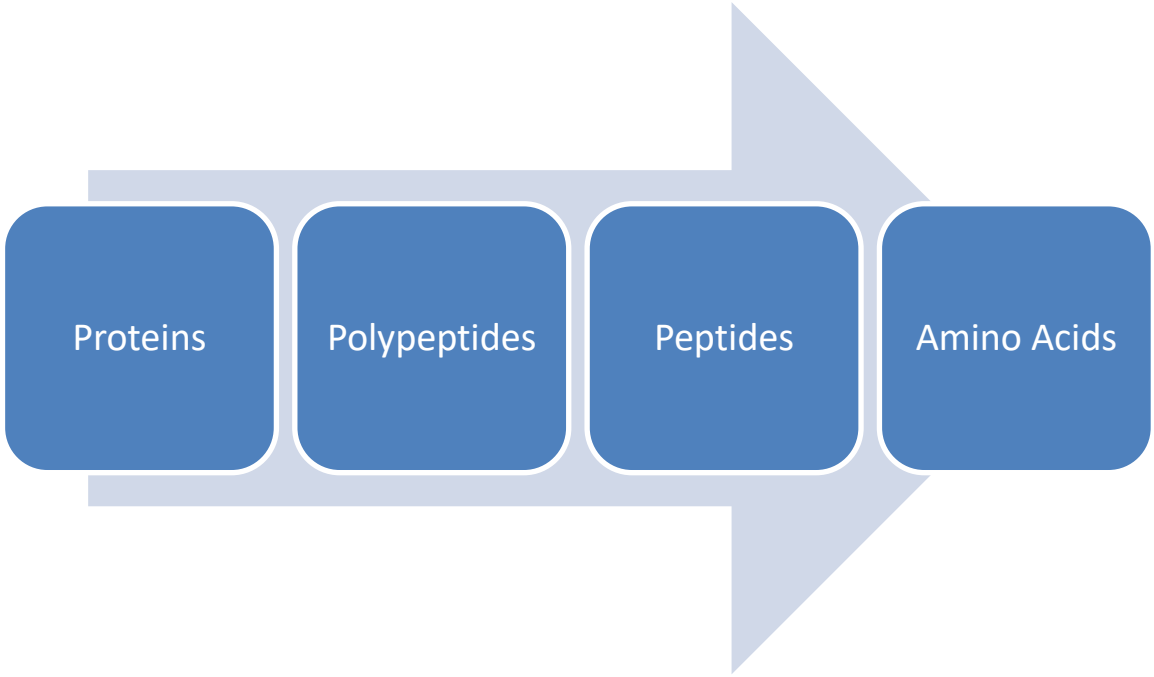
proteins give rise to greater metabolic loads and take more from a person's vitality. Animal proteins differ from each other considerably in this respect.

3. The end products of the metabolism of protein are ammonia which is converted into urea in the liver. Excess protein will therefore place additional strain on the detoxifying process in the liver and kidneys.
4. Proteins, and animal proteins in particular, if they reach the colon in an undigested or partly digested state, are liable to provide a medium for undesirable putrefying bacteria. The resulting putrefaction gives rise to the production of more toxins from the actual amino acids in the protein. These are absorbed into the body as 'morbid matter' and increase the toxic load, placing additional stress upon the organs of elimination and causing chronic health situations.
5. If protein is incompletely absorbed it can lead to the development of allergies. Gluten is a classic example of this where recent research (Fassano at Harvard) suggests that it is not possible to break down certain elements of gliadin. Gluten also contributes to leaky gut.
6. Milk for example has traditionally always been boiled to make it more digestible. Pasteurisation does not take the milk to boiling point therefore the milk has a) lost valuable enzymes that aid in the digestion of milk and b) the proteins have not been broken down leaving the milk a far more difficult food to digest. Yoghurt is partially broken down by the bacteria which have converted the lactose to lactic acid. Therefore many people can tolerate yoghurt whereas they can react to milk.

Digestion and breakdown of proteins

Proteins are broken down by digestive enzymes in the stomach and small intestine. These enzymes break the proteins down in to peptides and eventually to amino acids by severing all the peptide bonds. The breakdown of proteins proceeds smoothly under normal conditions in the small intestine, converting the proteins into their constituent amino acids by way of an intermediate size polypeptide and then into smaller peptide molecules:

Breakdown of proteins in stomach and small intestine:



The digestion takes place through a first stage in the stomach and a second stage in the small intestine:

Enzyme	Breaks down	End result
Pepsin (stomach)	Protein	Large polypeptides
Trypsin (duodenum)	Peptides	Small peptide chains
Chymotrypsin	Peptides	Small peptide chains
Carboxypeptidase	Small peptides	Amino acids

As the proteins reach the stomach they meet the enzyme pepsin. Pepsin only effectively operates under acidic conditions-hence the need for the hydrochloric acid. Both pepsin and hydrochloric acid are produced by the stomach lining. Pepsin is not capable of converting proteins in to amino acids but it starts the process by breaking down the proteins into large polypeptides. After approximately 2 hours the food passes from the stomach via the pyloric sphincter into the first part of the small intestine, the duodenum.

Once in the duodenum the bile and pancreatic juice create an alkaline environment. This process is finely balanced. If the stomach acid level is too high then the duodenal contents may remain acidic in spite of the alkaline secretions. If there is pancreatic insufficiency in the presence of normal levels of stomach acid the result can be the same. Both scenarios will cause digestive upsets.

The protein digestive enzymes that are released by the pancreas are called trypsin, chymotrypsin, and carboxypeptidase. These three enzymes carry out the greatest amount of protein digesting work and have an optimal pH for working; just as pepsin needs an acidic environment, so these pancreatic enzymes require an alkaline environment to work effectively. The pancreatic enzymes are helped by enzymes that are produced by the intestinal wall itself, called peptidases, which help to convert the smaller peptides into amino acids.

Recap:

Pancreatic Protein digesting enzymes:

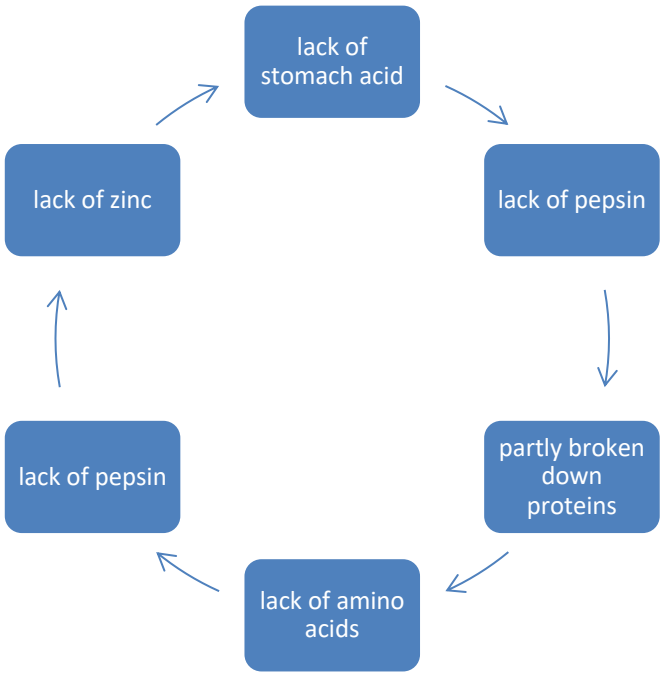
- Trypsin
- Chymotrypsin
- Carboxypeptidase

Digestive problems:

The most common on-going problem that occurs in the digestion of proteins is not enough stomach acid. A lack of pepsin may result because there is a deficiency of free amino acids in the blood, which also results in a lack of digestive enzymes. This failure to begin digestion of proteins in the stomach can have serious consequences lower down in the gut, and in the worst cases more or less of this undigested protein can even reach the large bowel causing pain, discomfort and bloating.

These problems can also occur through just overeating, especially high protein foods. The amount of pepsin produced may be sufficient for usual purposes, but not enough to deal with a 20oz steak. This mismanagement of one's digestive system frequently leads to digestive discomfort resulting in many people today having slightly compromised digestive systems that can cope with adequate daily protein but which fail when faced with moderate to gross overload.

We therefore have a 'catch 22' situation-without the stomach acid we have a lack of pepsin which leads to poorly broken down proteins. This results in a lack of amino acids to make the digestive enzymes and pepsin resulting in more of a deficiency. In addition, zinc is required to make stomach acid but we need sufficient stomach acid in order to absorb the zinc.



The hydrochloric acid and enzymes are the 'fire' referred to in Eastern nutrition and physiology. In Ayurveda it is Jathara Agni, the main Agni (fire) of digestion. In Ayurveda it is stated that a person is as old as his Agni. This statement goes some way into reinforcing the importance of digestion. If we cannot digest our food then we will not be able to absorb it and gain sufficient energy from it. During

your studies in Eastern nutrition we will revisit the importance of the stomach acid and digestive enzymes. In the meantime a list is given below of all the symptoms of low stomach acid and the various diseases that are associated with a lack of stomach acid.

Low hydrochloric acid

Symptoms of low stomach acid:

- Excessive burping, bloating immediately after meals
- Nausea after taking supplements
- Burning, flatulence immediately after meals
- Sense of fullness after eating
- Indigestion, diarrhoea, constipation
- Multiple food allergies
- Itching around rectum

Signs of low stomach acid:

- Weak, peeling and cracked finger nails
- Dilated blood vessels in cheeks and nose (in non-alcoholics)
- Acne
- Iron deficiency
- Chronic intestinal parasites or abnormal flora
- Undigested food in stool
- Chronic Candida infections
- Upper digestive tract gassiness

Diseases associated with low stomach acid:

- Addison's disease (adrenal exhaustion)
- Asthma
- Celiac disease
- Dermatitis herpetiformis (gluten sensitivity: sign of coeliac disease)
- Diabetes mellitus
- Eczema
- Gall bladder disease
- Grave's disease
- Chronic autoimmune disorders
- Hepatitis
- Chronic hives
- Lupus Erythematosus (auto immune)
- Myasthenia gravis (thyroid)
- Osteoporosis
- Pernicious anaemia (B12 deficiency)
- Psoriasis
- Rheumatoid arthritis
- Rosacea
- Sjogren's syndrome

- Thyrotoxicosis
- Hyper and hypothyroidism
- vitiligo

For more information about the importance of stomach acid **please read *'Why Stomach Acid is Good for You'* by Dr Jonathan Wright.**

Allergies to proteins

It is important to understand therefore that digestion is not a given definite. Some people are able to digest foods much more efficiently than others. Later in the module we will be looking at different humour imbalances and this will give you more insight into why this may be so. At this point we will focus on the digestive system and its ability to produce adequate hydrochloric acid and digestive enzymes. If these are depleted in any way then digestion becomes compromised.

Stress is known to inhibit digestion. When we are stressed the body, in an attempt to survive, places itself in the sympathetic side of the nervous system. This is the fight or flight side. We will produce adrenaline and cortisol in order that the body can run away from, or fight its predator. The body does not know the difference between a tiger or drinking a cup of coffee-it is still the same hormonal response of adrenaline (coffee contains caffeine which is a stimulant). When the sympathetic side of the nervous system is dominant the body shuts down the parasympathetic side of the nervous system. This is the 'rest and digest' side. The parasympathetic side governs the immune system, urinary system, reproductive system and the digestive system. When we are 'sympathetic dominant' the digestive system is 'shut down' making it far more difficult to digest food. Evolutionary speaking, we would not have been sitting down to eat a meal if we had a tiger running at us!

Thus stress, regardless of what the stress is, will cause a depletion of the digestive system. It is at this point that we will find it more difficult to break down certain proteins. Those foods that contain protein sequences that are more difficult to break down will become an added stress to the body and the partially broken down protein sequences can be attacked by the immune system causing allergic symptoms. Meat, dairy and gluten are the most likely to cause this type of problem because the proteins are more difficult to break down, especially if we have lower energy (remember that protein takes a lot of energy in its breakdown to urea).

When you are practicing therapists, in clinical situations, you will be faced by sick people who have compromised digestive systems. The degree to which a particular protein is broken down in the gut does not just depend upon the type of protein that it is but also a matter of the digestive capacity of the recipient. Even people who have adequate digestion can show fluctuations in their digestive capacity. Those people who are sick will also be suffering from seriously under-functioning organs and will therefore be exhibiting huge variations in their digestion. If the ability to digest protein is seriously compromised then giving more protein will only exacerbate the problem. Increasing the load on the digestive organs may well result in making the digestive capacity even worse.

At this stage this information is given to provide you an overview and allow you to view health and nutrition in a more naturopathic way.

To complete your study of proteins please refer to Ballantine and then answer the questions below. Answers can be found at the end of the next section:

PLEASE READ 'HUMAN NUTRITION' BY BALLANTINE CHAPTER 6 'PROTEIN: BUILDING BLOCKS' P111-155

Note that Ballantine makes reference (on page 131) about milk being a body builder. In Ayurveda it increases Kapha Dosha which represents the elements Water and Earth. In Unani it relates to the Phlegm humour. Milk therefore increases density and strength in the body and promotes growth. This is fine during the childhood years, which is the Phlegm stage of life and that of growth; but can be problematic if we continue this food into later years. We will be revisiting this aspect of milk in the naturopathic section and exploring its relevance to cellular function.

TO FINISH THIS UNIT PLEASE READ WHY STOMACH ACID IS GOOD FOR YOU BY DR JONATHAN WRIGHT

Self-assessment questions: Proteins:

Q3.1: What are some of the functions of proteins in the body?
Q3.2: What are the chemical components of proteins? How do they differ from carbohydrates?
Q3.3: What is the smallest component of protein; what are proteins ultimately broken down into?
Q3.4: What is a peptide bond?
Q3.5: What are peptides and polypeptides?
Q3.6: What is formed from the breakdown of nitrogen and how does the body dispose of it?
Q3.7: How much energy in the form of ATP is used in the excretion of urea?
Q3.8: Explain the 3 categories of amino acids.
Q3.9: Name the 8 essential amino acids:
Q 3.10: How does Western nutrition identify the amount of protein in any given food item?
Q3.11: According to Western nutrition, what is considered the ideal protein?
Q3.12: What is a second class protein?
Q3.13: What is a limiting amino acid?
Q3.14: What is the limiting amino acid in grains?
Q3.15: If grains are deficient in lysine what food group can we combine them with to make a better protein score?
Q3.16: What food can we add to beans and pulses to increase the protein score for a vegan?
Q3.17: What does the term 'complementary protein' mean? Give an example.
Q3.18: What is the naturopathic view of protein?
Q3.19: Which enzymes are required for the breakdown of protein and which pH do they function best in?
Q3.20: Which enzyme breaks peptides into amino acids?
Q3.21: Name three scenarios that will cause digestive disturbances.
Q3.21: Which mineral is required for the production of stomach acid?
Q3.23: Name 4 symptoms of low stomach acid
Q3.24: List the signs of low stomach acid (there are 8) (as much as possible without referring back to your notes)
Q3.25: List 10 diseases which are associated with low stomach acid
Q3.26: How does stress affect the digestive system?
Q3.27: During which stages of life do we require more protein?

Answers to SAQ's carbohydrates:

Q2.1 What does the body convert excess carbohydrate into?
A: fat
Q2.2: What are known as the building blocks of the body?
A: the proteins
Q2.3: When would we burn protein for energy instead of carbohydrate?
A: when the intake of carbohydrate is too low we can switch to burning proteins as a source of energy. This can include breaking down body proteins (tissues and muscles) in order to provide energy to the body.
Q2.4: What is the smallest component that carbohydrates are broken down into?
A: single sugars or monosaccharides such as glucose and fructose.
Q2.5: What is the difference between a monosaccharide, disaccharide and oligosaccharide?
A: monosaccharides= 1 sugar unit such as fructose or glucose, disaccharides=2 monosaccharides joined together; oligosaccharides =between 3-10 sugars joined together
Q 2.6: What is a glycosidic bond?
A: a bond that holds 2 simple sugars together
Q2.7: Which sugars combine to make up sucrose, common table sugar?
A: fructose and glucose
Q2.8: What do all carbohydrates contain?
A: hydrogen, oxygen and carbon
Q2.9: What is the chemical formula for carbohydrates?
A: C6 H12 06 or CH2O
Q2.10: How many sugars comprise oligosaccharides?
A: 3-10
Q2.11: Where might you find raffinose and which sugars is it comprised of?
A: soya beans, it is galactose, glucose and fructose and causes flatulence as it is broken down.
Q2.12: What are polysaccharides? How many monosaccharides are contained in a polysaccharide?
A: chains of more than 10 monosaccharides. They are divided into starch and non-starch (fibre)
Q2.13: Where is starch found in a plant?
A: roots, tubers and grains
Q2.14: What is inulin and which monosaccharide is it made up of? What is inulin good for?
A: Inulin is a 'fructan' meaning that it is composed entirely of fructose units. Inulin makes up the principle storage polysaccharide of chicory root and Jerusalem artichoke and also occurs in other vegetables to a lesser extent, such as asparagus. Inulin is particularly good for the bowel bacteria and acts as a prebiotic, feeding the beneficial bacteria and allowing them to proliferate and keep the bowel and immune system working well.
Q2.15: What is cellulose and where is it found?
A: cellulose is fibre and is the main polysaccharide found in plants
Q2.16: What are the two categories that polysaccharides are divided into?
A: starch and fibre
Q2.17: What food substance is of the utmost importance to the gut bacteria?
A: Fibre. The beneficial bacteria break the fibre down and form short chain fatty acids which keep the bowel wall healthy and protect against leaky gut
Q2.18: Explain carbohydrate digestion including the various enzymes involved.
A: carbohydrate digestion begins in the mouth with salivary amylase and then continues in the duodenum with the release of pancreatic amylase from the pancreas. Pancreatic amylase breaks down carbohydrates into monosaccharides, disaccharides, maltose and dextrose.
Q2.19: Why are carbohydrates called 'energy foods'?
A: carbohydrates are ultimately turned into simple sugars which are burned (oxidised) as energy within the mitochondria within the cells. It is this energy upon which our metabolism depends. This is the innate heat of Unani Tibb.

Q2.20: In very simple terms, explain blood sugar balance.
A: When we are hungry we eat foods that are ultimately turned into sugar. This causes the blood sugar levels to rise and we feel satiated. As we break down starch there is a steady flow of sugar released which provides energy for us. As the energy from the last meal dissipates so we begin to get hungry and look for more carbohydrate to burn as energy. If simple carbohydrates are eaten there is a rush of sugar into the blood stream which can cause a 'high' or 'sugar rush' and then the 'crash' afterwards as excess insulin is released to bring down the high levels of sugar in the blood (Ballantine 53-55)
Q2.21: What is the difference between white sugar and molasses?
A: Molasses is one of the by-products of the refining of sugar and still contains some of the nutrients which are found in sugar cane. Blackstrap molasses has less sugar but a more concentrated level of minerals.
Q2.22: What is Gur (Jaggery)?
A: Gur is raw sugar with the fibre and water removed from the sugar cane.
Q2.23: Explain why dental caries and diabetes did not appear in those who had eaten just sugar cane for years
A: sugar cane contains many minerals which help with the processing of sugar. Those who only ate sugar cane were not found to suffer from diabetes or dental caries whereas those who consumed refined sugar suffered from both dental caries and diabetes.
Q2.24: Explain nutrient debts
A: nutrient debts occur when the body has to supply nutrients from its stores to supply the necessary vitamins and minerals to process refined sugar. Eaten in its natural form, cane sugar contains all of the nutrients required to process it. In particular B vitamins and magnesium are lost through sugar consumption.
Q2.25: What are the 3 parts of grain?
A: the germ, endosperm and bran
Q2.26: What is the protein component of Wheat called?
A: gluten (consist of glutenin and gliadin)
Q2.27: According to Ballantine, what are the properties of wheat and why are some Indian physicians wary of it?
A: In India wheat is thought to produce growth which is good during childhood or convalescence but not considered beneficial for adults due to its tendency to promote growths, cysts and tumours.
Q2.28: What is phytic acid and is it always considered to be a problem?
A: phytic acid is found in most plant foods and especially in whole grains, beans and peas. It combines with minerals, especially calcium, iron and zinc, and carries them out of the body via the stool, thus creating malabsorption of many minerals. It is thought that we can adjust to having high amounts of phytic acid in our diet and that it is only in the early stages of eating foods containing phytic acid that the problem occurs. Other studies suggest the opposite and it would therefore seem to be down to the individual concerned, their inherited factors and the strength of their digestive system.
Q2.29: What are the drawbacks and benefits of refined flour?
A: drawbacks: loss of minerals, loss of fibre, turned into sugar quicker affecting blood glucose control. Benefits: easier to digest; therefore it can be useful for weaker digestive tracts and when convalescing; 95% of calories and protein utilised compared to 85% in whole grain flour.
Q2.30: Which nutrients are lost in the refining (polishing) of rice?
A: The B vitamins.
Q2.31: Which nutrients is corn particularly deficient in?
A: vitamin B3 and protein
Q2.32: Buckwheat generally grows in cool moist climates. Why is it considered suited to the people who live in this type of climate?
A: Because it has a warming, drying effect on the body. It is therefore an ideal wintertime dish.

Q2.33: Name the grains which contain gluten.
A: Wheat, rye and Barley. Oats have a similar protein to glutenin called avenin which can affect some people who are very sensitive to gluten, such as those with coeliac disease. Oats are grown with wheat, rye and barley and therefore there is cross contamination with the gluten grains that can cause some people much discomfort. Gluten free oats are merely grown separately to wheat, rye and barley. They still contain avenin and therefore can still cause problems for those very sensitive to gluten.

4: Lipids (Fats)

OBJECTIVES

- **TO HAVE A BASIC UNDERSTANDING OF THE CHEMISTRY OF FATS**
- **TO APPRECIATE THE DIFFERENCE BETWEEN SATURATED, POLYUNSATURATED AND MONOUNSATURATED FATS**
- **TO UNDERSTAND THE ROLE OF ESSENTIAL FATTY ACIDS IN MAINTAINING HEALTH**
- **TO HAVE A BASIC UNDERSTANDING OF THE ROLE OF CHOLESTEROL IN THE BODY**

Please note that the chapter number references to the book "Fats that Heal Fats that Kill" by Udo Erasmus refer to the third edition of printing. You may have a later edition and the chapters may have different numbers, however the chapter names should be the same. If in doubt, please contact the college for clarity.

Introduction to Fats

Fats are essential to life. The type of fats that we consume will be incorporated into our cell membranes and thus influence how we act and think. These notes are designed to give you a basic understanding of the importance of fats in human health, the difference between good and bad fats, and the nutritional requirements for utilising fats effectively.

First we will start with understanding the digestion of fats:

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 33 'DIGESTION OF FATS, OILS, AND CHOLESTEROL'

Chemistry:

Fats consist of:

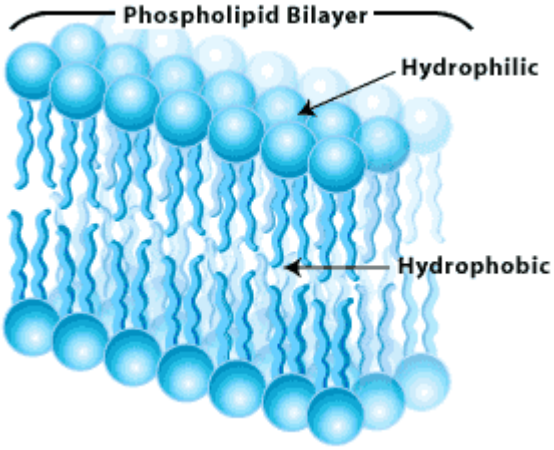
- Carbon
- Hydrogen
- Oxygen
- Methyl group- CH_3
- Carboxyl group- COOH (acid)

Structure of fatty acids:

A fatty acid molecule is shaped like a caterpillar. It is so tiny that 100 quintillion (or 100 followed by 18 zeroes) are present in a *single* drop of oil. Each tiny caterpillar is composed of two parts: a **fatty chain** at one end and an **acid group** at the other end.

The **fatty chain** is water insoluble (hydrophobic or water hating). This means that it dissolves in oil and not water. The fatty chain is made entirely of carbon and hydrogen atoms. The **acid end** of the molecule is water soluble (hydrophilic or water loving), and a weak organic acid known as a carboxyl group which dissolves in water but not in oil.

This unique function of fatty acids is of vital importance to cellular membrane activity. The water hating tails of the fatty acids group together leaving the water loving heads either side of the cell membrane thus:



Recap Fatty Acids:

- Shaped like a caterpillar
- 100 quintillion in a single drop of oil
- Consists of fatty chain and acid group
- Water hating and water loving
- Unique function of vital importance to cell membrane activity

Chain length:

- Can range from 4 carbons (butyric acid in butter) to 24 carbons (DHA in fish oil and brain tissue)

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 3 'FATTY ACIDS OVERVIEW' AND CHAPTER 4 'WHAT'S IN A NAME?'

The Concept of Saturation and Unsaturation:

If hydrogen atoms are attached to all of the carbon atoms then the fatty acid is saturated (i.e. saturated with hydrogen atoms). However, plant and animal cells can modify saturated fatty acids by inserting one or more 'double bonds' into the chain by removing two hydrogen atoms. This results in the chain becoming unsaturated and thus differs in shape and properties of saturated fatty acids such as melting point and ability to react to water.

Unsaturated fats are less stable and more chemically active than saturated fatty acids which are generally stable and inert. Plants can insert double bonds as close as 3 and 6 carbons from the methyl end of the chain. These are known as the omega 3 and omega 6 families of fatty acids respectively.

Saturated fats:

If hydrogen atoms are attached to each carbon atom ="saturated"

Double bonds in the chain result in less hydrogen atoms (i.e. not every carbon atom has 2 hydrogen atoms attached = "unsaturated"

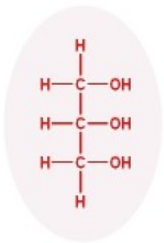
- Unsaturated fats more unstable
- Saturated fats stable
- Saturation affects melting point

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 5 'HARD FATS AND SATURATED FATTY ACIDS'

Triglyceride:

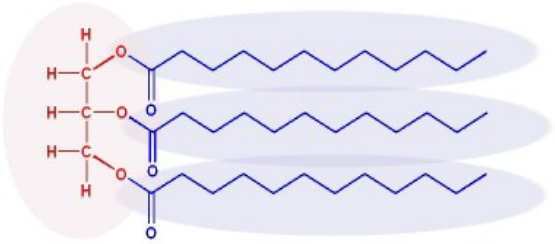
All fats and oils are mixtures of triglycerides and they make up 95% of the fats that we eat. A triglyceride means it has one molecule of glycerol and three fatty acids. See diagram below: the glycerol molecule is the backbone and from each of its three carbon atoms hangs a free swinging fatty acid making a molecule that looks like a three pronged fork.

Glycerol



A "free" Fatty Acid

Triglyceride



Triglycerides-main kind of body fat:

- All fats and oils are mixtures of triglycerides
- Make up 95% of the fats that we eat
- Carried in blood stream
- High triglycerides are a risk factor for cardiovascular disease
- Sugars turned into saturated fat are carried as triglycerides

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 9 'TRIGLYCERIDE FATS'

Categories of fatty acids

There are two main categories of fatty acids:

1. Saturated fatty acids
2. Unsaturated fatty acids (this category contains polyunsaturated fatty acids)

Unsaturated fatty acids:

- Contain one or more double bonds between carbon atoms
- For each double bond they have given up 2 hydrogen atoms

Unsaturated fats are further divided:

1. Monounsaturated (one double carbon bond)
2. Polyunsaturated (more than one double carbon bond)

Monounsaturated:

- Contains one double carbon bond
- Examples:
    - Oleic acid (olive oil, almond, peanut, pistachio, pecan, canola, avocado, hazelnut, cashew and macadamia oils) also known as omega 9

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 7 'LIQUID OILS AND UNSATURATED FATTY ACIDS'

Polyunsaturated:

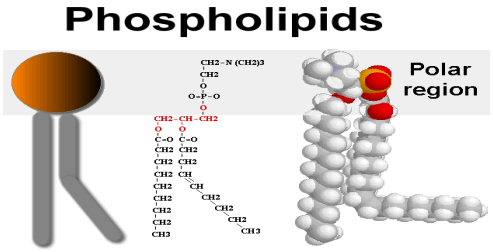
- More than one double carbon bond
- Examples:
    - Sunflower oil
    - Hemp oil
    - Linseed oil
    - Corn oil
    - Rape seed oil
    - Essential fatty acids omega 3 & 6

Saturated:

- Ghee
- Butter
- Coconut oil

PHOSPHOLIPIDS:

In contrast to triglycerides which contain one unit of glycerol to 3 fatty acids, phospholipids hold a phosphate group at the third position. Phospholipids comprise 75% of cell membrane and are therefore of the utmost importance to health.



Phospholipids:

- Phosphate group is polar and water soluble
- Fatty acids are oil soluble
- Able to spread out in a thin layer over surfaces of water and form natural membranes
- Phospholipids usually hold an essential fatty acid-which is bent and takes up more space and keeps the membrane from hardening

Note: Phosphatidyl Choline 'LECITHIN' is a phospholipid. Phosphatidyl choline carries out the following functions:

- Helps keep cholesterol soluble
- Keeps cholesterol isolated from arterial linings
- Protects cholesterol from oxidation
- Helps prevent and dissolve gall and kidney stones
- Supports liver detoxification
- Increases resistance to disease by its effects on the thymus gland
- Important part of cell membrane: phospholipids are involved in electric phenomena and membrane fluidity
- Important component of bile and helps to break down fats into droplets (emulsification) to increase their surface area and thus aid digestion.

Phosphatidyl choline (lecithin) is therefore a useful supplement to include in a client's programme. It will provide some omega 6 and assist the liver with breaking down fats, plus support cell membrane integrity.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 10 'PHOSPHOLIPIDS AND MEMBRANES'

PLEASE READ 'HUMAN NUTRITION' BY BALLANTINE CHAPTER 5 'FATS AND OILS: STORED ENERGY' P91-110

From reading this chapter it should be very clear that the types of fats that we eat are of paramount importance to our overall health. Also take note of the history of fats and margarines and public awareness of cholesterol and how Western nutrition often 'jumps to conclusions' without fully investigating the area thoroughly. As previously mentioned, Western nutrition does not have a philosophy so it can never make sense of anything to any great degree. This results in the general public following the latest reported health and food research, lurching from one health scare to another. Remember that many of the trials are paid for by the food industry who have vested interests in only certain information being released to the public.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERASMUS CHAPTERS (third printing) SECTION 3 'FAT CATS IN THE FATS LANE: HISTORY, OIL MAKING, TOXIC PRODUCTS AND PROMOTION'. THIS INCLUDES THE FOLLOWING CHAPTERS:

- **CHAPTER 14 A BRIEF HISTORY OF OIL MAKING**
- **CHAPTER 15 THE BUSINESS OF FATS AND OILS**
- **CHAPTER 16 FROM SEED TO OIL**
- **CHAPTER 17 FROM OIL TO MARGARINE**
- **CHAPTER 18 MARGARINES, SHORTENINGS, AND TRANS FATTY ACIDS**
- **CHAPTER 19 OTHER TOXIC PRODUCTS**
- **CHAPTER 20 ERUCIC ACID: TOXIC OR BENEFICIAL?**

Cholesterol:

The important thing to remember here is that cholesterol is essential to life and is not the evil that it has been made out to be by the food industry. Politics and the food industry became involved in the research into cholesterol which has ended in confusion.

Ballantine was writing in the 1970's when the great cholesterol argument was in its ascendency. The food industry took the recommendations of Ancel Keys, who was a US government nutritional advisor, and reduced the fat in many foods. Ancel Keys compared 6 countries in the 1950's and made a correlation between heart attacks and high fat intake. Had he compared 22 countries at the same time he would have found no correlation. His theory was not questioned and high fat/saturated fat diets became demonised and low fat sought after. What people didn't realise was that the food industry substituted fat for sugar. Therefore the sugar industry continued to thrive and become even more powerful and people were fed more sugar which has resulted now, 50 years later, in an unprecedented rise in obesity and diabetes and all of their related complications. There was one lone voice in the UK, a professor at Oxford University called John Yudkin, who tried to expose the health risks of sugar and that it was sugar, and not fat, that was causing all of the health problems. His voice was silenced by the nutrition industry which was largely run and funded by the sugar industry. His book, '*Pure White and Deadly'* is back in print and makes very interesting reading.

Cholesterol, as mentioned, is essential for health. We make the majority of cholesterol in the body with only small amounts coming from our food. Cholesterol is needed for hormone synthesis, thus we need it to make the steroid hormone pregnenolone, from which we make progesterone, testosterone, estrogen, aldosterone and cortisol. Cortisol is produced when we are stressed, thus the more stressed we are, the more cholesterol we produce in order that we can make more cortisol. We will be studying this more in the nutrition weekend.

Cholesterol is:

- Essential for life
- Compensates for changes in membrane fluidity
- Steroid hormones made from cholesterol (female infertility could be as a result of low cholesterol)
- Adrenal hormones made from cholesterol
- Vitamin D made from cholesterol
- Important for metabolism of vitamin A, E and K
- Bile acids derived from cholesterol
- Secreted by glands in skin, covers and protects our skin against dehydration, cracking and effects of sun, wind and water
- Placenta produces cholesterol from which it manufactures progesterone to maintain the pregnancy
- Also produced by cells, liver, intestines, adrenal and sex glands

Cholesterol is made in the body:

- Made by hooking 15 two-carbon acetates (vinegars) end to end to make a 30 carbon chain.
- Cells break down fatty acids, sugars, starches and amino acids in the citric acid cycle by clipping off 2-carbon acetates at each step
- Alcohol also provides acetates for cholesterol production
- Foods rich in refined carbohydrates produce an excess of acetates
- Stress increases cholesterol production

The most important point above is that stress increases cholesterol production. When we are stressed the body increases cortisol production. Cortisol is made from cholesterol, therefore when we are stressed we ultimately produce more cholesterol. You will see later in the naturopathic nutrition part of this module how the cell uses the excess cholesterol to protect itself from the effects of stress.

Food sources of cholesterol:

Only from animal sources:

- Eggs
- Meat
- Dairy products
- Fish
- Shellfish

Removal of cholesterol:

- Only removed from the body via stool in form of bile acid and cholesterol molecules
- Removal increased by dietary fibre
- Beneficial bacterial play a role in cholesterol management. Therefore a healthy gut is of the utmost importance in the maintenance of health and the balance of cholesterol levels.

Reduction of cholesterol helped by:

- Plant sterols
- Phosphatidyl Choline (lecithin)
- Dietary fibre
- Essential fatty acids
- Reduction of stress
- Vitamin B3, Vitamin C,
- Calcium, chromium, copper, zinc
- Water
- Red rice yeast: this acts in a similar way to statins.

It is best to bring the body back into balance via diet and other Unani therapies, supporting the thyroid if necessary and reducing stress levels at which point cholesterol levels should begin to normalise.

- Low levels:
  - Associated with impaired cognitive abilities from borderline intellectual functioning to profound mental retardation
  - Weaker constitution

- High levels:
  - stronger constitution
  - Stronger cell membrane-less permeable
  - Protective in older women
  - People with high cholesterol live longer

- Thyroid connection: when levels are raised it always suggests there is an underlying thyroid imbalance.

Later in the naturopathic section of this module we will look at further connections between cholesterol production, stress and cellular function.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS THE FOLLOWING CHAPTERS:

- **CHAPTER 12 'CHOLESTEROL'**
- **CHAPTER 41 'BLOOD CHOLESTEROL=PLASMA LIPOPROTEINS= HDL, LDL & Lp(a)'**
- **CHAPTER 45 'CHOLESTEROL IN FOODS'**
- **CHAPTER 71 'IS THE CHOLESTERO THEORY WRONG?'**

PLEASE READ THE GREAT CHOLESTEROL CON BY DR MALCOLM KENDRICK or watch 'Statin Nation' free film by Justin Smith:
http://statinnation.com/?ss_source=sscampaigns&ss_campaign_id=5eafc1363a641471976283ca&ss_email_id=5eaffe658264e96994d85c62&ss_campaign_name=FREE+to+Watch%2C+Share+the+Link&ss_campaign_sent_date=2020-05-04T11%3A37%3A44Z

Essential Fatty Acids

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 8 'THE HEALING ESSENTIAL FATTY ACIDS'

Essential fatty acids are always polyunsaturated. There are 2 essential fatty acids: omega 3 and omega 6. Essential fatty acids are broken down to form prostaglandins which support the hormone system. As the name suggests, they are essential to life and we can only get them from our diet. In order to break them down into prostaglandins we need the following nutrients to be available in our diet:

- Vitamin B3
- Vitamin B6
- Vitamin C
- Vitamin E
- Magnesium
- Zinc

The following factors will inhibit their breakdown:

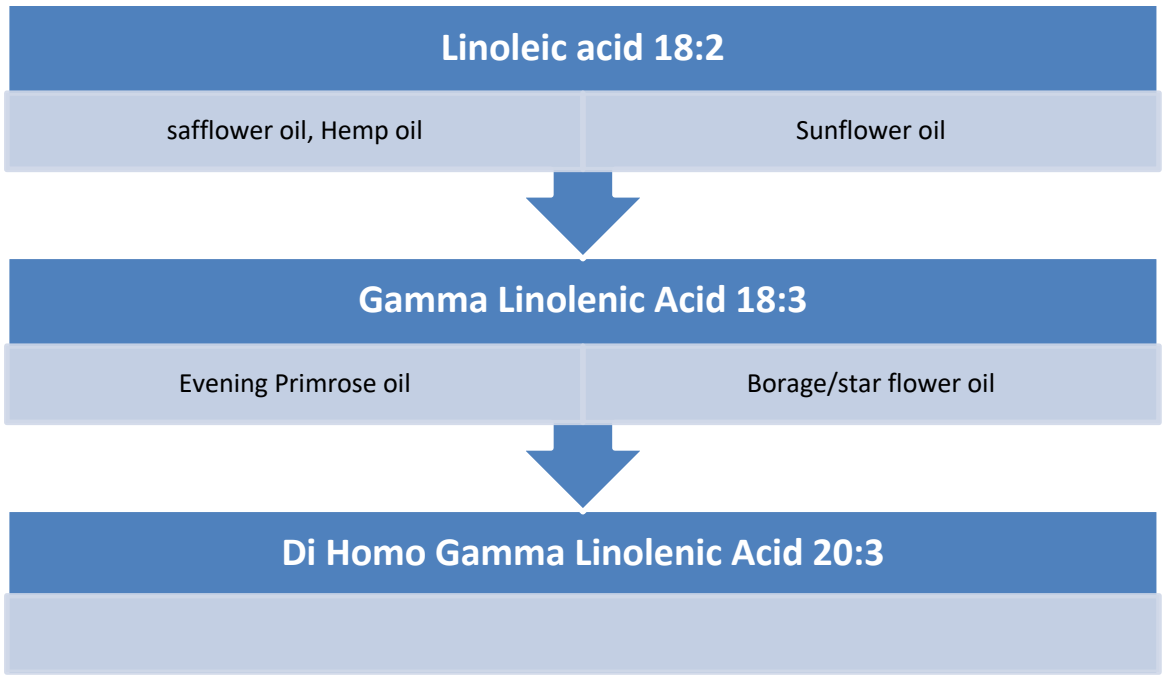
- Too much saturated fat
- Damaged fats (unhealthy fats)
- Cholesterol
- Aging
- Alcohol
- Chemical carcinogens
- Radiation
- Imbalanced insulin

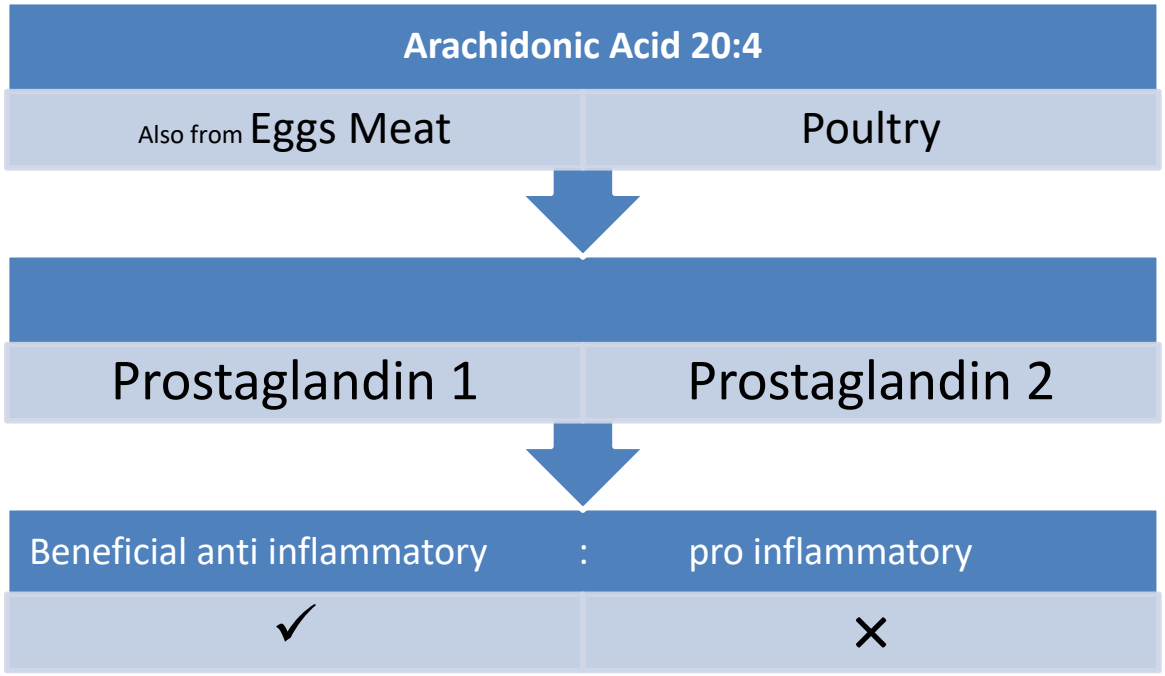
Wheat will also inhibit the conversion of omega 6 to prostaglandin 1. This will result in increased inflammation and lowered immunity.

Omega 6

Omega 6 starts as Linoleic acid (known as a parent essential oil) and is broken down through a number of steps to gamma linolenic acid (GLA) and di-homo gamma linolenic acid (DGLA). The most well-known forms of GLA are evening primrose oil and borage (star flower) oil. These forms are particularly useful if someone is not able to make the breakdown efficiently themselves.

Omega 6 Breakdown pathway:





Prostaglandin 1 and 2 are both inflammatory and anti-inflammatory, with prostaglandin 2 considered to be most inflammatory. Prostaglandin 2 is increased thorough eating lots of red meat and/or if we are deficient in vitamin C, B3 and zinc. If we are eating a lot of oily fish or taking fish oil capsules (as so many people do) then we can imbalance the delicate ratio between omega 3 and omega 6, resulting in too much omega 3 and a relative lack of omega 6.

Note also that imbalances in insulin will stop the breakdown of omega 6 into GLA. We will be studying blood sugar control a little later in the module and you will notice how imbalances of blood sugar levels (and therefore insulin) has a big effect on many symptoms in the body. In the case of essential fatty acids, destabilised insulin levels will affect the breakdown of omega 6 and lead to deficiency symptoms, the most common of which is tender breasts in women before menstruation. However, we can begin to see how water, insulin levels and essential fatty acids are all intricately linked, and thus the connection with diabetes, if left uncorrected.

Sources of GLA:

- Evening primrose oil (9%)
- Black currant seed oil (15%)
- Borage oil/starflower oil (20%)
- Hemp oil (2% GLA/55% linoleic/20% ALA)

Omega 6 Deficiency signs

Have a look at the following list of deficiency symptoms of omega 6. Remember that the cell membrane is made up of fats and the health of the cell membrane will be determined by the types of fats that we eat. It is also the cell membrane that keeps the body water in place. Our bodies are at least 70-80% water and it is the fats that keep the water in place. We will be studying this further in

the naturopathic section. For now you need to make the connection between water balance and essential fatty acids.

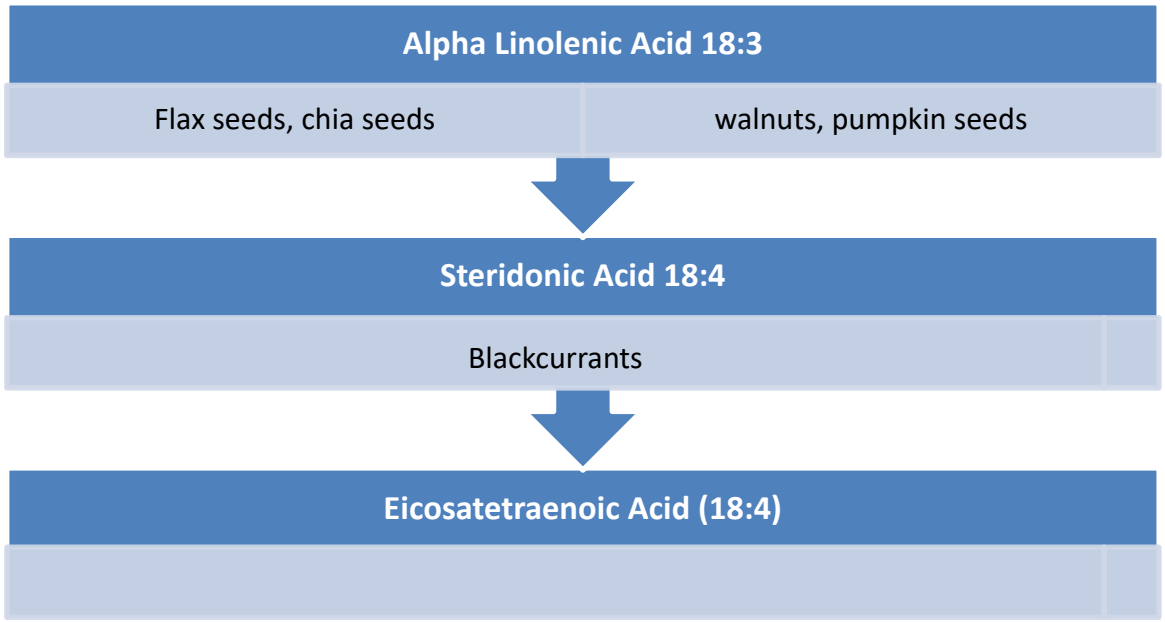
- Eczema like skin eruptions
- Loss of hair
- Liver and kidney degeneration
- Excessive water loss via skin with thirst
- Drying up of glands
- Susceptible to infections/low immunity
- Failure of wound healing
- Male sterility
- Miscarriage in females
- Arthritis like conditions
- Heart and circulatory problems
- Growth retardation
- Hyperactivity
- Tender breasts in females before menstruation

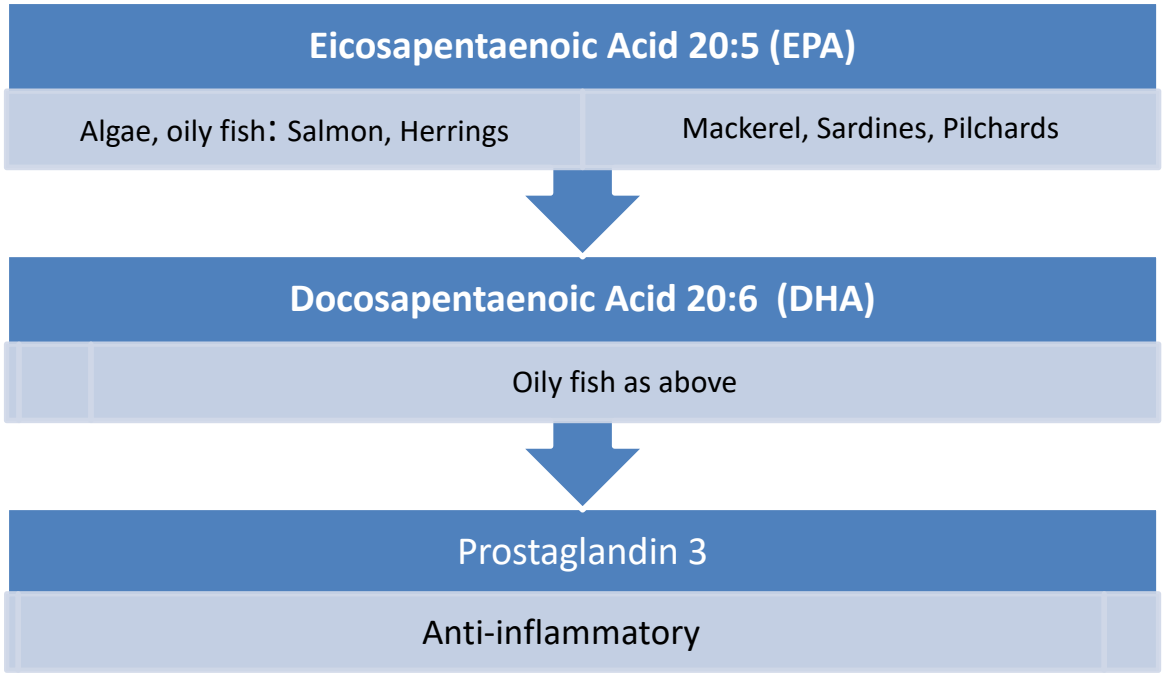
You will notice that some of these symptoms are those that indicate diabetes such as excess thirst, low immunity and failure of wound healing. We can therefore make the connection that there is most likely a deficiency of essential fatty acids (EFA's) in people with diabetes and that the underlying problem is likely to be a mismanagement of water balance in the body due to essential fatty acid depletion. You also know that unstable insulin levels can affect the breakdown of EFA's; thus we have an indication of where to start working nutritionally with someone who is diabetic.

Omega 3

Omega 3 starts as Alpha linolenic acid (ALA) and is eventually broken down into EPA and DHA which are also found in oily fish. For those people that have a problem breaking down essential fatty acids fish oil may be a temporary measure while you adjust their diet and support their digestion.

Omega 3 Breakdown pathway:





Sources of ALA:

- Flax oil (50%)
- Hemp seed oil (20%)
- Pumpkin seed oil (0-15%)
- Canola oil (up to 10%)
- Walnut oil (3-11%)

Sources of Stearidonic acid:

- Black currant seed oil

Sources of EPA and DHA:

- Oily fish-salmon, herrings, mackerel, sardines, pilchards, trout
- Land animals-testes, eyeball, adrenal glands
- Antarctic Krill
- Algae

Omega 3 Deficiency signs

- Growth retardation
- Weakness
- Impairment of vision and learning ability
- Motor incoordination
- Tingling sensations in arms and legs
- Behavioural changes/hyperactivity

- Excessive thirst
- High triglycerides
- Hypertension
- Sticky platelets
- Tissue inflammation
- Oedema
- Dry skin
- Mental deterioration
- Low metabolic rate
- Immune dysfunction

As a rough rule EPA works more with the endocrine system and DHA works more with the central nervous system.

Functions of Essential fatty acids

As mentioned earlier, EFA's are eventually broken down to form prostaglandins which:

- Regulate steroid production and hormone synthesis
- Regulate pressure in eyes, joints and blood vessels
- Regulate responses to pain, inflammation and swelling
- Mediate immune response
- Regulate body secretions and their viscosity
- Dilate or constrict blood vessels
- Regulates smooth muscle and autonomic reflexes
- Directs hormones to their target cells
- Regulates the rate at which cells divide
- Prevents blood cells from aggregation
- Mediates the release of cellular pro-inflammatory substances that may trigger either excess inflammation or allergic conditions
- Regulate nerve transmission
- Maintains the fluidity and rigidity of cell membranes
- Regulates the flow of substances into and out of the cells
- Influences the transport of oxygen by the red blood cells
- Keep saturated fats mobile in the blood stream
- Regulates nerve transmission

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS:

- **CHAPTER 55 'OILS FROM FISH AND SEAFOODS:EPA AND DHA'**
- **CHAPTER 57 'EVENING PRIMROSE, BORAGE, AND BLACK CURRANT OILS: GLA'**
- **CHAPTER 58 'PROSTAGLANDINS'**
- **CHAPTER 59 'FLAX: LNA'**
- **CHAPTER 60: 'HEMP: LA, LNA, & GLA'**

Correct ratio of essential fatty acids

There is an ongoing argument about the correct ratio of EFA's. The main research in this area was done by Yehuda et al which showed that the correct ratio of parent essential oils (linoleic acid: alpha linoleic acid) was 4:1. There is no conclusive research to suggest what the broken down ratio is (i.e. GLA: EPA&DHA) most likely because we are all individual and, as such, have individual needs for

essential fatty acids depending upon where we live and our predispositions and inherited factors. We need to consider the following when deciding which essential fatty acids and in which form, to prescribe to our clients.

- A question of balance and where person is living
- Research only for LA (linoleic acid) and LNA (alpha linolenic acid) done in Israel
- 4:1 ratio (80% LA to 20% LNA):
- Flax oil=1:3.5 (17%:58%)
- Position of first double carbon bond important
- Omega 3 has shorter tail to move-thus has more energy
- Omega 3 has higher frequency
- Omega 3 'win' the metabolic race and suppress omega 6 fats by commanding attention of the desaturase enzymes
- Body Bio balance oil: contains a good balance of omega 6: omega 3 in a 4:1 ratio of omega 6: omega 3

Consider:

The correct ratio between omega 3 and 6 will depend upon many factors such as inheritance, lifestyle and diet, state of health, how dehydrated/hydrated one is, which part of the hemisphere one lives in and the time of year. We will explore this further in the nutrition weekend. Please see also Udo Erasmus 'Fats that Heal Fats that Kill':

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS CHAPTER 67 'OILS AND SUNSHINE-LIGHT AND HEALTH'

When in doubt it is best to suggest either a 4:1 parent essential fatty acid such as Body Bio Balance oil or organic cold pressed Flax oil (alpha linolenic acid) and organic cold pressed sunflower oil or Hemp oil (providing linoleic acid). Broken down forms of EFA's should only be used short term to create a change in the body. Remember that the body will quickly balance under the correct circumstances which are what you will be doing with your dietary recommendations and other Unani therapies. Once it is balanced it will be able to extract the essential fatty acids from food and break them down as required.

Finally, as a therapist, you will be asked many times which are the healthiest fats or safest fats to cook with. Opinion changes regularly on this but the saturated fats, being the most stable, are safest to heat. These include coconut oil, butter and ghee. Extra virgin olive oil is once again considered safe as long as it is not heated to high temperatures (which cause oxidation), however, this may change and you are advised to always keep up with the latest research in this area. Man-made oils such as canola oil are not considered healthy. In fact, canola oil, which is rape seed oil, is a massive industry and able to spend a lot of money on research to show that it is 'the best' and safest to use for a variety of health conditions. It is therefore promoted by doctors and dieticians because they are heavily influenced by the research. However, keep in mind that rape seed oil in its natural form contains levels of erucic acid which are considered poisonous to humans and has therefore been modified to be safe. Raised levels of erucic acid are considered dangerous in children up to the age of 10. Please do your own research in this area so that you can answer your client's questions about the suitability of using certain fats. When in doubt go back to the original teachings of Ayurveda and Unani medicine where you will find clarity.

When using the polyunsaturated oils always make sure that they are cold pressed and organic, otherwise they will be detrimental to health.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERUMUS THE FOLLOWING CHAPTERS:

- **CHAPTER 21 'LIGHT, FREE RADICALS, AND OILS**
- **CHAPTER 27 ''COLD-PRESSED': A MEANINGLESS TERM**
- **CHAPTER 29 'PACKAGING AND STORING OILS'**
- **CHAPTER 51 'BUTTER VERSUS MARGARINE'**

To complete this section please answer the following questions without referring to your notes. Check your answers against those given at the end of the next section.

Self-assessment questions: Fats

Q4.1: What are fats comprised of from a chemical perspective?
Q4.2: Are fats hydrophilic or hydrophobic?
Q4.3: What is the range in chain length for fatty acids?
Q4.4: Explain the chemical difference between a saturated and non-saturated fat.
Q4.5: Which are the most stable fats, saturated or unsaturated?
Q4.6: What is a triglyceride?
Q4.7: What are high triglycerides an indication of when seen on a blood test?
Q4.8: What type of fat is olive oil?
Q4.9: To which category of fats do essential fatty acids belong: saturated, monounsaturated or polyunsaturated?
Q4.10: What is the difference between a phospholipid and a triglyceride?
Q4.11: Which fats make up the cell membrane?
Q4.12: What is Phosphatidyl choline and how can it be useful in a nutritional programme?
Q4.13: What is the process of hydrogenation?
Q4.14: Which vitamin antioxidants help to protect oils from oxidation?
Q4.15: List 6 functions of cholesterol
Q4.16: What are the food sources of cholesterol?
Q4.17: How is cholesterol removed from the body?
Q4.18: What might you consider if someone is diagnosed with raised cholesterol levels?
Q4.19: Which nutrients do we need available in our diet to break down and utilise essential fatty acids?
Q4.20: Which factors will inhibit the breakdown of essential fatty acids?
Q4.21: What is the parent essential oil for omega 6?
Q4.22: Name the two main sources of gamma linolenic acid (GLA)
Q4.23: Which prostaglandin is considered to be most inflammatory?
Q4.24: List 10 symptoms of omega 6 deficiency.
Q4.25: What is the parent essential fatty acid for omega 3?
Q4.26: What are the main sources of omega 3 that you could recommend someone include in their diet?
Q4.27: List 10 deficiency symptoms of omega 3.
Q4.28: Which prostaglandin is omega 3 broken down into?
Q4.29: List 10 functions of prostaglandins
Q4.30: What is considered the correct ratio of essential fatty acids?
Q4.31: What factors might we consider when deciding which essential fatty acids someone

requires?
Q4.32: What are the safest fats to recommend to your clients?

Answers to self-assessment questions Proteins:

Q3.1: What are some of the functions of proteins in the body?
A: check your list against the following: Protein is needed for the structure and activity of the following:

- Building blocks of the entire body: for growth and tissue repair
- Enzymes within the cells: all biochemical transformations at a cellular level
- In cell membranes
- For muscles
- Hormones
- Skin and hair
- organs

Q3.2: What are the chemical components of proteins? How do they differ from carbohydrates?
A: proteins contain carbon, hydrogen and oxygen; as do carbohydrates and fats. In addition, they also contain an amine group NH2 (nitrogen). Some proteins contain sulphur as well.
Q3.3: What is the smallest component of protein; what are proteins ultimately broken down into?
A: Amino acids
Q3.4: What is a peptide bond?
A: this is similar to a glycosidic bond with carbohydrates. A peptide bond holds amino acids together to make strings of amino acids which are known as peptides.
Q3.5: What are peptides and polypeptides?
A: peptides are strings of amino acids joined together. Polypeptides are many strings of peptides joined together, but all too small to be called a protein.
Q3.6: What is formed from the breakdown of nitrogen and how does the body dispose of it?
A: Ammonia. It is detoxified via the urea cycle in the liver and then sent to the kidneys for excretion.
Q3.7: How much energy in the form of ATP is used in the excretion of urea?
A: 1 unit of urea requires 3 units of ATP to excrete it
Q3.8: Explain the 3 categories of amino acids.
A:

1. Essential: they must be provided by the diet. There are 8 essential amino acids, 9 for children (Histidine)
2. Conditionally essential: they become essential if one of the essential amino acids is deficient
3. Non-essential: can be produced in the body or are readily available via diet

Q3.9: Name the 8 essential amino acids:
A: the essential amino acids:

1. Tryptophan
2. Threonine
3. phenylalanine
4. Methionine
5. Isoleucine
6. Lysine
7. Leucine
8. Valine
9. Histidine (in infants)

Q 3.10: How does Western nutrition identify the amount of protein in any given food item?
A: by dry weight. E.g. Soya beans contain 34.1% protein wet weight, which is 37.9% protein when the adjustment for dry matter is made.
Q3.11: According to Western nutrition, what is considered the ideal protein?
A: egg protein which contains all 8 essential amino acids in an ideal amount or above. Therefore all other protein sources are compared to eggs as a ratio of 100.
Q3.12: What is a second class protein?
A: a protein source that is less than 70% in its composition of amino acids as compared to eggs as an ideal.
Q3.13: What is a limiting amino acid?
A: the amino acid that is lower than the ideal amount in any given food source.
Q3.14: What is the limiting amino acid in grains?
A: Lysine
Q3.15: If grains are deficient in lysine what food group can we combine them with to make a better protein score?
A: the pulses which are generally high in lysine but lower in cysteine and methionine. The grains generally have good levels of cysteine and methionine making beans and grain a good combination for vegetarian forms of protein
Q3.16: What food can we add to beans and pulses to increase the protein score for a vegan?
A: sesame seeds/tahini: this is particularly high in methionine (and magnesium).
Q3.17: What does the term 'complementary protein' mean? Give an example.
A: This is where two (or more) protein sources are combined to increase their levels of available amino acids and thus increase their protein score. An example would be Soya beans, rice and tahini (sesame) which would give good levels of all amino acids. Other examples could be lentils and rice or kidney beans and rice. These combinations are still lacking in methionine though so the simple addition of tahini, which is high in methionine, brings the protein score to one which is higher than some fish and meat protein scores.
Q3.18: What is the naturopathic view of protein?
A: Protein takes up a lot of energy (1 x urea: 3 x ATP) and therefore is using up energy that can be used elsewhere in the body for healing. Vegetables sources of protein are considered easier to digest and therefore make fewer demands on the body's overall energy reserves, thus allowing the body to use the energy to heal and rebalance itself. The end result of protein breakdown is ammonia which is highly toxic and which places more work upon the liver and kidneys to excrete it via the urea cycle.
Animal proteins can also putrefy in the intestines, causing an increase in pathogenic bacteria which then leads to auto-intoxication via the bowel wall, again placing more pressure upon the liver.
Q3.19: Which enzymes are required for the breakdown of protein and which pH do they function best in?
A: Pepsin and hydrochloric acid (acidic conditions in stomach), trypsin, chymotrypsin, and carboxypeptidase (alkaline conditions in duodenum)
Q3.20: Which enzyme breaks peptides into amino acids?
A: carboxypeptidase
Q3.21: Name three scenarios that will cause digestive disturbances.
A:

1. Lack of stomach acid leading to partially digested proteins in large intestine resulting in a lack of digestive enzyme production and a lack of zinc.
2. Excess stomach acid leading to too acidic an environment in the duodenum for the pancreatic enzymes to work effectively
3. Normal stomach acid but low pancreatic enzymes, leading to a too acidic environment in the duodenum

Q3.22: Which mineral is required for the production of stomach acid?

A: zinc

Q3.23: Name 4 symptoms of low stomach acid

A: check your list against the following:

1. Excessive burping, bloating immediately after meals
2. Nausea after taking supplements
3. Burning, flatulence immediately after meals
4. Sense of fullness after eating
5. Indigestion, diarrhoea, constipation
6. Multiple food allergies
7. Itching around rectum

Q3.24: List the signs of low stomach acid (there are 8) (as much as possible without referring back to your notes)

A:

1. Weak, peeling and cracked finger nails
2. Dilated blood vessels in cheeks and nose (in non-alcoholics)
3. Acne
4. Iron deficiency
5. Chronic intestinal parasites or abnormal flora
6. Undigested food in stool
7. Chronic Candida infections
8. Upper digestive tract gassiness

Q3.25: List 10 diseases which are associated with low stomach acid

A: check your list against the following:

1. Addison's disease (adrenal exhaustion)
2. Asthma
3. Celiac disease
4. Dermatitis herpetiformis (gluten sensitivity)
5. Diabetes mellitus
6. Eczema
7. Gall bladder disease
8. Grave's disease
9. Chronic autoimmune disorders
10. Hepatitis
11. Chronic hives
12. Lupus Erythematosus (auto immune)
13. Myasthenia gravis (thyroid)
14. Osteoporosis
15. Pernicious anaemia (B12 deficiency)
16. Psoriasis
17. Rheumatoid arthritis
18. Rosacea
19. Sjogren's syndrome
20. Thyrotoxicosis
21. Hyper and hypothyroidism
22. vitiligo

Q3.26: How does stress affect the digestive system?

A: stress will activate the sympathetic side of the nervous system causing the fight or flight hormones of adrenaline and cortisol. The parasympathetic side of the nervous system is shut down during stress and it is this side that governs digestion.

Q3.27: During which stages of life do we require more protein?
A: childhood, teenage years and during pregnancy and breast feeding.

5: Vitamins

OBJECTIVES

YOU SHOULD BE ABLE TO:

- **UNDERSTAND THE FUNCTIONS OF THE VITAMINS IN THE BODY AND THE FACTORS THAT HELP AND HINDER THEIR BEST FUNCTIONING.**
- **HAVE AN APPRECIATION OF THE COMMON SOURCES OF VITAMINS IN FOODS, AND THE APPROPRIATE CONDITIONS FOR SUPPLEMENTATION.**

Vitamins are essential to life, without them we cannot reproduce. There are many textbooks which give information about the vitamins, plus the internet is a vast resource of information. When studying the vitamins and minerals make use of additional sources as you will need to have a 'working knowledge' of all of the vitamins and minerals and their main actions and functions in the body. Ballantine's book, '*Human Nutrition'* will provide you with an easy to read resource but you will need to keep up to date with recommended daily amounts (RDA's) because these change from time to time as new research is released.

Vitamin A

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 VITAMINS: P157-168 (INTRODUCTION AND HISTORY AND VITAMIN A)

The gut is where health begins, and is also home to a huge microbiome made of innumerable species of bacteria. Vitamin A is the key to the gut making the right decisions. Researchers at Brown University (Vaishnava) found that moderate levels of vitamin A in the gut prevent the immune system from becoming over reactive.

Forms of vitamin A:

- Retinol
- Retinal
- Retinoic acid
- Beta carotene (precursor)

It has historically been believed that we convert beta carotenoids into vitamin A. However it has been found that some people lack the gene that converts beta carotene into retinol. Research at Newcastle University, UK, found that 50% of women in their trial could not convert beta carotene into Retinol.

Essential functions:

- Essential for immune function
- Essential for eye health
- If large amounts taken before MMR vaccination the vitamin will latch on to receptors and stop the uptake of the measles virus.
- Essential for skin-the medical profession use Roaccutane for acne which is a retinoid, a derivative of vitamin A
- Fears of toxicity have reduced the RDA to 10,000IU daily
- Vitamin A is essential during pregnancy for the sight of the baby. Children born to mothers who are deficient in vitamin A are likely to suffer from blindness. High amounts during pregnancy are thought to cause birth defects
- A deficiency during pregnancy can lead to cleft palate and other abnormalities.

Vitamin A is fat soluble and can therefore be stored in the body (Liver).

Vitamin B Complex

The B vitamins are all involved in energy production; therefore a deficiency will result in fatigue. They are known as the anti-stress vitamins. Apart from B12, which can be stored, an intake is needed every day because they are water soluble and cannot be stored.

Thiamine: B1

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 VITAMINS: P168-175 'VITAMIN B COMPLEX AND B1 THIAMIN'

Deficiency symptoms:

- Numbness and tingling in hands and feet
- Absence of ankle jerk
- Burning feet
- Chronic fatigue
- Congestive heart failure
- Elevated blood pyruvate and lactate
- Glaucoma
- Gut disorders
- Hair loss
- Hypotension
- Inability to concentrate
- Insomnia
- Irritability
- Lactic acidosis
- Mental depression
- Moodiness
- Nausea
- Sleep disturbance
- Rapid pulse
- Sore calf muscles

Alcohol inhibits B1 absorption; therefore alcoholics are always vitamin B1 deficient.

Coffee also inhibits B1 absorption.

Riboflavin: B2

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 VITAMINS B2 RIBOFLAVIN P175-176

The following factors deplete B2:

Coffee, alcohol, Diabetes, hyperactivity, oral contraceptives, smoking, stress, sugar and refined food intake, B6 overload.

Deficiency symptoms:

Alopecia, angular cheilitis, blurred vision**,** cataracts, conjunctivitis, dermatitis, geographic tongue, redness to lips, sore tongue.

A broken down form of B2, FADH is used throughout the citric acid cycle. It is therefore essential for energy production.

Niacin: B3

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 VITAMINS B3 'NIACIN' P176-183

Deficiency results in pellagra or the 3 D's-dermatitis, dementia and diarrhoea. If this is not corrected it causes death and is therefore also known as the 4 D's as well.

Niacin is extremely effective at reducing high cholesterol levels; however, a very large amount is given which needs to be monitored by a physician.

The Niacin Flush:

Niacin can cause flushing in susceptible individuals and in large doses. The flush can cover the body and is itchy. It generally lasts for up to an hour. It does not have to be a large dose that triggers the flush. Most supplements now contain vitamin B3 as niacinamide or nicotinamide which do cause flushing. It is not known why some people are more susceptible than others but may be linked with high copper levels because the flushing action helps to detoxify copper.

Formation of vitamin B3 from tryptophan:

Part of the definition of a vitamin is that it should be an essential substance that the body cannot synthesise. Vitamin B3 is the exception to the rule because it can be synthesised in the body from the amino acid tryptophan. The amount of tryptophan eaten therefore affects vitamin B3 requirements.

The pathway from tryptophan to nicotinic acid has co factors of its own. These include iron, riboflavin, pyridoxine, and B3 in its broken down form of NADH. NADH is also required by the citric acid cycle to produce energy within the cellular mitochondria.

Niacin and mental illness:

- Large amounts of niacin have been found essential in the control of schizophrenia and other mental disorders (from the work of Abram Hoffer)
- Niacin raises histamine levels.
- Niacin works together with B12 and folic acid in keeping adrenaline and noradrenaline in balance and from preventing the abnormal production of adrenochrome in the brain (a chemical which can produce hallucinations; from the work of Abram Hoffer).
- Niacin, B12 and folic acid also help to raise abnormally low histamine levels, which is also associated with hallucinations.
- Niacin, through its flushing action, helps to detoxify copper and other trace elements which are associated with mental illness, and improves oxygen supply to the brain.
- Niacin is also needed for the brain to make use of essential fatty acids.
- Niacin helps with the conversion of tryptophan to serotonin.
- Nicotinic acid helps with cigarette withdrawal as nicotine works on the same receptors as nicotinic acid.

Vitamin B5 Pantothenic acid

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS PANTOTHENIC ACID' P190-193

Pantothenic means universally available, thus this vitamin is thought to be fully available in our diet. The active form is known as Co enzyme A and it is estimated that some 85% of all B5 occurs in the form of co-enzyme A. Co enzyme A is essential for the production of energy in the citric acid cycle from the breakdown of carbohydrate, protein and fats. It is the formation of acetyl co enzyme A from all three of the bulk nutrients that is a crucial reaction of energy metabolism.

Pantothenic acid and adrenal fatigue:

In the case of adrenal exhaustion an amount of 500mg daily as calcium pantothenate can be given. Doses of 1-3g may even be required however always work within your knowledge and never over prescribe nutrients. 'More' does not mean 'better'.

Allergies and Pantothenic acid:

High levels of calcium pantothenate of 1-3g can help ease allergic conditions. As allergies are connected with an element of adrenal fatigue you will be able to make the connection between using high levels of B5 for allergies and also for adrenal fatigue.

Deficiency symptoms:

- Alopecia
- Abdominal pains
- Burning feet
- Convulsions
- Depression
- Dermatitis
- Fatigue
- Fertility disorders
- Hypotension
- Insomnia

- Tenderness in heels

Vitamin B6 Pyridoxine

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS B6 PYRIDOXINE' P183-185

It is thought by many practitioners that some patients may have a problem breaking down B6 and that the broken down form of pyridoxal 5 phosphate (or P5P) is more effective. In the naturopathic section we will look at cellular function and the movement of the electrolytes. If this process is imbalanced then B6 breakdown may be impeded.

Therapeutic uses:

1. Allergy
2. Asthma
3. Anxiety
4. Autism
5. Breast cancer
6. Carpal tunnel syndrome
7. Chemical sensitivity
8. Coeliac disease
9. Depression
10. PMT
11. Dysmenorrhoea
12. Epilepsy
13. High homocysteine
14. Infertility
15. Pregnancy nausea
16. Schizophrenia
17. Seizures in new born
18. Stress
19. Sun sensitivity

RDA:

1.6-2.6mg but often much larger therapeutic doses are given but do not exceed 50mg unless you are trained in nutritional medicine or are a nutritional therapist. Some nutritional therapists give as much as 100mg daily.

P5P- 10-50mg

Drugs affecting B6:

The following drugs/nutrients will block breakdown and utilisation of B6: Amphetamine, iron, L-Dopa, marijuana, oestrogen, oral contraceptives, penicillamine, steroids, thiazide diuretics, anti-convulsants.

Folic Acid

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS FOLIC ACID' P187-190

Folic acid is a precursor to methyl tetrahydrofolate (MTHF). Some people are unable to break down folic acid due to a defect in the methyl tetrahydrofolate reductase gene (MTHFR). These patients will need to take folic acid in a broken down form when pregnant to reduce the risk of spina bifida. Most good dietary supplements now provide folic acid in its broken down form and it will show as L-5 methyl tetrahydrofolate (L-5-MTHF), 5-formyl tetrahydrofolate (5-formyl THF).

It is important to note that folic acid works closely with vitamin B12 and a deficiency in one can mask a deficiency in the other. An example would be megaloblastic anaemia which bears a relationship to the pernicious anaemia of vitamin B12, though obviously the cause is different. This is covered in more detail in the section on folic acid in Ballantine's book.

Deficiency symptoms:

- Anaemia (megaloblastic or microcytic)
- Anorexia
- Cervical dysplasia
- Constipation
- Cracks on lips
- Fatigue
- Irritability
- Mental sluggishness
- Red tongue
- Reproductive failure
- Skin disorders
- Birth defects
- Mental deterioration
- Pigmentation on face during pregnancy

Folic acid is required for a process called methylation in the body which breaks down homocysteine to cysteine and SAMe. Raised levels of homocysteine are associated with many different symptoms, especially fatigue and an increased risk of heart attacks. Homocysteine naturally increases as we get older and is also indicated in Alzheimer's and Parkinson's disease. A lack of folic acid will lead to increased levels of homocysteine and impaired liver detoxification.

Drug interactions:

The toxic drug methotrexate, which is used for cancer, psoriasis, RA and other autoimmune diseases, works by destroying folic acid. This effectively stops cell replication but has severe consequences. The medical profession are aware of the problem with destroying folic acid and suggest that patients taking methotrexate take folic acid as well, often at a different time to the medication. You will need to proceed with caution if anyone is taking this drug. Another anti-cancer drug Cisplatin increases the excretion of folic acid. NSAID's also increase the release of folic acid.

Vitamin B 12

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS; VITAMIN B12' P185-187

B12 deficiency:

A vegan diet may produce deficiency. B12 absorption relies upon sufficient production of the intrinsic factor in the stomach. Low stomach acid states will affect utilisation. You have learnt that we need adequate levels of zinc in order to produce stomach acid. Zinc is predominantly found in meat, thus vegetarian diets may be deficient leading to a lack of production of stomach acid, resulting in less absorption of whatever B12 may be in their diet.

You have already learned of the importance of stomach acid in the absorption of nutrients. Those nutrients specifically reliant upon the stomach acid for absorption are B12, folic acid, calcium and iron.

Clinical symptoms of deficiency may not appear for 20-30 years because B12 can be stored in the body, predominantly in the liver.

Deficiency occurs in stages:

- Serum concentrations diminish
- Cell concentrations also diminish
- Biochemical deficiency occurs, with less DNA synthesis, raised homocysteine and methylmalonic acid (MMA produced in the body when proteins break down) levels in the serum.
- Finally anaemia occurs

Classic Symptoms of B12 deficiency:

Signs and symptoms come from inadequate formation of the myelin sheath around the nerves:

- Numbness and tingling in hands and feet
- Diminished vibration sense and position sense (commonly occurring first in the ankles and feet)
- Unsteadiness, poor muscular co-ordination with walking difficulties
- Moodiness, mental slowness and poor memory
- Confusion, agitation and depression
- Dim vision (sometimes)
- Delusions, hallucinations and even overt psychosis

Deficiency in B12 is connected with Alzheimer's disease and Parkinson's disease. Both of these diseases show reduced levels of methylation and B12 is essential for adequate methylation. Low levels of B12 can therefore lead to raised homocysteine levels and the range of symptoms associated with raised homocysteine and reduced methylation.

Important note and warning:

Folic acid administration can dispel the symptoms of megaloblastic anaemia caused by a B12 deficiency. However, folic acid does nothing to correct the myelination problems that arise from a B12 deficiency. Hence folic acid supplementation can hide a continued underlying B12 deficiency. This is covered in Ballantine's book, *Human Nutrition*.

Pernicious anaemia:

Pernicious anaemia is a disease of the stomach. Gastric tissue secretes a glycoprotein called intrinsic factor (IF) which complexes with ingested B12 and promotes its absorption through the small intestine. Pernicious anaemia is the outcome of insufficient production of IF from the stomach. The commonest reason for the trouble is auto immune attack.

Alcohol will also hinder B12 absorption.

For students who want to research B12 in more detail the books *'Vitamin B12 Deficiency in Clinical Practice'* by Dr Joseph Chandy Kayyalackakom or '*Could it be B12'* by Stuart and Pacholok are recommended.

To complete the study of B vitamins please read Ballantine:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS' 'OTHER B VITAMINS' P193-195

To complete your studies of B12 please read *one* of the following books:

- **'Could it be B12?, An Epidemic of Misdiagnosis' by Sally Pacholok and Jeffrey Stuart**
- **'Vitamin B12 Deficiency in Clinical Practice; Doctor, you gave me my life back' by Dr Joseph Chandy Kayyalackakom**

Vitamin C: Ascorbic Acid

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS; VITAMIN C' 195-203

Vitamin C is water soluble. Some people have a gene polymorphism (SNP) which reduces the absorption and utilisation of vitamin C.

Historically a deficiency resulted in scurvy which is now extremely rare; however symptoms of scurvy such as bleeding gums and slow wound healing are certainly common and may respond to vitamin C supplementation.

Vitamin C is a powerful antioxidant and anti-histamine and can thus reduce histamine levels. It is therefore useful to use for allergies, possibly in connection with vitamin B5 (calcium pantothenate covered earlier). The adrenal glands use large amounts of vitamin C, thus we need higher amounts when we are stressed. Vitamin C can help with symptoms of adrenal fatigue and is a simple remedy to give mid-morning and mid-afternoon to support the adrenal glands and energy levels. Use if you suspect adrenal fatigue or exhaustion.

The current RDA (2020) for vitamin C is 60mg, however most nutritional therapists and researchers consider this far too low and regularly prescribe 1000-2000mg daily, especially for allergies and low immunity.

The following factors suggest an increased demand:

- Low stomach acid
- Inflammation
- AIDS

- Allergies
- Arthritis
- Atherosclerosis
- Athletic performance
- Burns
- Cancer
- Diabetes
- Drug toxicity
- Hyperglycaemia
- Hypertension
- Prolonged infections
- Pregnancy and lactation
- Pressure sores
- Stress

Vitamin D

There has been a huge amount of research into vitamin D since Ballantine wrote his book. Vitamin D deficiency is associated with many disease states including autoimmune diseases, diabetes, dementia, Parkinson's, bone disorders and cancer.

We tend to associate vitamin D and sunlight. However, many of us don't receive the amount of sunlight that we need in order to gain the amount of vitamin D. Many people have also become frightened of the sun and the danger of skin cancer and therefore cover themselves with sun lotion, the effects of which are unknown.

Vitamin D is synthesised by the action of sunlight on the skin. Sources disagree as to how much vitamin D we can effectively synthesise and in which months of the year this is most effective. It would appear therefore that some level of supplementation is called for, especially in people with darker skins who are living in the UK. Remember also that the conversion takes place in the liver and kidneys. Therefore low levels of vitamin D may be related to reduced liver and kidney function.

In the naturopathic section we will look at the cell and how it utilises light. If we can't utilise light effectively then our absorption of vitamin D will be impaired. Just because the sun is shining doesn't mean that we will absorb sufficient to manufacture the vitamin D that we need. We need to keep this in mind when we are trying to help clients who are deficient in vitamin D. It is not as straight forward as giving a supplement. We also need to understand why the person is not able to utilise light effectively. We will study this in more detail later in this module.

The liver and other tissues metabolize vitamin D, whether from the skin or oral ingestion, to 25OHD, the principal circulating form of vitamin D. 25OHD is then further metabolized to $1,25(OH)_2D$ principally in the kidney. $1,25(OH)_2D$ is the principal hormonal form of vitamin D, responsible for most of its biologic actions.

The main deficiency symptom of vitamin D is rickets. Vitamin D promotes the absorption of calcium therefore a deficiency can manifest as a calcium deficiency and bone disorders or central nervous system disorders.

Vitamin K is required to aid the absorption of vitamin D. Supplements often contain vitamin D3 and vitamin K2.

Doctors will often test for vitamin D now. At the time of writing a level of 50 nmol/L is considered sufficient by the medical profession. Nutritional therapists prefer it to be 70nmol/L and above for optimum function. If your client's doctor won't test you can ask your client to do a simple test via Birmingham university hospital: City Assays: http://www.vitamindtest.org.uk/ for £29 (price at time of writing 2020).

Functions of vitamin D:

- Bone health
- Gene expression
- Pregnancy
- Cancer
- Obesity
- Asthma and allergies
- Immune system
- Crohns and colitis
- MS
- Alzheimer's disease, dementia and brain function
- Schizophrenia
- Mood and depression.
- Hypertension and heart disease
- Diabetes

Supplements:

- Cod liver oil-good source of D3. A teaspoon can supply 450 IU. However, the seas are very toxic now and the liver concentrates toxins, therefore cod liver oil may not be as healthy as it was 50 years ago.
- Vitamin D2-has been used successfully for years to address rickets and osteomalacia.
- Vitamin D3. Most practitioners prefer D3 due to the general view that it is in the form closest to what we can obtain from nature.

RDA:

The daily upper limit is 1000IU for infants up to 12 months and 2000IU for children, adults, pregnant and lactating women. Long term supplementation of high levels like this need to be monitored by a blood test. Note the RDA's can change and it Is important therefore to keep up to date with research.

Interactions:

Long term supplementation will adversely affect magnesium absorption, most probably due to vitamin D's action of calcium absorption.

Absorption:

Taking vitamin D with fructose will lower phosphate levels and increase circulating vitamin D levels. Lycopene and vitamin D work synergistically in reducing tumour proliferation.

Do not give to sarcoidosis patients

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS; VITAMIN D' P204-209.

Please also see this insightful article correlating Vitamin D with viral activity;
https://blog.cytoplan.co.uk/the-role-of-vitamin-d-against-covid-19-the-latest-research/

Vitamin E

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS; VITAMIN E' P209-217

Vitamin E is fat soluble and can therefore be stored in the body. It is a major anti-oxidant and often given with vitamin A, C, selenium and zinc.

The principle action of vitamin E is now recognised to be the protection of the phospholipids of the cell membranes from free radical attack. In this role it supports the work of the central nervous system. Vitamin E supports the very long chain fatty acids, needed for brain and CNS function.

Food sources include vegetables oils, nuts, seeds, and leafy green vegetables.

Supplementing with vitamin E may help the following:

- To help maintain a good state in blood vessels, stabilising the vascular system
- Help to control high blood pressure
- To help maintain skin elasticity
- Prevent or relieve fibrocystic breast disease
- Slow the progression of Parkinson's disease
- Reduce the severity of neurological disorders
- Reduce tissue injury from ischemia, i.e. any condition from a lack of oxygen
- Delay cataract development
- Improve mobility of arthritis patients
- Decrease the severity of the complications of diabetes:
    - Reducing insulin requirement
    - Reducing complications
    - Reducing platelet aggregation and thus the risk of thrombosis
    - Assist in healing gangrene associated with diabetes

CARE!

Drug interactions:

Do not use with Warfarin or Coumarin or other anti-coagulant drugs. Do not combine with large amounts of aspirin. Vitamin E thins the blood therefore it will enhance the action of these drugs.

Trials have also shown vitamin E (and vitamin A) to increase the risk of lung cancer in smokers. It is therefore a vitamin to be used with extreme caution and always with additional research before recommending it.

Vitamin K

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 7 'VITAMINS'; 'OTHER VITAMINS' AND 'VITAMINS SUMMING UP' P217-221

There has been a lot of research into vitamin K in recent years, and certainly since Ballantine wrote his book. Vitamin K is thought to be 'Factor X' which was mentioned by Weston Price, the dentist who travelled around the world looking for the cause of dental caries. Vitamin K helps with calcium utilisation and therefore would have helped in the prevention of caries.

Food sources are predominantly green leafy vegetables.

In addition to food sources, vitamin K is synthesised in the gut. There are 3 forms of vitamin K:

1. vitamin K1 is found in plants (Phylloquinone)
2. vitamin K2 is synthesized by the gut bacteria (Menaquinone)
3. Vitamin K3 is converted to K2 by gut bacteria. (Menadione)

Functions:

- blood clotting
- bone mineralisation
- calcium metabolism
- promotes the breakdown of clots
- production of prothrombin

Deficiency may cause or be associated with:

- birth defects (underdeveloped nose, mouth and mid face, shortened fingers, cupped ears, flat nasal bridge)
- bone abnormalities
- cognitive impairment
- decreased vitality
- eye haemorrhage
- easy bruising
- GI bleeding
- Haemorrhages
- Lowered bone density
- Nose bleeds
- Osteoporosis
- Osteopenia

Interactions:

Patients on anti-coagulants such as warfarin are advised against eating foods high in vitamin K.

Effects of overdose:

Phylloquinone is non-toxic but menadione can cause haemolytic anaemia, decreased appetite, decreased movement or activity, enlarged liver.

Pregnant women taking anti-convulsants may be advised to take 20mg daily for 2 weeks prior to delivery to prevent foetal haemorrhage.

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 18 'MEGAVITAMINS' 509-525

Assignment: To finish this section on vitamins please prepare a chart with all of the vitamins listed, their role within the body, their interactions with other vitamins and the minerals, their RDA, deficiency symptoms, excess (toxicity) symptoms and food sources. This is to be sent to your tutor for marking.

Self-assessment questions: Vitamins:

Q5.1: Which vitamin deficiency is associated with scurvy?
Q5.2: Where does the term 'vitamin' originate from?
Q5.3: What are the main functions of vitamin A?
Q5.4: What is the precursor for vitamin A?
Q5.5: Where is vitamin A found in food?
Q5.6: What is the upper recommended amount for vitamin A supplementation?
Q5.7: What inhibits B1 absorption?
Q5.8: Which system of the body does a deficiency in B1 affect?
Q5.9: What are the best food sources of vitamin B1?
Q5.10: What disease is associated with a deficiency in B1?
Q5.11: Name 6 factors that deplete vitamin B2
Q5.12: List 6 deficiency symptoms of vitamin B2
Q5.13: What is the main deficiency disease of vitamin B3, niacin?
Q5.14: Which mental illness may be associated with low levels of niacin?
Q5.15: Where does the term for vitamin B3, Niacin, originate from?
Q5.16: List 5 deficiency symptoms of vitamin B5
Q5.17: Why is vitamin B5 of critical importance to energy production?
Q5.18: What is the broken down form of B6 called?
Q5.19: Name 10 deficiency symptoms of B6
Q5.20: Which pregnancy complications may be caused by a B6 deficiency?
Q5.21: Taking folic acid supplements can mask the deficiency of which nutrient?
Q5.22: What is the significance of having a gene defect (snp) on the MTHFR gene?
Q5.23: List 6 symptoms of folic acid deficiency
Q5.24: How long might a person be deficient in B12 before deficiency symptoms develop?
Q5.25: What is needed for B12 to be absorbed efficiently?
Q5.26: What are the main symptoms that would alert you to a possible B12 deficiency?
Q5.27: What will hinder the absorption of B12?
Q5.28: Name one of the main symptoms of vitamin C deficiency, which is also a sign of scurvy.
Q5.29: Explain 2 ways that vitamin C can support allergic symptoms.
Q5.30: What are some of the possible side effects listed by Ballantine of taking high doses of vitamin C?
Q5.31: List 5 symptoms that suggest an increased need for vitamin C
Q5.32: What considerations would you make if you knew someone was deficient in vitamin D?
Q5.33: List 10 areas where vitamin D deficiency may be causing symptoms.
Q5:34: Which other vitamin is required to aid the absorption of vitamin D?
Q5.35: Why is vitamin D important for bone health?
Q5.36: How is vitamin D formed in the body?
Q5:37: Which mineral is detrimentally affected by long term supplementation or high dose supplementation of vitamin D?

Q5.38: What considerations would you give if recommending vitamin E?
Q5.39: Which foods contain good sources of vitamin E?
Q5.40: Why are clients taking anti-coagulants advised to avoid foods which are high in vitamin K?
Q5.41: List 2 functions of vitamin K
Q5.42: What are the main food sources of Vitamin K?

Answers to self-assessment questions: Fats:

Q4.1: What are fats comprised of from a chemical perspective?
A: carbon, hydrogen, oxygen, a methyl group CH3 and carboxyl group COOH
Q4.2: Are fats hydrophilic or hydrophobic?
A: They are both. Fats comprise of a fatty chain which at one end is water insoluble and at the other end is water soluble. The fatty chain is water insoluble (hydrophobic or water hating). This means that it dissolves in oil and not water. The fatty chain is made entirely of carbon and hydrogen atoms. The acid end of the molecule is water soluble (hydrophilic or water loving), and a weak organic acid known as a carboxyl group which dissolves in water but not in oil.
Q4.3: What is the range in chain length for fatty acids?
A: They can range from 4 carbons (butyric acid in butter) to 24 carbons (DHA in fish oil and brain tissue)
Q4.4: Explain the chemical difference between a saturated and non-saturated fat.
A: A saturated fat has 2 hydrogen atoms attached to each of its carbon backbone whereas an unsaturated fat will have some carbon atoms which only have 1 hydrogen atom attached to some of the carbon backbone.
Q4.5: Which are the most stable fats, saturated or unsaturated?
A: saturated. The loss of a hydrogen atom or insertion of double carbon bonds makes the fatty acid more volatile and sensitive to high temperatures
Q4.6: What is a triglyceride?
A: Most fats are triglycerides and comprise of 98% of the fats that we eat. A triglyceride has one molecule of glycerol and three fatty acids.
Q4.7: What are high triglycerides an indication of when seen on a blood test?
A: cardiovascular disease
Q4.8: What type of fat is olive oil?
A: olive oil contains oleic acid which is omega 9. It is monounsaturated.
Q4.9: To which category of fats do essential fatty acids belong: saturated, monounsaturated or polyunsaturated?
A: polyunsaturated
Q4.10: What is the difference between a phospholipid and a triglyceride?
A: a phospholipid holds a phosphate group at the third position whereas triglycerides contain glycerol.
Q4.11: Which fats make up the cell membrane?
A: phospholipids (75%) and cholesterol (25%)
Q4.12: What is Phosphatidyl choline and how can it be useful in a nutritional programme?

A: Phosphatidyl choline (lecithin) is important for cell membrane integrity and supports the body with the following functions:

- Helps keep cholesterol soluble
- Keeps cholesterol isolated from arterial linings
- Protects cholesterol from oxidation
- Helps prevent and dissolve gall and kidney stones
- Supports liver detoxification
- Increases resistance to disease by its effects on the thymus gland
- Important part of cell membrane: phospholipids are involved in electric phenomena and membrane fluidity
- Important component of bile and helps to break down fats into droplets (emulsification) to increase their surface area and thus aid digestion.

Q4.13: What is the process of hydrogenation?

A: this was used by the fats industry to 'bubble' hydrogen through vegetable oils to 'fill in' the missing carbon atoms so that each was 'saturated' with hydrogen. This made a previously liquid fat more solid. The process was later found to be detrimental to health and is largely avoided now.

Q4.14: Which vitamin antioxidants help to protect oils from oxidation?

A: Vitamin C and E

Q4.15: List 6 functions of cholesterol

A: check your answer against the following list:

1. Compensates for changes in membrane fluidity
2. Steroid hormones made from cholesterol (female infertility could be as a result of low cholesterol)
3. Adrenal hormones made from cholesterol
4. Vitamin D made from cholesterol
5. Important for metabolism of vitamin A, E and K
6. Bile acids derived from cholesterol
7. Secreted by glands in skin, covers and protects our skin against dehydration, cracking and effects of sun, wind and water
8. Placenta produces cholesterol from which it manufactures progesterone to maintain the pregnancy

Q4.16: What are the food sources of cholesterol?

A: Only from animal sources:

- Eggs
- Meat
- Dairy products
- Fish
- Shellfish

Q4.17: How is cholesterol removed from the body?

A:

- via stool in form of bile acid and cholesterol molecules
- Removal increased by dietary fibre
- Beneficial bacterial play a role in cholesterol management. Therefore a healthy gut is of the utmost importance in the maintenance of health and the balance of cholesterol levels.

Q4.18: What might you consider if someone is diagnosed with raised cholesterol levels?

A:

1. Possible thyroid imbalance
2. Raised stress levels
3. Check diet for excess high cholesterol foods

4. Consider liver support
5. Consider gut support (remember that the gut bacteria regulate cholesterol levels and that fibre helps to eliminate excess cholesterol from the body)

Q4.19: Which nutrients do we need available in our diet to break down and utilise essential fatty acids?

A:

- Vitamin B3
- Vitamin B6
- Vitamin C
- Vitamin E
- Magnesium
- Zinc

Q4.20: Which factors will inhibit the breakdown of essential fatty acids?

A:

- Too much saturated fat
- Damaged fats (unhealthy fats)
- Cholesterol
- Aging
- Alcohol
- Chemical carcinogens
- Radiation
- Imbalanced insulin
- Wheat

Q4.21: What is the parent essential oil for omega 6?

A: Linoleic acid

Q4.22: Name the two main sources of gamma linolenic acid (GLA)

A: Borage oil and evening primrose oil

Q4.23: Which prostaglandin is considered to be most inflammatory?

A: Prostaglandin 2

Q4.24: List 10 symptoms of omega 6 deficiency.

A: check your list against the following:

1. Eczema like skin eruptions
2. Loss of hair
3. Liver and kidney degeneration
4. Excessive water loss via skin with thirst
5. Drying up of glands
6. Susceptible to infections/low immunity
7. Failure of wound healing
8. Male sterility
9. Miscarriage in females
10. Arthritis like conditions
11. Heart and circulatory problems
12. Growth retardation
13. Hyperactivity
14. Tender breasts in females before menstruation

Q4.25: What is the parent essential fatty acid for omega 3?

A: Alpha linolenic acid

Q4.26: What are the main sources of omega 3 that you could recommend someone include in their diet?

A: oily fish (salmon, herring, sardines, mackerel, pilchard, trout) and flax seed oil

Q4.27: List 10 deficiency symptoms of omega 3.

A: check your list against the following:

1. Growth retardation
2. Weakness
3. Impairment of vision and learning ability
4. Motor incoordination
5. Tingling sensations in arms and legs
6. Behavioural changes/hyperactivity
7. Excessive thirst
8. High triglycerides
9. Hypertension
10. Sticky platelets
11. Tissue inflammation
12. Oedema
13. Dry skin
14. Mental deterioration
15. Low metabolic rate
16. Immune dysfunction

Q4.28: Which prostaglandin is omega 3 broken down into?

A: prostaglandin 3

Q4.29: List 10 functions of prostaglandins

A: check your list against the following:

1. Regulate steroid production and hormone synthesis
2. Regulate pressure in eyes, joints and blood vessels
3. Regulate responses to pain, inflammation and swelling
4. Mediate immune response
5. Regulate body secretions and their viscosity
6. Dilate or constrict blood vessels
7. Regulates smooth muscle and autonomic reflexes
8. Directs hormones to their target cells
9. Regulates the rate at which cells divide
10. Prevents blood cells from aggregation
11. Mediates the release of cellular pro-inflammatory substances that may trigger either excess inflammation or allergic conditions
12. Regulate nerve transmission
13. Maintains the fluidity and rigidity of cell membranes
14. Regulates the flow of substances into and out of the cells
15. Influences the transport of oxygen by the red blood cells
16. Keep saturated fats mobile in the blood stream
17. Regulates nerve transmission

Q4.30: What is considered the correct ratio of essential fatty acids?

A: omega 6: 4:1 omega 3 (Yehuda et al)

Q4.31: What factors might we consider when deciding which essential fatty acids someone requires?

A:

- Symptoms
- Ability to break essential fatty acids down: availability of
    - Vitamin B3
    - Vitamin B6
    - Vitamin C
    - Vitamin E
    - Magnesium

- Zinc
- Strength of digestion
- Blood glucose control and whether insulin levels are stable
- Overall dietary habits and whether it contains essential fatty acids
- Where person is living and amount of light available
- Hydration

Q4.32: What are the safest fats to recommend to your clients?

A: for cooking: the saturated fats: butter, ghee and coconut oil and extra virgin olive oil if not heated much. For adding on afterwards *cold pressed organic* safflower oil, sunflower oil, hemp oil, avocado oil, walnut oil and flax seed oil

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6: Minerals:

OBJECTIVES

- **TO HAVE AN UNDERSTANDING OF THE MACRO MINERALS AND THEIR ROLE WITHIN THE BODY**
- **TO HAVE AN UNDERSTANDING OF THE FOOD SOURCES OF THE MACRO MINERALS**
- **TO HAVE AN APPRECIATION OF WHEN IT IS APPROPRIATE TO SUPPLEMENT THE MACRO MINERALS**

In this section we will look at the macro and micro minerals that are known to be essential to health plus a brief look at the 'heavy' metals, which are also known as the toxic metals. Please also do your own research into minerals and their various interactions. The notes provided in this module give you an additional, more alternative view of the micronutrients, one that is often missing from more conventional sources. To begin this section then, please refer to Ballantine:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'MINERALS' P223-224

The Macro Minerals

Potassium and Sodium

These two minerals will be covered in more depth in the naturopathic section of this module, in year 2. In the meantime please read Ballantine:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'MINERALS' P259-268 'SODIUM AND POTASSIUM AND WATER'

Calcium

Calcium, along with iron, is probably the main mineral that everyone is aware of. Calcium is one of the few nutrients that the medical profession focus on, the others being iron, folic acid (for pregnant women) and vitamin B12. Unfortunately, western medical doctors are not trained in nutrition at all; therefore they have an extremely limited understanding of how these nutrients interact with each other. If one nutrient is given in large quantity then it will suppress the absorption and utilisation of another nutrient. Calcium and magnesium are a classic example of this. Large amounts of calcium are prescribed to women with osteoporosis with no consideration as to whether it can be utilised effectively, or even asking the question as to why the problem with calcium utilisation occurred in

the first place. Although calcium is now given with vitamin D, magnesium is still ignored. Calcium requires magnesium in order to be utilised correctly. Without sufficient magnesium calcium becomes mismanaged in the body resulting in problems such as arthritis and osteoporosis.

The dangers of giving large amounts of calcium was highlighted in some research from New Zealand in 2008 when it was found that women given calcium to prevent osteoporosis were more susceptible to fatal heart attacks[2]. More recent research is still inconclusive. Interested students are directed towards this research paper: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4125316/ '*Calcium supplements and cardiovascular risk: 5 years on'* by Bolland, Grey and Reid.

As you work though the naturopathic section in year 2 you will begin to understand why calcium supplementation can be problematic.

In this section we will look at calcium from a more alternative perspective, beginning with Ballantine's exploration of this essential mineral.

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'CALCIUM' P225-232

Calcium metabolism:

Calcium metabolism is controlled by a fine tuned balance between hormones released by the thyroid and parathyroid glands. The blood calcium levels must remain stable to + or – 3%. There are three hormones that regulate calcium metabolism:

1. Parathormone from the parathyroid gland-releases calcium from the bone into the blood, decreases calcium loss in the urine and increases the production of calcitriol.
2. Calcitonin from the thyroid gland-stimulates processes to decrease blood calcium by decreasing the release of calcium from the bone and promoting the loss of calcium via the urine
3. Calcitriol, which is a derivative of vitamin D. It is produced by two chemical changes being made to Vitamin D, one in the liver and one in the kidneys. Its full name is 1, 25 dihydroxy vitamin D3. Calcitriol increases blood calcium concentration and maintains conditions favourable to bone mineralisation, including absorption from the intestines.

In response to falling levels of calcium in the blood the parathyroid releases parathormone which causes the bone to release calcium in to the blood. When blood levels are sufficient the thyroid releases calcitonin which aids the bones to take up calcium again.

Good sources of Calcium:

Lambs quarters (a green leafy vegetable) are particularly high in calcium, one cup of cooked leaves supplies 400mg calcium compared to a cup of broccoli providing 200mg and mustard greens 310mg. In comparison, a ¼ litre of milk provides 300mg. Sesame seeds are a particularly good source of calcium; one cup contains 1000mg. Other good sources include almonds, buckwheat, egg yolk, 'green leafy vegetables', molasses, sardines, turnips.

Requirements:

[2] Vascular events in healthy older women receiving calcium supplementation: randomised controlled trial. Bolland MJ, Barber PA, Doughty RN, Mason B, Horne A, Ames R, Gamble GD, Grey A, Reid IR. BMJ. 2008 Feb 2;336(7638):262-6. doi: 10.1136/bmj.39440.525752.BE. Epub 2008 Jan 15

It is difficult to say how much calcium is required by each individual. This is also covered by Ballantine. However the following RDA's are generally accepted:

Calcium requirements (estimated):

Adult men and women-700-800mg daily

Teenagers-1200mg daily

Infants-360-540mg daily

Pregnant and lactating women-minimum 1200mg daily

Functions of calcium:

- Secretion of hormones
- Activates insulin, calcitonin, thyroid hormone release
- Blood clotting
- Bone and teeth formation
- Cell membrane permeability
- Decreases blood level of parathyroid hypertensive factor
- Takes nutrients in to the cells
- Maintenance of electrolyte, blood acid and alkali balance
- Muscle contraction
- Nerve transmission
- Regulation of cell division
- Regulates heart beat

Factors increasing demand:

- Alcohol
- Bed rest
- Bone fractures
- Caffeine
- High phosphate intake
- High protein and sugar diets
- High sodium intake
- Hypoglycaemia
- Hypothyroidism
- Magnesium deficiency
- Pregnancy

Absorption:

Factors affecting absorption:

- Achlorhydria (low stomach acid)
- Age
- Excessive phosphate intake (main source fizzy/carbonated drinks)
- Lack of magnesium and vitamin D

- Hyperglycaemia-affects the amount of vitamin D available (diabetics and hyperglycaemics have low blood levels of calcium (calcium is needed in the blood stream to regulate blood sugar levels and insulin release).
- Lead hinders absorption.
- Lead, mercury, cadmium and aluminium all increase absorption of calcium into the cells which leads to arteriosclerosis and hypertension (calcium should be predominantly outside the cell in the extra cellular fluid and in the blood). You will understand the significance of this once you have studied the naturopathic section.
- Phosphotase is an enzyme found in milk that helps break down the milk and allow the absorption of calcium. In all heat treated milk (i.e. pasteurisation and homogenisation) this enzymes has been destroyed, thus the calcium in heat treated milk is difficult to absorb.
- Oxalic acid
- Phytic acid
- Too much sodium increases the absorption of calcium into the cells. This is mentioned in Ballantine's section on sodium and potassium and will be covered in more detail in the naturopathic section.
- Apple juice helps calcium absorption.
- The amount of protein taken in the diet will influence calcium absorption-too little protein will result in reduced calcium absorption. Similarly, a very high intake of animal protein can also depress calcium retention, as always it is a question of balance.
- Alkaline diets aid absorption-especially raw fruit and vegetables, whole grains, nuts and yoghurt.
- Acid forming foods hinder absorption such as tea, coffee, sugar, some grains, seafood, and alcohol. Alcohol intake can lead to negative calcium balance.

If there is a shortage of calcium in the diet the body has the ability to adapt and utilise the calcium that is available by increasing absorption. It would appear that the less calcium available the better the absorption rate, however this would be dependent upon the following factors:

- Milk consumption
- Diet high in animal protein
- Diet high in phosphorus
- Excess release of PTH

Secretion of hormones:

Calcium helps to control endocrine secretions and is necessary to open the secretory ability of hormone glands. Therefore the pancreas can only release insulin when adequate amounts of calcium are available *outside the cell*.

Negative calcium balance:

The body loses more calcium than it takes in. This can result in porous bones and softening bones due to:

- Deficiency in diet
- Deficiency in vitamin D
- High protein intake
- Disturbances to thyroid and parathyroid
- High phosphorus in diet (fizzy drinks)

- Low levels of estrogen
- Low stomach acid

Drug interactions:

Drugs affecting calcium include:

Caffeine, cimetidine, corticosteroids, digoxin, diuretics, glucocorticoids, fluoride, magnesium oxide, methotrexate, Phenobarbital and tetracycline.

Foods detrimentally affecting calcium absorption include:

- Those containing high levels of oxalic acid
- Those containing phytic acid
- Caffeine (not technically a food)
- Excess protein

Please research foods containing oxalic acid and send it to your tutor for marking. What is the significance of foods which are high in oxalic acid? What symptoms are associated with eating high oxalate foods?

Calcium mishandling:

Calcium mishandling is defined as '*the failure to deposit calcium into the bone at an appropriate and normal rate'*. People who show signs of calcium mishandling often suffer from hardening of their soft tissues. Most often it is muscle tissue (because there is far more muscle tissue than any other form of soft tissue). Frozen shoulder is an example of calcium dumping/mishandling. As the cell becomes less efficient in keeping extracellular calcium out of the cell a hardening of muscles and organs can occur. As calcium is needed for cellular activity such as secretion of hormones, this mismanagement has far reaching effects.

An increase in tissue calcium leads one to be more susceptible to viral infections.

Hyperparathyroidism:

The parathyroid helps with calcium utilisation. When it is over functioning the following symptoms may be apparent:

- Excessive thirst
- Muscle aches
- Recent memory loss
- Tendinitis
- Calcification of cartilage
- Depression
- Fatigue
- Hearing difficulties
- Restless legs
- Constipation
- Dyspepsia

- Kidney stones and gall stones
- Conjunctivitis

The medical term for calcium mishandling is 'bones, groans and stones'

Calcium dumping:

This is the concept that the body 'dumps' calcium out of solution due to excesses in sodium. This can result in symptoms such as arthritis, spondylitis, gallstones, renal stones, arterial atheroma.

Calcium and hair analysis:

High levels of calcium are associated with:

- slow oxidation rate and an exhaustive stage of stress
- Often indicates that calcium is leaving the blood and accumulating in the soft tissues of the body
- Indicates hidden copper toxicity
- Often reflects low thyroid and adrenal function

Low levels of calcium are associated with:

- Fast oxidation and an alarm stage of stress
- Excessive thyroid and adrenal activity
- Often indicates that calcium is being lost in the urine
- Associated with a copper deficiency

Reasons for calcium supplementation within hair analysis results:

- To slow the oxidation rate
- To help remove lead and cadmium
- To balance key mineral ratios
- To replace calcium being lost either into the tissues or through the urine
- Symptomatic-i.e. for muscle cramps, irritability, insomnia, anxiety or osteoporosis.

"Calcium shell"

This is the term given by Paul Eck, one of the pioneers of hair analysis. It describes why high levels of calcium are found on a hair analysis and how these raised levels help to buffer the individual against stress. High levels are often found in charts of people who are under a lot of stress. The calcium helps to numb the senses to the effects of stress and effectively becomes a shell in which to hide. It is like living behind a wall of calcium, and the person is generally out of touch with reality to some degree. It suggests psychological withdrawal and defensiveness.

TB Miasm:

The TB miasm, according to homeopathy, is a combination of two miasms (inherited taints), the Sycotic or gonorrhoeal miasm and the syphilitic miasm. On a physical level this miasm will cause calcium mishandling. There will be increased mucus production due to an inherited toxic load, dehydration and disease suppressions. There is a lot of activity in throwing out toxins. Diseases associated with this miasm include arthritis, eczema and bowel problems. If these diseases are

allowed to progress or are not corrected naturopathically then the cells can become more cut off and be unable to communicate correctly with one another. The miasm can then become deeper and move to produce mental level imbalances such as bipolar disorder, schizophrenia, anorexia, bulimia, and depression.

Calcium ring:

The sodium/calcium/cholesterol ring is a clearly visible ring seen in the eyes of generally older people. However it may appear, especially in genetically brown eyed people, in their 30's. It suggests an imbalance between sodium, calcium and cholesterol. Disturbances to calcium utilisation in the body, calcium dumping, high levels of sodium are all features of this manifestation. In fact, many opticians, upon seeing the ring, will send the patient to the doctor for a cholesterol check. On an emotional level the person is also becoming more rigid in their outlook.

Magnesium

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 MAGNESIUM P232-234

Magnesium is essential for the action of the cellular sodium pump. Therefore any deficiency of magnesium will directly affect the ability of the pump to work effectively at keeping sodium (and calcium) out of the cells. In addition, magnesium is required inside the cell to produce energy via ATP. A magnesium deficiency results in lowered energy and the rise of acidity within the cells. As the cells start to retain more sodium, potassium will be lost from the body. The cell requires energy to push toxicity out of the cell, thus, lowered levels of magnesium leads to increasing levels of toxicity in the body tissues.

Magnesium is also a co factor to delta 6 desaturase therefore a deficiency affects essential fatty acid breakdown.

Functions of Magnesium:

- Co factor in synthesis on cAMP and ATP
- Stimulator of many enzymes in energy producing pathways
- Homeostasis of calcium and regulates intracellular calcium, sodium and potassium ions
- DNA replication
- Improves immune competence
- Improves insulin resistance
- Inhibition of platelet aggregation
- Initiation of fatty acid oxidation
- Lecithin production
- Maintenance of heart muscle
- Regulation of body temperature

Factors increasing demand

- Low stomach acid
- Athletes
- Arthritis
- Chronic alcoholism
- Chronic fatigue
- Coffee

- Diabetic acidosis
- Diarrhoea
- Diabetes (type 2)
- Eclampsia
- Epileptics
- Heart failure
- High fat and sugar intake

Spotting a deficiency:

Magnesium is a natural sedative, therefore the more serious the deficiency the edgier the person may become. An individual may become excessively anxious and short tempered. The following are common tell-tale signs:

- Jumping at the least provocation
- Hyper-irritability
- Muscle tremors
- Inability to concentrate
- Apathy
- Depression
- Hyperactivity in children
- Increased perspiration (from even the slightest exertion)
- Foul body odour
- Cramps
- Frequent urination (due to muscles around the bladder not being able to relax properly)
- Constipation
- Insomnia-fall asleep readily but then wake and only sleep lightly/toss and turn.
- Pre-eclampsia in pregnancy is often due to magnesium deficiency.

The endocrine glands and magnesium

The thyroid, parathyroid and adrenal glands significantly influence magnesium in the body. Increased thyroid speeds up the metabolic rate and this increases the need for magnesium to keep up. Increased parathyroid activity amplifies the intestinal absorption of calcium and causes the kidney to reabsorb it. If the gland becomes overactive a “relative” magnesium deficiency can occur. If the parathyroid underachieves, a magnesium deficiency also results. This is because if the parathyroid reduces its output then the thyroid will increase output, leading to lower magnesium levels.

The adrenals release stress hormones that trigger the release of magnesium.

Daily dosage

RDA 330-350mg daily

It is widely accepted by official sources that there is a widespread magnesium deficiency due to there being insufficient magnesium in the soil. It must be remembered that just because we are eating foods that we believe are rich in certain nutrients doesn’t mean that what we are eating has a good supply of the given nutrient. It will depend upon the quality of the soil it is grown in. It is quite

likely, due to modern farming methods that certain nutrients, including magnesium, are not in the soil to any degree in the first place. In addition to this we also have to take into account that we have to be able to absorb the nutrient efficiently as well. This will depend upon our general balance of vitamins and minerals and the efficiency of our digestive processes.

Synergistic nutrients

Vitamins B1, B6, C, D, potassium, boron, calcium, chromium, manganese, zinc, potassium.

Please note that the utilisation of B1 (thiamine) requires adequate amounts of magnesium. Thiamine cannot be utilised when a magnesium deficiency exists. If thiamine is given to a person with low magnesium it can aggravate the magnesium deficiency.

Drug interactions with magnesium

Drugs affecting magnesium include:

Alcohol, aldosterone, antibiotics (oxytetracycline, tetracycline), calcium and iron supplements, vitamin D supplements, caffeine, conjugated estrogens, corticosteroids, folic acid, digitalis, digoxin, diuretics, furosemide, oral contraceptives, penicillin, Phenobarbital, B2, thyroxine.

Magnesium, hypoglycaemia and diabetes

Many reports indicate that magnesium exerts considerable influence upon the control of blood sugar levels. If you consider that magnesium is a co factor for many of the ATP linked enzymes that are involved in glucose breakdown then this will come as no surprise.

Glucose utilisation is therefore diminished in magnesium deficiency. Magnesium is also a co factor in the process by which glucose is transported into the cells, making glucose utilisation during a magnesium deficiency even more difficult. It has been found that insulin release from the pancreatic tissue is influenced by the calcium/magnesium ratio and that the Islets of Langerhans cells have to take up extra magnesium from their surroundings in order to be able to increase their output of insulin in response to high blood glucose levels. The consumption of refined carbohydrates, confectionary and sugar can therefore result in chronic magnesium deficiency. This is part of the nutrient debts that you learnt about earlier.

Magnesium and hypertension

It has been known since 1925 that high blood levels of magnesium cause a fall in blood pressure and magnesium has been commonly used to treat hypertension in pregnancy.

Candida and magnesium

Magnesium deficiency is the commonest biochemical abnormality found in candida infection and that patients with candida are vulnerable to excessive losses of magnesium via the kidneys.

Types of supplements

Citrate, taurate and bis-glycinate forms are easiest to absorb.

Also consider Epsom Salt Baths which are magnesium sulphate. These are particularly useful for children with autism and ADHD as they supply magnesium in the sulphate form. It is quite common with these children, especially those with autism, to have problems converting sulphur to sulphate. This results in compromised liver detoxification. Epsom salt baths can provide sulphate and this assists with liver detoxification by helping to remove toxins via the skin.

Naturopathic considerations

As magnesium assists in cellular energy and the rebalancing in the cellular environment, the taking of magnesium will lead to cellular cleansing. It is therefore imperative to have the routes of elimination open and supported; bowels, liver and kidneys, plus consideration to assisting the skin with skin brushing and Epsom salt baths. Magnesium will expel sodium from the cell together with excess toxicity/acidity. The following considerations should be borne in mind:

- The dose of magnesium and the length of time taking it
- Other eliminatory treatment factors, both dietary and supplementary
- Patients constitution and consideration to his weak and strong organs
- The patient's person idiosyncrasies with regard to their patterns of elimination, as to which routes are most likely to be used and with what degree of vigour, speed and responsiveness.

PLEASE READ: 'THE MAGNESIUM MIRACLE' BY DR CAROLYN DEAN.

Please answer the following self-assessment questions before moving on to study the micro minerals:

Self-assessment questions: Macro minerals:

Q6.1: What are macro minerals and which ones are they?
Q6.2: Where are potassium and sodium found predominantly in the body?
Q6.3: What might be the consequence of taking in too much salt?
Q6.4: What is the RDA of salt and sodium?
Q6.5: What is the RDA of potassium?
Q6.6: According to Ayurveda, what effect does salt have on the body?
Q6.7: From a Chinese perspective, is salt considered to be yin or yang?
Q6.8: Which glands regulate calcium metabolism?
Q6.9: Explain the action of the various hormones that regulate calcium metabolism.
Q6.10: Which are the main nutrients that calcium requires for adequate absorption and utilisation?
Q6.11: Why do hospitals try and get people walking as soon as possible after operations?
Q6.12: Which minerals are detrimentally affected by taking large amounts of calcium?
Q6.13: Name good sources of calcium.
Q6.14: How does protein affect calcium absorption?
Q6.15: What is the RDA for calcium and why do you think sources differ?
Q6.16: Name 10 functions of calcium.
Q6.17: What factors will increase the need for calcium?
Q6.18: What is the significance of low levels of calcium and blood sugar control?
Q6.19: What does negative calcium balance mean?
Q6.20: Which factors contribute towards negative calcium balance?
Q6.21: What dietary factors affect calcium absorption?
Q6.22: How is calcium associated with viral infections?
Q6.23: What does calcium dumping mean?
Q6.24: Which heavy metal competes with calcium for absorption?
Q6.25: In Iridology, what is the calcium ring?
Q6.26: What are the main food sources of magnesium?
Q6.27: Name 5 functions of magnesium
Q6.28: Name 5 factors which increase the demand for magnesium
Q6.29: List 5 symptoms that may suggest a magnesium deficiency.

Q6.30: Give 5 reasons why someone may be deficient in magnesium
Q6.31: Which nutrients work with magnesium or are affected by magnesium?
Q6.32: What is the connection between candida and a magnesium deficiency?

The Micro Minerals:

OBJECTIVES

YOU SHOULD BE ABLE TO:

- **UNDERSTAND THE FUNCTIONS OF THE MICROMINERALS IN THE BODY AND THE FACTORS THAT HELP AND HINDER ABSORPTION.**
- **HAVE AN APPRECIATION OF THE COMMON SOURCES OF THE MICROMINERALS IN FOODS, AND THE APPROPRIATE CONDITIONS FOR THEIR SUPPLEMENTATION.**

NB: At this level of learning you should not consider supplementing the trace minerals in isolation

Zinc

Zinc is responsible for over 200 functions in the body and is especially known for its effect upon the immune system, the reproductive system, the skin and mental/emotional functioning. Copper and zinc work together in the body, however, they will compete for absorption thus excess copper will deplete zinc.

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'ZINC' P247-251

Zinc and reproduction

Zinc is required for the unborn foetus to grow; if the mother is already deficient in zinc then the baby will draw on all her stores, leaving both mother and baby depleted. This can result in post-natal depression and low birth weight babies (less than 7lb). Copper is needed by the body at the end of pregnancy for the body to contract, thus the mother is left in a high copper state. The main source of zinc for the baby is via the placenta. All other mammals (apart from humans) eat their placenta after giving birth, thus restoring the levels of zinc to the mother, ready for breast feeding. You will now be able to understand why a mother who is already deficient in zinc can become severely depressed after childbirth.

Morning sickness is due to a zinc and B6 deficiency.

Zinc requires B6 for effective absorption. Consider giving B6 in a broken down form for easier access.

Zinc and mental functioning

Carl Pfeiffer did lots of research into zinc and various types of schizophrenia. For interested students his books *'Zinc and other Micronutrients'* and '*Nutrition and Mental Illness'* are highly recommended. Zinc allows more uptake of dopamine; this may be its mode of action in ADHD.

High levels of copper will hinder the absorption of zinc. Copper is a brain stimulant while zinc has an anti-anxiety effect. Tension occurs when blood levels of copper are highest and blood zinc is lowest. Estrogen also affects copper levels and vice versa. High levels of estrogen generally go 'hand in hand'

with raised copper levels; as estrogen rises, copper levels rise also. Raised copper levels are considered one contributory cause of PMT.

Zinc and absorption

An inability to utilise zinc may be associated with an inability to utilise EFA's. Many of the features of zinc deficiency and of essential fatty acid (EFA) deficiency are similar in both animals and humans. Remember also that zinc requires vitamin B6 for absorption and utilisation.

Excessive calcium intake impairs zinc absorption. Zinc competes with calcium and iron for absorption.

Blood sugar control

Zinc deficiency will impair normal glucose metabolism due to a diminished response to the hormone insulin. Zinc has been thought to stabilise insulin in the body, to help maintain circulating levels of insulin and to reduce the tendency to insulin resistance.

Zinc and the sodium/potassium balance

Zinc is required as a co factor in the production of energy, thus any deficiency will reduce ATP generation and affect the sodium pump. Rectifying a sodium/potassium imbalance in the presence of a zinc deficiency may be almost impossible.

Stress

Stress will cause the body to lose zinc and B6 (amongst other minerals) which can cause a person to become pyroluric. The increased loss of zinc will cause an imbalance with copper, potentially leading to a high copper scenario which will result in mental and emotional imbalances such as OCD, depression, schizophrenia and manic depression.

Pyroluria

Pyroluria is probably a lot more common than suspected by orthodox medicine and nutrition. Pyroluria is a condition, often thought to be inherited, where kryptopyrroles bind to pyridoxine (vitamin B6) and zinc and take it out of the body. Stress is known to increase pyroluria in those susceptible. Symptoms include anxiety, irritability, fatigue, poor short term memory, little or no dream recall (a common B6 deficiency), mood swings and increased sensitivity to light, sounds, chemicals etc. It is sometimes called 'the mauve factor' due to the mauve colour visible on the urine testing strips; King George 3rd was thought to suffer from it.

Factors increasing demand

Low stomach acid, alcoholism, anorexia nervosa, burns, copper and lead toxicity, diabetes, elderly people often deficient due to lowered stomach acid, diets high in phytic acid, hypertension, poor appetite, pancreatic enzyme insufficiency, pregnancy, schizophrenics, stress, viral infections and vegetarian diets.

Deficiency symptoms

Deficiency symptoms include:

Acne, all skin problems, anorexia nervosa, bulimia, all mental problems, decreased Leptin levels, poor immunity, impaired wound healing, impaired growth, learning disorders, low sperm counts, poor concentration and memory, sleep problems, white spots on finger nails, dandruff, epilepsy,

infertility, loss of taste, premature greying of the hair, stretch marks, loss of appetite, possible predisposing factor in alcohol addiction.

The zinc deficient person has cold extremities and poor peripheral circulation, hair and nails often don't grow very well and the brittle nails may often have white spots.

Synergistic nutrients

Vitamin A, B6, D, E, cysteine, glutathione, magnesium and manganese.

Copper, iron and high levels of calcium are antagonistic.

Zinc works closely with copper and manganese. If there is an excess of these two minerals then zinc will not be absorbed effectively, resulting in a relative deficiency. Care must be taken with a patient that has been taking zinc long term that they do not cause a relative iron, manganese (or copper) deficiency.

Drug interactions

Drugs affecting zinc include:

Alcohol, beta blockers, cimetidine, excess iron and copper intake, glucocorticoids, oestrogen, oral contraception, penicillin, progesterone, steroids, tetracycline, valproic acid.

Copper

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'COPPER' P243-247

Firstly, copper is essential to us. It is required for the following enzyme functions:

- Cytochrome oxidase
- Superoxide dismutase (SOD)
- Ascorbate oxidase

Deficiency symptoms

Neutropenia (a low count of Neutrophils: white cells in the blood), hypochromic microcytic anaemia (a form of anaemia in which the red blood cells are both low in haemoglobin content and are also very small in size), osteoporosis (a loss of substance, especially the mineral hardening substance, of the bone. Consequently the bones are very fragile), slow healing of wounds, MS, irregularity of heart beat, raised blood cholesterol levels, tachycardia, heart attack, poor hair quality.

Copper and anaemia

One of the earliest conditions found to be associated with copper deficiency was iron deficiency anaemia. When a copper deficiency is present the body has difficulty utilising iron properly.

Copper and arthritis

Excess iron builds up in the tissues of the body, often being deposited at joints, contributing to rheumatoid arthritis. A chronic bacterial infection can cause this imbalance between iron and copper. The infection can cause a depletion of the body's copper reserves, thereby allowing iron accumulation around the joints.

It is well known that patients can enjoy a spontaneous relief of arthritis when they contract a condition that causes an increase in copper retention. For example, pregnancy and gall bladder obstruction cause an increase in copper retention. Copper is normally excreted via the gall bladder, thus when the gall bladder is obstructed copper excretion diminishes and can build up, relieving symptoms of deficiency. There is also a connection between estrogen and gall bladder activity where estrogen has been found to increase the release of biliary cholesterol resulting in an increased susceptibility to gall stones.

Copper and viral infections

High copper levels will predispose one to increased viral activity

Copper and fertility

Copper is essential for the growing foetus, a deficiency can result in spontaneous abortion or still death. Copper is needed to increase towards the end of the pregnancy in order for the mother's body to contract and go into labour. This means that the baby is born in a 'high copper state'. The baby (and mother) need large amounts of zinc to correct the increased levels of copper. Animals that eat the placenta receive a concentrated form of zinc. As humans we no longer consider it acceptable to eat the placenta and thus the mother (and baby) remains in a state of high copper and more susceptible to post-natal depression. It is therefore important to offer zinc (and B6) supplementation to women who have just given birth.

Copper and epilepsy

As we have seen in the previous section about zinc, copper is required by the body in order to contract (labour). High levels of copper are also found in epileptics where the copper is causing the seizures and affecting brain chemistry. Epilepsy is also connected with excess glutamate.

Effects upon the nervous system

Carl Pfeiffer studied mental illness extensively and discovered that copper acts as a stimulant to the brain. High serum levels of copper induce conditions of over activity in the brain while low serum levels of copper have the opposite effect. Pfeiffer identified that high copper levels accompany several types of mental illness. High copper may produce a mental illness similar to that of B3 deficient pellagra.

Factors affecting copper levels

- Vitamin C deficiency raises copper levels
- The combined deficiency of both vitamins C and B3 may synergistically raise copper levels.
- Copper water pipes
- Copper cookware
- Drinking water contaminated with copper
- Birth control pills and copper coil IUD
- Vitamin and mineral supplements
- Fungicides for swimming pools and foods
- Vegetarianism and other high copper diets
- Dental appliances
- Occupational exposure (plumbers, welders)
- Adrenal gland exhaustion
- Congenital copper imbalance (from mothers who are deficient in zinc or high in copper)
- Slow metabolic rate-the slower the rate, the higher the levels of copper.

The contraceptive pill and copper

The contraceptive pill increases estrogen and thus also copper via its effects upon the gall bladder. Animals given estrogen show a marked reduction in blood levels of vitamin C and increased levels of copper. Deficiency in B6 and zinc are extremely common in women taking the pill and these nutrients should be considered for supplementation.

The copper personality

This has been devised and researched by Paul Eck, one of the pioneers of hair analysis. He has researched various symptoms that he attributes to a 'copper personality'; a person who has high levels of copper or accumulates copper easily. Symptoms include headaches, fatigue, insomnia, depression, skin issues, spaciness/detachment, learning disorders and PMT (copper levels rise before menstruation).

For those that want to research this more visit www.arltma.com.

Manganese

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'MANGANESE' P240-242.

Manganese is known as the maternal mineral because women and animals that are deficient in it are not able to bond with their babies.

Roles in body

- Essential for energy production
- Involved in glucose metabolism
- Helps maintain the integrity of tendons and ligaments
- Essential for bone development and arterial integrity
- Maternal bonding

Deficiency symptoms

- Allergies
- Diabetes
- Dizziness
- Fatigue
- Fractures or osteoporosis
- Hypoglycaemia
- Tinnitus
- Muscular weakness
- Weak ligaments and tendons
- Lack of maternal bonding

Manganese interacts with copper and zinc therefore excesses of either copper or zinc will suppress manganese utilisation.

Carl Pfeiffer is renowned for his research into zinc and mental illness. Unfortunately, his books are out of print but it is still sometimes possible to pick up a reasonably priced one via the internet. Failing that the following link will take you to a book that he co-authored about mental illness,

schizophrenia and pyroluria. The information in this book will give you a good overview of his work and how important zinc is for healthy mental functioning.

https://riordanclinic.org/wp-content/uploads/2014/12/The_Schizophrenias_Ours_to_Conquer-Riordan-Clinic-Books.pdf

His other books, if you are able to find a reasonably priced copy, are:

- **'Zinc and Other Micronutrients' by Carl Pfeiffer**
- **Nutrition and Mental Illness: An Orthomolecular Approach to Balancing Body Chemistry' by Carl Pfeiffer**

Selenium

Selenium is an essential trace mineral; however in excess it is toxic. It is an anti-oxidant and often included in anti-oxidant supplements such as 'ACE, Selenium and Zinc'. Selenium is also essential for the conversion of thyroxine (T4) into triiodothyronine (T3). It is therefore often included in supplements that support thyroid activity. Care must be taken that clients self-medicating on supplements do not exceed the safe upper limit which is 400mcg. This could be quite easy if they are taking a multi vitamin and mineral, an anti-oxidant plus a thyroid support supplement.

Deficiency symptoms

- Pancreatic damage
- Confusion
- Depressed CD4 T lymphocytes
- Depression
- Depressed glutathione peroxidase
- Growth impairment
- Abnormal sperm motility
- Hostility
- Hypothyroidism
- Infertility

As selenium is required for the conversion of T4 to T3 a deficiency could result in the many differing symptoms that are attributed to an underactive thyroid.

RDA

50-200mcg daily. The upper safe limit is 400mcg daily.

Synergistic nutrients

Vitamin B3, C, E, Co Enzyme Q10, Cysteine, Glutathione, Methionine, zinc, iodine.

Iron

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'IRON' P255-259

Roles in body

Iron has 3 principle functions:

1. Oxygen transport –iron is part of the haemoglobin molecule that carries oxygen in the blood

2. Cellular energy production-iron is required in the final steps of the electron transport system to produce ATP
3. Removal of harmful free radicals-the catalase enzyme system requires iron.

Deficiency symptoms

- Fatigue
- Weakness
- Decreased resistance
- Pallor
- Anaemia
- Hydrochloric acid deficiency
- Brittle or ridged nails
- Slow oxidation
- Low blood pressure
- Dizziness
- ADHD
- Sore tongue
- Hair loss

Absorption

Absorption of iron is increased by the following:

- acid foods
- animal foods
- vitamin C
- alcohol
- glucose and other sugars
- Requires copper and B12 for utilisation.

Iron absorption is decreased by:

- phytic acid
- phosphate
- egg protein
- manganese
- zinc
- nickel
- chromium
- copper (excess)
- calcium
- magnesium
- cadmium
- vegetarian diets.

The ferrous form of iron is better absorbed than ferric.

There are two forms of iron from the diet: haem iron from meat and non-haem iron from food sources such as eggs, lentils, beans, tofu, cashew nuts, and green leafy vegetables. Non-haem iron is generally in the ferric form and thus considered more difficult to assimilate.

Hemochromatosis

This is an iron storage disease, predominantly inherited, where iron is not utilised correctly and large amounts are stored in the liver. Symptoms include:

- Abdominal pain
- Fatigue, weakness
- Generalized darkening of skin colour (often referred to as bronzing)
- Joint pain
- Lack of energy
- Loss of body hair
- Loss of sexual desire
- Weight loss

If there is a history of Hemochromatosis in the family **DO NOT** give iron-this includes iron in a multi vitamin and mineral. Choose an iron free supplement.

Blood tests for iron status

Serum iron is the figure most often given. This is the amount of iron in the blood stream. Another figure that is useful to know is the TIBC, total iron binding capacity. This is a carrier protein for iron which will increase if iron is deficient in order to try and utilise more iron. If Ferritin is low this suggests bacterial infections or an increased risk of bacterial infections. Hair grows best when Ferritin levels are 25+.

Low ferritin levels are also connected with low thyroid activity because iron is needed for thyroid hormone conversion. Low thyroid activity is also connected with increased viral and bacterial infections.

Hair loss

Many women suffer from hair loss which is extremely worrying for them. Once other factors have been addressed such as low adrenals and kidney energy, try a product from Lamberts called 'Florisene'. This contains iron (as ferrous glycine sulphate), Vitamin C, Vitamin B12, and L-Lysine.

This supplement should not be given with other vitamin and mineral supplements that contain iron or if there is a family history of Hemochromatosis. It should not be taken long term.

Molybdenum

Molybdenum is important for liver detoxification; in particular, for the pathway that detoxifies certain chemicals. If you have a client that complains of chemical sensitivity (e.g. they are affected by strong smells) then consider whether they may be lacking molybdenum.

Functions

- Fat, aldehyde, uric acid metabolism, copper, iron and sulphur homeostasis
- Detoxification of copper, sulphite, sulphate, aldehydes

- Purine metabolism
- Anti-cancer
- Prevents tooth caries

Therapeutic uses

- Asthma
- Cancer
- Infertility
- Exposure to pollutants
- Nausea
- Tooth decay
- Yeast and fungal infections

Boron

Functions

- Increases production of estrogen and testosterone
- Helps prevent osteoporosis and post-menopausal symptoms
- Improves the development and maintenance of bone
- Involved in parathyroid hormone function
- Activates vitamin D via its action on the kidney

Deficiency symptoms

- Osteoporosis
- Hot flushes
- Vaginal dryness

Therapeutic uses

- Osteoarthritis
- Osteoporosis
- Arthritic pain
- Menstrual symptoms
- Poor memory

Chromium

Approximately 56% of the population is at risk of being deficient in chromium.

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'CHROMIUM' P238-240

Functions

- Part of the glucose tolerance factor-chromium is involved in maintaining blood sugar levels and energy levels.
- Potentiates insulin function
- Cholesterol regulation
- Fat, protein and carbohydrate regulation

Iodine

Iodine is crucial to the production of thyroid hormones in the thyroid gland. In deficiency of iodine, the thyroid gland in the neck can swell, producing a goitre, which is a very visible indication of iodine deficiency.

Iodine deficiency occurs commonly on the Great Lakes region of the USA, due to iodine deficient soils, and this deficiency has been corrected by the routine iodising of salt.

Iodine is plentiful in all seafood, and is also commonly supplemented in the form of kelp tablets. Since the daily requirement is so low, in many parts of the world we can easily satisfy this from fruits, vegetables and grains, but in other regions the soil content is simply not high enough to satisfy our requirements

RESEARCH (ASSIGNMENT) IODINE

This is an important area with on-going research. It is important to keep up to-date with this research. There are two schools of thought with iodine: 1) those who fear it and suggest it can cause many problems if supplemented and 2) those who advocate it as a 'heal all'. Levels of estrogen increase when iodine levels are low. This is an important consideration when we consider the number of estrogenic cancers and diseases that affect us such as endometriosis, fibroids, breast cancer, etc. Iodine is also thought to exacerbate thyroid peroxidase antibodies in those with Hashimoto's disease (autoimmune hypothyroid). For more information students are directed to '*Iodine: why we need it and why you can't live without it'* by Dr. Brownstein or visit his website www.drbrownstein.com. Please also research the opposite school of thought in which Iodine is considered potentially dangerous. Until there is clarity on this issue it is strongly suggested that you do not recommend the use of iodine unless you monitor the client regularly with reputable laboratory tests.

Please send your research assignment to your tutor for marking

The following books are recommended for students to research the topic of iodine further:

One of:

- **'Iodine, Why you need it and why you can't live without it' by David Brownstein**
- **'The Iodine Crisis, What you don't know about Iodine can wreck your life' by Lynne Farrow**

Heavy metals

The heavy metals or toxic metals are:

- Lead
- Cadmium
- Mercury
- Arsenic
- Aluminium

Copper is also considered toxic in excess due to the effects that it has on the body.

Please do your own research in this area, starting with Ballantine:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 'LEAD' P234-238, 'CADMIUM' P251-255, 'FLOURINE' 269-271

To complete this section please complete your reading of Ballantine's chapter on Minerals:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 8 FROM 'MINERAL WATERS' TO THE END OF THE CHAPTER: P271-278

Assignment: To finish this section on Minerals please prepare a chart with all of the minerals listed, their role in the body, their interactions with other vitamins and minerals, their RDA, deficiency symptoms, excess (toxicity) symptoms and food sources. This is to be sent to your tutor for marking. You can either have one chart for vitamins and one for minerals or combine the two together.

Self-assessment questions: Minerals

Q6.33: What is considered to be the nutritional cause of post-natal depression?
Q6.34: What might you consider for a client suffering from morning sickness? How could you enhance the absorption of zinc?
Q6.35: Which nutrients affect zinc utilisation?
Q6.36: How does zinc affect blood glucose control?
Q6.37: List 10 factors that affect the utilisation of zinc
Q6.38: List 10 zinc deficiency symptoms
Q6.39: Which nutrients are antagonistic to zinc utilisation?
Q6.40: What is pyroluria and what are its symptoms?
Q6.41: Name 5 symptoms of copper deficiency
Q6.42: What is superoxide dismutase? Which mineral is essential for its production?
Q6.43: What is the connection between iron anaemia and copper?
Q6.44: What is the connection between copper, estrogen and the gall bladder?
Q6.45: List five factors affecting copper levels in the body
Q6.46: Which nutrients are depleted by the contraceptive pill?
Q6.47: Name 3 roles of manganese
Q6.48: List 5 deficiency symptoms attributed to manganese
Q6.49: What are the deficiency symptoms of selenium?
Q6.50: What are the three principle functions of iron in the body?
Q6.51: Name 10 deficiency symptoms of iron
Q6.52: Which nutrients are required for iron to be absorbed efficiently?
Q6.53: Name 5 factors or nutrients that inhibit iron absorption
Q6.54: Where would you advise a vegan to obtain their sources of iron from?
Q6.55: What is Hemochromatosis and what are the symptoms?
Q6.56: What is the glucose tolerance factor?
Q6.57: What role does molybdenum play in the body?
Q6.58: Which heavy metal displaces calcium? Which supplements would be used to detoxify it?
Q6.59: What is TIBC when seen on a blood test?
Q6.60: What do low ferritin levels on a blood test suggest?

Answers to Self-assessment questions: Vitamins:

Q5.1: Which vitamin deficiency is associated with scurvy?
A: vitamin C
Q5.2: Where does the term 'vitamin' originate from?
A: from 'vital amine' because they were found to be vital for life and amino acid like.
Q5.3: What are the main functions of vitamin A?
A: check your list against the following:

- Essential for immune function
- Essential for eye health
- Essential for skin
- Vitamin A is essential during pregnancy for the sight of the baby.
- A deficiency during pregnancy can lead to cleft palate and other abnormalities.

Q5.4: What is the precursor for vitamin A?
A: beta carotene
Q5.5: Where is vitamin A found in food?
A:

- carotenoids (found on orange and yellow vegetables and fruits)
- butter
- liver
- cod liver oil
- dark green leafy vegetables
- eggs

Q5.6: What is the upper recommended amount for vitamin A supplementation?
A 10,000iu
Q5.7: What inhibits B1 absorption?
A: coffee and alcohol
Q5.8: which system of the body does a deficiency in B1 affect?
A: nervous system
Q5.9: what are the best food sources of vitamin B1?
A: fish, seeds, nuts, beans, tofu, brown rice, asparagus
Q5.10: What disease is associated with a deficiency in B1?
A: beri Beri: from those eating polished rice
Q5.11: Name 6 factors that deplete vitamin B2
A: Check your answers against the following list:

1. Coffee
2. Alcohol

3. Diabetes
4. Stress
5. Hyperactivity
6. Steroid drugs including the contraceptive pill
7. Smoking
8. Sugar
9. Excess refined food
10. Excess B6

Q5.12: List 6 deficiency symptoms of vitamin B2

A: check your list against the following:

1. Alopecia
2. Angular cheilitis (splits at corner of mouth)
3. Blurred vision
4. Cataracts
5. Conjunctivitis
6. Dermatitis
7. Geographic tongue
8. Sore tongue
9. Red lips

Q5.13: What is the main deficiency disease of vitamin B3, niacin?

A: Pellagra: dermatitis, diarrhoea and dementia

Q5.14: Which mental illness may be associated with low levels of niacin?

A: schizophrenia

Q5.15: Where does the term for vitamin B3, Niacin, originate from?

A: from nicotinic acid vitamin in 1942. Nicotine takes its name from Count Nicotin in France where the alkaloid found in the leaves of the tobacco plant were oxidised.

Q5.16: List 5 deficiency symptoms of vitamin B5

A: check your list against the following:

1. Alopecia
2. Abdominal pains
3. Burning feet
4. Convulsions
5. Depression
6. Dermatitis
7. Fatigue
8. Fertility disorders
9. Hypotension
10. Insomnia
11. Tenderness in heels

Q5.17: Why is vitamin B5 of critical importance to energy production?

A: because its active form is Acetyl Co enzyme A which feeds into the citric acid cycle within the mitochondria to make energy. All nutrients, proteins, fats and carbohydrates are converted into acetyl co enzyme A before entering the citric acid cycle.

Q5.18: What is the broken down form of B6 called?

A: pyridoxal 5 phosphate

Q5.19: Name 10 deficiency symptoms of B6

A: check your answer against the following list:

1. Allergy
2. Asthma
3. Anxiety
4. Autism

5. Breast cancer
6. Carpal tunnel syndrome
7. Chemical sensitivity
8. Coeliac disease
9. Depression
10. PMT
11. Dysmenorrhoea
12. Epilepsy
13. High homocysteine
14. Infertility
15. Pregnancy nausea
16. Schizophrenia
17. Seizures in new born
18. Stress
19. Sun sensitivity

Q5.20: Which pregnancy complications may be caused by a B6 deficiency?
A: 'morning sickness'/pregnancy nausea, pre-eclampsia (with magnesium) and maternal diabetes (also with magnesium).

Q5.21: Taking folic acid supplements can mask the deficiency of which nutrient?
A: pernicious anaemia: a B12 deficiency

Q5.22: What is the significance of having a gene defect (snp) on the MTHFR gene?
A: MTHFR is the enzyme which breaks down folic acid into methyltetrahydrofolate or MTHF. Those people who have a snp on this gene will have more problems utilising folic acid and more likely to suffer from deficiency symptoms plus raised homocysteine levels.

Q5.23: List 6 symptoms of folic acid deficiency
A: compare your list to the one below:

1. Anaemia (megaloblastic or microcytic)
2. Anorexia
3. Cervical dysplasia
4. Constipation
5. Cracks on lips
6. Fatigue
7. Irritability
8. Mental sluggishness
9. Red tongue
10. Reproductive failure
11. Skin disorders
12. Birth defects
13. Mental deterioration
14. Pigmentation on face during pregnancy
15. Raised homocysteine levels and poor methylation (resulting in compromised detoxification)

Q5.24: How long might a person be deficient in B12 before deficiency symptoms develop?
A: B12 can be stored in the liver and tissues. It may therefore be 20-30 years before a deficiency develops.

Q5.25: What is needed for B12 to be absorbed efficiently?
A: adequate stomach acid and the intrinsic factor which carries B12 to the ileum where it is absorbed.

Q5.26: What are the main symptoms that would alert you to a possible B12 deficiency?
A: numbness and tingling, fatigue, poor memory and mental health changes.

Q5.27: What will hinder the absorption of B12?
A: lack of stomach acid, lack of intrinsic factor (can be autoimmune) and alcohol.
Q5.28: Name one of the main symptoms of vitamin C deficiency, which is also a sign of scurvy.
A: bleeding gums and slow wound healing
Q5.29: Explain 2 ways that vitamin C can support allergic symptoms.
A: as an anti-histamine and in its support of the adrenal glands which are connected with allergies
Q5.30: What are some of the possible side effects listed by Ballantine of taking high doses of vitamin C?
A: deactivation of vitamin B12, demineralisation of bones and inhibition of calcium absorption, possible formation of kidney stones.
Q5.31: List 5 symptoms that suggest an increased need for vitamin C
A: check your answer against the following list:

1. Low stomach acid
2. Inflammation
3. AIDS
4. Allergies (as an anti-histamine and adrenal support)
5. Arthritis
6. Atherosclerosis
7. Athletic performance
8. Burns
9. Cancer
10. Diabetes
11. Drug toxicity
12. Hyperglycaemia
13. Hypertension
14. Prolonged infections (low immune system)
15. Pregnancy and lactation
16. Pressure sores
17. Stress (due to effects upon the adrenal glands)

Q5.32: What considerations would you make if you knew someone was deficient in vitamin D?
A: how well they were able to utilise light, how much time they spent out of doors, liver and kidney function, colour of skin (darker skin requires brighter light which isn't available in UK).
Q5.33: List 10 areas where vitamin D deficiency may be causing symptoms.
A: check your answer against the following:

1. Bone health
2. Gene expression
3. Pregnancy
4. Cancer
5. Obesity
6. Asthma and allergies
7. Immune system
8. Crohns and colitis
9. MS
10. Alzheimer's disease, dementia and brain function
11. Schizophrenia
12. Mood and depression.
13. Hypertension and heart disease
14. Diabetes

Q5:34: Which other vitamin is required to aid the absorption of vitamin D?

A: vitamin K

Q5.35: Why is vitamin D important for bone health?

A: because it is essential to the absorption of calcium.

Q5.36: How is vitamin D formed in the body?

A: vitamin D taken in by sunlight or food is converted into 250HD by the liver and then further converted in the kidneys to its active form of $1,25(OH)_2D$. Vitamin K is required for its conversion and utilisation.

Q5:37: Which mineral is detrimentally affected by long term supplementation or high dose supplementation of vitamin D?

A: magnesium.

Q5.38: What considerations would you make if recommending vitamin E?

A: not to give alongside anti-coagulant drugs, heart medication, or to a smoker.

Q5.39: Which foods contain good sources of vitamin E?

A: vegetables oils (especially wheat germ oil), nuts, seeds and leafy green vegetables

Q5.40: Why are clients taking anti-coagulants advised to avoid foods which are high in vitamin K?

A: because one of the main activities of vitamin K is the clotting of blood

Q5.41: List 2 functions of vitamin K

A:

1. Calcium utilisation: bone health, lowered bone density, birth defects, osteoporosis, osteopenia
2. Blood clotting: easy bruising, GI bleeding, haemorrhages, eye haemorrhages, nose bleeds

Q5.42: What are the main food sources of Vitamin K?

A: leafy green vegetables

7: Naturopathic Nutrition in practice

OBJECTIVES

- **TO HAVE A BASIC UNDERSTANDING OF THE EFFECTS OF A RAW FOOD DIET ON HEALTH**
- **TO BE ABLE TO COMPARE A RAW FOOD DIET AND COOKED DIET FOR VARIOUS HEALTH BENEFITS AND DRAWBACKS**
- **TO HAVE A BASIC UNDERSTANDING OF A BALANCED DIET FROM A WESTERN NUTRITIONAL PESPECTIVE**
- **TO HAVE A BASIC UNDERSTANDING OF FOOD ALLERGIES AND THEIR IMPACT UPON HEALTH**
- **TO HAVE A BASIC UNDERSTANDING OF SINGLE NUCLEOTIDE POLYMORPHISMS**
- **TO UNDERSTAND RED FLAGS AND WHEN TO REFER TO A MEDICAL DOCTOR**
- **TO HAVE A BASIC UNDERSTANDING OF USING NUTRITIONAL SUPPLEMENTS**
- **TO HAVE AN UNDERSTANDING OF HOW TO TAKE A NATUROPATHIC CASE HISTORY**

In this section we will study the practicalities of dietary advice so that you can become familiar with using diet and nutrition from a western perspective. We will also consider red flags which are symptoms that must be referred to a medical doctor because they suggest an underlying serious pathology which needs to be checked by the medical profession. There is also a section on an introduction to prescribing supplements which we will continue to build on in year 2. We will look at blood glucose control and the various symptoms associated with hypoglycaemia and also an introduction to case taking and how to present a case history. We finish with a look at gene testing and how it can benefit and inform nutritional practice.

Red flags

First of all let's look at Red flags and the symptoms that you need to be aware of in your practice which could suggest a more serious underlying pathology and therefore MUST be checked by the medical doctor. It is vitally important, if you are a practitioner (of any discipline), for your own protection, that you are quite clear that clients, friends and family must seek a medical opinion for any of the red flag symptoms listed below. You will need to learn the red flags so that you recognise them instantly. They will therefore form part of the end of year examinations.

Pain

- Any pain which is persistent, particularly if severe or in the head, abdomen or central chest.
- Pain in the eye or temples, with local tenderness,
- Pain in the elderly or rheumatic patient
- Pain on passing urine in a man
- Cystitis recurring more than three times in a women
- Absence of pain in ulcers, fissures etc
- Sciatic pain if associated with objective neurological deficit.

Bleeding

- Blood in sputum, vomit, urine or stools
- Vomit containing "coffee grounds" (coagulated blood, twisted bowel)
- Black, tarry stools (cancer)
- Non menstrual vaginal bleeding (inter-menstrual, post-menopausal, or at any time in pregnancy)
- Vaginal bleeding with pain in pregnancy or after missing one period

Psychological

- Deep depression with suicidal ideas
- Hearing voices
- Delusional beliefs
- Incongruous behaviour

Persistent

- Vomiting and/or diarrhoea
- Vomiting and/or diarrhoea in an infant
- Thirst
- Increase in passing urine
- Cough
- Unexplained loss of weight (1lb a week or more)

Sudden

- Breathlessness
- Swelling of the face, lips, tongue or throat
- Blueness of the lips
- Loss of consciousness
- Loss of vision
- Convulsions
- Unexplained behavioural change

Difficulty

- Swallowing
- Breathing

Change

- In bowel habit
- In a skin lesion (size, shape, colour, bleeding, itching, pain)

Others

- Pallor
- Unexplained swellings or lumps
- Neck stiffness in patients with fever
- Unexplained fever, particularly if persistent and/or recurrent

Practical Nutrition

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERASMUS CHAPTER 40 'WHY CALORIE COUNTING FAILS & WHAT TO DO TO LOSE WEIGHT'

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 9 'DEVELOPING A BALANCED DIET' THE WHOLE CHAPTER P279-302

Ballantine, being vegetarian, has written his diet recommendations from a vegetarian perspective. Nevertheless, this chapter is useful for giving a simple foundation to building a standard 'reasonably healthy' western diet. Later in this section we will study blood glucose control and you will then see that incorporating a lot of grains into the diet may be problematic for some people, especially those that are Blood group O or have lots of sugar cravings.

Note the dietary analysis examples throughout this chapter and how western nutrition can be quite narrow in its approach. Notice also how it can be easy to obtain sufficient quantities of the bulk nutrients of proteins, carbohydrates and fats but be lacking in the micro nutrients of vitamins and minerals.

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 13 'BEYOND NUTRIENTS' THE WHOLE CHAPTER P389-408

As previously mentioned, Ballantine was writing in the late 1970's however, most of his comments stand the test of time. A lot more is now known about the substances found in foods called phenols however. It is a vast subject and a classic example of western reductionism; nevertheless, it gives us useful information about certain substances in foods that we can then apply to our knowledge of that food when we understand it from a Unani perspective.

Ballantine mentions epicatechins which are found in green tea and which have been found to be immensely beneficial to health. Similarly, quercetin, which is found in onions has anti-cancer, anti-inflammatory properties and is an antioxidant. These superfoods are mentioned in the year 1 slides that accompany this module.

Next we turn our attention to cooked food versus raw food. Raw food has gained in popularity in recent years with raw foodists insisting that raw food retains all of the enzymes and nutrients required by humans. The counter argument states that a lot of food needs to be cooked to release its nutrients and also that cooked food is easier to digest. Certainly if you have a client with digestive insufficiency you would not want them pursuing a raw food diet. In addition a raw food diet can be considered extremely cold from an Eastern nutritional perspective. This could result in energetic imbalances with the humours, especially if you had a client who was melancholic or phlegmatic eating a raw food diet.

Keeping these comments in mind please read Ballantine's thoughts on this matter:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 14 'COOKED VERSUS RAW' THE WHOLE CHAPTER P 409-422

Ballantine also makes the observation that eating too much raw food will aggravate people because it is too light. In Ayurvedic terms this relates to an increase in Vata (Ether and Air elements) which is similar to the Melancholic temperament. Vata is light, cold and dry; therefore eating a diet which increases this energy in the body will result in excess Vata which could manifest as dizziness, light headedness, anxiety or depression. You will notice as you work through the second part of this section, where we study hypoglycaemia, that these symptoms are also symptoms of when the blood glucose levels drop too low.

Similarly, in macrobiotics, the Japanese tradition, raw food is considered too yin and light and thus we arrive at the same conclusion. If a person were very yang then some raw food would help to balance this quality. It is always dependent upon the person eating the food and what is correct for their constitution, the season and any imbalance that they may have.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERASMUS THE FOLLOWING CHAPTERS:

- **CHAPTER 22 'FRYING AND DEEP FRYING'**
- **CHAPTER 42 'DIET CONTROVERSIES'**
- **CHAPTER 43 'RATING OILS IN DIETS'**
- **CHAPTER 44 'HOW FAT ARE YOUR FOODS'**

AND SKIM READ THE FOLLOWING CHAPTERS:

- **CHAPTER 46 'MEATS'**
- **CHAPTER 47 'MOTHER'S MILK AND DAIRY PRODUCTS'**
- **CHAPTER 48 'POULTRY'**
- **CHAPTER 49 'EGGS'**
- **CHAPTER 50 'OILS AND SEEDS'**

We will now move on and look at the process of cooking and the use of spices:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 16 'COOKING' THE WHOLE CHAPTER P449-478

Food Allergies, Sensitivities and Intolerances

We will now turn our attention to food allergies. We will also cover this topic in more detail during the first year nutrition weekend.

There is often confusion about the terminology with food 'allergies'. A true allergy results in anaphylactic shock and requires immediate adrenaline and steroids to revive the patient. It is the *type* of immune reaction which will determine the difference between the body going into anaphylactic shock or having a skin rash or headache. The confusion occurs because the terms allergy, sensitivity and intolerance are used interchangeably. Have a look at the following definitions:

1. Food allergy: this would cause anaphylactic shock and is caused by an IgE immune response
2. Food sensitivity: this is caused by an IgG response and presents mild (in comparison) symptoms which generally last for 4 days. They can appear within half an hour of exposure to the food or at any point within the 4 days, but most commonly within the first 24 hours.
3. Food intolerance: symptoms are digestive related and due to a lack of stomach acid and/or digestive enzymes.

Food 'allergies' are becoming more prevalent and can cause a range of problems. The most typical are digestive disturbances however the correct term for this type of reaction is *food intolerance* and may often be due to digestive deficiency or insufficiency. Many people think they are 'allergic' to beans and pulses because of the gas that they cause. This effect is due to indigestible starches such as raffinose which we looked at in the carbohydrate section. One trial of 4 weeks found that eating pulses daily resulted in 75% fewer symptoms by the end of the 4 weeks. If you have clients who say they can't digest the pulses suggest mung beans or split mung beans (Moong dhal) as these are considered tri-Doshic in Ayurveda which means they don't aggravate Vata, the wind energy, which is predominantly in the large intestine.

Other classic symptoms of food sensitivity include skin rashes, mood swings, headaches, muzzy head, confusion and changes in bowel habits. If it is a food that is causing a symptom then it will most commonly last for 4 days because it takes 4 days for a food to fully pass out of the body. Its effects are still in the blood 4 days later. Ballantine also mentions this. The problem arises when people eat the same food on a daily basis, thus their symptoms can be permanent and be treated by

the medical profession as a particular condition. At present the medical profession doesn't recognise food intolerance or sensitivities to any great degree therefore symptoms are often diagnosed as something else such as eczema, hives, trigeminal migraines, or more serious diseases. A food sensitivity will aggravate any weak inherited area in the body, thus there are such an array of symptoms that medics concentrate on symptoms only and discount diet as being responsible. In the case of coeliac disease, which is an allergy to gluten, it can take up to 30 years to diagnose because it may not present as a digestive complaint. Only 1 in 8 people with coeliac disease are diagnosed. The other 7 go undiagnosed because they don't have a digestive disturbance.

The most problematic foods are as follows:

- Gluten (wheat, rye, barley and often oats)
- Corn
- Dairy products
- Eggs
- Peanuts
- Cashew nuts
- Shell fish
- Soya
- Tree nuts

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 18 'MEGAVITAMINS AND FOOD ALLERGIES P526-533 THE SECTION: 'FOOD ALLERGY AND FOOD ADDICTION'

You have already studied the effects of gluten on the immune system in unit 2. Please now study the effects of food and environmental allergies and the varied symptoms that can manifest as a result:

PLEASE READ 'DIET WISE' BY DR KEITH SCOTT MUMBY: in 1986 a crown court accepted his evidence that a food allergy was capable of making a youth murderously violet.

Hypoglycaemia

OBJECTIVES

- **HAVE A BASIC UNDERSTANDING OF BLOOD SUGAR AND ITS REGULATION WITHIN THE BODY**
- **HAVE A BASIC UNDERSTAND OF THE VARIOUS DISEASES THAT ARE DIRECTLY RELATED TO BLOOD SUGAR BALANCE**
- **HAVE AN UNDERSTANDING OF WHICH FOODS ADVERSELY AFFECT BLOOD SUGAR LEVELS AND WHICH FOODS HELP TO STABILISE BLOOD SUGAR LEVELS.**
- **TO BE ABLE TO SUGGEST A DIET THAT WILL HELP TO STABILISE BLOOD SUGAR LEVELS**
- **TO UNDERSTAND THE INFLUENCE OF STRESS ON BLOOD SUGAR CONTROL**

The following quote is from The Textbook of Functional Medicine:

"Insulin insensitivity may be the single most important underlying metabolic dysfunction relating to chronic disease"

The regulation of blood sugar control is fundamental to successful nutritional therapy. Many of the clients that you see will have an underlying blood glucose control issue, most generally, low blood sugar or hypoglycaemia. The symptoms of hypoglycaemia are given below and you will notice that they are extremely common symptoms. Therefore, by just correcting blood glucose control you will be able to help a lot of people with their symptoms. Also, because hypoglycaemia is so prevalent, you won't really have a clear picture with your clients and their symptom picture until their blood sugar is stable. Generally about 90% of people feel better by just correcting blood glucose levels and eating more vegetables and fruit.

In this section we will look in detail at blood sugar and its regulation as this is a major part of nutritional therapy. Once the blood sugar levels have been stabilised it has a 'knock on' effect to the rest of the body. For example, the pancreas will be under less stress, the endocrine system will start to regulate (insulin affects levels of estrogen and testosterone), and the adrenals can start to work more effectively. The adrenals are responsible for the stress reaction, help support blood sugar levels, reduce inflammation and regulate sodium balance in the body so it is easy to see how stabilising the blood sugar level can have a beneficial effect upon health. Stabilising blood sugar levels via diet helps to support adrenal function and allow these important glands to work more effectively with reducing inflammation and regulating sodium balance. This has a knock on effect to more balanced health overall.

The symptoms of hypoglycaemia are many and varied. Those of you that are familiar with Candida Albicans will notice that the symptoms are almost identical. Sugar feeds yeast, thus someone suffering with low blood sugar symptoms will be trying to rectify the falling blood sugar by increasing their carbohydrate intake (often as sugary snacks) or by turning to stimulants (including drugs), working to deadlines and/or taking on too many commitments. All of these factors have the same effect upon the body, which is the production of glucose, either by eating refined carbohydrates or by the stimulatory effect upon the adrenal glands.

Symptoms of hypoglycaemia

The following table gives a list of the more commonly attributed symptoms of hypoglycaemia:

Fatigue	Suicidal tendencies	Panic feelings
Irritability	Excessive sweating	Stomach cramps
Anxiety	Unable to lose weight	Convulsions
Forgetfulness	Poor concentration	Narcolepsy
Nightmares	Indigestion	Stomach ulcers
Heart disease	Headaches	Weight gain
Muscular stiffness	Breathlessness	Overweight
Blurred vision	Migraine	P.m.t
Lack of sex drive	Food cravings	Numbness
Angina	Hyperactivity	Joint pain
Cold extremities	Fainting	Epilepsy
Excessive smoking	Unable to face food first	Vertigo
Depression	Thing in the morning	Phobias
Allergies	Asthma	Blackouts

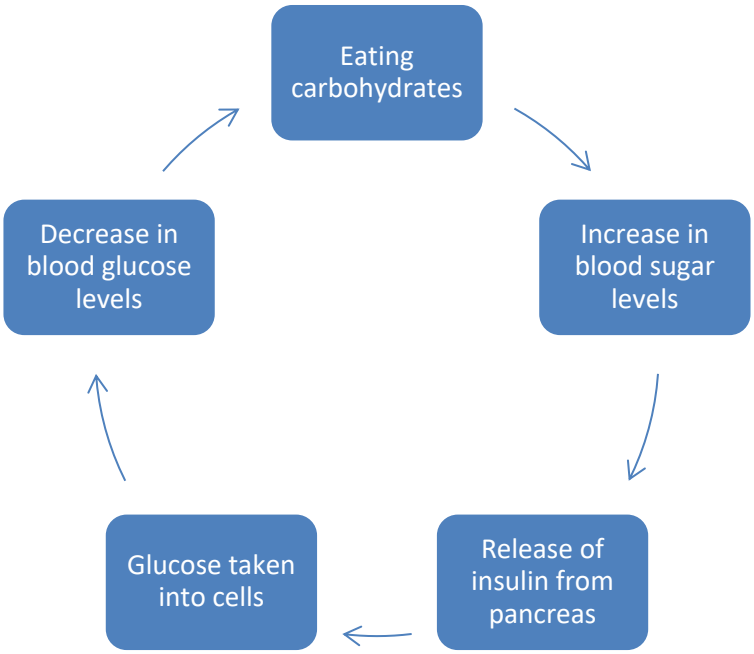
Tinnitus Nausea	Neuralgia Palpitations	Agoraphobia

Any of these symptoms are classed by doctors as stress disorders, which is hardly surprising when the main nutrient needed by the nervous system is glucose. The activity of the brain, for example, in terms of glucose utilisation may amount to 20-25% of the total body activity. In spite of this, the total amount of glucose concentrated within the brain, at any one time, would normally be exhausted in 10-15 minutes.

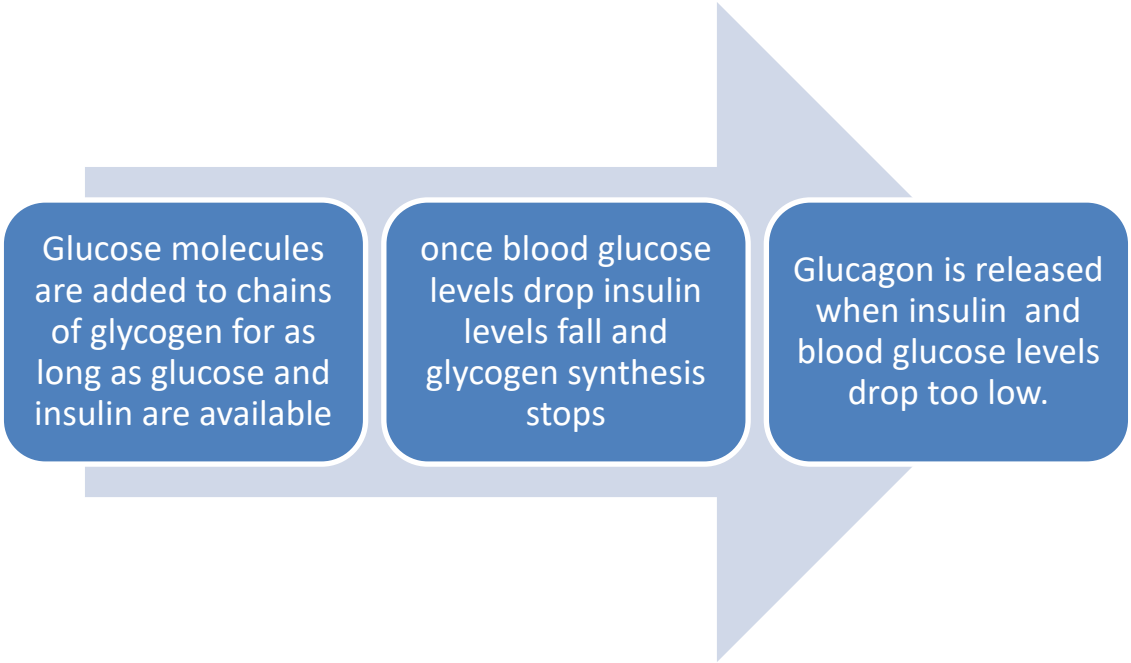
When blood glucose levels drop the main changes in the body involve the adrenal gland, part of whose action is concerned with the body's reaction to stress situations. If there are persistent low levels of blood glucose the symptoms that result are similar to those produced by chronic stress such as palpitations, breathing difficulties and angina type symptoms.

In order to correct falling blood glucose levels the adrenal glands release adrenaline, which allows the liver to release stored sugar (glycogen). If the stress continues, cortisol is released which again, activates the liver to release stored sugar. This corrects the low blood sugar temporarily, until the pancreas releases more insulin to take the stored sugar into the cells. If the pancreas is continually triggered to correct high levels of sugar in the blood from the consumption of refined carbohydrates and stimulants such as tea, coffee, alcohol and cigarettes, it can become exhausted and not release enough insulin. This results in too high a level of sugar in the blood (diabetes). Alternatively due to large amounts of glucose in the blood, the cells can become 'insulin resistant', meaning that they require higher levels of insulin before the glucose can be moved into the cells. The subsequent drop in the blood glucose levels (due to high levels of insulin), result in many of the hypoglycaemic symptoms listed above.

The following diagram simplifies the process of blood sugar control. Remember that insulin acts like a key by 'opening the cells' to allow the glucose to enter:



The following diagrams show the sequence of events that takes place once the glucose enters the cells:



Note that glucagon is released in response to low levels of blood glucose. Glucagon takes stored sugar from the liver and converts it to glucose in order to keep a steady flow of glucose in the blood.

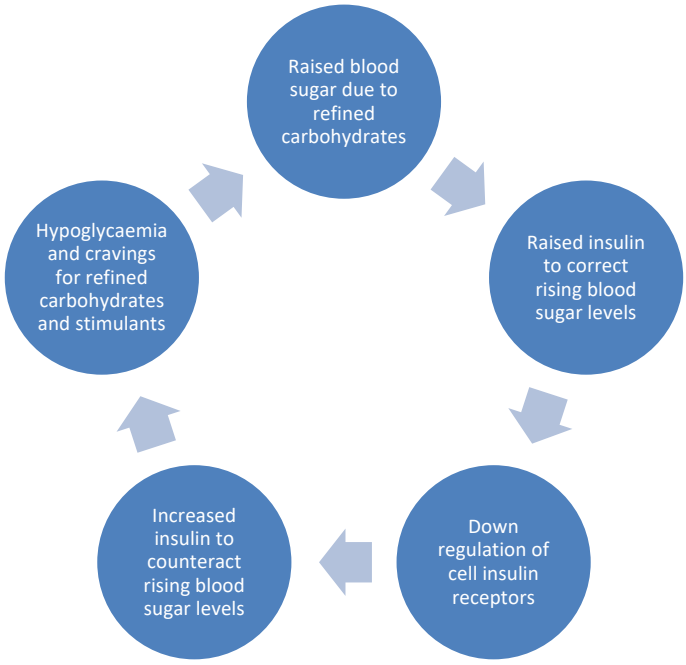
So, how does this mechanism go wrong? Why do so many people suffer from symptoms of hypoglycaemia? Why is there an epidemic of 'Diabesity', the new term for diabetes and obesity? What is the metabolic syndrome or syndrome X?

Let us look at each of these questions in turn:

So, how does this mechanism go wrong?

There have been many changes in our diet in the last 100 years. Not only are we eating vastly more carbohydrates than our ancestors did, but they are predominantly refined, which means that there is little breaking down to do and this results in elevated blood glucose levels. This leads to increased pressure on the pancreas to keep producing insulin. The increase of insulin causes the cells to be swamped with insulin so they 'down-regulate' (reduce) their insulin receptors, resulting in less glucose being taken into the cells. The rising levels of blood sugar prompt the pancreas to release yet more insulin which further exacerbates the picture. High levels of insulin can exacerbate many health problems.

Take a look at the following simplified diagram:

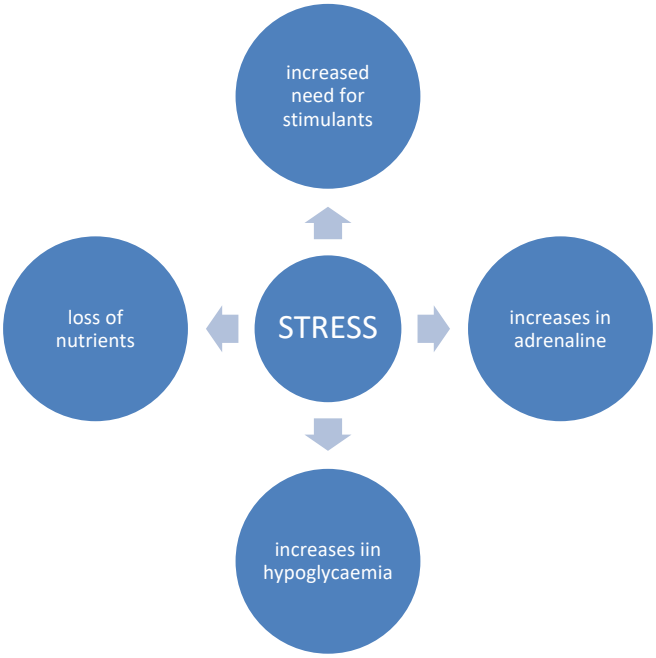


Why do so many people suffer from symptoms of hypoglycaemia?

We all have huge amounts of stress. This comes in the form of emotional stress, structural stress, work stress, vitamin and mineral deficiencies, lack of water, environmental pollutants, electro-magnetic stress etc. As we become stressed the adrenal glands release adrenaline and cortisol which

take stored sugar from the liver and increase the blood sugar. This leads to a release of insulin and an eventual down regulation of cell receptors for insulin. The pancreas has no option but to release increasing amounts of insulin to try and counteract the continual fluctuations in blood sugar.

If we add stress into the diagram we see the following:



Metabolic Syndrome or Syndrome X

What is the metabolic syndrome or syndrome X?
Metabolic syndrome, also known as syndrome X, is a collection of symptoms known to be associated with insulin resistance (when the cells are not responding correctly to insulin). It is the fore runner of diabetes.
The symptoms associated with metabolic syndrome include:

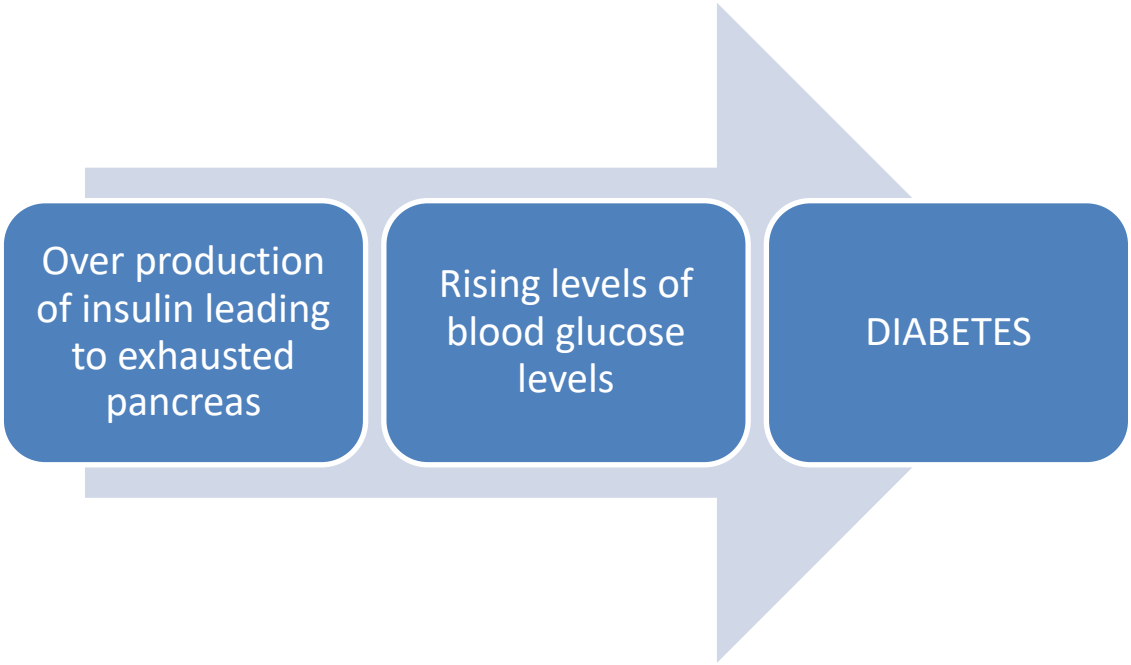
- Insulin resistance
- Hypertension (high blood pressure)
- Cholesterol abnormalities
- Increased risk of blood clots
- Patients are most often overweight or obese.

Diabetes:

Why is there an epidemic of 'Diabesity', the new term for diabetes and obesity?

As the pancreas continues to release insulin in an attempt to regulate blood glucose levels the cells become more and more 'insulin resistant'. That is, they have down regulated their receptors so that they no longer react to insulin efficiently. The increased levels of sugar in the blood stream are laid

down in the body tissues as fat and these fat cells become part of the hormone system and start releasing hormones of their own which further exacerbates the insulin resistance and increases inflammation in the body. Eventually the pancreas becomes exhausted and releases less insulin, resulting in high levels of blood glucose which is type 2 diabetes.



Obesity:

There is an epidemic of obesity, with governments apparently intent on understanding why this has happened. There are many political reasons as to why, in the 1950's we were told that carbohydrates were important and fats were bad for us. It is beyond the confines of this course to examine this in any detail but the information is easily found for those who wish to research this area further. Suffice it to say that the 'food pyramid' was developed and we were 'told' to eat more carbohydrates and cut down on fat consumption. The food industry fuelled the fire by advertising 'healthy' polyunsaturated margarines and we were told that saturated fats resulted in heart attacks. The end result of this, over the last 50+ years, is that more and more of us have blood sugar control issues and are struggling to lose weight. The diet industry is booming, but only serves to further fuel the fire because when people stop dieting the weight piles back on, plus even more weight.

So what is happening here?

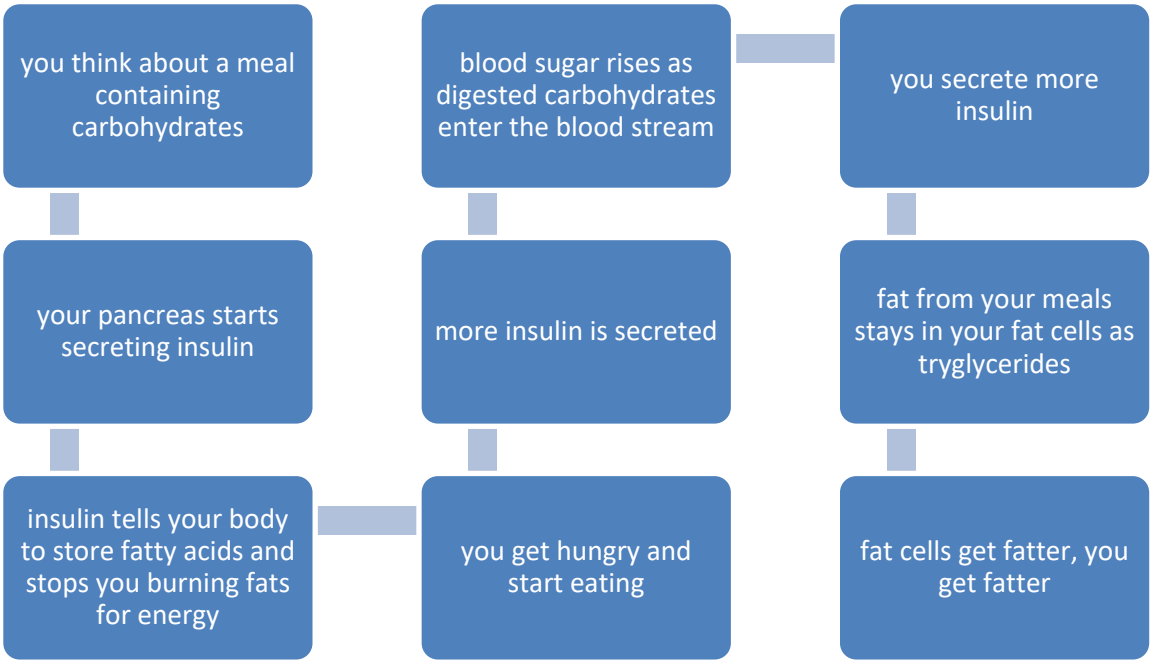
Fat flows in and out of our cells constantly but it is the fat that is stored inside the cells that make us fatter. Anything that promotes the flow of fats across the cell membrane will make us fatter and anything that promotes the flow of fats out of the cell will make us lose weight.

Exercise draws on energy production, causing the body to convert fats into glucose via the citric acid (energy) cycle. Insulin is also a primary regulator of fat metabolism and of lipoprotein lipase (LPL) which is on the cell membranes and pulls fats into the cells. The more insulin we produce the more active LPL is on the membrane and the more fat will enter our cells.

Therefore:

1. When insulin levels go up we store fat
2. When insulin levels drop we use that fat as fuel.

Have a look at the following simplified flow diagram. Remember that insulin is essentially a storage hormone-:



The worst offending foods are:

- Refined carbohydrates such as bread, pasta, cereals
- Liquid carbohydrates such as beer, soda and fruit juice
- Starches such as corn, potatoes and rice.

It is the amount of carbohydrates that we are eating that will determine how much insulin is in the blood stream. It is the quality and quantity of the carbohydrates that will determine the amount of insulin that is secreted, therefore it is the amount of carbohydrates that we are eating that determine how much fat is stored in our fat cells.

PLEASE READ 'FATS THAT HEAL FATS THAT KILL' BY ERASMUS CHAPTER 6 (third printing) 'THE SUGAR-FAT CONNECTION'

PCOS (polycystic ovary syndrome)

PCOS also comes under the umbrella of conditions associated by faulty blood sugar regulation. PCOS is a pre diabetic picture and, as such, is treated with diabetic medications such as metformin to try and regulate the action of insulin.

Women with polycystic ovary syndrome (PCOS) are at an increased risk of getting metabolic syndrome because PCOS is associated with blood sugar regulation abnormalities and increased levels of testosterone.

PCOS is characterised by hirsutism (addition body hair growth), obesity, irregular menstruation, infertility and acne. Sufferers may or may not have cysts on their ovaries. It is common for women to have just a couple of symptoms, or to have no symptoms but to have multiple cysts on their ovaries. The increased levels of insulin affect the sex hormones estrogen, progesterone and testosterone. In PCOS there is an increase of testosterone which is connected to the increase of insulin. If insulin levels can be corrected via diet and supplements there is hope that this condition can be reversed.

Alzheimer's and Dementia

Some of you may be surprised to find dementia and Alzheimer's disease listed under blood sugar irregularities. It is important to remember that normal brain function is dependent upon adequate levels of glucose and to respond to insulin as part of its normal function. These illnesses have been termed 'diabetes 3' as research has shown that insulin is also produced in the brain as well as the pancreas.

This research, carried out by the US Brown Medical School research team in 2005 identified the possibility of a new form of diabetes after finding that insulin is also produced by the brain. Alzheimer's and dementia are therefore diseases that relate to insulin resistance in the brain. Further research in 2012 for Rhode Island Hospital to investigate the link between insulin and Alzheimer's discovered that resistance to insulin and insulin-like growth factor was a key part of the progression of Alzheimer's disease.

Type 3 diabetes differs from diabetes type 1 and 2; whereas type 1 and type 2 diabetes are characterised by hyperglycaemia (increased blood sugar) in the body, a separate study, carried out by the University of Pennsylvania and published in 2012, excluded people with a history of diabetes. They studied the brains of deceased people with Alzheimer's and used only those who did not have diabetes. It is possible that the people included in the research had blood sugar regulation issues but these had not progressed as far as diabetes.

The research demonstrated that Alzheimer's could progress by the brain becoming resistant to insulin in people with 'normal' blood sugar levels.

Increased risk of Alzheimer's:

Further research suggests that people that have insulin resistance, in particular those with type 2 diabetes, have an increased risk of suffering from Alzheimer's disease estimated to be between 50% and 65% higher.

Researchers have discovered that many type 2 diabetics have deposits of a protein called amyloid beta in their pancreas which is similar to the protein deposits found in the brain tissue of Alzheimer's

sufferers. Progress continues to be made into understanding the link between diabetes, insulin resistance and Alzheimer's disease.

Other factors that need to be considered in Alzheimer's are:

- Correction of low stomach acid
- Correction of B12 status
- Correction of raised levels of homocysteine
- Correction of mineral deficiencies especially magnesium and zinc.
- Investigation of heavy metal toxicity, especially aluminium and mercury.

Those students who are interested in learning more about the research into Alzheimer's disease and diet and lifestyle changes which are halting its progression and in some cases reversing it are directed to the research of Dr Dale Bredesen and his book: *'The End of Alzheimer's'*. With his fellow researchers, one of whom is trained in Ayurvedic medicine; a diet, nutrient and herbal programme has been devised depending upon the type of Alzheimer's diagnosed.

Dietary recommendations to support stable blood glucose levels:

The diet is approached in stages.

1. Stage 1 is for people who have been relying upon stimulants to keep their blood sugar supported by excess stimulation of the adrenal glands.
2. Stage 2 is for when blood sugar levels have stabilised with additional snacks between meals
3. Stage 3 is for people with stable blood sugar levels.

Water and hunger:

Firstly consider the following:

Many people mistake thirst for hunger. If we do not drink water when we are thirsty within half an hour the body will send out signals of hunger. If food is eaten when a person is actually thirsty then it won't matter what is eaten or how much, the craving will still be there. If diuretic stimulants are used instead of water when the body sends out the thirst signals then this further exacerbates the dehydration and the calls for water, which are generally mistaken for calls for food.

We can begin to see a connection here between water and diabetes.

Stage 1:

If tea, coffee, caffeinated drinks, or other stimulants have been relied upon then these need to be reduced (and eventually eliminated). Instead of drinking tea or coffee a snack should be eaten instead which contains some protein. A carbohydrate snack will cause the blood sugar to increase and then cause the subsequent drop in blood sugar as insulin is triggered. By adding protein to the snack there is less glucose released, resulting in less insulin production and less of a plummet in blood sugar levels.

There are various options in stage 1. Many people find that by eating a protein breakfast that their blood sugar regulates for the rest of the day. Other people find that they need a mid- morning snack

but are fine in the afternoon. It is very common to be hungry about 4pm as this is when adrenal function is low and therefore there will be little support from the adrenal glands in regulating blood sugar levels. This is why many people crave their tea and cake or something sweet at this time of day.

If cravings are particularly difficult to cope with in the afternoon or falling blood sugar levels are causing the person to suffer any of the hypoglycaemia symptoms mentioned above, then an early lunch is suggested, between 11.30am-12.30am, followed by a protein snack at 2.30pm.

Stage 2:

In this stage the majority of the snacks can be dropped, leaving 3 meals a day which should be eaten with at least 4 hours gap between them. This helps to stabilise leptin levels which are a major hormonal factor in blood sugar regulation. Once a person is stable eating three meals daily without any blood sugar 'dips' they can progress to stage 3 if they want to.

Stage 3:

In this stage blood sugar levels are stable and the person is able to consider incorporating fasting or intermittent fasting into their programme. True hunger will be experienced in this phase, rather than the ups and downs of insulin and blood sugar levels. Ideally, food should only be consumed when hungry. This is also what Ayurveda and Unani advises. If food is eaten when a person is not hungry then the ability to digest it is greatly diminished.

Supplement suggestions for supporting blood sugar control:

The following supplements in particular help to regulate blood sugar and insulin. Using a good multi vitamin and mineral formulation that incorporates these nutrients will further support blood glucose control:

- 'Glucobalance' multi vitamin and mineral from Biotics Research has been formulated by 2 doctors to stabilise blood glucose levels
- Chromium
- Magnesium
- B vitamins
- Essential fatty acids omega 3 and 6
- Vitamin D

At this stage in your training you are only able to recommend a multi vitamin and mineral, a B complex vitamin supplement, a probiotic, vitamin C and essential fatty acids. This is explained in the next section and also in more depth in year 2, within your training as a Nutritional Therapist.

To complete this sub-section covering hypoglycaemia please read Ballantine:

PLEASE READ HUMAN NUTRITION BY BALLANTINE CHAPTER 17 'INTERACTION BETWEEN DIET AND MIND' THE WHOLE CHAPTER P 483-507

PLEASE READ 'FAT CHANCE-THE BITTER TRUTH ABOUT SUGAR' BY ROBERT LUSTIG *OR* watch one of his online lectures*

And one of:

- **'Low Blood Sugar' by Martin Budd**
- **'Pure, White and Deadly' by John Yudkin**

***There are also numerous lectures on line given by Robert Lustig:**
https://www.youtube.com/watch?v=zx-QrilOoSM).

Working with clients

LEARNING OBJECTIVES:

- **TO HAVE A BASIC UNDERSTANDING OF WORKING WITH SIMPLE SUPPLEMENTS**
- **TO HAVE AN UNDERSTANDING OF HOW TO TAKE A CASE HISTORY**
- **TO UNDERSTAND HOW TO PRESENT A CASE HISTORY FOR ASSIGNMENTS**

In this section we will look at working with clients, using supplements and how to take a case history. Part of your end of year assignments is to do a live case study. This section guides you through an example case study and gives you the template to use when sending your case study assignment in for assessment.

An introduction to supplementation

As year 1 leads to a Nutrition Advisor qualification only basic supplements will be covered. It is most important that you only work within your limits of understanding. At this level of understanding you are only qualified to use the following:

- Multi vitamin and mineral
- B complex supplement containing all of the B vitamins in a balanced format
- Vitamin C
- A probiotic
- Essential fatty acids: evening primrose oil, fish oil or parent omega oils such as flax seed oil, organic cold pressed safflower oil or sunflower oil.

Free training is available from the various supplement companies and it is recommended that you take advantage of this training so that you can become familiar with their products. The supplement industry is massive and growing all of the time. It is therefore not possible to know all of the supplements. It is strongly suggested that you stick to supplements that you are totally familiar with and, if in doubt, don't prescribe!

It is suggested that you initially stick to just a few supplements so that you can begin to build up your repertoire of supplements that you have 'tried and tested' and that you have confidence in and, most importantly, understand.

So as not to overwhelm you, the following two companies have a naturopathic approach and also offer regular free webinars about various aspects of health from a naturopathic perspective. Both give free training advice about their supplements:

- Conella Holdings: https://www.conellaholdings.com/
- Bionutri Ltd: https://www.bionutri.co.uk/

Working naturopathically means that we do not use many supplements at once. The naturopathic understanding that the body has an innate wisdom to be able to heal itself, given the correct circumstances, is totally in accord with Unani Tibb. We therefore work with diet first, taking away the challenging foods and correcting blood glucose balance. We may consider supplementation at this stage or we may wait to see how the client feels on making just dietary changes. About 80% of people will feel better on dietary changes alone.

We also need to consider the term "given the correct circumstances". This means that there is very little challenge to the body resulting in it being able to utilise this additional energy to heal itself. It may mean adding in a multi vitamin and mineral to provide all of the nutrients that have been sadly lacking from a previously poor diet. It could also mean adding in essential fatty acids for a person demonstrating signs of deficiency. The art of naturopathy is to be able to ascertain the vitality of the client, their predispositions to disease and their ability to detoxify. This is all studied in more depth in year 2. At this point in your studies keep in mind that if someone is exhausted then adding in a whole load of supplements could challenge them quite a bit because the body then needs to find additional energy, which it doesn't have, to process the supplements. This is when supplementation can make conditions worse and become suppressive.

The following guidelines are given for you to consider with each and every client. We will revisit this in year 2 when you have studied detoxification and naturopathic nutrition in more detail. The following list assumes that you have already addressed the diet and eliminated challenging foods, such as sugar, gluten, dairy, caffeine and alcohol, and added in more water, fruit and vegetables and educated your client about blood glucose control.

1. Support digestion: this is paramount and is at the heart of all Eastern medical disciplines. In year 2 you will learn about various supplements that you can use in more detail. At nutrition advisor level it is suggested that you consider food combining for your clients (avoiding eating starches/grains with proteins; also known as the Hay diet) or using 1-2 teaspoons of cider vinegar in a shot glass of warm water before meals. Your Unani studies will also provide you with information about how to improve digestion using various spices and herbs.
2. Address gut health. At this level you could use a probiotic. Just increasing vegetables and the fibre they provide will also help gut health
3. Liver support: in year 2 you will learn more about supportive supplements for the liver. At this level including the following list of foods in the diet will support liver function. Also remember that gluten inhibits the liver, therefore avoiding gluten will help support liver detoxification.

    a. Beetroot, radish, watercress stimulate bile release from the gall bladder
    b. Sulphurous vegetables supply sulphates for phase 2 detoxification; kohlrabi, turnip roots, broccoli, cabbage, Brussels sprouts. But they can be very gas producing - if you experience excess gas after eating them, avoid
    c. Turmeric is protective to liver cells
    d. Onions, garlic, carrots, artichoke and asparagus

e. Dark fruits e.g. black grapes, blueberries, blackberries are said to stimulate the flow of liver energy
f. Ground flax, pumpkin, sunflower and sesame seeds
g. Hemp oil, olive oil, unheated
h. Bio live yoghurt
i. Protein for the detoxification process - vegetable sources from beans, peas and lentils
j. Wholegrains: brown rice, quinoa, millet, buckwheat
k. Snack on fruit, raw vegetables, nuts (a small handful at a time) and seeds
l. Hot water with lemon juice first thing in the morning
m. Drink around 2 litres of filtered or bottled water daily (at body temperature, not ice cold) and plenty of herbal and green tea.

4. Essential fatty acids: these may be required depending upon the case. Remember also that EFA's can support blood glucose regulation and are needed for hydration.
5. Vitamins and Minerals: once other areas have been considered and supported you can then move on to using a multi vitamin and mineral formulation. In the second year we will consider the use of specific nutrients depending upon your client's needs.

Case taking

Careful case taking is at the root of a successful naturopathic treatment plan. It is important for the therapist to understand the underlying reason for the disease or symptoms being presented. The cause of the disease could be due to a nutrient deficiency, such as an essential fatty acid, or it could be an inherited tendency. Dietary factors play an important part in whether genes are 'turned on or off' meaning that the dietary choices of an individual can influence whether they suffer with inherited diseases such as hypertension or whether they can control the tendency via correct diet and lifestyle. In the next section you will be studying single nucleotide polymorphisms (SNP's). Keep in mind that just because someone has these SNP's doesn't always mean they are active.

When taking a case history the following questions should be asked:

1. Details of all presenting symptoms; how and why they want you to help them, length of time of each symptom and detailed information of when the symptom started and any information about what makes it worse or better (e.g. weather, certain foods aggravating it)
2. Details of current prescriptive medications. Include also all supplements including nutritional, herbal and homeopathic.
3. Details of all operations
4. Details of bowel movements-type of movement, frequency, any digestive problems such as indigestion, bloating and flatulence
5. Information about current energy levels (this will give an indication of the vitality of the person)
6. Details about dental amalgams (this will provide information about heavy metal toxicity)
7. How well do they sleep? Do they wake refreshed? This question will offer information about calcium and magnesium status and also liver function. The liver detoxifies while we sleep, allowing us to wake refreshed with lots of energy. Waking tired reflects a possible impairment to liver detoxification.
8. For women, questions regarding menstruation: the age when it started, any problems, regularity, and pre-menstrual tension. Also, questions about any pregnancies, their age,

health during pregnancy, birth weight of baby, whether breast or bottle fed and any post-natal depression.

Once you have all of this current information you are then ready to record their history and family history:

1. Details of the pregnancy their mother had with them, if known, including birth weight and whether bottle fed or breast fed.
2. Problems or illnesses during 0-10 years, 10-20 years etc. and up to date. How were illnesses treated-eg with homeopathy, grandmother's herbal remedies or allopathic suppressive medicine?
3. Details of parents health, including relevant details of uncles and aunts as well
4. Details of grandparent's health or what they died from.

Finally, go through their diet in detail. Ideally they will have accurately recorded what they have eaten over the last 7 days. Realistically, most clients fill in their diet diary from memory recall and miss out a lot of valuable information.

1. Details of diet, ideally ask the client to fill in a diet diary for a week. Most people forget what they eat during the day and often only mention a fraction of what they actually eat.
2. Details of how many diuretic drinks they have each day and how much water they consume
3. Details of lifestyle, what kind of work they do, whether they enjoy their work, information about any stresses in their life

Once you have all of this information you will begin to see a picture forming as to the strength or weakness of the individual's constitution and whether their symptoms are inherited (e.g. paternal grandfather and father both suffered from digestive complaints), diet related (e.g. drinking too much coffee and not enough water), blood sugar related or whether they relate to a nutrient deficiency. You can also use your knowledge of Unani Tibb and identify the client's temperament and introduce simple dietary advice to maintain balance. Again, this will be studied in more detail in the second year.

Remember, as mentioned earlier in this session, that simple changes to diet can have a profound effect upon the body's innate wisdom and power to correct itself. It is certainly not necessary to provide large amounts of supplements. Once the digestive function has been addressed through simple dietary changes and the addition of some water many people can feel remarkably better.

It is also important to remember and recognise situations where it would be advisable not to offer naturopathic nutrition to a potential client. Situations such as for those who are chronically ill, suffering from cancer, or on a cocktail of drugs are all examples of when they should be referred back to their doctor. Naturopathic nutrition may help *prevent* chronic illnesses but once an individual is chronically ill and has used many suppressive medicines there is little that naturopathic nutrition can do to help the situation, other than to perhaps maintain the symptoms so that they don't get any worse. Remember that the life force of such an individual will be severely diminished.

Similarly, there are many occasions where the addition of another therapy will augment the results of nutritional medicine. Energy medicines such as reflexology, acupuncture and homeopathy are excellent examples of therapies which can support naturopathic nutrition and help to increase the

vital energy of an individual. As you progress through your studies of Unani Tibb you will learn Unani therapies that can help to bring balance to your client's health.

You are now ready to start developing your client questionnaire if you would like to. Many practitioners prefer to have a questionnaire completed before the consultation so that they can prepare for their client in advance and research conditions if necessary. Others prefer to take the case when they see the client and be guided by the energetics on the day. Work with whatever feels easiest for you. Initially you may prefer to have a list of questions so that you don't forget to ask anything.

Have a look at the following template. You will be using this to do all of your live case study write ups:

Case Study template

1: ASSESSING THE CLIENT'S NEEDS AND THE APPROPRIATENESS OF NUTRITIONAL THERAPY

SYNOPSIS OF CURRENT PRESENTING SYMPTOMS – Portrait of your client at the point you have taken on the case.

In this section include the following:

a. Initials, age, gender
b. Details of operations
c. Details of medical diagnosis
d. Presenting symptoms and length of time they have been apparent for
e. Current drugs prescribed (length of time prescribed for)
f. Current supplements/herbs/homeopathics used
g. Bowel habits
h. Energy levels
i. Sleep habits
j. Lifestyle
k. Dental procedures/amalgam etc
l. Full history of health including parents and grandparents health

EXPLAIN THE SELECTION OF ASSESSMENT METHODS USED TO DETERMINE CLIENT TREATMENT.
Include your methods of information gathering

e.g. questionnaire, tongue, iris and nail diagnosis, questioning during consultation, physical assessment, any blood test or other lab results, questioning.

RATIONALE - Provide a rationale for the initial hypothesis using valid and reliable information. Identify possible antecedents and triggers (precipitating and perturbing factors) and possible mediators. This is the section where you explain how you have arrived at your conclusions for your client's symptoms and the recommendations that you intend to make and why. You could include relevant research in this section if you want to.

RESOURCES, OPTIONS and RISKS - Identify range of resources and options available to the client and also potential risks to client in following recommended treatment protocol. In this section be sure to show that you have checked for all drug nutrient interactions and identified any other risks that may be applicable to your client

2. EDUCATING THE CLIENT

DIETARY ADVICE – provide an outline with rationale for any dietary changes recommended.

INITIAL SUPPLEMENT PROTOCOL WITH RATIONALE:

Guidelines:

- present a generic nutraceutical protocol in the first instance and include appropriate rationale which demonstrates your understanding of the individual nutrients and/or non-nutritive substances.
- explain your choice of proprietary brands to support your initial findings. Your tutor may not necessarily know the content of branded formulations so you must tell them. You may photocopy or scan this information from supplement company websites.
- provide information on dosage, dosage form, timing of intake, and length of prescription
- demonstrate safety in relation to dosage and interactions with food/nutrients/herbs/ phytochemicals/ lifestyle
- demonstrate intention to work within the limits of the client's medication and to protect the client in regards to side effects and/or potential interactions

LIFESTYLE ADVICE – Provide an outline with rationale for any lifestyle changes recommended

SUMMARY – Reflect on each consultation and articulate on any preparation you intend before the follow-up appointment e.g. the focus of future appointments, further investigations/tests and referral as applicable. Review effectiveness of the client-practitioner relationship in terms of improved client health outcomes.

Lets have a look at how this works in practice. Consider the following case study:

Sample case study:

Client:

- 30 year old female known as SR

Presenting symptoms:

- Fatigue: 8 years
- PMT: consisting of irritableness, more emotional , tender breasts, food cravings and no energy: 10 years
- Constipation: since childhood

Medications:

- None

Operations:

- None

Bowel movements:

- Bristol stool chart type 1 every 2-3 days. Also experiences wind and bloating. No official diagnosis of IBS

Energy:

- Fatigue is one of her presenting symptoms. She has suffered with this for 8 years. She wakes tired and is extra tired before menstruation. After menstruation she feels a bit better. Client rates her fatigue out of 10 (where 10 is good) as 2/10 for 3 weeks of her cycle, dropping to 1/10 a couple of days before menstruation. After menstruation, for 1 week, her energy increases to 5/10

Dentistry:

- No problems

Sleep:

- Sleeps well but wakes more tired than when she went to sleep

Menstruation:

- Another reason for the consultation. Client suffers from PMT which includes irritableness, more emotional, food cravings and no energy. This started approximately 10 years ago. Menstruation is regular but with a heavy flow for 4 days and cramping pains

History:

0-10: 8lb birth weight; bottle fed, 3rd child with 18 month gaps between siblings, colic as baby, eczema treated with cortisone creams. Lots of chest infections and tonsillitis treated with antibiotics. Constipation as long as she can remember. Energy levels good.

10-20: menstruation started at 14; heavy and painful. Chest infections and tonsillitis improved. Tried contraceptive pill at 18 years old for 3 years: felt exhausted so stopped taking it. Exhaustion

continued. Stress in work place. Left home at 20 for university and then moved away from home town to work after graduation. Ongoing constipation.
20-30: Fatigue since 22, thought it could be related to the contraceptive pill so stopped taking it. PMT starting at 20: cravings, irritable, increased fatigue, more emotional and tender breasts. Wakes feeling tired. Ongoing constipation.
Family history:
Siblings:

- Eldest: IBS
- Younger: PMT and depression

Mother: hypothyroid, pre-diabetic.
Father: hypertension
Maternal Grandparents:

- Grandmother: type 2 diabetes
- Grandfather: type 2 diabetes

Paternal grandparents:

- Grandmother: died heat attack aged 79
- Grandfather: stroke and vascular dementia. Died aged 82

Diet and lifestyle:

- Sedentary lifestyle: office work, works Monday –Saturday 9am-6pm
- Hobbies: no time but used to enjoy craftwork and swimming
- Diet:
    - Breakfast: cereal, cows milk and sugar on top or toast and jam
    - Lunch: sandwiches: cheese, chicken, egg and salad
    - Evening meal: ready meals because too tired to cook: pizza, pasta dishes, cottage pie, curry and rice, roast meal with carrots, peas and potatoes once a week
    - Snacks: chocolate, cake, biscuits

Drinks: 2 x coffee (breakfast and mid-morning), 3 x tea (2 x mid-afternoon, 1 with main meal) milky drink before bed, 2 small glasses of water daily at most

Now we will interpret the case study from a naturopathic and nutritional perspective using the template above:

ASSESSING THE CLIENT'S NEEDS AND THE APPROPRIATENESS OF NUTRITIONAL THERAPY

SYNOPSIS OF CURRENT PRESENTING SYMPTOMS –

Female client 'SR', 30 years old presenting with the following symptoms:

- Fatigue: 8 years: worse before menstruation (1/10; better after menstruation for 1 week (5/10), otherwise 2/10)
- PMT: consisting of irritableness, more emotional , tender breasts, food cravings and no energy: 10 years
- Constipation: since childhood. Type 1 on the Bristol stool chart and move every 2-3 days. SR also experiences wind and bloating

Sleep:

- Sleeps well but wakes tired

Operations and medication:

- SR has not had any operations and is currently not taking any prescriptive medication, herbs, nutritional supplements or homeopathics. Contraceptive pill was taken from age 18-21 years old

Lifestyle

- Sedentary office job. On computer all day. No energy to exercise

Full history of health including parents and grandparents health:

Childhood: 0-10: constipation, eczema (treated with hydrocortisone cream), tonsillitis and chest infections (treated with antibiotics)

Teens: 10-20: menstruation started at 14: heavy, painful. Chest infections and tonsillitis stopped. Contraceptive pill 18-21. On-going constipation

20's: 20-30: fatigue starting 22. Stopped taking contraceptive pill, PMT started 20, on-going constipation

EXPLAIN THE SELECTION OF ASSESSMENT METHODS USED TO DETERMINE CLIENT TREATMENT.

Information was gathered from a nutritional assessment questionnaire and careful questioning and case taking

RATIONALE –

The following is considered to be causing SR's symptoms:

- Constipation:
    - Increased retention of toxicity will lead to autointoxication and fatigue as the liver becomes overwhelmed by circulating toxins that it can't eliminate effectively via the bowel.
    - The kidneys are compromised* due to a lack of water, a high sodium diet (convenience foods) and diuretic drinks of tea and coffee
    - Possible dairy sensitivity (childhood colic and eczema. Constipation since a baby)
    - Lack of fruit and vegetables in the diet
    - Dysbiosis due to several rounds of antibiotics in childhood
    - Dehydration: little water and lots of diuretics resulting in very little water to aid digestion and elimination
- PMT:

    - Hypoglycaemia leading to dips in blood glucose levels before menstruation. Symptoms of hypoglycaemia include feeling emotional, irritable and fatigued
    - Magnesium deficiency: due to cramping and irritability; lack of magnesium in diet, diuretics of tea and coffee will take magnesium out of body. Magnesium is also required to stabilise the blood glucose levels
    - Dehydration: leading to electrolyte imbalance and resultant blood glucose imbalance
    - Liver affected due to lack of water. leads to compromisation with elimination of hormones
    - Possible deficiency in omega 6 EFA's (tender breast before menstruation). Insulin affects delta 6 desaturase and therefore the breakdown to omega 6 before menstruation can be compromised in some females
- Fatigue: due to
    - Dehydration: very little water and mainly diuretics in diet, likely food sensitivities to gluten and dairy re challenge to body, very few vegetables to provide any hydration
    - Constipation and retention of toxic waste in the colon which is reabsorbed and places more pressure on liver detoxification.
    - Reduced liver detoxification
    - Relying upon stimulants (tea and coffee) affects blood glucose control and adrenal activity
    - Lack of elimination from liver and kidneys as mentioned in 1 above*
    - Possibly iron deficiency due to heavy menstruation. Write to doctor to ask for iron test
    - Possible iron deficiency because drinks tea with main meal which will inhibit the absorption of iron
    - Possible nutrient deficiencies due to poor absorption and digestion (bloating and wind)
    - Fatigue started when taking the contraceptive pill. This will block a route of elimination and place more strain upon a liver which is already struggling due to a constipated bowel.
    - Menstruation has always been heavy suggesting the body was using it as a route of elimination. Chest infections and tonsillitis both stopped in teens due to an additional route of elimination available
    - Consider possible low levels of B12 for fatigue and write to doctor for B12 test. Poor digestion so may not be absorbing B12 efficiently
    - Consider asking doctor for thyroid TSH test re ongoing fatigue for 8 years and heavy menstruation
- Hypoglycaemia: cravings for sweet foods, caffeinated drinks, PMT, fatigue, inherited a predisposition to faulty blood glucose control (parent and grandparents with type 2 diabetes; sister with PMT)
- Possible sensitivity to dairy products: colic as a baby, childhood eczema, chest infections, on-going constipation. SR drinks milk daily in tea, coffee and a milky drink before bed. This challenge can lead to continual triggering of the adrenal glands and result in hypoglycaemia and exhaustion. Sibling with IBS may also indicate a dairy/gluten sensitivity

- Possible sensitivity to gluten: constipation, similar protein sequences to dairy, affects bowel and inhibits liver detoxification; bloating and wind; sibling with IBS
- Poor liver detoxification: fatigue before menstruation is worse and then improves afterwards for a week suggesting that SR is using her menstruation as a route of elimination. Constipation affecting liver detoxification; lack of water, lack of fibre and vegetables.

RESOURCES, OPTIONS and RISKS –

The following are options for SR:

- Dietary changes to include increased water, no stimulants, diuretics, increased vegetables and blood glucose control
- Lifestyle: to factor in more relaxation time and time for craftwork. This will help to reduce stress levels
- SR is not taking any prescriptive drugs therefore there are no drug nutrient interactions to consider.
- SR is otherwise in good health and no other risks were identified

2. EDUCATING THE CLIENT

DIETARY ADVICE –

- Dietary advice will include the following:
    - Dietary guidelines to stabilise blood glucose levels: protein with each meal and snack
    - Gradual reduction and then elimination of tea and coffee
    - Gradual increase of water to 2 litres daily, drunk away from meals
    - Increase of fruit and vegetables in the diet to be 70% of diet, twice daily. To favour vegetables rather than fruit due to fruit possibly destabilising blood glucose levels initially.
    - Introduction of oily fish
    - Introduction of short grain brown rice (the original rice) to provide fibre and hold water in the colon
    - Linseed tea to support rehydration
    - To provide meal suggestions which SR can easily incorporate into her life, keeping in mind her fatigue.

INITIAL SUPPLEMENT PROTOCOL WITH RATIONALE:

The following programme is for 4 weeks only and will then be reviewed:

- Multi vitamin and Mineral containing good levels of magnesium for energy production and blood glucose control
- Vitamin C for adrenal support
- Essential fatty acids in the form of broken down omega 3 and 6
- Probiotic to support bowel function

(note that this is the extent of what you can prescribe at this level of knowledge)

- Proprietary brands:
    - Maxi Mag Plus: Conella Holdings 2 x daily providing:
        - Magnesium (as citrate) 60mg 16% Hydroxypropyl methyl cellulose (capsule shell) –
        - Choline (as bitartrate) 30mg –
        - Pantothenic acid (as calcium pantothenate) 30mg 500%
        - Vitamin C (as Ascorbyl Palmitate) 12mg 15%
        - Inositol 30mg - Brown rice flour –
        - Vitamin B6 (as Pyridoxal-5-Phosphate) 10mg 714%
        - Vitamin B1 (as Thiamine Hydrochloride) 10mg 909%
        - Vitamin B2 (as Riboflavin) 10mg 714%
        - Niacin (Vitamin B3 as Nicotinamide) 10mg NE 62%
        - Para Amino Benzoic Acid 10mg –
        - Citrus Bioflavonoids (Citrus sinensis peel) 10mg - (Min 35% Hesperidin)
        - Zinc (as Citrate) 3mg 30%
        - Manganese (as Citrate) 1mg 50%
        - Vitamin D (as Cholecalciferol) 5µg 100%
        - Beta Carotene (with soy protein) 1.5mg - Equivalent to Vitamin A 250µg RE 31%
        - Black Pepper extract (min 95% piperine) 600µg - (Bioperine™)
        - Chromium (as Picolinate) 25µg 62%
        - Selenium (as L-Selenomethionine) 50µg 91%
        - Molybdenum (as Ammonium Molybdate) 33µg 66%
        - Iodine (as Potassium Iodide) 25µg 17% Biotin 30µg 60%
        - Folic acid 25µg 12%
        - Vitamin B12 (as Cyanocobalamin) 5µg 200%

This product contains good levels of magnesium without the inhibitory calcium. It also provides B vitamins including Vitamin B12, Vitamin B 5 and vitamin C for adrenal support and molybdenum for liver detoxification.

    - Vitamin C Conella Holdings 2 x daily breakfast x 1 and lunch x 1 providing:
        - Vitamin C (as magnesium ascorbate) 400mg 500%
        - Bilberry fruit extract 100mg - (Compound ingredients – maltodextrin, cellulose) Hydroxyproplmethyl cellulose (capsule shell) –
        - Vitamin C (as ascorbyl Palmitate) 12mg 15% Rice hull concentrate 10mg

This product will support adrenal and immune system function. It has been included at breakfast and lunch to provide energy in the earlier part of the day.

- Bionutri Ltd: Ecodophilus 1 x daily with breakfast: probiotic to support reintegration of beneficial bowel bacteria containing:
  - Lactobacillus acidophilus
  - Lactobacillus bulgaricus
  - Bifidobacterium lactis

This product have been formulated with transient beneficial bacteria to help re-educate the gut microbiome

- Cytoplan Ltd Omega Balance 1 x daily with main meal to provide broken down forms of omega 3 and 6 containing:
  - Algae oil 500mg
  - DHA 150MG
  - EPA 75MG
  - Evening primrose oil 500mg
  - GLA 46mg

This product was chosen for its balance of broken down omega oils and good levels of evening primrose oil. This product would need reviewing as the PMT improves.

LIFESTYLE ADVICE –

A letter was prepared for SR to give to her doctor asking for blood tests for B12, folate, TSH (thyroid function) ferritin and iron levels.

Discussion included available time for rest and relaxation.

Client to investigate flexitime or short term job sharing to allow time to recover from fatigue. She recognises that her job is part of the problem and is determined to address this.

SR is keen to take up craftwork again and will look at ways to find time to incorporate this into her weekly routine.

SUMMARY –

SR seems motivated to change her diet and can see how her pre-dispositions and history have led her to the symptoms that she is currently experiencing. Dietary guidelines and maintenance of blood glucose levels were prioritised as it is considered that these play a major factor in SR's symptoms.

Hopefully the blood tests will be done and the results back before the next consultation. The results of these will inform the next part of the programme, dependent upon the test results and the doctor's action. It could be that iron levels are borderline and need supplementation. B12 levels may also be lower than optimum, even though within mainstream medical limits. These 2 blood tests will give an indication of absorption and whether the production of hydrochloric acid needs to be addressed.

The next consultation will be in 4 weeks time at which point the following we be reassessed:

- Results of blood tests and action if needed
- Reassessment of blood glucose levels
- Reassessment of all symptoms
- Detailed discussion of dietary changes that have been made and any that have proven difficult
- Additional help with diet and lifestyle planning if required by SR
- Consideration of additional digestive support

We will now move on and look at the interesting subject of single nucleotide polymorphisms or SNP's.

Nucleotides and Single Nucleotide Polymorphisms

LEARNING OBJECTIVES:

- **TO HAVE A BASIC UNDERSTAND OF NUCLEOTIDES**
- **TO UNDERSTAND THE STRUCTURAL DIFFERENCE BETWEEN DNA AND RNA**
- **TO HAVE A BASIC UNDERSTANDING OF THE NUCLEAR BASES FOR DNA AND RNA**
- **TO HAVE A BASIC UNDERSTANDING OF GENETIC MUTATIONS**
- **TO UNDERSTAND THE STRUCTURE AND FUNCTION OF NUCLEIC ACIDS**

Nucleotides

Nucleotides are a macromolecule and are found within the nucleus of the cell, within the cell itself, and are continually produced in the body and taken in from our diet. An increased need for nucleotides would arise during periods of excess growth, such as pregnancy and childhood. As you know, cells are being made daily, therefore the coding and DNA requires a good supply of nucleotides to continue the genetic code of the body. The best sources of nucleotides are offal such as liver and kidneys, meat and seafood. Vegetarians and vegans who avoid pulses may become deficient.

The nucleotides are the building blocks of the nucleic acids which are known as RNA and DNA. Nucleic acids are thought to be the most important of all biomolecules and are found in abundance in all living things. Nucleotides are composed of a nitrogenous base (known as a nuclear base), a five carbon sugar (ribose or deoxyribose) and at least one phosphate group.

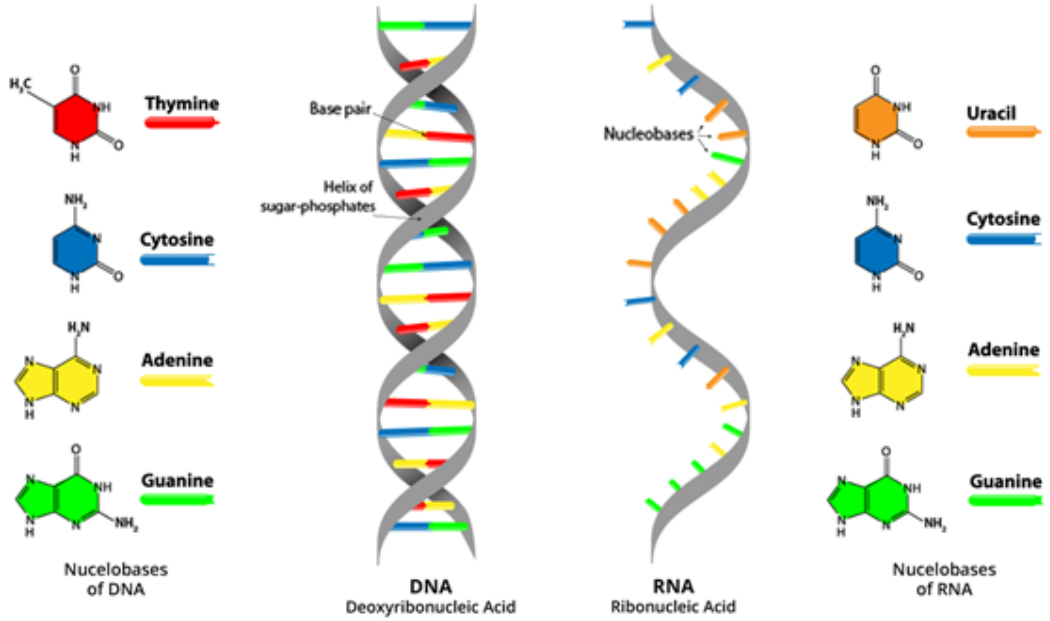
Nucleotides play a central role in cellular metabolism and carry adenosine triphosphate (ATP), guanosine triphosphate (GTP), cytidine triphosphate (CTP) and uridine triphosphate (UTP) throughout the cell aiding the many cellular functions that require energy.

It is DNA which carries the inherited gene information from our parents. DNA allows the cell to replicate and provides the blueprint for making the protein sequences in the body. Ribonucleic acid (RNA) in simple terms is a messenger for DNA and conveys genetic information from the cell nucleus to the rest of the cell. RNA and DNA differ in structure:

- Whereas DNA is double stranded, RNA is a single stranded molecule.
- The sugar molecule in DNA is deoxyribose where as in RNA it is ribose
- The complementary base in DNA to adenine is thymine whereas in RNA it is uracil which is an un-methylated form of thymine.

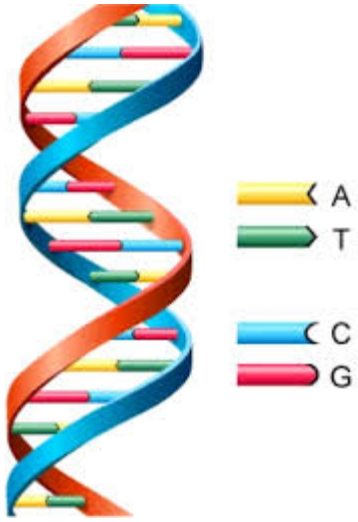
Strings of nucleotides are bonded to make the helical backbone and made into chains of pairs from the five nucleobases of adenine, cytosine, guanine, thymine and uracil. Note that thymine is only found in DNA and uracil only found in RNA.

DNA comprises two strands which are interwoven around a common axis to form a double helix whereas as RNA is a single strand. Have a look at the following diagram and note the nucleobases mentioned of A,T, C, and G represent the nucleobases of adenine, thymine, cytosine and guanine respectively. In RNA thymine is replaced by uracil:



https://bestdifferencebetween.com/differences-between-dna-and-rna/

Have a look at the following diagram that shows the nucleobases more clearly for DNA:



It is the change in the sequence of the nucleobases of A, T, C and G that create the single nucleotide polymorphisms or SNP's. We will shortly be looking at some common SNP's which are useful in Nutritional Therapy practice.

The functions of nucleic acids are absolutely fundamental to the life of the cell. DNA is mainly concentrated in the nucleus where it stores genetic information and RNA is mainly contained in the cytoplasm, especially in the ribosomes and the rough endoplasmic reticulum. Some RNA migrates to the nucleus where it is involved in copying the information for protein synthesis.

Mutations can occur within the cells and this will be dependent upon many factors such as environment, toxicity levels and diet. Ionizing radiation for example, such as radiation, X Rays and cosmic rays can cause mutations in the genetic coding, as can toxicity within the tissues. Both radiation and mutagenic chemicals produce their effects by the formation of free radicals which leads to the largest part of toxic damage within the cell. An adequate supply of anti-oxidants such as glutathione, vitamins ACE, selenium and zinc are required to continually quench these free radicals. If a mutation occurs within a germ cell (ovum or sperm) then the parent organism is not affected but the offspring will have a change in the genetic coding. If a pathogenic mutation occurs in a body cell then the most advantageous event would be for the cell to be destroyed and to be replaced by cells that have unaltered DNA. If the cell survives and the DNA is badly altered it may become pre-cancerous and then cancerous. Any cancer cell is a cell with badly damaged DNA.

Single nucleotide polymorphisms SNP's

LEARNING OBJECTIVES:

- **TO HAVE AN UNDERSTANDING OF THE DIFFERENCE BETWEEN THE TERMS NUTRIGENOMICS AND NUTRIGENETICS**
- **TO UNDERSTAND THE INFLUENCE OF EPIGENETICS**
- **TO UNDERSTAND THE IMPACT ON HEALTH OF SINGLE NUCLEOTIDE POLYMORPHISMS (SNP's)**
- **TO HAVE A BASIC UNDERSTANDING OF HOW CERTAIN SNP's AFFECT NUTRITIONAL STATUS**

Before we start this section please refer back to your anatomy and physiology course notes if you need to refresh your memory about homozygous recessive, heterozygous and homozygous dominant genes.

The terms nutrigenetics and nutrigenomics seem to be interchangeable however there is a subtle difference. Nutrigenetics generally refers to the effect of genetic variation on dietary responses. This can often involve just one gene and one nutrient such as the LCT gene and lactose breakdown, or the HLA gene group and gluten (covered shortly in more detail). Nutrigenomics, on the other hand, refers to the impact of nutrients and food on gene expression.

SNP's are a substitution of a nucleotide that occurs at a specific position in the genome. The sequence of the various nucleotides is known for the majority of the population and this is compared to each individual. As an example, adenine may occupy the place of cytosine in a small percentage of the population. This is called a SNP at this specific position in the chain and the two possible nucleotide variations of either adenosine or cytosine are said to be alleles for this position. SNP's therefore underlie our susceptibility to certain diseases. Examples of life changing SNP's are sickle cell anaemia, cystic fibrosis or thalassemia.

In this section we will look at some of the SNP's that are useful to be aware of in Nutritional Therapy. Coeliac disease is a good example to understand SNP's. In order to be coeliac a person must have the HLA DQ genes. Just having these genes though doesn't make a person coeliac. Only about 30% of people carrying these genes will actually move into coeliac disease. The other 70% have a predisposition to coeliac disease which may or may not cause a problem. About 90% of people with coeliac disease have a SNP on the HLA DQ1 gene and about 8% on the HLA DQB1 gene. The level of risk is highest with two HLA-DQA1 variants (homozygous genotype), known as HLA DQ2.5 positive. It would be wise for these people to reduce their consumption of gluten if they have not already been diagnosed coeliac.

There are a few companies now that offer genetic testing to the general public such as Ancestry and 23andme. There are also laboratories that offer comprehensive genetic testing and full interpretation of results to practitioners. It will depend upon the laboratory as to whether they accept BANT registered practitioners or NNA and FNTP practitioners as well. It is worth contacting the following companies and asking for their registration details and requirements. At the time of writing (2020) both of the following companies accept NNA and FNTP registered nutritional therapists.

My DNA health: https://mydnahealth.co.uk/

Lifecode Gx: https://www.lifecodegx.com/

My DNA health also includes lifestyle questionnaires in their analysis thus incorporating diet, lifestyle and gene information into their programmes and reports. It also offers the opportunity to test whether a person carries the genes for coeliac disease.

Let's have a look at some of the SNP's that can affect nutritional requirements. The two companies mentioned above will only test for SNP's that are relevant to nutritional practice and that have enough research behind them to warrant testing for them.

MTHFR: Methyltetrahydrofolate reductase (MTHFR C677T) and (MTHFR1298)

This is perhaps the best known of SNP's and is the enzyme that breaks down folate into methyltetrahydrofolate or MTHF. It is a central cog in the methylation pathway. Genetics variants in this gene can be associated with MTHFR deficiency leading to potentially problems with methylation. This gene produces an enzyme that is necessary for properly using folate, as well as converting homocysteine into methionine, which the body needs for proper metabolism and which is also needed for glutathione creation. Phase 2 detoxification also involves this enzyme, so those with a SNP may have trouble effectively eliminating toxins from their body. Methylation may need to be supported. One copy (heterozygous C/T) gives a 35%-40% reduced ability of the enzyme to work efficiently, two copies (homozygous T/T) would give a 70%-80% reduction in the action of the enzyme.

One allele change for the MTHFR 1298 gene would result in a 20% reduction in the work of the enzyme with methylation perhaps needing some support.

It should be noted however that the enzyme will still work, just a lot slower. By substituting 5-MTHF as a supplement long term, important steps in the reduction of folate will be missed which can impact the BH4 cycle. Interested students can research this via lectures from Bionutri (Sue McGarrigle) and webinars on the My DNA health website. It is therefore vital to look at the bigger picture of diet, lifestyle, inherited factors, and digestion and absorption of nutrients.

APOE 4: Apolipoprotein 4

This is the gene associated most frequently with Alzheimer's disease and dementia. This gene is on chromosome 19 and is involved in fat metabolism in the body. It is responsible for transporting cholesterol healthily to the brain but is inhibited by sugar. People who carry this gene can make a huge difference to their health by eating healthily and avoiding sugar. The APOE 4 gene also gives an increased risk of heart attack from strokes. You can now make more of a connection between dementia being known as diabetes 3. For people carrying this gene it becomes extremely important to regulate blood glucose levels to avoid old age dementia or Alzheimer's disease.

COMT: Catechol-O-Methyltransferase

This gene provides instructions for the enzyme Catechol-O-Methyltransferase (COMT) which breaks down neurotransmitters and hormones such as dopamine, adrenaline and noradrenaline. Carriers of SNP's with this gene will have a decreased ability to breakdown neurotransmitters and hormones especially if they also have problems with methylation (MTHFR).

CYP 1A1, 1A2, 1B1: Cytochrome P450 enzymes

These enzymes are the stage 1 liver detoxification enzymes. A few of these are tested for by the companies. The ones here relate to coffee metabolism (CYP1A2) and metabolism of estrogen (CYP1A1 & CYP1B1). These CYP's will also give more information about liver detoxification.

eNOS: endothelial nitric oxide synthase 3

This gene plays a key role in the regulation of vascular tone. SNP's can result in an increased risk of hypertension and atherosclerosis.

FABp2: Fatty acid binding protein 2

This gene is located in the small intestine epithelial cells and is involved in the absorption and metabolism of fats. Genetic variants are associated with increased fat absorption, insulin resistance, obesity and type 2 diabetes.

FADS1: encodes for delta 5 desaturase

You will remember Delta 5 desaturase from your study of the breakdown of essential fatty acids. A SNP here will affect the breakdown of omega 3 and predispose to increased inflammation.

FADS2: encodes for Delta 6 Desaturase

A SNP will increase the action of delta 6 desaturase which could increase inflammatory states, diabetes, obesity and insulin resistance.

GTSM1 & GSTT1: Glutathione s transferase

Glutathione is a major antioxidant in the liver and is necessary for effective action of the phase 2 glutathione pathway. A lack of this gene, or decreased action of it, will lead to a decreased ability to detoxify effectively. Those who do not have this gene can benefit from adding huge amounts of colourful vegetables to their diet including garlic and onions, to support detoxification. An absence of GSTT1 results in a decreased ability to utilise vitamin C which will impact detoxification and the clearance of hormones such as estrogen, and heavy metals such as mercury, lead, cadmium and aluminium.

IL6R: interleukin 6 receptor

Interleukin 6 is involved in inflammatory states. People with variants in this gene are thought to have some protection against inflammatory states, RA and cancer. However, there is an increased susceptibility to asthma.

MnSOD: manganese superoxide dismutase

Superoxide dismutase is an extremely powerful antioxidant and destroys free radicals within the cells and mitochondria. During the first year nutrition weekend we briefly study oxidation which will leave you in no doubt of its importance to health. Those with SNP's need to ensure they have plenty of antioxidants in their diet and to consider supplementation as well.

MTRR: methionine synthase reductase

This gene catalyses cobalamin (B12) therefore a SNP will predispose to an increased need for B6 and B12.

TNFa: Tumour necrosis factor alpha

This gene is the inflammatory marker released by fat that causes artery inflammation and diabetes. Inflammation of the arteries makes it more difficult to store glucose resulting in insulin resistance, obesity and diabetes. The variant is also associated with CRP levels, also an inflammatory marker.

VDR fok: vitamin D receptor

This gene produces the vitamin D receptor protein which is responsible for binding vitamin D

VDR taq: vitamin D receptor

The VDR gene also provides instructions for making a protein called the vitamin D receptor which allows the body to respond correctly to vitamin D. VDR proteins are found in the brain and stimulate enzymes that generate dopamine. The CC allele has no impact but the CT allele causes poorer calcium absorption and suggests that calcium, magnesium and vitamin D need to be addressed within the diet. Caffeine should be reduced to supply optimum function for those with SNP's with this gene. T allele carriers are more susceptible to insulin resistance if deficient in vitamin D.

BCO1: Beta carotene oxygenase1

This gene converts beta-carotene to retinol. You will remember from your study of vitamins that research from Newcastle University found that 50% of women could not convert beta-carotene into retinol. It is quite probably that those women in the trial carried a SNP on this gene. The combined effect of two BCO1 SNP'S can reduce gene activity by as much as 69%. A person with no variants (2 wild type SNP's) would expect to have high BCO1 activity and no problems with conversion.

CLOCK gene Circadian Locomotor Output Cycles Kaput gene

This gene is responsible for regulating circadian rhythms. My DNA Health check for this gene in their optimum health screen test.

There are many more SNP's that are tested for and incorporated into easy to understand reports for you and your clients. It is recommended that you contact the companies and carry out a gene test on yourself so that you can witness the process first hand and become familiar with the terminology. Both companies offer training and will support you as you become more familiar with gene testing.

Conclusion to year 1

You are almost at the end of your studies of the year 1 nutrition module. All that is left now to do is to complete the self-assessment questions and then work through the assignments and case studies. These are all detailed after the unit 7 self-assessment questions. Guidance can also be found in the recorded lecture that accompanies this section of the module.

Self-assessment questions for Practical Nutrition, Hypoglycaemia and SNP's:

Q7.1 According to Ballantine are cooked foods more yin or yang?
Q7.2: Which amino acid is often made unavailable to the body through the browning action of cooking?
Q7.3: According to Ballantine which spices can help correct intestinal gas?
Q7.4: What is the difference between food intolerance, food sensitivity and a food allergy?
Q7.5: How long would a food sensitivity symptom generally last for?
Q7.5: What are the most common food sensitivities?

Q7.6: Name 15 symptoms of hypoglycaemia
Q7.7: Apart from the pancreas and adrenals becoming exhausted, which other organ, mentioned by Ballantine, may be responsible for hypoglycaemia?
Q7.8: Explain the actions of glucagon and glycogen
Q7.9: What does 'down regulation of receptors' mean?
Q7.10: Explain how the adrenal glands help to keep blood sugar levels stable
Q7.11: What is metabolic syndrome and what are its symptoms?
Q7.12: Explain how the insulin mechanism becomes exhausted, resulting in diabetes
Q7.13: Explain the link between obesity and insulin
Q7.14: Explain how carbohydrates contribute towards weight gain
Q7.15: What are the symptoms of PCOS?
Q7.16: What is diabetes 3?
Q7.17: Give 3 risk factors for Alzheimer's disease
Q7.18: Explain the 3 stages of blood sugar control
Q7.19: What are nucleotides?
Q7.20: When would an increased need for nucleotides arise?
Q7.21: How do the nucleotides contribute to cellular metabolism?
Q7.22: What are the functions of DNA?
Q7.23: What is the role of RNA?
Q7.24: What is the difference between RNA and DNA?
Q7.25: Name the 5 nucleobases that make up gene sequences
Q7.26: What is it that creates the single nucleotide polymorphisms known as SNP's?
Q7.27: Why do gene mutations occur?
Q7.28: Explain the difference between nutrigenomics and nutrigenetics
Q7.29: What is an example of a life changing SNP?
Q7.30: Which genes relate to coeliac disease?
Q7.31: If someone has the MTHFR SNP what does it mean?
Q7.32: What are the repercussions of having a SNP for MTHFR?
Q7.33: What is the percentage reduction in conversion for someone who is homozygous for MTHFR?
Q7.34: What is the significance of having the APOE4 gene?

Answers to self-assessment questions: Minerals:

Q6.1: What are macro minerals and which ones are they?
A: these minerals are found in the body in much bigger quantities than the trace minerals or micro minerals. They are phosphorus, calcium, magnesium, potassium and sodium.
Q6.2: Where are potassium and sodium found predominantly in the body?
A: potassium is predominantly found inside the cell and sodium found outside the cell in the fluid surrounding the cell and in the blood
Q6.3: What might be the consequence of taking in too much salt?
A: excess sodium can lead to an accumulation of sodium outside the cells which may have an effect on the water inside the cell by pulling it out of the cell and creating a feeling of bloating or puffiness. There is also research to suggest that excess sodium can lead to high blood pressure but some people with high sodium diets can have good levels of blood pressure so it is not conclusive.
Q6.4: What is the RDA of salt and sodium?
A: sources vary but it is in the region of 1.5g of sodium daily, about ¾ tsp salt daily.
Q6.5: What is the RDA of potassium?
A: again, sources vary but it is in the region of 3.5g-4.7g (3500mg-4700mg) daily. However the Mayo clinic says that a deficiency in potassium is rare and therefore places the RDA at 1.6g-2g daily (1600-2000mg). The problem is in the ratio between sodium and potassium which will be covered in the naturopathic section.
Q6.6: According to Ayurveda, what effect does salt have on the body?
A: the salty taste increases Pitta, which is the fire element in the body. It therefore helps digestion but can also increase aggressiveness if taken in excess.
Q6.7: From a Chinese perspective, is salt considered to be yin or yang?
A: salt is classified as yang as it has an active, assertive, hot nature.
Q6.8: Which glands regulate calcium metabolism?
A: thyroid and parathyroid glands
Q6.9: explain the action of the various hormones that regulate calcium metabolism.
A:

1. Parathormone from the parathyroid gland-releases calcium from the bone into the blood, decreases calcium loss in the urine and increases the production of calcitriol.
2. Calcitonin from the thyroid gland-stimulates processes to decrease blood calcium by decreasing the release of calcium from the bone and promoting the loss of calcium via the urine
3. Calcitriol, which is a derivative of vitamin D. It is produced by two chemical changes being made to Vitamin D, one in the liver and one in the kidneys. Its full name is 1, 25 dihydroxy vitamin D3. Calcitriol increases blood calcium concentration and maintains conditions favourable to bone mineralisation, including absorption from the intestines.

Q6.10: Which are the main nutrients that calcium requires for adequate absorption and utilisation?
A: vitamins D and K, boron and magnesium
Q6.11: Why do hospitals try and get people walking as soon as possible after operations?
A: because calcium is lost from the bones when lying prone. Even at night during sleep, calcium can be lost from the bone.
Q6.12: Which minerals are detrimentally affected by taking large amounts of calcium?
A: manganese, zinc, iron and magnesium.
Q6.13: Name good sources of calcium.
A: broccoli, lambs quarters, mustard greens, sesame seeds/tahini, milk, yoghurt
Q6.14: How does protein affect calcium absorption?

A: too much protein can depress calcium retention and too little protein will result in reduced calcium absorption

Q6.15: What is the RDA for calcium and why do you think sources differ?

A: sources range from 500mg-1000mg daily with more for teenagers, pregnancy and breast feeding. Discrepancies arise because certain people in various areas of the world have very low intakes and yet have adequate blood and bone calcium. Other research suggests that everyone is different as to how much calcium they require to maintain adequate levels in the body. This will depend upon inherited factors, genes and the presence of TB in ancestors, which gives a predisposition to mismanage calcium utilisation.

Q6.16: Name 10 functions of calcium.

A: check your answer against the following list:

- Activates insulin, calcitonin, thyroid hormone release
- Blood clotting
- Bone and teeth formation
- Cell membrane permeability
- Decreases blood level of parathyroid hypertensive factor
- Takes nutrients in to the cells
- Maintenance of electrolyte, blood acid and alkali balance
- Muscle contraction
- Nerve transmission
- Regulation of cell division
- Regulates heart beat
- Secretion of hormones

Q6.17: What factors will increase the need for calcium?

A: check your answer against the following list:

Factors increasing demand:

- Alcohol
- Bed rest
- Bone fractures
- Caffeine
- High phosphate intake
- High protein and sugar diets
- High sodium intake
- Hypoglycaemia
- Hypothyroidism
- Magnesium deficiency
- Pregnancy

Q6.18: What is the significance of low levels of calcium and blood sugar control?

A: calcium is required for hormone release. If there are low levels then insulin cannot be released efficiently leading to high levels of blood sugar/diabetes.

Q6.19: What does negative calcium balance mean?

A: where the body takes in less calcium than is needed or loses more calcium than is required

Q6.20: Which factors contribute towards negative calcium balance?

A: check your answer against the following list:

- Deficiency in diet
- Deficiency in vitamin D
- High protein intake
- Disturbances to thyroid and parathyroid
- High phosphorus in diet (fizzy drinks)

- Low levels of estrogen
- Low stomach acid

Q6.21: What dietary factors affect calcium absorption?

A:

- Those containing high levels of oxalic acid
- Those containing phytic acid
- Caffeine (not technically a food)
- Excess protein

Q6.22: How is calcium associated with viral infections?

A: a mismanagement of calcium leads to more calcium in the tissues (rather than outside the cell and in the blood stream). Increases in tissue calcium is associated with an increase in viral infections.

Q6.23: What does calcium dumping mean?

A: where calcium is 'dumped' in the body, out of solution. Therefore it is not in its correct place outside the cell but has entered the tissues and been 'dumped' where it will begin to cause problems.

Q6.24: Which heavy metal competes with calcium for absorption?

A: lead: if lead is seen on a hair analysis calcium and vitamin C are used to eliminate it.

Q6.25: In Iridology, what is the calcium ring?

A: a white ring that forms in the outer part of the iris. It suggests a mismanagement of calcium, sodium and cholesterol.

Q6.26: What are the main food sources of magnesium?

A: green leafy vegetables, sesame, nuts and seeds, grains

Q6.27: Name 5 functions of magnesium

A: check your answer against the following list:

- Energy production: Co factor in synthesis on cAMP and ATP
- As a co enzyme for delta 6 desaturase (essential fatty acid breakdown)
- For working the sodium pumps on the cell membrane to keep sodium and calcium out of the cell, and thus keeping toxicity out of the cell
- Nerve function: magnesium is very calming for the central nervous system
- Stimulator of many enzymes in energy producing pathways
- Homeostasis of calcium and regulates intracellular calcium, sodium and potassium ions
- DNA replication
- Improves immune competence
- Improves insulin resistance: keeps calcium out of the cell which assists with hormone production
- Inhibition of platelet aggregation
- Initiation of fatty acid oxidation
- Lecithin production
- Maintenance of heart muscle
- Regulation of body temperature

Q6.28: Name 5 factors which increase the demand for magnesium

A: check your answer against the following list:

- Low stomach acid
- Athletes
- Arthritis
- Chronic alcoholism
- Chronic fatigue
- Coffee
- Diabetic acidosis
- Diarrhoea

- Diabetes (type 2)
- Eclampsia
- Epileptics
- Heart failure
- High fat and sugar intake

Q6.29: List 5 symptoms that may suggest a magnesium deficiency.

A: check your list against the following:

- Jumping at the least provocation
- Hyper-irritability
- Muscle tremors
- Inability to concentrate
- Apathy
- Depression
- Hyperactivity in children
- Increased perspiration (from even the slightest exertion)
- Foul body odour
- Cramps
- Frequent urination (due to muscles around the bladder not being able to relax properly)
- Constipation
- Insomnia-fall asleep readily but then wake and only sleep lightly/toss and turn.
- Pre-eclampsia in pregnancy is often due to magnesium deficiency.

Q6.30: Give 5 reasons why someone may be deficient in magnesium

A:

1. Eating a magnesium deficient diet such as the standard western diet heavy in convenience foods and sodium
2. Eating lots of refined carbohydrates and sugar
3. Thyroid and parathyroid imbalance
4. Eating a 'good' diet but the vegetables eaten are grown in magnesium deficient soil
5. Stress: stress is a diuretic which leaches magnesium from the body: more about this in the naturopathic section
6. Excess calcium, either from diet or as a supplement
7. Alcoholic
8. Lack of digestive capacity to extract nutrients from food

Q6.31: Which nutrients work with magnesium or are affected by magnesium?

A: Vitamins B1, B6, C, D, potassium, boron, calcium, chromium, manganese, zinc, potassium.

Q6.32: What is the connection between candida and a magnesium deficiency?

A: those people with a candida imbalance have been found to be deficient in magnesium and that candida causes excessive losses of magnesium from the kidneys.

Q6.33: What is considered to be a cause of post-natal depression?

A: zinc deficiency in the mother during pregnancy. The baby requires zinc to grow so it will take all available sources of zinc from the mother, leaving her deficient and a possible low birth weight baby (less than 7lbs). In addition, zinc affects mental and emotional function; therefore a deficient mother could manifest post-natal depression.

Q6.34: What might you consider for a client suffering from morning sickness? How could you enhance the absorption of zinc?

A: zinc and B6 deficiency, giving a range of B vitamins and B6 in its broken down form of pyridoxal 5 phosphate. Consideration of essential fatty acid status also needs to be made. Correction of blood glucose levels will also help morning sickness. Adequate stomach acid is also required for zinc absorption. Zinc is required for production of stomach acid so correction of stomach acid balance is essential.

Q6.35: Which nutrients affect zinc utilisation?

A: copper, iron, calcium, manganese, vitamin A and E, deficiency in EFA's,

Q6.36: How does zinc affect blood glucose control?

A: zinc is required for the hormone insulin to work efficiently. Zinc has been thought to stabilise insulin in the body, to help maintain circulating levels of insulin and to reduce the tendency to insulin resistance.

Q6.37: List 10 factors that affect the utilisation of zinc

A: check your list against the following:

1. Low stomach acid
2. Alcoholism
3. anorexia nervosa
4. burns
5. copper and lead toxicity
6. diabetes
7. elderly people/age
8. diets high in phytic acid
9. hypertension
10. poor appetite
11. pancreatic enzyme insufficiency
12. pregnancy
13. schizophrenics
14. stress
15. viral infections
16. vegetarian diets

Q6.38: List 10 zinc deficiency symptoms

A: check your answer against the list below:

1. Acne and all skin problems
2. anorexia nervosa
3. bulimia
4. all mental problems
5. decreased Leptin levels
6. poor immunity
7. impaired wound healing
8. impaired growth
9. learning disorders
10. low sperm counts
11. poor concentration and memory
12. sleep problems
13. white spots on finger nails
14. dandruff
15. epilepsy
16. infertility
17. loss of taste
18. premature greying of the hair
19. stretch marks
20. loss of appetite
21. possible predisposing factor in alcohol addiction
22. cold extremities and poor peripheral circulation
23. hair and nails often don't grow very well and the brittle nails may often have white spots.

Q6.39: Which nutrients are antagonistic to zinc utilisation?

A: high levels of calcium, high levels of manganese, copper and iron.

Q6.40: What is pyroluria and what are its symptoms?

A: pyroluria is where pyrroles bind to zinc and B6 and excrete them via the urine. It is increased during stress and can cause the following symptoms: anxiety, irritability, fatigue, poor short term memory, little or no dream recall (a common B6 deficiency), mood swings and increased sensitivity to light, sounds, chemicals etc.

Q6.41: Name 5 symptoms of copper deficiency

A:

1. Neutropenia (a low count of Neutrophils: white cells in the blood)
2. hypochromic microcytic anaemia (a form of anaemia in which the red blood cells are both low in haemoglobin content and are also very small in size)
3. osteoporosis
4. slow healing of wounds
5. MS
6. irregularity of heart beat
7. raised blood cholesterol levels
8. tachycardia
9. heart attack
10. poor hair quality.

Q6.42: What is superoxide dismutase? Which mineral is essential for its production?

A: Superoxide dismutase is a powerful antioxidant. It is essential to health. Copper is required for its production.

Q6.43: What is the connection between iron anaemia and copper?

A: copper is required to make red blood cells. A deficiency in copper can therefore lead to iron deficiency anaemia

Q6.44: What is the connection between copper, estrogen and the gall bladder?

A; copper is excreted via the gall bladder, thus if the gall bladder becomes obstructed then copper levels can rise in the body. Similarly, estrogen affects the gall bladder by increasing the release of biliary cholesterol and hence raising the risk of gall stones forming. Raised levels of estrogen are often found with raised copper, raised candida and raised insulin.

Q6.45: List five factors affecting copper levels in the body

A:

- Vitamin C deficiency raises copper levels
- The combined deficiency of both vitamins C and B3 may synergistically raise copper levels.
- Copper water pipes
- Copper cookware
- Drinking water contaminated with copper
- Birth control pills and copper coil IUD
- Vitamin and mineral supplements
- Fungicides for swimming pools and foods
- Vegetarianism and other high copper diets
- Dental appliances
- Occupational exposure (plumbers, welders)
- Adrenal gland exhaustion
- Congenital copper imbalance (from mothers who are deficient in zinc or high in copper)
- Slow metabolic rate-the slower the rate, the higher the levels of copper.

Q6.46: Which nutrients are depleted by the contraceptive pill?

A: the contraceptive pill increases levels of copper, therefore zinc is automatically suppressed. Vitamin C and B6 are also affected by the contraceptive pill.

Q6.47: Name 3 roles of manganese

A: check your answer against the following:

1. Essential for energy production
2. Involved in glucose metabolism

3. Helps maintain the integrity of tendons and ligaments
4. Essential for bone development and arterial integrity
5. Maternal bonding

Q6.48: List 5 deficiency symptoms attributed to manganese

A: check you list against the following:

1. Allergies
2. Diabetes
3. Dizziness
4. Fatigue
5. Fractures or osteoporosis
6. Hypoglycaemia
7. Tinnitus
8. Muscular weakness
9. Weak ligaments and tendons
10. Lack of maternal bonding

Q6.49: What are the deficiency symptoms of selenium?

A:

- Pancreatic damage
- Confusion
- Depressed CD4 T lymphocytes
- Depression
- Depressed glutathione peroxidase
- Growth impairment
- Abnormal sperm motility
- Hostility
- Hypothyroidism: plus all of the symptoms associated with low thyroid activity
- Infertility

Q6.50: What are the three principle functions of iron in the body?

A:

1. oxygen transport –iron is part of the haemoglobin molecule that carries oxygen in the blood
2. cellular energy production-iron is required in the final steps of the electron transport system to produce ATP
3. Removal of harmful free radicals-the catalase enzyme system requires iron.

Q6.51: Name 10 deficiency symptoms of iron

A: check your list against the following:

- Fatigue
- Weakness
- Decreased resistance
- Pallor
- Anaemia
- Hydrochloric acid deficiency
- Brittle or ridged nails
- Slow oxidation
- Low blood pressure
- Dizziness
- ADHD
- Sore tongue
- Hair loss

Q6.52: Which nutrients are required for iron to be absorbed efficiently?

A: vitamin C (because it reduces phytic acid) B12 and copper.

Q6.53: Name 5 factors or nutrients that inhibit iron absorption:

A:

1. phytic acid
2. phosphate
3. egg protein
4. manganese
5. zinc
6. nickel
7. chromium
8. copper (excess)
9. calcium
10. magnesium
11. cadmium
12. vegetarian diets.

Q6.54: Where would you advise a vegan to obtain their sources of iron from?

A: eggs, lentils, beans, tofu, cashew nuts, and green leafy vegetables. You would also ensure that they had adequate stomach acid to absorb the iron.

Q6.55: What is Hemochromatosis and what are the symptoms?

A: an inherited disease where a person stores excessively high levels of iron in the body. Symptoms include:

- Abdominal pain
- Fatigue, weakness
- Generalized darkening of skin colour (often referred to as bronzing)
- Joint pain
- Lack of energy
- Loss of body hair
- Loss of sexual desire
- Weight loss

Q6.56: What is the glucose tolerance factor?

A: The glucose tolerance factor, or GTF is an enzyme which is necessary for correct production and utilisation of insulin. Chromium is an important part of the GTF. As a supplement, chromium has been found to help stabilise blood glucose levels.

Q6.57: What role does molybdenum play in the body?

A:

- supports liver detoxification, especially chemical sensitivity,
- Fat, aldehyde, uric acid metabolism, copper, iron and sulphur homeostasis
- Detoxification of copper, sulphite, sulphate, aldehydes
- Purine metabolism
- Anti-cancer
- Prevents tooth caries

Q6.58: Which heavy metal displaces calcium? Which supplements would be used to detoxify it?

A: lead displaces calcium. Vitamin C will help to move it out of the body, alongside adequate calcium. Lead and calcium use the same cell receptors for absorption, therefore not enough calcium (and deficiencies in iron and zinc) will result in increased lead take up, depending upon exposure.

Q6.59: What is TIBC when seen on a blood test?

A: TIBC is total iron binding capacity. This is a carrier protein for iron which will increase if iron is deficient in order to try and utilise more iron

Q6.60: What do low ferritin levels on a blood test suggest?

A: possible low thyroid activity and increased bacterial infections

End of year assignments:

Please complete the following assignments and send them to your tutor for marking:

Assignments:

- **(from mineral section) Assignment: Please research foods containing oxalic acid and send it to your tutor for marking. What is the significance of foods which are high in oxalic acid? What symptoms are associated with eating high oxalate foods?**
- **(from mineral section) Assignment: Please research the benefits and drawbacks of using Iodine in practice. Send to your tutor for marking**
- **(from vitamin section) Assignment: To finish this section on vitamins please prepare a chart with all of the vitamins listed, their action in the body, their interactions with other vitamins and the minerals, their RDA, deficiency symptoms, excess (toxicity) symptoms and food sources. This is to be sent to your tutor for marking.**
- **(from mineral section) Assignment: To finish this section on Minerals please prepare a chart with all of the minerals listed, their action in the body, their interactions with other vitamins and minerals, their RDA, deficiency symptoms, excess (toxicity) symptoms and food sources. This is to be sent to your tutor for marking. You can either have one chart for vitamins and one for minerals or combine the two together.**

Short answer questions

Nutritional Biochemistry:

The following questions require 1-2 paragraphs of explanation per question:

1. **Describe the chemical structure of carbohydrates, lipids and proteins. How are they similar and how do they differ? Explain bonding of molecules within your answer.**
2. **Describe the structure of nucleic acids?**
3. **What are enzymes and what is their role and purpose in the body?**
4. **Describe the various functions of carbohydrates in the body**
5. **Describe the various functions of lipids in the body**
6. **What are essential fatty acids?**
7. **How could you include both omega 3 and omega 6 into the diet of one of your clients?**
8. **How could you include omega 3 into the diet of a vegan?**
9. **Describe the various functions of proteins in the body**
10. **What is the protein score?**
11. **What does the term 'complimentary proteins' mean? How would you explain the importance of complimentary proteins to a vegetarian or vegan?**
12. **Explain the digestion and breakdown of carbohydrates into simple sugars**
13. **Explain how the cell produces energy via the citric acid cycle. Be sure to explain how proteins, fats and carbohydrates 'feed' into the cycle and which nutrients are required for the 'cycle' to work.**

14. **Explain the digestion and breakdown of proteins into amino acids**
15. **Explain the digestion and breakdown of fats into fatty acids**
16. **Explain the 4 stages of water**
17. **Explain the role of buffers in the maintenance of an alkaline pH**

Single nucleotide polymorphisms

The following questions require only 1-2 sentences as an answer.

1**: What is COMT and what is the significance of having a SNP on the gene that codes for COMT?**

2: Which genes affect liver phase 1 detoxification?

3: Which gene will give information about the absorption and metabolism of fats? What imbalances will genetic variants result in?

4: Which gene SNP's will affect the breakdown of omega 3?

5: What symptoms could a SNP on FADS2 result in?

6: What are the implications of SNP's for GTSM1 & GSTT1?

7: Which gene is associated with an increased susceptibility to asthma?

8: Which SNP can give you information about a person's ability to quench free radicals

9: Which gene will give you information about a persons need for additional B6 and B12?

10: Which 5 genes would you check if you were looking to see if someone was susceptible to more inflammation?

11: Which gene gives information about a person's utilisation of vitamin D?

12: What is the significance of the BCO1: Beta carotene oxygenase1 gene? What would a SNP suggest?

13: What does the CLOCK gene do?

Essay questions**: all to be approximately 2000-2500 words maximum**

Essay 1:

"Explain the evolution of human nutrition and why a 'one diet approach to all' would cause disharmony and eventual ill-health"

Essay 2:

"Explain the benefits and drawbacks of organic and non-organic food both from a health perspective and from an environmental sustainability perspective"

Essay 3:

"Describe how dietary requirements can vary according to individual requirements and throughout the life cycle"

Case Study 1:

A 35 year old female client called Jenny consults you with the following symptoms:

- **Premenstrual tension**
- **Headaches, especially before menstruation**
- **Fatigue**
- **Anxiety and panic attacks**
- **Bloating, flatulence and constipation**
- **Allergy just started to cats: sneezing and runny nose and eyes**

Jenny has been a vegan now for a number of years and is asking for your advice as to whether her diet could be deficient in certain nutrients. Her diet consists of the following:

- **Breakfast: commercial cereal with rice milk**
- **Snack: soya milk chocolate, dark chocolate covered nuts**
- **Lunch: sandwich with vegan cheese or peanut butter**
- **Snack: 2 pieces of fruit**
- **Evening: Quorn or soya based commercial meat substitutes such as mince, sausages etc. with chips, peas, carrots and broccoli.**
- **Drinks: coffee, peppermint tea, some water.**

Explain the following:

1. **Why do you think Jenny is suffering from these symptoms?**
2. **Which nutrients might she be deficient in?**
3. **What ethical considerations do you need to think about when working with this client?**
4. **Why do you think Jenny has developed allergies?**
5. **Suggest basic dietary and supplement guidelines that will begin to help her symptoms**

2000 words maximum

Live case study:

Please submit a live case study of a family member or friend. Follow the protocol detailed earlier and which is given again below for you. You are asked to only carry out the initial consultation and give your recommendations for diet, lifestyle and supplements. You will need to interpret the case study and give reasons for your recommendations.

Remember the following:

1. **Use the template given below and which was used in the example in the course**
2. **DO NOT work outside your comfort zone. If you are unsure then mention this in your case history. It is imperative that the college can see that you are working safely and that you are aware of your boundaries**
3. **From your knowledge of Western nutrition mention what you think is contributing to the symptoms (e.g. which nutrient deficiencies, possible SNP's, dietary considerations, blood glucose imbalances)**
4. **Provide a meal plan**
5. **Remember red flags**

Case Study Instructions - please ensure that you read these before doing your live case studies

- Word count: approximately 2000-3000. Support material, such as a food diary, suggested recipes and the questionnaire, which must be submitted with your case study, are not included in the word count.

- Make sure that you retain the anonymity of your case study. Only their initials should be used.

- Use the Case study template given below. This template has been developed to guide you through your case study presentation. The template is based on the Clinical section of the National Occupational Standards (NOS) for Nutritional Therapy.

- Use appropriate technical language when writing your case study but ensure that handouts and other patient/client material is client orientated.

- You should demonstrate reflective practice throughout.

- As you write up each case study you should demonstrate your knowledge, understanding and skill.

- Bullet points, tables or any method of your choosing that is clear and concise is the preferred method of presentation.

- Please see the example case study in unit 7 which will show you how to use this template in practice.

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CASE STUDY TEMPLATE

Please ensure that you maintain patient confidentiality in any material that you submit.

CASE STUDY NUMBER …… [MARK AS APPROPRIATE]

Case study initials…….

1: ASSESSING THE CLIENT'S NEEDS AND THE APPROPRIATENESS OF NUTRITIONAL THERAPY

SYNOPSIS OF CURRENT PRESENTING SYMPTOMS – Portrait of your client at the point you have taken on the case.

In this section include the following:

m. Initials, age, gender
n. Details of operations
o. Details of medical diagnosis
p. Presenting symptoms and length of time they have been apparent for
q. Current drugs prescribed (length of time prescribed for)
r. Current supplements/herbs/homeopathics used
s. Bowel habits
t. Energy levels
u. Sleep habits
v. Lifestyle
w. Dental procedures/amalgam etc
x. Full history of health including parents and grandparents health

EXPLAIN THE SELECTION OF ASSESSMENT METHODS USED TO DETERMINE CLIENT TREATMENT.
Include your methods of information gathering

e.g. questionnaire, tongue, iris and nail diagnosis, questioning during consultation, physical assessment, any blood test or other lab results, questioning.

RATIONALE - Provide a rationale for the initial hypothesis using valid and reliable information. Identify possible antecedents and triggers (precipitating and perturbing factors) and possible mediators. This is the section where you explain how you have arrived at your conclusions for your client's symptoms and the recommendations that you intend to make and why. You could include relevant research in this section if you want to.

RESOURCES, OPTIONS and RISKS - Identify range of resources and options available to the client and also potential risks to client in following recommended treatment protocol. In this section be sure to show that you have checked for all drug nutrient interactions and identified any other risks that may be applicable to your client

2. EDUCATING THE CLIENT

DIETARY ADVICE – provide an outline with rationale for any dietary changes recommended.

INITIAL SUPPLEMENT PROTOCOL WITH RATIONALE:

Guidelines:

- present a generic nutraceutical protocol in the first instance and include appropriate rationale which demonstrates your understanding of the individual nutrients and/or non-nutritive substances.
- explain your choice of proprietary brands to support your initial findings. Your tutor may not necessarily know the content of branded formulations so you must tell them. You may photocopy or scan this information from supplement company websites.
- provide information on dosage, dosage form, timing of intake, and length of prescription
- demonstrate safety in relation to dosage and interactions with food/nutrients/herbs/ phytochemicals/ lifestyle
- demonstrate intention to work within the limits of the client's medication and to protect the client in regards to side effects and/or potential interactions

LIFESTYLE ADVICE – Provide an outline with rationale for any lifestyle changes recommended

SUMMARY – Reflect on each consultation and articulate on any preparation you intend before the follow-up appointment e.g. the focus of future appointments, further investigations/tests and referral as applicable. Review effectiveness of the client-practitioner relationship in terms of improved client health outcomes.

Answers to self-assessment questions Practical Nutrition, Hypoglycaemia and SNP's:

Q7.1 According to Ballantine are cooked foods more yin or yang?
A: yang
Q7.2: Which amino acid is often made unavailable to the body through the browning action of cooking?
A: lysine
Q7.3: According to Ballantine which spices can help correct intestinal gas?
A: Cumin, coriander, black pepper
Q7.4: What is the difference between food intolerance, food sensitivity and a food allergy?
A:

- Food allergy: this would cause anaphylactic shock and is caused by an IgE immune response
- Food sensitivity: this is caused by an IgG response and presents mild (in comparison) symptoms which generally last for 4 days.
- Food intolerance: symptoms are digestive related and due to a lack of stomach acid and/or digestive enzymes.

Q7.5: How long would a food sensitivity symptom generally last for?
A: 4 days
Q7.5: What are the most common food sensitivities?
A:
Gluten (wheat, rye, barley and often oats)
Corn
Dairy products
Eggs
Peanuts
Cashew nuts
Shell fish
Soya
Tree nuts
Q7.6: Name 15 symptoms of hypoglycaemia
A: check your list against the following:

1. Fatigue
2. Irritability
3. Anxiety

4. Forgetfulness
5. Nightmares
6. Heart disease
7. Muscular stiffness
8. Blurred vision
9. Lack of sex drive
10. Angina
11. Cold extremities
12. Excessive smoking
13. Depression
14. Allergies
15. Tinnitus
16. Nausea
17. Suicidal tendencies
18. Excessive sweating
19. Unable to lose weight
20. Poor concentration
21. Indigestion
22. Headaches
23. Breathlessness
24. Migraine
25. Food cravings
26. Hyperactivity
27. Fainting
28. Unable to face food first
29. Thing in the morning
30. Asthma
31. Neuralgia
32. Palpitations
33. Panic feelings
34. Stomach cramps
35. Convulsions
36. Narcolepsy
37. Stomach ulcers
38. Weight gain
39. Overweight
40. P.m.t
41. Numbness
42. Joint pain
43. Epilepsy
44. Vertigo
45. Phobias
46. Blackouts
47. Agoraphobia

Q7.7: Apart from the pancreas and adrenals becoming exhausted, which other organ, mentioned by Ballantine, may be responsible for hypoglycaemia?

A: a sluggish liver function

Q7.8: Explain the actions of glucagon and glycogen

A: glycogen is the storage molecule for glucose which is held in the liver and muscle. When blood glucose levels drop glucagon is released which instructs the liver to convert glycogen to glucose

Q7.9: What does 'down regulation of receptors' mean?

A: a reduction in receptors on the cell membrane. This generally occurs when there is an excessive amount of a certain message or hormone in order to protect the cell from excess signalling.

Q7.10: Explain how the adrenal glands help to keep blood sugar levels stable

A: the adrenal glands release adrenaline and cortisol which take stored sugar from the liver and increase the blood sugar

Q7.11: What is metabolic syndrome and what are its symptoms?

A: Metabolic syndrome is a collection of symptoms known to be associated with insulin resistance (when the cells are not responding correctly to insulin). It is the fore runner of diabetes.

The symptoms associated with metabolic syndrome include:

Insulin resistance

Hypertension (high blood pressure)

Cholesterol abnormalities

Increased risk of blood clots

Patients are most often overweight or obese.

Q7.12: Explain how the insulin mechanism becomes exhausted, resulting in diabetes

A: As the pancreas continues to release insulin in an attempt to regulate blood glucose levels the cells become more and more 'insulin resistant'. The increased levels of sugar in the blood stream are laid down in the body tissues as fat and these fat cells become part of the hormone system and start releasing hormones of their own which further exacerbates the insulin resistance and increases inflammation in the body. Eventually the pancreas becomes exhausted and releases less insulin, resulting in high levels of blood glucose which is type 2 diabetes.

Q7.13: Explain the link between obesity and insulin

When insulin levels are imbalanced the appetite is disturbed and people can feel continually hungry. This is also tied in with leptin release as well. Insulin is a storage hormone and will store the excess sugar as fat.

Q7.14: Explain how carbohydrates contribute towards weight gain

Carbohydrates trigger insulin release which is a storage hormone. Insulin causes the blood glucose levels to drop which results in increased appetite (often a false appetite). The more carbohydrates that are eaten the greater the release of insulin resulting in storage of excess carbohydrates as fat.

Q7.15: What re the symptoms of PCOS?

A: PCOS is characterised by hirsutism (addition body hair growth), obesity, irregular menstruation, infertility and acne. Sufferers may or may not have cysts on their ovaries.

Q7.16: What is diabetes 3?

A: Diabetes 3 is the name given to dementia and Alzheimer's disease. Research has shown that the brain also releases insulin. Insulin is needed for the brain to work effectively because the brain exists on a steady flow of glucose for its optimum function. People with Alzheimer's disease have been found to have impaired glucose handling in the brain but not necessarily in the body. Researchers have termed this impaired glucose handling as diabetes 3.

Q7.17: Give 3 risk factors for Alzheimer's disease

A:

1. Diabetes or hypoglycaemia
2. Low stomach acid leading to low levels of B12 and folic acid. This can result in raised homocysteine levels which have been found to be positively correlated to dementia and Alzheimer's disease.
3. Mineral deficiencies especially magnesium and zinc.

Q7.18: Explain the 3 stages of blood sugar control

1. Eliminate stimulants such as tea, coffee, alcohol and sugar and replace with regular meals and snacks contain protein. Protein does not trigger insulin and can therefore help to reduce the GI of a meal and thus the amount of insulin produced.
2. Once blood glucose levels are stable, eliminate the snacks and eat 3 good meals daily, containing good forms of protein and complex carbohydrates plus lots of vegetables.

3. Detoxing and fasting can now be undertaken if the person wishes.

Q7.19: What are nucleotides?

A: Nucleotides are a macromolecule and are found within the nucleus of the cell, and are the building blocks of the nucleic acids which are known as RNA and DNA

Q7.20: When would an increased need for nucleotides arise?

A: An increased need for nucleotides would arise during periods of excess growth, such as pregnancy and childhood

Q7.21: How do the nucleotides contribute to cellular metabolism?

A: Nucleotides play a central role in cellular metabolism and carry adenosine triphosphate (ATP), guanosine triphosphate (GTP), cytidine triphosphate (CTP) and uridine triphosphate (UTP) throughout the cell aiding the many cellular functions that require energy.

Q7.22: What are the functions of DNA?

A: DNA which carries the inherited gene information from our parents. DNA allows the cell to replicate and provides the blueprint for making the protein sequences in the body

Q7.23: What is the role of RNA?

A: Ribonucleic acid (RNA) in simple terms is a messenger for RNA and conveys genetic information from the cell nucleus to the rest of the cell.

Q7.24: What is the difference between RNA and DNA?

A: RNA and DNA differ in structure:

- Whereas DNA is double stranded, RNA is a single stranded molecule.
- The sugar molecule in DNA is deoxyribose where as in RNA it is ribose
- The complementary base in DNA to adenine is thymine whereas in RNA it is uracil which is an un-methylated form of thymine.

Q7.25: Name the 5 nucleobases that make up gene sequences

A: the five nucleobases are adenine, cytosine, guanine, thymine and uracil. Thymine is only found in DNA and uracil only found in RNA.

Q7.26: What is it that creates the single nucleotide polymorphisms known as SNP's?

A: It is the change in the sequence of the nucleobases of A, T, C and G that create the single nucleotide polymorphisms or SNP's. These changes would be influenced by the environment and be adaptive changes.

Q7.27: Why do gene mutations occur?

A: Mutations can occur within the cells and is dependent upon many factors such as environment, toxicity levels and diet. Ionizing radiation for example, such as radiation, X Rays and cosmic rays can cause mutations in the genetic coding, as can toxicity within the tissues. Both radiation and mutagenic chemicals produce their effects by the formation of free radicals which leads to the largest part of toxic damage within the cell.

Q7.28: Explain the difference between nutrigenomics and nutrigenetics

A: Nutrigenetics generally refers to the effect of genetic variation on dietary responses. This can often involve just one gene and one nutrient such as the LCT gene and lactose breakdown, or the HLA gene group and gluten. Nutrigenomics, on the other hand, refers to the impact of nutrients and food on gene expression.

Q7.29: What is an example of a life changing SNP?

A: Thalassemia, sickle cell anaemia and cystic fibrosis

Q7.30: Which genes relate to coeliac disease?

A: HLA DQ genes. In addition about 90% of people with coeliac disease have a SNP on the HLA DQ1 gene and about 8% on the HLA DQB1 gene. The level of risk is highest with two HLA-DQA1 variants (homozygous genotype), known as HLA DQ2.5 positive

Q7.31: If someone has the MTHFR SNP what does it mean?

A: they will have a reduced ability to convert folate to methyl tetrahydrofolate. They can experience problems with methylation

Q7.32: What are the repercussions of having a SNP for MTHFR?

A: reduced methylation and therefore reduced liver detoxification namely phase 2 pathways: reduced sulphation, methylation and glutathione pathways

Q7.33: What is the percentage reduction in conversion for someone who is homozygous for MTHFR?

A: 70-80% reduction in the enzyme working efficiently

Q7.34: What is the significance of having the APOE4 gene?

A: an increased chance of Alzheimer's disease and dementia.