The role of macronutrients

In developed countries such as the UK, diets and lifestyles have changed dramatically since the end of the Second World War. Coronary heart disease (CHD) is the principal cause of death among adult men and women accounting for approximately ninety four thousand deaths (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). The increase in the incidence of CVD is supported by evidence which suggests that the leading factors contributing to this condition are obesity, high blood pressure, psychological stress, poor cardiovascular system health, an unsuitable diet and tobacco and drug use (Diet, nutrition and the prevention of chronic diseases, WHO, 2003; BBC heath website; De Lorgeril et al, 1999). 33% of all deaths are believed to be caused by CVD with developing countries hit the hardest (Diet, nutrition and the prevention of chronic diseases, WHO, 2003) It is possible too that the developing world which includes countries like China, India, some middle east countries, Africa and South America will suffer large effect sizes in the incidence of CVD in the future.

Macronutrients that increase the risk of CVD

Various fatty acids including LDL cholesterol (low density lipoprotein) sometimes called saturated fatty acids, have been highlighted by many types of study as increasing the incidence of CVD among samples of the populations tested (De Lorgeril et al 1999; Diet, nutrition and the prevention of chronic diseases, WHO, 2003; BBC heath website, 2011). High blood cholesterol levels and CVD are strongly and positively correlated (BBC health website, 2011). Amongst these, myristic acid and palmitric acid have been found to increase the risk of CVD and are abundant in foods such as diary and meat products. Myristic acid is a common saturated fatty acid and can

be found is foods such as coconut milk and butter oil as well as in animal fats. Palmitric acid is another saturated fatty acid and is commonly found in plant and animal fats as well as butter, cheese, milk and some meats. Trans-fatty acids are another risk factor for CVD and are found in the form of a monounsaturate and a polyunsaturate and have been found to increase LDL cholesterol (BBC health website, 2011).

Folate (vitamin B9) and homocysteine (a homologue the amino acid cysteine) have both been found to be risk factors for CVD (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). However, both folic acid and homocysteine may be a consequence and not a cause of conditions such as arthrosclerosis (De Lorgeril et al, 1999; Diet, nutrition and the prevention of chronic diseases, WHO, 2003).

High sodium content in the diet has been strongly correlated with CVD (De Lorgeril et al 1999; Diet, nutrition and the prevention of chronic diseases, WHO, 2003; BBC heath website, 2011). High blood pressure associated with excessive ingestion of sodium salts has been shown in many studies to be a predictor of myocardial infarction and subsequently increases the probability of both types of stroke with the greatest risk being among the male obese populations (BBC heath website; De Lorgeril et al 1999; Diet, nutrition and the prevention of chronic diseases, WHO, 2003).

Macronutrients that decrease the risk of CVD

Foods such as fresh vegetables, fruits, fish oils have been found to be effective in reducing the risk of CVD (Diet, nutrition and the prevention of chronic diseases, WHO, 2003; De Lorgeril et al 1999; BBC heath website).

Polyunsaturated vegetable oils such as linoleic acid have been found to be promoters of low risk for CVD (De Lorgeril et al 1999; BBC heath website). Some fibres consist of polysaccharides and lignin which is a constituent of plant cells walls and aids water transport and structure. These types of fibre along with more traditional celluloses have been found to reduce the incidence of LDL's as part of a regular diet (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). Wholegrains are another type of fibre that has in clinical trials been found to reduce the risk of CVD, this type of fibre is abundant in the cereal crops. Antioxidants are found in fresh fruit and vegetable and have been suggested to reduce the risk of CVD (Diet, nutrition and the prevention of chronic diseases, WHO, 2003; De Lorgeril et al 1999; BBC heath website) however the evidence for this is not strong and the decreased risk of CVD may be due to other nutrients present in the food. For example, vitamin C, E and beta-carotene have all been studied for their potential positive effects on individuals at risk from myocardial infarction and stroke. The results of this research are as yet however inconclusive (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). Flavonoids are also present in many plants and display anti-allergic, anti-cancer, anti-microbial and anti-inflammatory properties (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). A negative correlation has been found between some flavonoids and incidence of CVD although methodological problems have been mentioned in such studies (Diet, nutrition and the prevention of chronic diseases, WHO, 2003). Potassium salts have been found in a number of cohort studies to be a protective factor in CVD an may measurably decrease systolic and diastolic blood pressure (De Lorgeril et al 1999; Diet, nutrition and the prevention of chronic

diseases, WHO, 2003). Some of these studies found an inverse relationship between risk of a stroke and potassium salt ingestion as part of a regularly monitored diet.

The essential fatty acids such as omega-3 have been found to be conducive to the reduction in the risk of CVD for a number of reasons including reducing triglycerides (a VLDL) which is associated with high incidence of atherosclerosis, heart disease and stroke (De Lorgeril, 1999). Omega 3 is an unsaturated fatty acid found in oily fish such as tuna and herring, other beneficial cardiovascular effects may be reduced blood clotting (helping to reduce aneurisms and other blockages) and possibly promoting heart beat regulation (BBC health website, 2011). Stanols and sterols are plant derived esters which have been found to reduce levels of LDL cholesterol in the blood supply of sample populations (BBC website, 2011). These types of esters can be found in fruits, vegetables, nuts, seeds, cereals, legumes, and vegetable oils and may help to reduce previously high levels of cholesterol. Moderate levels of alcohol have been found in some studies to reduce the risk of CVD (BBC website, 2011). This beneficial effect however is based upon the consumption of the no more than the recommended daily limit for a person of a given weight, height and age (BBC website, 2011). Alcohol ingestion has been correlated with increases in the beneficial HDL cholesterol.

Pathophysiological processes that occur in relation to macronutrients and CVD

The major pathophysiological change that may occur in the human body in relation to macronutrients or lack of is cardiovascular disease which may

also be associated with obesity and diabetes (Poirier et al, 2006). Atherosclerosis is a disease of the arterial system in which the arterial vessels become blocked due to a build up of the LDL fats (atheromas or atherosclerotic plaques) which accumulate inside the epithelium of the vessel walls thus reducing the blood flow and increasing the risk of infarction (Merck medical library, 2008). All the factors already mentioned above have been strongly linked to atherosclerosis (tobacco smoke, long term saturated fat ingestion, diabetes, lack of exercise, stress and excessive levels of cholesterol in the blood supply). The vital organs are particularly vulnerable (heart, kidneys brain) as well as some not so vital areas like the arteries of the legs. (Merck medical library, 2008; Poirier et al, 2006). Subtle repeated injury to the arterial system appears to be the main developmental factor leading to atherosclerosis, the artery gradually becomes thicker and loses its elastic ability, this leads to a situation where the blood is restricted and the heart is placed under greater and greater pressure due to the resistance in the increasingly furred arteries (Merck medical library, 2008; Poirier et al, 2006). This effect can be compounded by obesity and diabetes which interfere with circulation and metabolism and may even lead to infection (Merck medical library, 2008; Poirier et al, 2006). Atherosclerosis can be recognised histologically when arterial walls creates endocrine signals that cause monocytes and T cells to accumulate within the affected artery. Monocytes and T cells move into the wall of the artery where they are signalled to turn into another type of cell, foam cells. Foam cells accumulate cholesterol and trigger growth of smooth muscle cells in the artery wall. These foam cells form patchy deposits and are covered with a fibrous cap. Over time calcium accumulates in these plaques. Plaques normally form

where the arteries branch and over time cause such a stress upon the cardiovascular system that it may suddenly fail (usually bought on by a combination of high blood pressure, bad diet and obesity) or a major blockage may form causing a stroke (Merck medical library, 2008; Poirier et al, 2006; Diet, nutrition and the prevention of chronic diseases, WHO, 2003; De Lorgeril et al 1999; BBC heath website).