The effects of lifestyle on the cardiovascular and respiratory system

Scientists have identified four " fatal lifestyle behaviours" that unite to augment the risk of premature death. The behaviours include: poor diet, lack of physical activity, alcohol consumption and smoking. Researchers in a prospective study, collected lifestyle data on almost 5, 000 adults aged 18 and over between 1984 and 1985 in the United Kingdom (UK). Over the next 20 years a total of 1, 080 participants died, 431 from Cardiovascular Disease (CVD), 318 from cancer, and 331 from other causes that included respiratory diseases such as Chronic Obstructive Pulmonary Disease (COPD). Individuals with all four poor health behaviours were three times more likely to die of heart disease or cancer than those with none. They also had four times the risk of dying from other causes. Their overall death risk was equivalent to being 12 years older than they actually were (Kvaavik et al, 2010).

CVD is the leading cause of morbidity worldwide, accounting for one third of all deaths among men and women (Mosca et al, 2007). CVD is predicted by the World Health Organization (WHO) to remain the number one global cause of mortality for decades (WHO, 2003). In the UK, over five million people are living with CVD, which also results in over 40, 000 premature deaths each year (National Institute for Health and Clinical Excellence, (NICE) 2010). The incidence of CVD is not evenly distributed across the UK. There are regional differences, with higher incidences in Scotland, Northern Ireland and the north of England than in Wales or the South of England (British Heart Foundation (BHF), 2003). In addition there is an increased incidence among people on low income and certain ethnic groups linked to the increased prevalence of CVD risk factors. For example there is a 50% higher incidence in the Asian population (Allender et al, 2007).

Respectively, respiratory disease is the second largest cause of mortality globally, after cardiovascular disease (British Thoracic Society (BTS), 2006). Respiratory disease such as lung cancer and COPD accounts for 20% of all deaths in the UK (BTS, 2006). Similarly, a survey of 2, 500 patients with COPD conducted by the British Lung Foundation (2000) identified that four out of five patients had substantial difficulty with everyday tasks. Asthma and pneumonia are two other diseases that can be affected by lifestyle choices that are made by individuals and that can be said to be ' forced' upon others, such as passive smoking. The aim of this essay is to explore the above negative lifestyle behaviours and their impact on the cardiovascular and respiratory systems, and the diseases that are brought about as a result of partaking in the said behaviours.

The cardiovascular system is the body's major transport system. It comprises of the heart, blood, blood vessels and lymphatic system. This system's most important role is to deliver oxygenated blood, nutrients and chemical signals, such as hormones, to the organs and tissues. It also transports carbon dioxide to the lungs and waste products, such as urea and uric acid, to the kidneys for elimination. As well as this, the system plays a major role in thermoregulation, distributing and dissipating heat throughout the body. A healthy, efficient cardiovascular system is essential for systemic health (Montague, 2005).

Correspondingly, the respiratory system consists of the upper airway, including the nasal passages, sinuses, pharynx and larynx, and the lower airway includes the trachea, bronchi, lung, bronchioles and alveoli. The respiratory system has numerous functions. In addition to its major role in

gaseous exchange, it is involved in regulating blood pH and controlling blood pressure, and plays an important role in the non-specific immune responses. Every living cell in the body requires oxygen for cellular respiration and generates carbon dioxide as a waste product. Therefore an efficient respiratory system, allied with a healthy cardiovascular system, is essential for optimal cellular function and general health (Montague, 2005).

With regard to the cardiovascular system, CVD describes conditions of the heart and circulatory system. CVD encompasses coronary heart disease (CHD), stroke and peripheral vascular disease. CHD is the most common form of CVD and can present clinically in various ways, the most frequent being angina, myocardial infarction (MI) and sudden death. These conditions are frequently brought about by the development of atheroma and thrombosis (Walsh and Crumbie, 2007). As mentioned, CVD is the UK's topmost cause of death. It is, however, a largely preventable disease and the main risk factors for it include smoking, obesity, a physically inactive lifestyle, poor diet, too much salt, alcohol, diabetes and raised blood pressure (NICE, 2010). Therefore, it is proposed that premature CVD could be prevented by making minimal changes to diet, smoking and physical activity.

Concerning diet, individuals who are obese have an increased risk of developing CVD. In the UK, about one quarter of adults are classified as obese, with two thirds of men and more than half of woman categorised as being overweight. Three in ten young people aged between two and 15 years are classified as either overweight or obese, with no difference in gender (Department of Health (DH), 2009a). It is also estimated that a further two million men and one million women in England will be obese by

the year 2010 (DH, 2006). The government has predicted that by the year 2025 almost half of men and one third of woman aged 21-60 years will be obese (NHS Information Centre for Health and Social Care, 2009).

Research suggests that most human obesity results from the excessive consumption of highly palatable foods, such as fats, and more recently calorific beverages sweetened with high fructose corn syrup (Bray, 2008). Diets rich in fat and sugar may be responsible for promoting addictive-like behaviour leading to subsequent over consumption of such foods. (Ifland et al, 2009). However, research also proposes that other non-palatable foods can still be desired and consumed in excess (Pelchat, 2009). It is also posited that there is a link between excess body fat and the risk of a number of serious diseases, including diabetes, some cancers and CVD (Swain and Sacher, 2009). The relationship between obesity and the development of CVD has been demonstrated (Yusuf et al, 2004). It was found that while an abnormal lipid profile is mainly as a consequence of poor diet lacking in fruit and vegetables, smoking and lack of exercise was a major risk factor for MI. Abdominal obesity was responsible for 20% of MI, and also indirectly responsible for high blood cholesterol and hypertension (Yusuf et al, 2004). Epidemiological studies have demonstrated that elevated levels of plasma total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) are major risk factors for CHD, whereas high concentrations of plasma high-density lipoprotein cholesterol (HDL-C) and a low ratio of plasma TC to HDL-C are protective against CHD (Chen et al, 2008). A relationship between plasma TC and the risk of CHD is well established at concentrations above 240mg/dl (Chen et al, 2008).

However, additional risk factors include a family history of CHD and diabetes (Yusuf et al, 2004). All of the risk factors mentioned are common, regardless of sex, ethnic group or age and are frequently not found in isolation, thereby increasing the risk (Yusuf etal, 2004). As previously mentioned, some risk factors are modifiable, for example, cholesterol, diabetes, hypertension, obesity, physical inactivity and smoking. Therefore, efforts should be made to increase awareness of how to reduce the likelihood of developing CHD both in the person who has identified risk factors and in the population as a whole (Yusuf et al, 2004).

CHD can develop at any age. Initially, an area of atheromatous plaque forms in the coronary artery. The mechanism for plaque formation is unclear, although the predominant view is that lipid accumulates under the lining of the coronary artery. Because the lipid infiltrate is a foreign matter, white blood cells called macrophages engulf it, and create foam cells. Smooth muscle cells then invade the area, which enlarges. It is not until the plaque obstructs more than 50 per cent of the lumen of the coronary artery that the flow of blood to the heart muscle, the myocardium, is reduced. This usually means that when resting, or undertaking minimal activity, the blood supply to the heart is adequate. However, when the heart requires a greater supply of oxygen, as occurs during exercise or emotional episodes, the blood supply cannot increase sufficiently and the person will experience chest discomfort. This is referred to as angina pectoris. Once plaque has formed, the wall of the coronary artery is damaged and irregular in shape and platelets cluster around the obstruction. This reduces the size of the lumen still further and consequently the blood supply is also reduced. Sometimes platelet

aggregation can be sudden causing an abrupt and total occlusion of the coronary artery. At this time the person will experience an MI (Buckley, 2008).

Research has also shown that excess weight and obesity are responsible for about 80% of cases of type 2 diabetes in Europe (WHO Europe, 2007). Type 2 diabetes has been described as reaching epidemic proportions and should current trends continue, it is predicted that 200 million individuals worldwide will have diabetes by the year 2010 and 300 million people will have the condition by the year 2025 (Bastaki, 2005). This is a cause for concern as the health risks associated with diabetes include microvascular complications such as retinopathy, nephropathy, neuropathy and CVD (Kar and Holt, 2008).

According to the Department of Health's (DH) the ' Be Active, Be Healthy: A Plan for

Getting the Nation Moving', report (DH, 2009b), it is important to incorporate physical activity into the daily routine to ensure good health. Physical activity not only has a significant effect on the prevention and treatment of obesity (Peterson, 2007), but may also reduce the risk of coronary events in patients with CHD (Scrutinio et al, 2005). Increased physical activity may also prevent the development of metabolic syndrome, which is associated with obesity (Gelaye et al, 2009; McMillen et al, 2009). To prevent obesity, individuals will need to participate in between 45 and 60 minutes of moderate intensity physical activity each day (DH, 2004). This does not have to be accomplished in one session, and can be divided into six ten-minute periods during the day. However, research shows that approximately one fifth of

men and one third of women fail to achieve at least one 30-minute session of physical activity a day (Department for Children, Schools and Families, 2008).

Apart from the commencement of a more active lifestyle, debatably, good nutrition is imperative to maintain a healthy weight and therefore, decrease the risk of CHD. Weight control is important and can be achieved in a variety of ways. Eating less fat, sugar and alcohol is helpful but, to achieve a healthy body weight. Various benefits are associated with weight loss of just 5-10 kg including: a 20-25% fall in overall mortality; 30-40% fall in diabetes-related deaths and a 40-50% fall in obesity-related cancer deaths. Blood pressure is also lowered (10mmHg fall in diastolic and systolic pressures), and there is up to a 50% fall in fasting blood glucose, reducing the risk of developing diabetes by more than 50%. Lipid levels are also reduced. There is a 10% decrease in total cholesterol, 15% fall in low-density lipoprotein and 30% decrease in triglycerides. Another positive factor of a weight loss of between 5-10kg is that there is an increase of 8% in high-density lipoprotein (Blenkinsopp, 2004)

However, it is argued that weight reduction is not as simple as just eating healthy food and increasing physical activity. It is recommended that healthy eating habits should be adopted early on as they will have a significant effect on health in later life (Turnbull et al, 2007). Parents have an important role in the development of an infant's food preferences and intake (Scaglioni et al, 2008). However, arguably, in times of financial hardship, some parents may only be able to afford cheaper, processed foods, which are high in refined sugars, starches and fats. Conversely, while parental input is invaluable,

children should continue to develop basic food knowledge and incorporate new skills and practical abilities through nutritional education in schools to assist and empower them to make healthier food choices throughout their lives (Food Forum, 2000). The School Food Trust (SFT, 2007) has produced guidelines for parents on which foods are suitable for packed lunches. However, it is unknown whether these guidelines are culturally sensitive, easy to read and understand and easily accessible. In addition, the SFT is seeking to assist schools in the provision of healthier school meals and is monitoring these changes. This strategy is not without its challenges and the main reasons for children not eating school meals relate to cost, personal preference for packed lunches, not liking the food served and poor dining facilities. This suggests that there is still some work to be accomplished within this area (SFT, 2007). It is also important to note that physical activity, in conjunction with a balanced diet from an early age, is essential if children are to maintain a healthy energy balance (DH, 2005).

Alcohol in moderation (one to two units daily for women, two to three units for men), may reduce the risk of CHD by potentially increasing HDL cholesterol slightly and reducing thrombotic tendencies (Mukamal et al, 2001). A unit is defined as a half pint of beer, lager or cider, or a pub measure of wine, sherry or spirits. However, consuming too much alcohol places health at risk in a number of ways. When taken in excess, alcohol can damage the cardiac muscle, cause arrhythmias, stroke and coagulopathies (Lindsay and Gaw, 2004). Additionally it may contribute to obesity, high triglycerides and hypertension, risk factors for the development of CHD

(Lindsay and Gaw, 2004). Men should drink no more than three to four units of alcohol and women no more than two to three units a day.

Pertaining to smoking, in 1962, the Royal College of Physicians concentrated on the association between smoking and lung cancer, COPD and CHD with most smokers continuing to die from one of these illnesses (ASH (Action on Smoking and Health), 2001a). One in two long-term smokers will die prematurely (half in middle age) as a result of smoking (ASH, 2001a), and generally smokers experience poorer health than non-smokers. This is because smoking is associated with a wide range of health problems that cause disability and reduce quality of life. Apart from the above health problems mentioned others include: angina (x 20 risk); pneumonia; asthma and peripheral vascular disease among many others (ASH, 2001a).

As mentioned the two most common respiratory diseases caused by smoking are lung cancer and COPD (ASH, 2001a). According to a study of male British doctors between 1951 and 1991, smoking caused 81% of lung cancer deaths and 78% of deaths from COPD (Doll et al, 1994). A considerable body of evidence links passive smoke exposure in adults with increased risk of lung cancer and ischaemic heart disease (Poswillo, 1998). Smoking precipitates asthma attacks and increases their severity. New evidence indicates that the onset of asthma in adults may be induced by passive smoke exposure (Jaakkola et al, 2003). Similarly, the exposure of infants and children to passive smoking increases the risk of wheezing, the severity and frequency of asthma attacks, cough, and lower respiratory tract infections including bronchitis and pneumonia (ASH, 2001a). It is suggested that it is the toxic

components of tobacco and in particular cigarettes that have adverse effects on the cardiovascular and respiratory systems.

Constituents of tobacco smoke cause damage throughout the respiratory tree from the main airways (bronchi) to the peripheral airways (bronchioles), right down to the terminal alveoli (air pockets), as well as to the immune system. Loss of cilia and mucous gland hypertrophy occur in the upper airways; inflammation, epithelial changes, fibrosis and secretory congestion occur in the peripheral airways, and alveoli are destroyed with loss of gas exchange surface area and airways flexibility. There are vascular changes to the small arteries and capillaries of the bronchioles and the alveoli. Smoke also causes inflammation of the cells of the bronchial tree leading to squamous metaplasia (a precancerous condition), smooth muscle hypertrophy, and peribronchial fibrosis. Damage is evident in the results of bronchoalveolar lavage (a fibreoptic scope is placed into the lung of a patient, and sterile water is injected into the lung). The overall cell count in the lavage is increased with people who smoke, with many more neutrophils and eosinophils but fewer lymphocytes. Concentrations of the antibodies immunoglobulin M and immunoglobulin E (markers of sensitisation) are increased, showing that allergic processes are involved (Brannon and Feist, 2009).

Regarding lung disease associated with smoking, COPD is characterised by airflow obstruction. This obstruction is usually progressive, not fully reversible, and does not change markedly over several months (NICE, 2004). The changes induced by the irritant tobacco smoke produce the recognisable symptoms that include: a productive and persistent cough; regular chest

infections requiring antibiotics; shortness of breath at first on exercise, later after simple non-strenuous activities, and finally at rest. This disease has a very gradual onset and should be suspected in people aged over 35 who smoke, have a chronic productive cough with winter chest infections, and are breathless on exertion. Smokers do not generally present with symptoms until their 50s or 60s after many years of smoking. The patient will have a reduced FEV1 and FEV1/FVC ratio. FEV1 is the forced expiratory volume in one second and FVC is forced vital capacity (Brannon and Feist, 2009). A landmark study on COPD was published in 1977 (Fletcher and Peto, 1977). The authors demonstrated the key features of the disease including a wide range of susceptibility among smokers. They identified that stopping smoking was the only way to slow down the progressive decline of lung function. The disease is most prevalent in socioeconomically deprived people, a group that also has the highest prevalence of smoking.

Stopping smoking will also reduce CHD risk even if a person has smoked for many years. There are short and long-term benefits. Within eight hours nicotine levels will be reduced by half and within 24-48 hours carbon monoxide levels will be comparable to those of a non-smoker. The long-term benefits are considerable; excess cardiovascular risk from smoking reduces by half within one year and after five years reverts to about the same level as someone who has never smoked (Critchley and Capewell, 2003).

Concerning asthma, for some time it has been known that passive exposure to tobacco smoke increases the frequency and severity of asthma attacks in children and adults. As already mentioned a recent study has demonstrated for the first time that passive tobacco smoke inhalation increases the risk of

developing asthma in adults (Jaakkola, 2003). Not surprisingly cigarette smoking has a harmful effect on the lung capacity of people with asthma, which is demonstrated by impaired lung function tests. People with asthma should be advised not to start smoking or be given strong encouragement and support to quit (Jaakkola, 2003).

The risk of pneumonia is increased by the irritant effect of smoke inhalation accompanied by mucous gland hypertrophy and damage to the immune system. Pneumonia is not only more common among smokers but is also much more likely to be fatal. In 1995, a total of 9, 900 deaths from pneumonia were attributed to smoking (Health Education Authority, 1998).

On the subject of lung cancer, the risk of dying from lung cancer rises with the number of cigarettes smoked per day, although duration of smoking is the strongest determinant. Lung cancer is the second most common cancer diagnosed in the UK after breast cancer. Around 41, 000 people were diagnosed with lung cancer in the UK in 2008, which are 112 people per day. Lung cancer is the second most common cancer in men after prostate cancer, with more than 22, 800 new cases diagnosed in the UK in 2008. More than 17, 900 women were diagnosed with lung cancer in the UK in 2008, making it the third most common cancer in women after breast and bowel cancer. More than 8 in 10 lung cancer cases occur in people aged 60 and over. Rates of lung cancer in Scotland are among the highest in the world, reflecting their history of high smoking prevalence. In the 1950s, for every lung cancer case diagnosed in women in the UK, there were 6 in men. That ratio is now 3 cases in women for every 4 in men. Lung cancer incidence rates in men peaked in the late 1970s and since then have decreased by

more than 45%. This reflects the decline in smoking rates in men after World War II. Lung cancer rates among women increased slowly until the early 1990s and have since leveled off. The difference in lung cancer trends in men and women reflect variations in past smoking behaviour. Lung cancer is the most common cancer in the world with an estimated 1. 61 million new cases diagnosed in 2008 (Cancer Research UK, 2011).

In total, 95 per cent of patients die within five years of diagnosis, with most dying within the first year. Factors contributing to lung cancer including inhaled carcinogens from cigarette smoking play a major part in the development of all lung cancer (squamous cell, adenocarcinoma, small cell, and undifferentiated carcinomas) but lifestyle and genetic factors are also important. This is a highly complex area and understanding could be said to be in its infancy. When smokers give up, their risk of getting lung cancer starts decreasing so that after 10 years an ex-smoker's risk is about one-third to one-half that of those who continue to smoke. Regarding smoking cessation and respiratory symptoms, a recent study from the Netherlands by Willemse et al, (2004) reviewed the evidence for the impact of smoking cessation on the lungs. It confirmed that giving up smoking prevents further deterioration of lung function and results in an improvement in inflammation of the airways in smokers without respiratory symptoms. This improvement in inflammation is not seen in those with bronchitis or COPD although giving up smoking prevents an excessive decline in lung function in all groups of smokers (Willemse et al, 2004). The researchers concluded that more research is needed on how smoking cessation affects the lungs of people with COPD.

The four fatal lifestyle behaviours: poor diet, lack of physical activity, alcohol consumption and smoking account for a large number of premature deaths in the UK and worldwide. Poor diet leads to an increase in the risk of obesity with consequent risk of developing diabetes and CVD, with 80% of type 2 diabetes resulting from excess weight. CVD remains a significant cause of death and disability throughout the western world. Lack of physical activity can lead to extreme weight gain or obesity, which as a result increased the risk of CHD. Excessive intake of alcohol can damage the heart, raise blood pressure and can lead to incidences of stroke or MI. Smoking is responsible for 81% of lung cancer deaths and 78% of deaths from COPD. It is also responsible for increased risk of CHD. However, many of the risk factors for the development of the diseases mentioned are modifiable through attention to lifestyle and diet.