2. Literature Review

2.1. Introduction

Based on epidemiological evidence, physical activity is recognised as being an important factor in preventing chronic disease (Warburton, Nichol & Bredin, 2006). Recommendations for the level of activity required to maintain good health in adults has been established in the UK for over a decade (DH, 1996), yet data from government surveys continue to show that these levels are achieved by only a minority of the adult population (ONS, 2008). The effects of a predominantly sedentary lifestyle are also believed to have an impact on mental wellbeing as evidence accumulates linking a lack of activity to negative mental health states such as depression, anxiety and stress (Netz, Wu, Becker, & Tenenbaum, 2005). The aims of this review are to assess the current levels and trends of physical activity in the UK and investigate the evidence linking activity to both the negative and positive aspects of mental health. The biochemical, physiological and psychological mechanisms linking activity to wellbeing are also briefly considered. Finally, the concept and causes of happiness is explored and the possible relationship between physical activity and the feeling of happiness.
2.2 Physical activity

Physical activity is a complex multi-functional behaviour performed by everyone in order to maintain daily life. It varies considerably from person to person and changes throughout the human lifespan. The terms ‘exercise’, ‘physical activity’ and ‘physical fitness’ are often used interchangeably, both professionally and in common language. Therefore, for clarification the definitions proposed by Caspersen, Powell and Christenson (1985) have been applied throughout this review. (See Glossary). Activity is most commonly measured by calculating the amount of energy, in kilocalories (kcal), required to achieve an activity. Research frequently categorises daily activity according to specific elements of everyday living, e.g. occupational activity, household, leisure-time and sleep. Recent trends such as an increase in physical inactivity during leisure-time together with a decrease in occupational activity have created a ‘sedentary lifestyle’. This has been linked to obesity, CHD and other chronic diseases (King et al, 2001); (Hu et al, 2004). International recognition of the health hazards caused by these lifestyle changes has led to the publication of public health recommendations for physical activity which aim to prevent chronic disease, promote physical health and improve quality of life. (WHO, 2004)
2.2.1. Recommended levels of physical activity

Recommendations from leading health authorities in the 1990’s gave
international recognition to the acknowledgement that there was an inverse
dose-response relationship between activity and principally CHD, but also
several major health problems (ACSM, 1990; CDC/ASM, 1995; WHO, 1995).
In 1996, the DH also released their initial Strategy Statement on Physical
Activity, recommending 30 minutes of moderate intensity activity (3-6 METs)
should be taken on at least five days of the week. This recommendation was
confirmed in the Chief Medical Officer’s report of 2004 ‘At least five a week’ as
being the level of activity perceived sufficient to achieve health benefits. The
report also acknowledges that greater health benefits may be obtained by
more exercise but, ‘with a law of diminishing returns’, recognising that the
health risk does not always decrease linearly with increased activity. More
importantly, there was government consensus that 30 minutes of moderate
activity was achievable by a larger number of adults than could achieve a
tougher target, although it was acknowledged that this maybe insufficient to
prevent weight gain in some adults (DH, 2004, Blair, Lamonte & Nichaman,
2004).

2.2.2. Trends in physical activity

A study carried out by James and colleagues in 1995 suggested that the
average decline in daily energy expenditure between 1945 and 1995 was
approximately 800 kcal/day which corresponded with a fall in energy intake of
approximately 750 kcal. This leaves an energy imbalance of 50 kcal/day
which, James suggests, has lead to an average increase in body weight of 2.5kg, accumulated mainly between the ages of 25 and 75.

An article by Prentice and Jebb (1995) suggested that an overall increase in body weight in the UK corresponds to the increase in affluence within society. Primarily using data collated from national diet, income and health surveys, they identified lifestyle changes, such as increased use of domestic appliances, mechanised equipment, door to door car journeys, and increased television watching, which have significantly reduced activity levels. They also comment that the increased number of homes with central heating may have caused a thermogenic effect with a reduced need to expend energy to maintain body temperature. Similar trends have been noted by POST, (2001) suggesting that the doubling of obesity within England since the 1980’s parallels the reduction in daily physical activity. It also advocates that the decline in daily activities such as walking is partly due to fear for personal safety, particularly in older people, women and children and this in turn has led to an increase in sedentary pastimes such as television watching and computer games. Hardman and Stensil (2003) advocate that the focus on academic achievement in schools has also led to a reduction in time spent in physical education, and certain cultural beliefs and traditions may prevent people from some ethnic minority groups from taking part in sport or exercise. Figures released by the BHF (2008) suggest that changes in daily routines involving household and occupational activity have also led to a significant decrease in total physical activity over the last two decades. There has been a small increase in activity during leisure-time, predominantly due to participation in exercise or sport.
2.2.3. Current physical activity levels

Accurate data tracking recent trends in activity is difficult to obtain due to changes in recording methods (POST, 2001). However, a key government report, the Health for England Survey, periodically measures activity in an attempt to identify trends. The most recent figures from the 2006 survey report the activity levels of over 21,000 respondents. Levels were grouped in accordance with DH guidelines (2004): high activity category are those achieving the recommended guideline of 30 minutes, five times a week, medium category are those participating in moderate activity between one and four times a week, and the low category are those who do not do any activity of sufficient duration or intensity. The report identifies that approximately one third of the population (34%) did enough activity to meet the health recommendations, a figure which has increased since the 26% recorded in 1997. This coincides with a fall in the number of adults in the medium activity category, (from 36% to 33%) and a decrease in the number of people categorised as sedentary, also falling to 33%. These figures take into account both non-leisure time and occupational activity and therefore are particularly important in illustrating the accumulative effects of changes in activity patterns in relation to current health problems such as obesity (King et al., 2001).
2.2.3.1. Activity levels according to gender

According to data from the Health for England Survey (2006) males are more active than females, with 40% of men meeting the guidelines compared to 30% of women. These figures have increased significantly in the decade between 1996 and 2006, (32% to 40% in males, and 21% to 30% in females), but also coincided with a fall in numbers in the moderate activity category, and an increase in the number of females classed as sedentary (38% of females compared to 30% of all males).

2.2.3.2. Activity levels according to age

The percentage of adults achieving the recommended level of activity declines with age, most markedly over the age of 55. A BHF report on trends in physical activity (2008) states over this age, 81% of men and 87% of women do not reach activity levels which could benefit health. The 2006 Health Survey for England also recognised a decline in activity with age suggesting 37% of adults between 55 and 64 years do less than 30 minutes of moderate activity once a week. An analysis studies by Bokovoy and Blair (1994) identified that a positive relationship exists between activity, function and health in older individuals. More current research strengthens this position by indicating that regular physical activity plays an essential role in the maintenance of functional fitness as the body ages, (O'Brien-Cousins & Gillis, 2004; Leino-Arjas, Solovieva, Riihima¨ki, Kirjonen & Telama, 2004; McMurdо, 2000)
A study carried out by Skelton, Young, Walker and Hoinville (1999) using secondary data from the Allied Dunbar National Fitness Survey (1990) concluded that one in four women, and one in fourteen men, over 50 yrs were not able to climb stairs without assistance and one fifth of adults do not have the flexibility to wash their hair comfortably. Research into the physical effects of ageing has identified that exercise can slow down the natural loss in muscular strength and, as a result, prevent or reduce individuals reaching a level of incapacity in which they are unable to complete daily tasks (McMurdo, 2000).

2.2.3.4. Activity levels according to social class

A briefing document produced for the Health Development Agency to assess the effectiveness of public health interventions for increasing physical activity; found that higher levels of inactivity were associated with low social class, income and educational attainment. (Hillsdon, Foster, Naidoo & Crombie 2004). Similarly, Rowe, Beasley and Adams (2004) identified that a greater proportion of people in lower socio-economic groups were sedentary when compared to more affluent groups. However, where individuals in lower social economic groups were active to a level which would benefit their health, it was mainly due to occupational activity which was undertaken in lower paid manual jobs, as opposed to activity taken in leisure-time. Prior to this, the Health for England Survey (1998) estimated that leisure time physical activity was strongly related to income, with men and women in higher income groups
more likely to take part in exercise and sport but less likely to have active occupations.

Choosing Activity’ – the DH physical activity action plan (2005a) highlighted that men in managerial and professional households report higher participation in sport and exercise than males in lower social categories. Furthermore, in both males and females low educational attainment was associated with higher levels on inactivity.

A comparison of data suggests that occupational activity continues to be an important element in lower social groupings but in more affluent groups of higher income and educational attainment, planned sport and exercise are key areas of physical activity.

2.2.4. Leisure-time activity

It was noted by Morris and colleagues, almost five decades ago that if activity was going to benefit health, it would be dependant on exercise taken in leisure-time as society became increasingly inactive (Morris et al. 1953). Since then, several robust longitudinal studies have confirmed that regular leisure time activity is associated with reduced risk of premature mortality, and in order for health benefits to accrue physical activity levels must be maintained, (Harvard Alumni Study, 1978, 1986, 2000. Health Professionals’ Follow-up Study, 1996. Aerobics Longitudinal Study, 1998. Nurses Health Study, 1997 , Whitehall Study, 2000). Based on such research, the Chief Medical Officer for England and Wales describes long term activity as
“critical” (DH, 2004) as individuals only gain health benefits when an active lifestyle is maintained and once an individual becomes sedentary, most health benefits are lost.

In contrast to health recommendations, the most recent publication of the Time Use Survey (ONS, 2005) found that the three main activities carried out by people in the UK were sleeping, working and watching television/videos/DVD’s or listening to music. The survey, based on activities of 4,941 participants throughout the UK, found that watching TV and listening to music accounts for an average of 2hrs and 37mins per person/day compared to an average of 10mins per person/day currently spent on sport or outdoor activities. Figures are calculated by taking the average time per day of all people/proportion that participated x 100, and therefore may not portray an accurate picture. It does however give an indication of how low levels of activity are in some groups. Only 10% of all participants in this survey recorded involvement in sport or outdoor activities compared with 80% who were involved in watching TV/videos. Conversely, the Active People Survey (2006) reports that 21% of the adult population participate in regular sport of at least three times a week for 30minutes or more. Walking was found to be the most popular recreational activity and this may be linked to the low figure for sport reported in the Time Use Survey, as walking was categorised under transport rather than leisure. In terms of participation, the Active People Survey found walking was followed by swimming, gym related activities and recreational cycling in men, or aerobics/dance in women. Excluding walking, these activities account for approximately 40% of all participation sports.
Most leisure activities are affected by age and gender. Men are more likely to watch TV but also more likely to spend time reading, and above the age of 45, devote more time to visiting friends and socialising. (Time Use Survey, 2005). However for women, the most common non-occupational activity was housework in which 58% of women participated compared to 38% of men, (Health for England Survey, 1998).

2.2.5. Occupational activity

Although the contribution made to activity levels by occupational activity has fallen significantly over the last 50 years, the value it has in relation to energy expenditure and wider health benefits is unclear. Rowe, Beasley and Adams (2004) identified that in those achieving a level of activity sufficient to gain health benefits, 64% of the total activity hours were derived through occupation. A decline in manual industries and increase in mechanisation since the 1980’s has resulted in fewer people in physically active occupations. Between 1984 and 2004, the UK has seen a 64% fall in the number of people employed in heavy industries, (such as mining), a 32% fall in manufacturing, and a 36% fall in the number of people employed in fishing and agricultural jobs. There compares to an 80% increase in office based employment particularly finance and business services, managerial and professional occupations together and increased employment in the service industries. (Labour Force Survey, 2005, ). In 1995, Prentice and Jebb stated that only 20% of women and 10% of men were employed in active occupations, contributing to exceptionally low activity levels in certain population subgroups. Current occupational trends as highlighted above
suggest that far less energy continues to be expended at work than in previous generations.

Similar studies reviewing the changing value of occupational activity in relation to health have been conducted in Europe and the USA. Research conducted by King et al. (2001) assessed the contributions of occupational and leisure-time physical activity with the prevalence of obesity in a study involving healthy American adults (n=4889). A main conclusion from the survey was the importance of occupation in reducing the likelihood of obesity. Participants with a highly active occupation, (e.g. construction work) but engaging in a sedentary lifestyle were still 42% less likely to be obese, and therefore less likely to suffer from chronic diseases, than those in sedentary occupations. Occupational energy expenditure was not measured in this study but categorised by job type into low or high activity occupations, e.g. teaching was classed as a low activity occupation and waitressing, a high activity occupation. Research by Vaz and Bharathi (2004) resulted in the authors being apprehensive about job descriptors being used when determining physical activity status of sample populations. In their study involving 198 school and college teachers the authors found that the mean physical activity levels suggested a moderate rather then sedentary activity profile when based on WHO guidelines. Vaz and Bharathi concluded that occupational activity profiles may distort true activity levels as only 12% of their sample group were sedentary. The study also found that 41% of total energy expenditure was attributable to activity at work, again highlighting the importance of this domain when considering daily activity levels in relation to health.
Research in Finland by Hu et al (2004) assessed the effect of occupational, leisure time and commuting activity on mortality in 3316 diabetic adults. Results suggested that moderate/vigorous occupational activity was independently and significantly associated with a lower risk of total and CVD mortality among diabetic patients, (p= < 0.001). Although activity was self reported and may be open to miscalculation, the large sample size in this study substantiates the value of occupational activity in reducing CVD risk.

An interesting counter argument to the importance of occupational activity in relation to health has been raised in a discussion paper by Sturm (2004). Sturm suggests the decline in work activity plays only a minor role in the contribution to health and obesity related health problems in US citizens. He argues that if occupational activity was significant then weight gain levels would be lower for females whose energy expenditure through occupation has not decreased as much as males in recent decades. Additionally Sturm suggests that obesity trends would also be lower in children, the elderly and the unemployed, who have been unaffected by changes in occupational activity. Sturm’s view is that it has been the overall decline in time spent in productive activities outside work which has created the fall in energy expenditure.

Despite changes in occupational activity, and more time spent sleeping, resting, socialising and participating in passive hobbies (Time Use Survey 2005), increasing numbers of people in the UK feel themselves to be more overworked, stressed or under pressure than before (MIND, 2007). In 1948,
the WHO defined health as “a complete state of physical, mental and social wellbeing, and not merely the absence of disease and infirmity” (Ewles & Simnett, 2003) and although WHO has updated and developed its view since this time, the importance of physical, mental and social wellbeing as joint contributors to good health is still as relevant. However whilst the benefits of routine physical activity are unequivocal, there is less clarity surrounding the role activity may play in preventing and treating mental health problems. (Goodwin, 2003; Bauman, 2004; Brown et al, 2005) Therefore, the evidence associating activity with reduced risk of conditions such as depression and anxiety and with improved mental wellbeing is now reviewed.

2.3. Activity and mental health

Measurement of mental health continues to be a challenging area of research. Current concepts suggest that mental wellbeing is a multidimensional construct (Thøgersen-Ntoumani, Fox, & Ntoumanis, 2005), or “multifaceted phenomenon, especially in adults” (Netz et al. 2005). Attempting to clarify the complex nature of mental health, Hassmen, Koivula and Uutela, (2000) state “psychological well-being may be related to …positive affects such as happiness, vigour, and morale, and negative affects such as anxiety and depression”. Due to their increasing prevalence, the negative aspects of mental health, particularly depression, anxiety and stress, continue to be the predominant focus in mental health research (Fox, 1999; Bauman, 2004).

The WHO has predicted that depressive disorders will become the second leading cause of disease and disability in the world by 2020, second only to
ischemic heart disease (WHO, 2001). In the UK, mental health problems account for 23% of primary care trust consultations (ONS, 2000). The most common forms of mental distress are anxiety and depression, estimated to affect 9% of adults, although more minor conditions such as sleep problems and fatigue affect a further 29% (DH 2004). In 1999, the government white paper ‘Saving lives: our healthier nation’ estimated the cost to the NHS of treating mental illness was £7.5 billion p.a. with extensive unknown costs both to the government through social services provision and to the economy through absence from work and unemployment.

In a review of depression and its treatment in the UK, Mutrie (2000) suggests that exercise is a neglected intervention in mental health care with treatment continuing to focus on the use of drugs. This is in sharp contrast to chronic disease where the value of exercise is now undisputed and promoted through UK health services (DH, 2004). Callaghan (2004) recommends the potential benefits for promoting activity as an effective means of treating minor mental conditions should be considered highly desirable, particularly in view of the large number of people suffering mental illnesses and the costs associated with drug treatment.

2.3.1 Physical activity and depression

Mutrie (2000) defined depression as ranging from brief periods of unhappiness, to ongoing low mood and inability to find enjoyment. One of the largest longitudinal studies investigating the relationship between mental health and physical activity was the Alameda County Study conducted by Camacho, Roberts, Lazarus, Caplan and Cohen (1991). Data relating to the
physical health, behavioural, social and psychological habits of 6,928 respondents in Alameda County, USA was collected over an eighteen year period. Analysing the findings across three time points, Camacho et al. concluded that adults who reported a low activity level at the start of the study (1965) were of greater risk of depression throughout the study period than those who had reported higher activity levels at baseline. Furthermore, those participants who had low activity levels in 1965, but then increased their activity levels were at no greater risk of depression than those who had been active throughout the period. Conversely, those active at the start of the trial but who had become inactive, were more than one and a half times as likely to become depressed by close of the study in 1983. Although some of the statistical relationships between activity and depression were weak ($p = < 0.05$), Camacho et al. believe there is sufficient evidence to suggest that a physically active lifestyle can reduce the risk of depression.

As part of the Harvard Alumni study, Paffenbarger, Lee and Leung (1994) examined the incidence rates of physician – diagnosed depression among Harvard alumni for over twenty years. The study concluded there was a dose-response relationship between activity and depression over the 23 – 27 year period with more active males showing lower incidence of depression (28% lower) than the least active participants.

Whilst both these studies are highly credible, conclusions should be considered carefully. Depression is particularly difficult to measure and likely to fluctuate frequently over periods of time which may explain why subsequent studies have had conflicting results (Brown et al, 2005). Furthermore, it was
identified by Farmer et al. (1988) in a ground-breaking study into depressive symptomatology that depressive moods may be causative factors for inactivity rather than the reverse, as those suffering from depression are less likely to exercise.

A cross-sectional study conducted by Hassmen, Koivula and Uutela (2000) considered the association between physical exercise and psychological wellbeing in 3403 randomly selected Finnish participants. Statistical analysis using pair-wise comparisons showed that depression scores increased when exercise frequency decreased. Hassmen and colleagues concluded that frequent exercise was not only associated with lower levels of depression but there was also a consistent association between enhanced psychological wellbeing and regular exercise.

2.3.2 Physical activity, anxiety and stress

Taylor (2000) defines stress as an imbalance between an individual’s perceived capability and the perceived situational demands. Although not as prevalent as depression, stress and anxiety disorders still affect the lives of millions of people. UK figures for anxiety suggest 4.7% of adults experience anxiety at any one time (MIND, 2007) and surveys conducted by the HSE (2006/7) found that stress was the second most common ill-health condition related to work after muscoskeletal disorders. The DH (2004) report that a “large number” of studies have indicated that physical activity has weak to moderate beneficial effects on anxiety, particularly in sedentary individuals with high levels of anxiety. Studies by both Fox (1999) and Callaghan (2004)
suggest that exercise programmes of several weeks, particularly of an aerobic nature, can result in moderate reductions in anxiety and stress. Similarly Taylor (2000) concluded that studies consistently show that a period of exercise training can reduce certain forms of anxiety across a wide range of population subgroups. The relationship between daily activity and stress however appears less researched with studies focussing on planned exercise in terms of intensity and duration rather than the potential benefits of an active lifestyle.

2.3.3. Physical activity and self-esteem

Self-esteem as been defined in the medical dictionary as the “internalized sense of one's own worth” (McGraw-Hill, 2002). Fox, (2000) describes self-esteem as a vital part of mental wellbeing as it represents individuals ‘self rating’ and is therefore a key indicator of mental health. Of 36 studies reviewed by Fox (2000), 28 conclude that exercise promotes some aspect of self-esteem. However, a meta-analysis of 119 studies concluded that whilst physical activity can improve self-esteem, the link between self-esteem and exercise participation is “overstated”. (McGannon & Spence, 2002). Unfortunately, this report uses the terms ‘physical activity’ and ‘exercise’ interchangeably although the conclusion refers to exercise in relation to improved self esteem. A suggested cause of improved self esteem as a result of exercise such as weight training is due to improved body shape and thus self-perception (Fox, 2000). Research analysis conducted by Scully, Kremer, Meade, Graham and Dudgeon (1998) however, concluded that self-esteem
improved with increased physical activity regardless of physical activity type. Few studies have measured self-esteem over time and most focus on the difference between exercisers and non exercisers, rather than the effect of physical activity and lifestyle. In conclusion, the limited research carried out endorses the exercise – self-esteem theory suggesting activity “makes people feel better” (DH, 2004). But it appears self-esteem is not easily changed by success in a single life domain and for many people it needs to be linked to more general changes in self and lifestyle.

2.3.4 Physical activity, wellbeing and mood

It is noted by Bauman (2004) in an epidemiological review of the positive effects of physical activity on health, that whilst there are few current studies clarifying links between physical activity and mental health, there are even fewer exploring the relationship between activity and positive mental health. One of the problems facing researchers looking at the positive mental effects of activity is the valid measurement of both mood and emotion. Scales such as POMS (McNair, Lorr & Droppleman, 1971 cited by Biddle, 2000), the GHQ (Goldberg & Williams, 1988) or the Hospital Anxiety and Depression Scale [HAD], (Dagan, Chadwick & Trower, 2000) are the most frequently used in mental health and activity studies. Although reliable methods of measurement they are also criticised for only determining the level of negative feelings (e.g. depression) and not capturing positive feelings (e.g. happiness) which would indicate a sense of wellbeing. (Biddle 2000).
One of the largest UK studies to examine the relationship between physical activity and positive mental health was conducted by Thirlaway and Benton (1996). This involved 6200 adults randomly selected from the electoral register. Participants detailed their activities over a two week period and completed a validated GHQ. From the results, participants were categorised into five activity based groups ranging from ‘Active’ to ‘Totally Inactive’. Measuring levels of association, Thirlaway and Benton found that higher levels of physical activity were significantly associated with lower GHQ scores (i.e. lower score = better mental health) in women over 30 (p < 0.002) and men over 50 (p < 0.001). There was no association in either gender under the age of 30. Thirlaway and Benton’s results mirror those of a landmark study conducted by Stephens (1988) involving 55,979 participants across four populations in US and Canada. Stronger statistical associations between activity and mental health in females led Stephens to suggest that mental health, or dimensions of mental health, may be more strongly related to physical activity in females than males, although this was not verified by the study. The principal conclusion of the study was the positive association between physical activity and psychological wellbeing.

More recently, Thøgersen-Ntoumani, Fox and Ntoumanis, (2005) looked at the relationship between exercise and three elements of mental wellbeing in employees in a small I.T. company (n=312). The three elements, (physical self, work related mental health and global mental health), plus physical activity and exercise, were measured using seven different validated questionnaires. The results, when exercise was the independent variable, found that exercise levels were positively linked to enhanced feelings of
physical self and enthusiasm for work (p<0.001 with a significance level set at p=0.016). The results when physical activity was the independent variable also indicated that even moderate levels of physical activity were linked to higher physical self, more enthusiasm for work and increased levels of life satisfaction. Although ‘moderate exercise’ is not defined in the paper, the author’s findings lead to their recommendation that employers should promote lifestyle activity in order to benefit from employees with positive mental wellbeing.

A thorough review by Biddle (2000) considered the outcomes of reliable studies (conducted since 1987) which had explored the relationships between activity and mood, emotion or health–related quality of life. Examination of the evidence drawn from this review led Biddle to conclude that "physical activity is consistently associated with positive affect and mood".

Reviews such as Biddle’s provide reliable evidence that exercise does have positive effects on several aspects of mental wellbeing, particularly in the improvement of negative mental health conditions. Areas of research less conclusive relate to the physical and psychological mechanisms involved in the link between exercise and improved mental wellbeing. Although it is likely that multiple mechanisms are involved in a complex relationship between body and mind, hypotheses examining the association between physical activity and improved mental state currently fall into three main categories, biochemical, physiological and psychological.
2.4. Mechanism hypotheses relating activity to mental health.

2.4.1. Biochemical mechanisms

Biochemical theories attempting to explain improved mood after activity include increases in endorphin production, changes in serotonin levels and the effect activity has on neurotransmitters. Hoffman (1997) describes the biochemical hypotheses as being based on observations that there was an increase in plasma beta-endorphin production during long distance running which correlated to positive emotions, post exercise. This was referred to as “joggers high”. Beta endorphins are produced in the brain and secretion is known to be activated by extended exercise (Pauluska & Schwenk, 2000). When exercise stops the effects of this secretion in the body creates a positive ‘behavioural calm’ and in evolutionary terms, this may have been important in allowing a post exercise restoration of energy stores (Hoffman, 1997). Unfortunately, subsequent research has not supported Hoffman’s theory as it is not a common effect amongst all exercising individuals, nor has a correlation between endorphin levels and mood been substantiated (Fox, 1999, Pelusco & Guerra de Andrade, 2005). A second biochemical hypothesis is the monoamine hypothesis. This is based on the theory that exercise increases the synaptic transmission of monoamines, (predominantly serotonin, noradrenalin and dopamine). Monoamines are believed to work in the same way as antidepressant drugs, improving aminergic transmission, but the precise role exercise plays in their regulation has yet to be determined. It is also believed that other factors such as nutrition and the nature of exercise are implicated in the link between activities and hormonal response, (Kreamer
& Ratamess, 2005) but further research is required to clarify these relationships.

2.4.2. Physiological mechanisms

Central to the physiological theories linking activity to mental wellbeing is the thermogenic hypothesis. This involves the elevation of deep body temperature which occurs with physical activity, and has been postulated to being responsible for improved mood following exercise (Koltyn, 1997). Koltyn suggests that as whole body heating is directly correlated to a rise in the release of plasma beta-endorphin levels from the brain creating improved feelings of wellbeing. The perceived therapeutic effects of hot mineral waters, springs, sauna and hot baths have been practiced for generations, based on the theory that a heat induced reduction in muscle activity, together with increased cerebral blood flow, (caused by activity), leads to relaxed emotions and a positive mood. However, a lack of research to substantiate the theory suggests that it is unlikely that physiological mechanisms work in isolation but, when stimulated by activity, combine to create an improved mental disposition (Fox, 1999, Paluska & Schwenk 2000).

2.4.3. Psychological mechanisms

There are four main psychological mechanisms proposed to explain the beneficial effects of exercise on mental health (DH, 2004). However, how these mechanisms work has not been studied extensively and the theories
remain inconclusive and under-researched, particularly in the last decade, (Rochleau, Webster, Bryan & Frazier, 2004; Craft, 2005).

### 4.3.1. Self-efficacy hypothesis

The self efficacy theory was originally proposed by Bandura (1994), and defined as “people’s beliefs about their capabilities to produce designated levels of performance”. Bandura proposes that a strong sense of self-efficacy will enhance accomplishment and wellbeing in many ways. Conversely, people who doubt their abilities have low aspirations and weak commitment to the goals they choose to pursue. In relation to exercise this suggests that an individual’s belief in the ability to exercise is closely related to their ability to carry out the activity. Based on Bandura’s theories, a lifestyle education programme was introduced in 24 High Schools in the USA and claims to provide the first evidence that manipulation of self-efficacy by improving thought and behaviour can increase physical activity in adolescent girls (Dishman et al, 2004). It is hoped that these findings may stimulate further research into the cause and effect nature of mental health and activity.

### 2.4.3.2. Mastery hypothesis

Closely linked to the self-efficacy theory of Bandura is the mastery hypothesis, originally claimed by White in 1959 (as cited by Martinsen & Morgan, 1997) as one which could “easily” explain positive feelings of well-being found with activity. White suggested that as an individual takes command of a physically and mentally challenging activity, a sense of independence and success
results creating a positive emotion. Exercise thus provides a medium for the gradual development of self-empowerment and an ability to gain control over certain aspects of life, particularly important for those with low self esteem or depression (Fox, 1999). A counter argument to this theory however, is that experiencing repeated failures at mastery may lead to decreased feelings of self-efficacy and is therefore counter –productive (Craft, 2005). Unfortunately, since White’s proposal very little in-depth research has been done to prove or disprove these theories.

2.4.3.3. Distraction hypothesis

The distraction hypothesis theory is based on the suggestion that physical activity may serve as a diversion from negative stimuli and lead to improved mood during and after exercise (Peluso & Guerra de Andrade, 2005). It has been used recently to support tobacco users in reducing the number of cigarettes smoked by taking part in bouts of moderate intensity exercise in order to reduce cravings, with some limited but positive results (Daniel, Cropley, Ussher & West, 2004; Usser West, Doshi & Sampuran, 2006). Studies comparing exercise with other distraction activities such as relaxation, and assertiveness training have proved inconclusive (Craft, 2005) and it is likely that distraction is one of several mechanisms affecting mood, depending on the situation, activity and individual involved.
2.4.3.4. Social interaction hypothesis

The DH (2004) suggests that the role physical activity plays in improving social interaction is more important than limited evidence suggests. In their discussion paper on current concepts in mental health and physical activity, Paluska & Swenck, (2000) suggest that a substantial proportion of the benefits of exercise on mental health are derived from the social relationships formed. Social interaction through activity has previously been found to benefit retired age groups (McMurdo, 2000), but a current government initiative, LEAP, give focus to young people. LEAP (DH/SportEngland, 2005) aims to improve physical activity levels in the most deprived areas of the UK, but equally important to the initiative, is the theory that in establishing sports clubs and teams; positive social interaction between young people will increase and psychological well-being will improve as a result.

2.5. Physical activity and happiness

Although the mechanisms outlined lack clarity, the research evidence suggesting that increasing activity can lead to improvements in mental health is persuasive (Biddle, 2000). There is also some evidence, although limited, that physical activity can also improve satisfaction with life, and may increase overall happiness. (Giacoobbi, Hausenblas & Frye, 2003; Stubbe et al, 2007). The Four Population Study by Stephens (1988) remains one of the few large studies to examine the relationship between total activity, lifestyle and psychological wellbeing including positive moods such as happiness. Stephens examined the association between energy expenditure and the
positive affect scores for two domains of activities: recreation, and recreation plus household chores. After grouping the participants in relation to total expenditure levels, Stephens found that for each level of expenditure above the lowest, women were considerably happier engaged in recreation, than recreation plus household chores. One explanation put forward by Stephens is that women were ‘happier’ when able to expend energy recreationally than by when completing household tasks.

2.5.1. The concept of happiness

Happiness is a key component of positive wellbeing although the relationship between happiness and health is complex (Barak, 2006). Happiness is perceived to have an important role in maintaining good health (Argyle, 1997) and it has been suggested that nurturing positive emotions such as happiness may act as a buffer in the prevention of mental illness (Bekhet, Zauszniewski and Nakhla, 2008 citing Seligman, 1998). As yet, it has proved difficult to substantiate the extent to which happiness and good health are linked. The study of happiness is described by Barak (2006) as a ‘relative newcomer’ in clinical research, and there is currently little consensus over its definition or cause. Happiness is defined by Tatrkiewicz, 1976 (as cited by Bekhet et al. 2008) as “a lasting, complete and justified satisfaction with life as a whole”, Argyle (1997) suggests happiness is a “positive inner experience” and the “ultimate motivator for all human behaviours”, Veenhoven (2004) describes it
as “the ultimate goal of life”, whilst Diener (1984) suggests that happiness is the sum of many small pleasures which may fluctuate substantially over time.

2.5.2. Causes of happiness

Different academic theories postulate about the different causes of happiness. For example, social comparison theories suggest that happiness results from a comparison between a standard and an actual condition. Telic theories suggest that happiness is gained when some state, goal or need is fulfilled, (Furnham & Cheng, 2000) and activity theories state that happiness is derived from social interaction, leisure or other specific activities, Argyle (1997). Bekhet et al. (2008), return to the theories of Maslow (1970) in suggesting that there is strong relationship between gratification of needs and human happiness. Fulfilment of higher needs makes people happier, but to in order to obtain fulfilment, better environmental conditions (e.g. familial, economic, political and educational) are deemed necessary. A study by Furnham and Cheng (2000) explored the 'lay theories' of happiness, i.e. those which are personal and/or individual rather than scientifically observed and tested. Using a group of 230 participants, questionnaires to measured personality, self esteem, happiness and causes of happiness. From the results, identifying causes of happiness, Furnham and Cheng found that males believed that personal factors such as intelligence, physical attractiveness and financial security were key elements in happiness compared to females who believed friends and a strong social network was more important. However, by carrying
out a path analysis across all questionnaire results, the study concluded that the most powerful determinant of happiness was personality and self esteem, with those participants found to be stable, tender-minded and extravert, being the most happy. The link between personality and happiness has been proposed in several other studies including Furnham & Brewin, 1990; Furnham & Cheng, 1997; and Francis, 1999.

In 2002, Diener and Seligan compared undergraduates who scored high on a happiness and wellbeing questionnaire with those who had average scores. They concluded that ‘very happy’ individuals spent less time alone and had a more active social life than ‘moderately happy’ people. ‘Very Happy’ people also had stronger romantic and social relationships and were also found to be more extraverted and less neurotic. These studies confirm earlier findings by Argyle and Lu (1990) who concluded from the results of their study involving undergraduates (N= 131), that extraverts were happier than introverts who had less active social lives, attended fewer parties and were involved in fewer sports.

Jayasvasti and Kanchanatawan (2005) in a study involving 438 pregnant women found that women with a stable and extrovert personality type could be predicted to have a high happiness score. Other factors found to have a strong positive correlation with happiness (p < 0.05) were a good marital relationship and a high family income. The authors also found that pregnant women aged 31-35 had the higher levels of happiness than younger women, perceived to be due to more stable emotion, personality and financial security.
In examining these studies a consideration should be that the population samples may not be representative of the general population. Young undergraduates or women experiencing pregnancy could be perceived to be in unique but short term lifestyle situations which are not common to the general population but may have had an effect on personal happiness at that time. In 2006, a study by Cornelisse-Vermaat, Antonides, Van Ophem and Maassen Van Den Brink, looked at the relationship between happiness, perceived health and BMI in 700 Dutch citizens. The results of the study suggested that happiness was positively affected by being married or cohabiting. BMI also had an effect on happiness but was less significant. However, 98% of the sample was normal or overweight and this may have skewed the relationship between BMI and happiness identified in the study.

Links between happiness, relationships and the economic environment has been found in studies cited by Cornelisse-Vermaat et al., (including Easterlin 2001; Cohen, 2002; Van –Praag & Ferrer-i-Carbonell, 2004), who all concluded that income, housing, leisure, friends and marriage were the most influential factors. Conversely, studies by Oswald, (1997), Argyle (1999); Bowling & Windsor, (2001); Gerdtham & Johannesson, (2001); and Frey & Stutzer, (2002) also cited by Cornelisse-Vermaat et al., found children, gender, age, education and work had the highest positive correlation with feelings of happiness.

The results of these studies would suggest that no single factor automatically produces happiness in people and even happy people are not consistently happy. Diener and Seligan (2002) suggest the happiness ‘is like beautiful
symphonic music – necessitating many instruments without any one being sufficient for beautiful quality.”

2.5.3. The relationship between happiness and physical activity

Sport and exercise are described by Hill and Argyle (1998) as “the simplest and most reliable means” of inducing positive moods. Argyle cites the work of Thayer (1989) who suggests that even a 10 minute brisk walk can have positive measurable effects. A limitation of many of the studies investigating happiness is that the studies have used small selected samples without control groups which have impacted on the ability to generalise the study findings to larger populations. This leaves the association between activity and happiness uncharted in large population groups. A recently published study by Stubbe, Moor, Boomsma and Geus (2007) attempted to address this by investigating the association between exercise participation, life satisfaction and happiness in 8000 Dutch citizens aged between 18-65. The participants were selected from the Netherlands Twin Registry and involved 162 identical twins, 174 non-identical twins and sibling pairs, plus 2842 unrelated individuals. The data collected by a mail survey, defined “exercisers” as those who had partaken in at least one leisure time exercise activity (exceeding 4 METs) at least once a month, and the remainder were defined as "non-exercisers". Subjective wellbeing and happiness were assessed using two validated questionnaires producing total score in both areas. The results identified that at all ages and in both sexes, exercisers
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were more satisfied with their lives and happier than non-exercisers (p’s <0.01). The estimated mean scores across all age groups were 22.3 for non-exercisers and 22.8 for exercisers although happiness levels were higher for exercisers than non-exercisers in all age groups and for both genders. (See Table 2.1)

Table 2.1 Mean scores of life satisfaction and happiness as a function of exercise participation, gender and age.

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Sex</th>
<th>Exercise participation</th>
<th>Life Satisfaction</th>
<th>Happiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-30</td>
<td>Males</td>
<td>Exercisers</td>
<td>27.6</td>
<td>23.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>26.8</td>
<td>22.8</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>Exercisers</td>
<td>27.5</td>
<td>22.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>26.4</td>
<td>21.9</td>
</tr>
<tr>
<td>31-45</td>
<td>Males</td>
<td>Exercisers</td>
<td>27.5</td>
<td>23.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>26.9</td>
<td>22.8</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>Exercisers</td>
<td>27.1</td>
<td>22.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>26.7</td>
<td>22.6</td>
</tr>
<tr>
<td>46-65</td>
<td>Males</td>
<td>Exercisers</td>
<td>27.3</td>
<td>22.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>26.2</td>
<td>22.0</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>Exercisers</td>
<td>26.4</td>
<td>22.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non exercisers</td>
<td>25.8</td>
<td>21.9</td>
</tr>
</tbody>
</table>

(Stubbe et al, 2007).

Further statistical analysis using a twin-control factor led Stubbe et al to believe that the association between exercise, happiness and life satisfaction was not casual but was due to a “underlying factor”. They concluded the cause of the association was most likely due to genetic make-up, as previous
studies cited by the authors had suggested that both exercise behaviour (De Geus et al. 2003; Fredriksen & Christensen, 2003; Lauderdale et al, 1997) and psychological wellbeing (Lykken & Tellegen, 1996; Roysamb et al 2002, 2003, Tellergen et al., 1988) were highly heritable and due to genetic similarities. The effect of a large number of twin and sibling participants could be considered to be a limiting factor in this study, particularly in relation to genetic outcomes, however the author's state that no specific “twin effects” were found if the results from twins pairs were compared to non-twins. In addition, the levels of activity required by the ‘exercisers’, although higher than ‘non-exercisers’, were much lower than international recommendations for activity (as previously stated). The application of higher exercise bandings on the sample group and the effect that this may have had on the positive correlation with happiness would have been interesting to note.

With the exception of this study, the possible relationship between total activity and happiness appears unexplored, However, if activity can promote positive moods (Hills & Argyle, 1998; Biddle, 2000; Mutrie, 2000; Giacobbi et al, 2005), and exercise and happiness are linked (Stubbe et al, 2007), it can be hypothesised that individuals who participate in higher levels of activity are not only physically and mentally healthier, but also happier.

The main aim of this current study is to test the hypothesis that there is a positive correlation between physical activity and happiness in working adults aged between 21 and 65 years. The study also aims to examine if there is any differentiation between the source of activity (e.g. occupational and non occupational activity) and measured happiness, and thirdly to consider if age or gender have a significant effect on happiness levels of adults.