

**LUCY ANTHONY**

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**THE RELATIONSHIP BETWEEN BODY MASS**  
**INDEX, DIET AND PHYSICAL ACTIVITY IN**  
**ADOLESCENTS**

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## **Abstract**

It has been claimed that a lack of physical activity in young people increases the risk of obesity in the younger population. The current environment in which we live is changing gradually to one that promotes a sedentary lifestyle, in turn reducing physical activity levels. The purpose of the study was to investigate whether adolescents' physical activity levels and dietary intake related to their Body Mass Index (BMI), while also relating to the maximal oxygen uptake ( $\dot{V}O_2$  max). A school in South Wales was involved in the study, where 42 participants (males,  $n = 23$ ; females,  $n = 19$ ) aged 14years – 15 years (mean age: 14.6) were chosen at random. Two questionnaires identifying physical activity levels and dietary intake were designed by the author. Height and weight of the participants were also measured to calculate their BMI status. The evaluation of BMI values resulted in the following means, males BMI =  $21.42 \pm 2.67$  kg/m<sup>2</sup>, and females BMI =  $22.36 \pm 3.38$  kg/m<sup>2</sup>. All descriptive statistics were assessed for normality, resulting in the use of Pearson Product Moment Correlation Coefficient, to distinguish relationships between the variables in question. Following analysis of the results, there was no evidence found of a relationship between physical activity and BMI, or between BMI and  $\dot{V}O_2$  max ( $p > 0.05$ ). Nevertheless a significant positive relationship ( $p < 0.05$ ) was identified between BMI and dietary intake and between physical activity and  $\dot{V}O_2$  max, showing that a higher score of diet and physical activity relates to higher values of BMI and  $\dot{V}O_2$  max. In contrast to the statistical findings, the study found that obese and overweight participants had a lower physical activity score when compared to average weight participants. Further research is required to generalise findings and identify barriers and factors that affect participation, in turn aiding the design of future interventions to promote a healthy lifestyle and physical activity.

# **CHAPTER I**

## **INTRODUCTION**

## **Introduction**

There is a high level of debate concerning the physical activity levels of young people and whether the fact that they are not active enough increases their risk of becoming obese. (Martinez-Gonzalez *et al.*, 1999)

In previous years, the younger generation were considered to be fitter and more active compared to other age ranges (Bouchard, 2000), however evidence has shown that this is not the case now. Changes in technology have occurred in the past few decades that have affected physical activity levels of the population dramatically (Goran *et al.*, 1999). The current environment in which we live is changing gradually to one that promotes less physical activity resulting in sedentary lifestyles. Physical activity is an important aspect in maintaining a healthy status, as highlighted in the literature. The risk of developing heart disease, hypertension, osteoporosis, colon cancer and obesity has been found to decrease with regular physical activity and exercise (Bouchard, 2000).

Health enhancing effects can be promoted by physical activity and exercise with even the smallest change in energy expenditure improving an individual's health status. The relationship between obesity and low levels of physical activity was identified by several studies (Goran *et al.*, 1999; Trost *et al.*, 2001), suggesting that obese individuals often reported low levels of physical activity.

Obesity has been defined as a condition where there is excess body weight due to an abnormal accumulation of fat (Schemmel, 1980). Obesity has been identified as a

universal epidemic by the World Health Organisation (WHO: online 2008). There is a wide range of causes of obesity, though generally the cause develops from an imbalance of energy expenditure and intake (Goran *et al.*, 1999). Diseases that are related to obesity include cardiovascular disease and type 2 diabetes, which have been found to increase an adolescent's morbidity and mortality rates (Must, 1996).

Psychological and social hazards of obesity are serious factors contributing to the prevalence of obesity (Braet *et al.*, 1997), with aspects such as self-esteem, self-perception and body image having a negative effect on an individual (Strauss, 2000). Physical activity and exercise are found to have a reducing effect on anxiety and can improve physical self-perceptions and self-esteem (Fox 1999). These have been shown to improve quality of life (Ravens-Sieberer *et al.*, 2001) and strengthen attitudes in aid of behaviour change (Madden *et al.*, 1992).

The implementation of physical activity interventions in reducing the risk factors for obesity has been proven affective (Sahota *et al.*, 2001). The World Health Organisation (WHO: online 2008) states that 'schools present unique opportunities to provide time, facilities and guidance for young people', therefore enhancing a physically active lifestyle.

The purpose of this study was to examine the relationship between physical activity, dietary intake and the participants' Body Mass Index (BMI) while relating to maximal oxygen uptake ( $\dot{V}O_2$  max), a measure of aerobic fitness. It is believed that this research will enable an understanding of current physical activity levels and

dietary intake among adolescents, in turn aiding the process of evaluating adolescent obesity and facilitating recommendations to alleviate the current epidemic.

### **1.1. Hypothesis**

The hypotheses are that:

H01 – There is no significant relationship between BMI and dietary status.

Null H01 – There is a significant relationship between BMI and dietary status.

H02 – There is no significant relationship between BMI and physical activity

Null H02 – There is a significant relationship between BMI and physical activity.

H03 – There is no significant relationship between BMI and  $\dot{V}O_2$  max.

Null H03 – There is a significant relationship between BMI and  $\dot{V}O_2$  max.

H04 – There is no significant relationship between  $\dot{V}O_2$  max and physical activity.

Null H04 – There is a significant relationship between  $\dot{V}O_2$  max and physical activity

## **CHAPTER II**

# **REVIEW OF LITERATURE**

## **Review of Literature**

### **2.1. Childhood Obesity**

There is said to be a world wide epidemic of those who are overweight and obese and that this is an independent risk factor for increased morbidity and mortality (Deckelbaum *et al.*, 2001). Many researchers have provided strong evidence that higher levels of body mass index (BMI) during childhood can predict overweight and obesity in later life (Maffeis *et al.*, 1998).

Family environment and lifestyles have been found to contribute to the increased prevalence of obesity (Maffeis *et al.*, 1998). The increases in body weight are associated with increased food supply and caloric intake accompanied by decreasing levels of physical activity (Deckelbaum *et al.*, 2001).

Obesity has been defined as a condition where there is excess body weight due to an abnormal accumulation of fat (Schemmel, 1980). Most researchers agree that an individual is obese when their body weight is more than 15% above an ideal weight. The fundamental causes behind the rising levels of childhood obesity are an increase in energy dense food that are high in fat and sugar and low in vitamins and minerals, and decreased levels of physical activity (WHO, online 2008)

Goran *et al.* (2001) reviewed four longitudinal studies that showed the probability of overweight at 35 years old for children with BMI in the 85<sup>th</sup> to the 95<sup>th</sup> percentiles increased along with age. The most accurate prediction for adult weight was BMI

calculations at 18 years of age with the accuracy then decreasing for BMI calculations below the age of 13 years. The review concluded that the persistence of paediatric obesity into adulthood increases according to the age at which obesity is initially present.

Childhood obesity leads to approximately 30% of adult obesity. Guo *et al.* (2002) found through a longitudinal study that children or adolescents with a high BMI were more likely to become overweight or obese adults. Hardman *et al.* (2004) stated that obesity increases the risk of all-cause mortality by approximately 50%. Obesity increases an individual's risk of developing associated diseases, in particular type 2 diabetes (Must *et al.*, 1999).

Many studies have been conducted into obesity in an attempt to identify the causes and risks. Maffei (2000) states that twin adoption and family studies indicate that inheritance accounts for 25% to 40% of inter-individual difference in adiposity. However, genes involved in weight gain do not directly cause obesity, but can increase the susceptibility of fat gain in subjects in a specific environment. Factors concerning genetic and environmental issues are said to influence a positive energy balance, resulting in obesity.

Martinez-Gonzalez *et al.* (1999) conducted a study with the aim of estimating the association of leisure time sedentary and non sedentary activities with body mass index and the prevalence of obesity. The researchers (Martinez-Gonzalez *et al.*, 1999) explain that a decrease in energy intake and the increase in obesity suggest that the lack of physical activity may be a key determinant in the growing rate of

obesity. The results of the study revealed that a higher body weight and obesity are strongly associated with physical inactivity and a sedentary lifestyle.

A vast amount of research has been conducted that shows the importance of the family environment in contributing to the increasing prevalence of obesity. One study undertaken by Whitaker *et al.* (1997), found that the risk of adult obesity was greater in both obese and non-obese children if at least one parent was overweight. Similarly, Must (1996) conducted a review which indicated that long term health is negotiated by overweight during adolescence. The researcher found that overweight in adolescence and the persistence of overweight into adulthood was found to have a likely effect on long term health, possibly resulting in chronic diseases. In addition they reported that increased risk could possibly be present if obese adolescents were no longer obese in adult life.

Many studies have been conducted looking specifically at behaviour change and children with obesity. There are many co-morbidities associated with childhood obesity, which include both psychological and physiological factors. Psychological problems associated with childhood obesity include negative self-esteem, depression, anxiety and the feeling of rejection (Deckelbaum *et al.*, 2001). Strong evidence suggests that BMI in childhood is associated with various physiological and psychological effects which have a possibility of following into chronic disease risk factors in adulthood.

## **2.2. Childhood Obesity and Physical Activity**

Children's levels of physical activity are highly variable, and can be influenced by a range of factors, including physiological, psychological, and sociocultural factors. The beneficial effect of physical activity in children is supported by controlled exercise interventions implemented in schools, designed to increase children's activity levels, with results suggesting promising strategies (Sahota *et al.*, 2001).

Trost *et al.* (2001) identified that physical inactivity is an important contributing factor in the maintenance of childhood obesity. Interventions to promote physical activity in obese children have been shown to increase self-efficacy perceptions regarding exercise, increase health awareness and increase parental attitudes towards physical activity.

The World Health Organisation (2008) developed the 'Global Strategy on Diet, Physical Activity and Health (DPAS), which is a prevention aim strategy that aims to reduce the prevalence of obesity and their common risk factors, primarily unhealthy diet and physical inactivity.

The Health Education Authority (1997) stated that establishing an active lifestyle at a young age has been shown to be important in promoting lifelong participation in physical activity, with early experiences influencing subsequent behaviour.

Lack of physical activity is said to be an important contributing factor in the development of childhood obesity.

With regards to obese children, physical activity and exercise can:

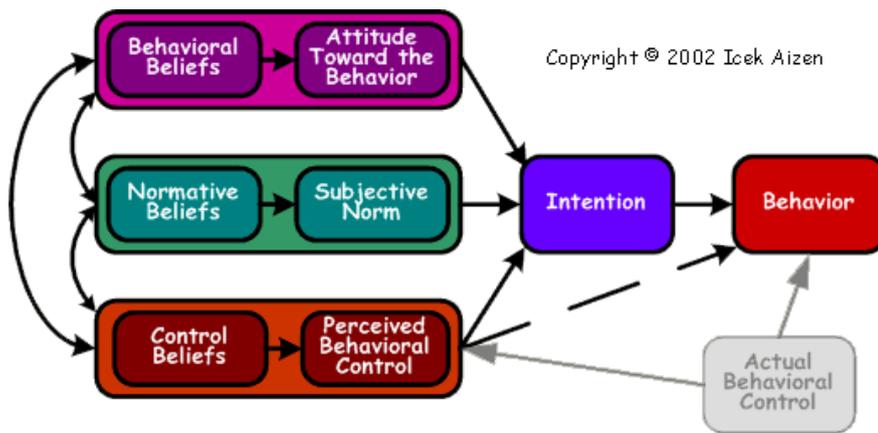
- Reduce the risk of dying prematurely
- Reduce the risk of developing heart disease
- Reduce the risk of developing cardiovascular disease
- Reduce the risk of developing diabetes
- Reduce the risk of high blood pressure
- Reduce the risk of developing colon cancer
- Reduce feelings of depression and anxiety
- Help to build and maintain healthy bones, muscles and joints
- Promote psychological well-being

(Bouchard, 2000)

It is important to consider the factors that influence physical activity in obese children when designing interventions and evaluating particular studies. The Health Education Authority (1997) suggests that together with a balanced diet and behaviour modification, physical activity can make an important contribution to reducing childhood obesity. However, it is difficult to determine the precise effects of physical activity upon young people, due to growth and maturation influencing body composition (Harris and Cale, 2006).

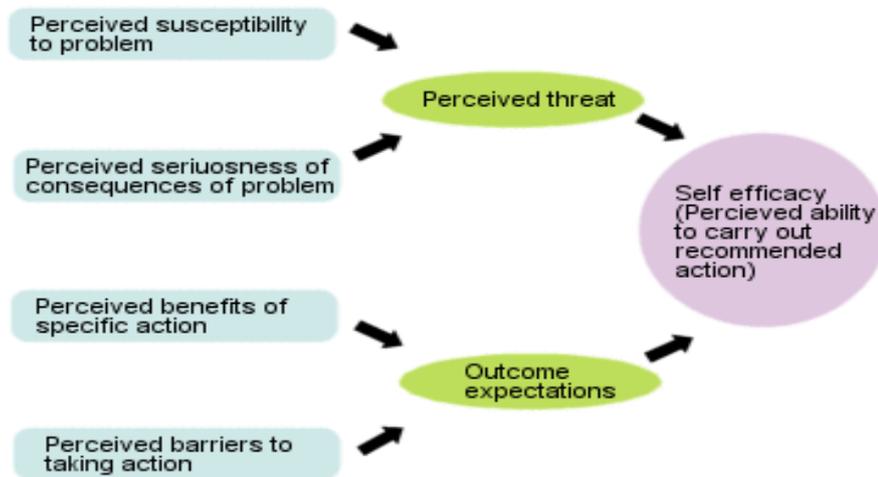
Many studies have been conducted specifically looking at behaviour change and children with obesity. This data is especially useful in finding out why obese children don't exercise. As with many behaviours, other factors such as feelings and self-efficacy can discourage an individual from participating in exercise. The theory of planned behaviour (TPB) developed by Ajzen (1988) is a modified version of the

theory of reasoned action. Madden *et al.* (1992) states that the theory is about the link between attitudes and behaviour and helps predict people’s behaviour. This theory helps us understand how we can challenge people’s behaviour and is important when helping to get overweight children to adopt a healthier lifestyle. Figure 1 shows a diagram of Ajzen’s Theory of Planned Behaviour.



**Figure 1.** Theory of Planned Behaviour (Ajzen, I. 1991)

The Health Belief Model can have a large impact on the degree to which a person will participate in regular physical activity (Buckworth *et al.*, 2002). Figure. 2 shows an illustration of the model. Beliefs such as perceived benefits of a particular behaviour, perceived barrier to that behaviour, and perceived threats posed by not engaging in a particular behaviour correlate significantly with preventive health behaviour (Janz *et al.*, 1984). An example of the perceived benefits of exercise might include improvement in physical appearance and long-term health benefits, while perceived barriers might include committing the time and effort required to maintain an exercise program. A child with high self-esteem would be more likely to overcome perceived barriers and would be more likely to perceive the benefits on their quality of life.



**Figure 2.** Health Belief Model (<http://ohprs.ca>, undated)

An active lifestyle in childhood could play a valuable role in reducing the development of cardiovascular disease risk factors (Health Education Authority, 1997). Research indicates that cardiovascular disease may begin to develop in childhood, and individuals who develop risk factors at a young age have a higher risk in adulthood (Goran *et al.*, 2003)

The World Health Organisation (2008) proposes that young people aged 5 years-18 years should:

- Daily participate in 60 minutes of moderate to vigorous intensity physical activity that involves a variety of activities.

### **2.3. Physical Activity and Health**

Physical activity and physical fitness have been linked with health and longevity for many years (Hardman *et al.*, 2004). It has been suggested that children are becoming less active (Deckelbaum *et al.*, 2001) and present greater problems with obesity and obesity-related illnesses in later years. Adolescents typically spend more than five and a half hours a day watching television or playing video games and there has been a dramatic decline in physical activity such as children walking and cycling, particularly to school (WHO, online 2008).

The World Health Organisation (WHO, online 2008) has developed a list of main factors that hinder the participation of young people in physical activity:

- Lack of time
- Poor Motivation
- Inadequate support and guidance
- Feelings of embarrassment or incompetence
- Lack of safe facilities
- Ignorance of the benefits of physical activity

The optimum amount of exercise for longevity has been difficult to identify due to the difficulty in accurately measuring physical activity (Hardman *et al.*, 2004). Childhood and adolescence are crucial periods of life when concerning physiological and psychological aspects, due to dramatic changes taking place (Ortega *et al.*, 2008). During the up bringing of children and adolescents, eating and lifestyle

behaviours are established which can have an ongoing influence on their adult behaviour and health status (Ortega *et al.*, 2008).

Starnes *et al.* (1995) suggested that the greatest potential cardiovascular benefit of exercise training is attained at a frequency of 60 minutes a day at a threshold of 75% maximal aerobic power ( $\dot{V}O_2$  max), however most physical demands of daily activities does not meet this criteria.

Harris and Cale (2006) conducted a review of children's fitness testing prompted by concerns about low fitness levels, which could have major consequences on their future health. The specific aim of the study was to determine the effectiveness of using fitness tests on welsh children. The researchers concluded that a large quantity of the data generated by fitness testing can be problematic and not capable to withstand rigorous interpretation, possibly due to methodological limitations. However, Harris and Cale (2006) also stated that appropriately employed fitness testing can play a role in promoting physical activity and also educate children about physical activity and physical fitness.

Estimates from the Harvard Alumni Health study suggests that the amount of additional life resulting from adequate exercise, compared with sedentary individuals is two or more years (Paffenbarger *et al.*, 1986). However, it is important to remember that health is about more than avoiding premature mortality. Health is about living without illness and with the functional capacities to do things while feeling good (Hardman *et al.*, 2004). The Health Education Authority (1997) evaluated several studies, concluding that caloric intake may have a greater influence

on body weight than physical activities, but studies evaluating both factors are sparse.

A current area of concern is the level of energy intake consumed by children and adolescents. Growth and development occurs at a young age, therefore a healthy lifestyle must begin in childhood (Harris and Cale, 2006).

It is important to monitor data to determine whether there is a change in physical activity levels and energy intake status along a number of years. Data concerning this is limited, however Durnin (1992) collected data from 1930 to 1980 which demonstrated a progressive decline in energy intake among young people. The researcher concluded that a marked reduction in energy intake without a change in body mass must indicate a reduction in energy expenditure, Durnin (1992) therefore states that particularly in the UK young people have become more sedentary in the last 50 years.

#### **2.4. Children's Attitudes Towards Physical Activity**

A current area of concern is the lack of physical activity performed by children, and the link to their attitude to exercise. A child who has a parent with a positive attitude to physical activity is more likely to partake in regular exercise and a healthier diet, aiding the weight loss process, improving their quality of life and decreasing the risks of disease and obesity in adulthood.

Identifying social and psychological influences affecting children's attitudes about physical activity is an important step in understanding individual differences in activity involvement. A study conducted by Brustad (1993) examined the influence of parental socialization and children's psychological characteristics upon attraction to physical activity. The results suggested that parental physical activity, parental encouragement levels, children's gender and children's perceived physical competence are important influences upon children's attraction to physical activity.

It is probable that children and adolescents share the same sedentary habits and attitudes as their parents and only a small number of individuals experience regular physical activity, aiding the development of a healthy body.

Armstrong *et al.* (1990) conducted a cross sectional study to examine the patterns of physical activity among British school children aged 11years to 16years to assess whether the children experienced intensity and duration of physical activity that stress the cardiopulmonary system. The study found that British children have surprisingly low levels of habitual physical activity. Findings concluded that boys are more active than girls, however the pubertal stage of development or body fatness did not seem to be sensitive indicators of physical activity in either girls or boys.

## **2.5. Depression, Self-esteem and Obesity**

There are a number of social and environmental factors that have an effect on childhood obesity and physical activity levels. The amount of obesity among British children is said to be affected mainly by low physical activity levels and this behaviour is more likely to lead to a sedentary lifestyle.

Adolescent obesity is a strong predictor of adult obesity. Studies have suggested an association between depression in adolescence and higher body mass index (BMI) in adulthood. However, whether depression leads to obesity or obesity causes depression is unclear. Goodman *et al.* (2002) conducted a longitudinal study to determine whether depressed mood predicts the development and persistence of obesity in adolescents. The study concluded that depressed adolescents are at increased risk of the development and persistence of obesity during adolescence. Similarly, Franklin *et al.* (2006) found that obesity impacts on the self-perception of children entering adolescence, especially girls. The researchers (Franklin *et al.*, 2006) also state that obese children are at a higher risk of low competence in sports, physical appearance and peer engagement.

Although childhood obesity may have detrimental consequences for childhood self-esteem, the prevalence and magnitude of this problem is controversial. Strauss (2000) found that obese children with lower self-esteem demonstrate higher levels of sadness and depression, which is found to lead to decreased levels of physical activity. The study concluded that if a child has low self-esteem there is an increased

risk of higher rates of sadness and loneliness, which can decrease their attitude towards physical activity and exercise.

Braet *et al.* (1997) conducted a study exploring the relationship between obesity and psychosocial adjustment. Findings from this study suggested that effective physical activities, training and exercise, and positive reinforcement strategies could enhance self-competence and prevent the development of obesity-related diseases in adulthood.

There have been several studies within this field of research which summarise that exercise promotes therapy for depression and anxiety. Fox (1999) conducted a study which concluded that moderate regular exercise and physical activity should be considered as a viable means of treating depression and anxiety and improving mental health along with physical health.

## **2.6. Benefits of Physical Activity and Exercise**

Young people who participate in physical activity have been found to accrue both short and long-term health benefits (Health Education Authority, 1997). Physical activity is said to help in the prevention and treatment of obesity in children. As stated by Deckelbaum *et al.* (2001) there are three levels of prevention towards childhood obesity:

1. Primordial prevention
2. Primary prevention
3. Secondary prevention

Primordial prevention aims toward maintaining a normal BMI status throughout childhood and adolescence; primary prevention is directed towards preventing overweight children (BMI being in the 85<sup>th</sup> to 95<sup>th</sup> percentiles) from becoming obese; and secondary prevention directed at treating obese children (BMI being over 95<sup>th</sup> percentile) to reduce co-morbidities and reverse overweight and obesity if possible.

Goran *et al.* (1999) provided an overview of research that examined different interventions to prevent obesity in children. Almost all studies indicated that the most effective strategy for promoting physical activity in children were theory based, involving school or community interventions that involve the whole family. Whether aerobic capacity or physical activity patterns in children affect long-term adult health outcomes were found to be unknown. However, given that patterns of physical activity formed during childhood tend to follow into adulthood, physical activity is likely to have both direct and indirect health consequences later in life.

Another study also focusing on physical activity interventions and obesity was conducted by Sahota *et al.* (2001) with the aim of determining whether risk factors of obesity were reduced by physical activity interventions. It was concluded that risk factors for obesity can be successfully targeted in schools and that change of behaviour can be achieved in this environment. From the results of this study it can be seen that if a child adopts a healthy behaviour to improve their body then this may result in a decrease of risk factors caused by obesity and may enhance quality of life in adulthood.

A longitudinal study conducted by Maffeis *et al.* (1998) with an aim to investigate the relationships between diet, body composition, physical activity and parent's obesity indicate that parent's obesity was the main risk factor for children in the chosen age range which suggests that changes in behaviour may not occur without the support of parents.

From a psychological point of view, the benefit of a child exercising is that it provides distraction from sedentary behaviour and day-to-day stressors. This is known as the distraction hypothesis and states that this process can result in mood-enhancing effects (Buckworth *et al.*, 2002). An overweight or obese child would especially benefit from physical activity and exercise due to the fact that it will reduce their body weight and decrease the chance of obesity extending into adulthood and also decrease the likelihood of life threatening diseases occurring, therefore improving quality of life as well as psychological and physiological well-being.

Considerable research has recorded multiple risk factors concerning the effects of childhood obesity when associated with low levels of physical activity and high energy intake. Many researchers have evaluated these risk factors as having a detrimental effect on an individual's health and well-being in later life. The aim of this study is therefore to investigate whether physical activity and diet has an effect on adolescents BMI values and physical fitness.

# **CHAPTER III**

## **METHODOLOGY**

## **Methodology**

This study attempts to determine a relationship between physical activity levels, dietary intake and Body Mass Index (BMI) while also investigating  $\dot{V}O_2$  max values. Two questionnaires were designed that identified a participant's physical activity level and dietary intake, being evaluated to determine whether the two variables are related to with the participant's BMI. This chapter defines the utilized methods and data analysis of the study.

### **3.1. Sample**

The study was undertaken in a large comprehensive school in the Carmarthenshire area. Prior to the start of the investigation and before the collection of any data, ethical consent was obtained from the UWIC Research Ethics Committee (UREC). The study focused on pupils in year 10, that is those young people aged 14years-15 years old. This group was selected as it is accepted that risk factors concerning obesity are more prevalent in adulthood if an individual is an overweight or obese adolescent (Guo *et al.*, 2002). Both sexes were evaluated to make the study relevant and valid. Participants were selected through a sample of convenience including mixed academic and physical ability; a group containing three form groups were chosen at random to participate in the present study.

There were 42 participants within the study, 23 males and 19 females. The mean and standard deviation measurements of the participants were  $164.2 \pm \text{SD}$  cm in height and  $59.6 \pm \text{SD}$  kg in weight. The mean age of the participants was  $14.6 \pm \text{SD}$  years as all participants were currently in year 10. Prior to the start of the study each participant was given a participant information sheet and consent form (See Appendix A), and each participant was required to provide written informed consent along with their parent's/guardian's consent prior to taking part in the study.

### **3.2. Questionnaires**

A questionnaire measuring physical activity level was designed (Appendix B), and also a diet intake questionnaire (Appendix C). The physical activity questionnaire consisted of thirteen questions concerning a variety of aspects regarding day-to-day living. The questions were formulated from the identification of key issues found from the literature concerning physical activity levels and general lifestyle behaviour, while taking into consideration previous questionnaires such as the 'Global Physical Activity Questionnaire' (WHO, no date). The dietary intake questionnaire consisted of three questions concerning a recall of food consumed within the previous twenty four hours. As school pupils were used for research the questionnaires were anonymous.

The measurement of the participant's physical activity levels was determined via an evaluation of the responses to the seven questions portraying high or low physical activity levels. In relation to the dietary intake questionnaire, an evaluation was made

about the amount and type of food consumed over a time period of twenty four hours.

The questionnaire was presented to the participants explaining the purpose. The participants were asked to complete the questions as honestly as possible, with the researcher available to answer any queries. A chaperone was present at all times.

### **3.3. Conducting the research**

The research was conducted in December 2007 and January 2008 over a period of two weeks. A letter was sent to the head teacher of the prospective school requesting permission to carry out the study using the schools pupils (Appendix E). Permission was given via a letter, and a meeting was arranged with a member of staff of the Physical Education department, discussing a suitable time to conduct the research. It was decided that the questionnaires were to be administered in a Physical Education lesson, along with measurements of height and weight being done in the same session.

The author measured the height and weight of all participants following the completion of the questionnaires. The height of the participants was measured in metres, determined by a stadiometer and a digital weighing scale (SECA model 770) supplied by the university and measured weight in kilograms.

It was necessary in gain informed consent from both parents/guardians and participants due to the age of the participants and nature of the study. Once the

consent forms had been returned, pupils completed the relevant procedures of the study. A total of 50 consent forms were given to pupils with a response rate of 84%.

Following the completion of relevant data, a multistage fitness test (bleep test) was undertaken in a separate session to evaluate the participant's  $\dot{V}O_2$  max. The multistage fitness test is used as an estimate of individuals  $\dot{V}O_2$  max, which involves running continuously between two points that are 20 metres apart which are synchronised with a pre-recorded CD. The bleep test CD was supplied by the participating school. Prior to the participant's participation in the test, they each completed a Physical Activity Readiness Questionnaire (PAR-Q) to determine their physical health (See Appendix D). The multistage fitness test was conducted in the school sports hall, the area being inspected for safety prior to the test. The primary researcher provided the participants with an explanation of the purpose and procedures of the test, following the explanation the participants were divided into four smaller groups to promote the safety of each participant. A chaperone was again present at all times.

### **3.4. Data Analysis**

Once the questionnaires and multistage fitness test were completed, the participant's BMI was calculated to assess their weight status, using the height and weight values.

The BMI is the mass (weight, kg) divided by the square height (m<sup>2</sup>);

$$\text{BODY MASS INDEX} = \frac{\text{KG}}{\text{M}^2}$$

The participant's physical activity levels were calculated by the answers to seven questions. If a participant marked an answer relevant to a high physical activity level, this scored a three; similarly if a participant marked an answer relevant to an average physical activity level, this scored a two, the same applied with a low physical activity level answer, and this scored a one. The seven scores were then added together to give a total score for each participant. The possible scores of the evaluation range from 7 ( $7 \times 1 =$  not physically active) and 21 ( $7 \times 3 =$  physically active) with an average physical activity level scoring 14 ( $7 \times 2 =$  moderately physically active).

To test for a relationship between adolescents' BMI status, physical activity levels, dietary status and maximal oxygen uptake ( $\dot{V}O_2 \text{ max}$ ) a Pearson's Product Moment Correlation Coefficient was used. The SPSS 12.0.1 programme was used to perform the statistical test, using the participants' BMI, physical activity, diet and  $\dot{V}O_2 \text{ max}$  scores, to establish whether the data combined showed a positive or a negative relationship between the variables in question. An independent T-test was used to determine whether males and females differed in their BMI, physical activity levels, dietary status and  $\dot{V}O_2 \text{ max}$  values.

The data obtained from the diet questionnaire concerning dietary intake was evaluated and participants were given a score relevant to their eating habits. If a participant reported a large quantity of food high in fat, these were considered unhealthy and given a score of three, similarly if the participant reported a medium

to low quantity of food which consisted of a variety of fat levels and included some vegetables; these were considered to be moderately healthy and given a score of two. The same applied to participants that reported a medium to low quantity of food which consisted of a number of fruit and vegetables and minimum levels of fat within their diet, these participants were considered to be healthy and given a score of one.

The scores obtained from the multistage fitness test were analysed and converted into a predicted maximum oxygen uptake value ( $\dot{V}O_2 \text{ max}$ ) for each participant. The table used for the conversion of the data (See Appendix F) was developed by the Department of Physical Education and Sports Science Loughborough University (1987)

# **CHAPTER IV**

## **RESULTS**

## Results

Throughout this chapter all heights are given in meters (m) and all weights in kilograms (kg). To determine relationships between the different variables, Pearson Product Moment Correlation Coefficient was used. Preliminary analyses were performed to ensure no violation of the assumptions of normality. The results shown are predominantly of the whole sample, but in parts are separated to define differences between gender and different BMI status.

### 4.1. Descriptive Analysis

The statistics for diet, physical activity, height, weight and BMI are presented in table 1 for the whole sample. As there may be differences in gender within the results, males and females are also presented separately.

**Table 1.** Descriptive analysis for participants within the study.

	Whole Sample			Males			Females		
	Mean	±	Sd	Mean	±	Sd	Mean	±	Sd
Height	1.64	±	7.83	1.67	±	8.07	1.59	±	5.14
Weight	59.57	±	9.86	60.14	±	8.16	58.88	±	11.79
BMI	21.91	±	3.01	21.42	±	2.67	22.36	±	3.38

## **4.2. Evaluating Weight Status**

Weight status was determined by the researcher according to Cole *et al.* (2000) which provided average values of age and gender specific.

- Individuals with a BMI < 17 kg/m were said to be underweight
- Females with a BMI < 24.17 kg/m and males BMI <23.60 kg/m, but > than a BMI 17 kg/m were said to be average weight.
- Females with a BMI >24.17 kg/m, but BMI <29.29, and males with a BMI > 23.60 kg/m, but BMI <28.60 kg/m were classified as overweight.
- Females with a BMI >29.29 and males with a BMI > 28.60 kg/m were classified as being obese.

The following table illustrates the classified weight status of participants according to number and percentage.

**Table 2.** The number and percentage of participants according to classified weight status.

	Females		Males	
	n	%	n	%
Underweight	0	0	2	8.6
Average	15	78.9	16	69.5
Overweight	3	15.8	4	17.4
Obese	1	5.2	0	0

### **4.3. Relationship between Diet and BMI**

One of the aims of the study was to determine subject's dietary habits and to test for a relationship between diet scores and weight status. Due to the low number of obese individuals, a combination of the two higher weight status groups was performed, providing a larger sample for testing. The following results have been obtained using the whole sample, males and females and the different weight status groups. The following table illustrates the statistics of the diet scores recorded by the different variable groups.

**Table 3.** The mean and standard deviation of diet scores

	Means $\pm$ Sd
Whole Sample	1.88 $\pm$ 0.63
Females	1.89 $\pm$ 0.65
Males	1.86 $\pm$ 0.62
Underweight	2.00 $\pm$ 0
Average weight	1.74 $\pm$ 0.51
Overweight/obese	2.33 $\pm$ 0.86

The following table displays the statistics of BMI values recorded by the different weight status groups.

**Table 4.** The mean and standard deviation of BMI values.

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	Mean $\pm$ Sd
Underweight	16.55 $\pm$ 1.34
Average weight	20.98 $\pm$ 2.22
Obese/Overweight	24.60 $\pm$ 3.92
Females	22.36 $\pm$ 3.38
Males	21.42 $\pm$ 2.67

---

The correlation between weight status and diet of the sample identified a positive relationship ( $r = 0.446$ ,  $P < 0.05$ ). This result defines evidence of a significant positive relationship between weight status and diet scores. The summary of the results are displayed in table 5.

**Table 5.** Pearson Product Moment Correlation Coefficient of the sample between weight status and Diet scores.

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	BMI/Diet
Whole Sample	0.446**
Males	0.349
Females	0.544*

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\*\*  $P < 0.01$ , \*  $P < 0.05$

#### **4.4. Relationship between Physical Activity and BMI**

The main aim of the study was to determine subject's physical activity levels and to test for a relationship between the physical activity scores, and weight status. The following results have been obtained using the whole sample, males and females and the different weight status groups. The following table illustrates the statistics of the physical activity scores recorded by the different variable groups.

**Table 6.** The mean and standard deviation of physical activity scores

---

	Means $\pm$ Sd.
Whole Sample	14.53 $\pm$ 2.71
Females	13.52 $\pm$ 2.50
Males	15.34 $\pm$ 2.72
Underweight	14.50 $\pm$ 6.36
Average weight	14.80 $\pm$ 2.46
Overweight/obese	13.55 $\pm$ 3.08

---

The correlation between weight status and physical activity of the sample identified no relationship ( $r = -0.194$ ,  $P > 0.05$ ). This result defines no evidence of significant relationship between weight status and physical activity scores. The summary of the results are displayed in table 7.

**Table 7.** Pearson Product Moment Correlation Coefficient of the sample between weight status and Physical Activity scores.

	BMI/Physical Activity
Whole Sample	-0.194
Males	-0.152
Females	-0.157

#### **4.5. Relationship between $\dot{V}O_2$ max and BMI**

The statistics for the  $\dot{V}O_2$  max values are presented in table 8, including the means and standard deviation for the whole sample as well as each sub group.

**Table 8.** The mean and standard deviation of  $\dot{V}O_2$  max values.

	Mean	Standard Deviation
Whole Sample	38.28	8.23
Males	42.92	7.32
Females	32.66	5.64
Underweight	35.00	7.35
Average weight	40.21	8.18
Obese/Overweight	32.34	6.41

The results of the correlation between  $\dot{V}O_2$  max and BMI of the sample revealed no significant evidence of a relationship ( $r = -0.285$ ,  $P > 0.05$ ). The table below illustrates the results.

**Table 9.** Pearson Product Moment Correlation Coefficient between  $\dot{V}O_2$  max and BMI.

	$\dot{V}O_2$ max /BMI
Whole Sample	-0.285
Males	-0.074
Females	-0.469*

\* P < 0.05

#### **4.6. Relationship between Physical activity and $\dot{V}O_2$ max**

The correlation results between physical activity and  $\dot{V}O_2$  max of the sample indicated a significant positive relationship ( $r = 0.551$ ,  $p < 0.01$ ). The following table displays the results.

**Table 10.** Pearson Product Moment Correlation Coefficient between physical activity and  $\dot{V}O_2$  max.

	Physical Activity/ $\dot{V}O_2$ max
Whole Sample	0.551**
Males	0.377
Females	0.623**

\*\* P < 0.01

#### **4.7. Independent Samples T-Test**

To evaluate whether males and females showed a difference in the BMI, physical activity, diet and  $\dot{V}O_2$  max, an independent sample T-test was performed, showing a variety of significance between the genders.

**Table 11.** The results of the independent samples T-test between gender scores.

	Males			Females			P
	n	m	Sd	n	m	Sd	
BMI	23	21.42	2.67	19	22.36	3.38	0.03
Physical Activity	23	15.34	2.72	19	13.52	2.50	0.90
Diet	23	1.86	0.62	19	1.89	0.65	0.00
$\dot{V}O_2$ max	23	42.92	7.32	19	32.66	5.64	0.32

# **CHAPTER V**

## **DISCUSSION**

## Discussion

In general, the findings of this present study suggest that physical activity measures combined with values of BMI are not significantly related (see table 7). However, the mean physical activity score of the obese and overweight participants were found to be lower than the scores of the average weight participants. The results also show that  $\dot{V}O_2$  max and BMI show no significant relationship (see table 9). The only factors that identify a relationship were BMI and dietary intake (see table 5), and physical activity and  $\dot{V}O_2$  max (see table 10). This study's findings provide support for the hypothesis, as all but two of the hypotheses were proven.

The results concerning BMI and dietary intake provided evidence of a positive significant relationship of the whole sample ( $r = 0.44$ ,  $p < 0.01$ ) and females ( $r = 0.54$ ,  $p < 0.05$ ), but not males ( $r = 0.34$ ,  $p > 0.05$ ). The results show that dietary intake is related to BMI values, suggesting that the data concerning diet was recorded and evaluated accurately.

The present study provides evidence of a significant positive relationship between dietary status and BMI amongst all participants (see table 5). The results of this present study are contrasted by a study conducted by Maffeis *et al.* (1998), who found that nutrient and energy intake did not contribute to the variance of BMI values in 8 year old children. A possible explanation of the contrasting results of the present study and that of Maffeis *et al.* (1998) is the effect of puberty. As stated by the researcher (Maffeis *et al.*, 1998), pubertal growth accelerates between the ages of 8years – 12 years and can have an effect on physical modifications in both genders.

As the participants in the present study were of the age of 14 years– 15 years, the main acceleration of the pubertal stage had been experienced, providing evidence towards the contrasting results.

A study conducted by Tucker *et al.* (1997) supports the results of the present study as energy intake was found to be positively related to adiposity in children. These results indicate that a larger quantity of unhealthy energy intake of children contributes to a higher BMI value and a role in the risk of obesity, independent of the influence of other contributing factors.

The results concerning physical activity and BMI values of the whole sample identified no significant relationship ( $r = -0.194$ ,  $p > 0.05$ ), however, the results concerning mean scores of physical activity provided evidence that obese and overweight participants reported lower scores of physical activity (see table 6). This indicates that although no significant relationship was found between these two variables, obese and overweight participants possessed a lower physical activity score than participants in other weight status groups.

A study conducted by Armstrong *et al.* (1990) provided evidence that the status of individuals body fatness did not indicate the level of physical activity in children aged between 11years – 16 years. Similarly, Maffeis *et al.* (1998) showed that physical activity did not significantly affect a change in individuals BMI values over a four year period ( $p > 0.37$ ). This supports the findings of the present study as no significant relationship was found between BMI and physical activity scores.

The findings of a study conducted by Trost *et al.* (2001) contrast those of the present study, as obese children exhibited significantly lower physical activity levels ( $p < 0.01$ ) than their non-obese counterparts. Trost *et al.* (2001) concluded that obese children were significantly less confident in their ability to overcome barriers to physical activity, presenting a rationale to the findings of the present study.

A study into physical activity has shown that males report a higher physical activity rate than females (Goran *et al.*, 1999). The results of the present study support that of Goran *et al.* (1999) as males displayed a higher mean score of physical activity compared to females (see table 6). A possible explanation of the differences in mean physical activity scores between genders is concluded by Brustad (1993), who states that boys received more encouragement to be physically active than girls. This suggests that external and psychological factors may have an influence on children's attraction to physical activity. Another factor which may have contributed to the lack of relationship between physical activity and BMI is the effect of puberty and maturation status. As stated by Maffeis *et al.* (1998) at the end of puberty if diet intake is constant then it is possible that extra fat re-gain may occur. Although observation of the mean scores of physical activity provided evidence that males reported higher scores, no significant difference was found between the genders when concerning physical activity scores (see table 11).

Further scrutiny of the physical activity questionnaire suggests that parental physical activity levels are an indicator of the participant's own activity patterns. The majority of participants who reported higher physical activity scores also reported their parents as being physically active, similarly participants who reported a low

physical activity score reported their parents as being physically inactive. A number of studies (Maffeis *et al.*, 1998; Trost *et al.*, 2001; Guo *et al.*, 2002) have provided evidence that lifestyle habits in families with obese parents may be different from families with non obese parents, possibly providing encouragement to the obese children that their lifestyle habits are normal and provide no threat to their health and well being. The occurrence of additional factors in affecting lifestyle habits continued with observations of the questionnaire. Participants who recorded a higher physical activity score also demonstrated a higher level of enjoyment towards sport and physical activity. Similarly, participants who recorded lower scores of physical activity also reported a low level or no enjoyment of sport and physical activity.

Speculating on possible reasons for the lack of physical activity of some participants, it could be that individuals with a more positive attitude and a greater amount of external encouragement have a greater tendency to adopt a physically active lifestyle as they perceive that lifestyle as being normal.

With respect to children and adolescents, literature concerning aerobic fitness is lacking, possibly due to ethical considerations and methodological constraints (Armstrong *et al.*, 1996). A review of literature has shown that males exhibit higher values of peak  $\dot{V}O_2$  than females and the gender differences increase as individual's progress through adolescents (Armstrong *et al.*, 1996). The present study supports that of Armstrong *et al.* (1996) as males displayed a higher mean  $\dot{V}O_2$  score in comparison to females (see table 8). A possible explanation for the difference in mean scores between the two genders could be due to males possessing greater muscle mass and haemoglobin concentration (Armstrong *et al.*, 1996).

The results concluded that there was no significant relationship between BMI and  $\dot{V}O_2$  max values ( $r = -0.285$ ,  $p > 0.05$ ). In support of the findings Goran *et al.* (2000) reported that reduced ability to maximally consume oxygen did not relate to fatness and excess body weight. Goran *et al.* (2000) concluded that overweight and obese individuals did not record a lower  $\dot{V}O_2$  max but a reduced sub-maximal aerobic capacity was observed. This suggests that the limiting factor in aerobic type activities for obese and overweight is a reduced ability in their sub-maximal aerobic capacity and shorter time to exhaustion. However, this study showed that the mean  $\dot{V}O_2$  max score of participants within the average weight category was higher than the mean score of the obese and overweight category, suggesting that the ability of obese and overweight participants in obtaining a higher  $\dot{V}O_2$  max score was influenced by fatigue.

Despite the evidence provided by the present study and that of Goran *et al.* (2000), Ortega *et al.* (2008) provided strong evidence indicating that cardio respiratory fitness levels are associated with total adiposity, when adiposity is assessed by anthropometric measures or by Dual Energy X-ray Absorptiometry (DEXA). This suggests that to observe a difference in the findings a more accurate evaluation of body fat is required. Ortega *et al.* (2008) also reported that individuals with lower adiposity also had a significantly higher cardio respiratory fitness level and that a significant relationship was found between adolescent cardio respiratory fitness and body fatness, when using anthropometric measures to assess body fatness.

With regards to physical activity and  $\dot{V}O_2$  max values, a significant positive relationship was found amongst all participants (see table 10). Supporting the results

of the present study a review conducted by Ortega *et al.* (2008) stated that regardless of adiposity status, results suggest that achieving 60 minutes or more of moderate physical activity daily is associated with a healthier cardio respiratory fitness level in adolescents. Independent of a chronological age, maturation development and gender, physical activity can improve physical fitness in children and adolescents (Ortega *et al.*, 2008). In contrast to the findings of the present study and that of Ortega *et al.* (2008), Harris and Cale. (2006) provides evidence that a child's aerobic fitness is determined by genetics, not by training or other contributing factors, suggesting that no matter how physically active an individual is, physical fitness has a limit due to genetics.

Despite the studies reporting that obese individuals are less active than non-obese individuals (Troost *et al.*, 2001), the evidence from the present study suggest that BMI is not a predictor for the level of physical activity of an individual. However, the average weight group did possess a higher mean physical activity score (see table 6), highlighting that even though BMI and physical activity did not show a significant relationship, obesity does contribute to the physical activity score of an individual. Males portrayed a higher mean physical activity score than females, supporting the literature in stating that males are generally more active than girls and possess a more positive attitude (Brustad, 1993). A positive correlation was found between the participants BMI and dietary score, in that the healthier their diet, the lower their BMI value.

In view of methodological strategies in conducting the research, the accuracy of the findings in the present study should be considered cautiously. The use of BMI as an

indicator of weight status can be questioned for its accuracy due to the fact that it provides a measurement of weight and height rather than a measurement of percentage body fat. Participants recording a high physical activity score and possessing a higher BMI could result in the individual having a higher muscle mass rather than excess fat mass, therefore being inadvertently placed into a weight status category.

A possible accurate measurement of body fat would be using anthropometric measurements (skinfold), however with the age range of the participants being 14years – 15 years old, ethical considerations could be an issue as it would be too invasive for children of that age. Another possible measurement of percentage body fat would be the use of Dual Energy X-ray Absorptiometry (DEXA). This is a very accurate measure of body fat but again would be too invasive for children. Due to the ethical considerations, time constraints and funding, the author was unable to obtain body fat measurements using the stated strategies.

A possible explanation for the relationship between BMI and physical activity is the method used to measure physical activity. In the present study only seven questions were used to measure the level of the participant's physical activity, the remaining questions were aimed at attitudes and external influences on physical activity patterns. If more questions were used to identify physical activity, or a diary was issued to report physical activity over a period of one month, a more thorough measurement of physical activity could have been obtained. However, due to time constraints of the present study and that of the participants, questionnaires were used to gather data concerning physical activity.

A possible influence on the results could be the use of adolescents in the final year of compulsory education. These adolescents receive less physical education classes unless opted for physical education as a subject at GCSE level. Therefore it may have been beneficial to have undertaken the study with additional participants in the age range of 11years – 12 years, and then comparing the physical activity levels to assess a difference in the age groups. However, due to the lack of physical education classes received by the participants and the analysis of the results, the present study provides evidence that the National Curriculum should included more time for physical education, and obesity and overweight is on the increases in children and adolescents.

To ensure an active lifestyle is maintained throughout adulthood, it is important to promote such a lifestyle as a child. This present study shows the importance of an active lifestyle on weight status and aerobic fitness, providing a strong base to promote such a lifestyle. Schools provide an ideal setting to promote healthy living, ensuring that activity levels are maintained in the future. However, parent's obesity and parental influence have been found to be the most important risk factor for overweight and obesity in children (Maffeis *et al.*, 1998). These findings provide clear evidence that parents and guardians should be included in the process of promoting a healthy, physically active lifestyle.

## **5.1. Limitations**

There are some limitations to the findings of this study. The measurement of lifestyle habits (physical activity and dietary intake) were obtained from questionnaires. It is therefore possible that participants did not record a true representation of their physical activity and dietary habits. In relation to the physical activity questionnaire, it is possible that each participant interpreted the questions differently, therefore portraying a variety of physical activity scores. This could possibly explain the lack of relationship between weight status and physical activity. Including more questions concerning lifestyle habits, or recording physical activity using a diary over a period of a month could improve the validity and reliability of the measurements obtained.

With the time constraints of the participating school, the diet questionnaire was useful in gaining the dietary status of each participant. However, the size of meals recorded may have been portrayed differently, depending on their weight and attitude. Recording dietary data via a one-to-one interview, although being more time consuming, could provide a more realistic representation of dietary intake.

The number of participants could have influenced the lack of relationship between the analysed variables within this study. As stated previously, the mean scores of obese and overweight participants have been different compared to average weight participants, signifying that an increased number of participants could equal a relationship between the variables in question.

Consent forms were issued to prospective participants to gain individual and parental permission for their participation in the study. Obese or overweight children may

have not given their permission to participate due to their poor self-esteem levels and insecurity, providing the researcher with a limited number of obese and overweight participants. Similarly obese and overweight parents or guardians may not want their child to participate due to the same reasons.

Fitness testing in children provides methodological limitations within this present study. Test results could reflect the adolescents' level of maturation and motivational levels rather than true physical fitness, therefore providing unreliable results.

The present study was limited regarding age. Given that physical activity has been seen to decline during adolescence and adulthood within the population, it is difficult to say how patterns of physical activity change with age.

## **5.2. Further Research**

A number of findings from this present study suggest recommendations for future research. As this study found females to have lower physical activity scores and  $\dot{V}O_2$  max values, a study investigating the reasons why would be beneficial to determine possible influences to increase participation in females. A better understanding of children's fitness testing is needed along with evidence of its effects on health and activity in children and adolescents.

An expansion of the research of this present study would be necessary to acknowledge true physical activity patterns. A study of this nature needs to be conducted regularly to ascertain whether a physical activity trend can be generalised to weight status groups and if changes occur with external influences such as psychological aspects. Main influences of lifestyle habits also need to be generalised so that the most prominent influence can be targeted to reduce BMI values and help decrease obesity in children and adolescents. The literature apparent in this study has provided strong evidence that parental influence has an effect on children and adolescents' lifestyle, therefore interventions designed to combat young people's physical activity patterns and dietary intake should include parents and guardians. A study analysing the effectiveness of such interventions would be beneficial to examine the success of these strategies, and whether obesity risk factors are reduced.

Data from this study indicate that there is a variety of physical activity patterns apparent in adolescents; recommendations for future research should include distinguishing the reasons for drop out in sport and exercise for this age group.

# **CHAPTER VI**

# **CONCLUSION**

## **Conclusion**

As indicated by the present study, the effect of physical activity and diet on BMI and physical fitness is controversial. Lower physical activity rates were confined to obese and overweight participants when compared to the average weight group. However, no significant relationship was found between the two variables in question. A variety of relationships were identified between BMI, diet and  $\dot{V}O_2$  max, therefore we can anticipate the true effect of physical activity, diet and physical fitness on weight status and health.

Research recommends that physical activity and diet in relation to weight status is an important issue, particularly with evidence that increased weight gain can have an influence on physical and mental well-being (Fox, 1999; Maffeis *et al.*, 1998; Trost *et al.*, 2001).

As discussed in the previous chapter many limitations are apparent in this area of research. A modification of these factors would be necessary to gain the greatest evaluation of physical activity rates in children and adolescents. To increase the reliability of future research, researchers should relate to the same methodological strategies to prevent controversial results.

In order to achieve increase participation in physical activity, it is clear that there is a need for further research to identify barriers and factors that affect participation. This will aid the design of future interventions involving overweight children and adolescents.

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# **APPENDICES**

# **APPENDIX**

## **A**

## **Participant Information**

### **General Information about the Study**

As the lack of physical activity is frequently in the media I am undertaking a study to evaluate whether physical activity and dietary intake relates to a Childs BMI. Knowing this information will increase your personal awareness of your status of health and also provide evidence to the media coverage which can then be applied to improve this current epidemic.

To take part in this study you will be required to have your height and weight measured, complete two questionnaires regarding your physical activity patterns and your dietary intake and also participate in a fitness test (multi stage fitness test) to determine your current fitness levels. Previous experience with this fitness test is required.

All measurements will be taken silently and in private and a chaperone will be present at all times.

### **Why have you been asked?**

You are currently in year 10 you are in your final stages of compulsory education, which means that you have opted to do things that interest you. As the rate of drop out increases as children get older, it is beneficial to find out whether these rates are influencing children's health and therefore leading to an increased BMI.

### **What happens if you change your mind?**

Participation is entirely voluntary and you can withdraw from this study at any time.

### **What are the risks?**

There are no obvious risks in participating in this study, other than general health and safety issues regarding the fitness test.

### **What happens to the results?**

All the information gathered will be kept on a computer where only I and my supervisor will be allowed access. Confidentiality will be upheld and your name will not be recorded.

### **Are there any benefits from taking part?**

The only direct benefit of participating in this study is the knowledge of your health status at the end of the collection of data. Indirect benefits include improving research.

### **Contact details of my Supervisor**

Deborah Welford

Email: DWelford@uwic.ac.uk

Phone: 02920 41 7062

**PARTICIPANT CONSENT FORM**

UWIC Ethics Protocol Number: **12.12/07**

Participant name:

Title of Project: **How Physical activity and Diet relates to a Childs BMI**

Name of Researcher: **Lucy Anthony**

---

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understand the information sheet dated ..... for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my relationship with UWIC, or my legal rights, being affected.

3. I understand that relevant sections of any of research notes and data collected during the study may be looked at by responsible individuals from UWIC for monitoring purposes, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.

4 I agree to take part in the above study.

---

Signature of Participant:.....Date:.....

---

Signature of Parent/Guardian:.....Date:.....

---

Name of person taking consent: **Lucy Anthony**

Signature of person taking consent:.....Date:.....

---

# **APPENDIX**

## **B**

# Physical Activity Questionnaire

Please help me with my research by answering a few short questions

Please answer all the questions as honestly as you can

**Q1** How many hours a week do you take part in moderate physical activity (such as light sports and physical exercise or long walks)?

- 0-2 hours.....
- 2-6 hours.....
- 6+ hours.....

**Q2** How many hours a week do you take part in hard or very hard physical activity (such as jogging, running, swimming or strenuous sports)?

- 0-2 hours.....
- 2-6 hours.....
- 6+ hours.....

**Q3** On average over the past year what time do you get up?

- On a weekday.....
- On a weekend.....

**Q4** On average over the past year what time do you go to bed?

- On a weekday.....
- On a weekend.....

**Q5** How do you get to and from school?

- Bus.....
- Car.....
- Walk.....
- Cycle.....

**Q6** Which form of transport do you use MOST OFTEN apart from your journey to school?

- |                   | Car                      | Walk                     | Bus                      | Cycle                    |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Less than 1 mile  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1-5 miles         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| More than 5 miles | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Q7** Do you enjoy taking part in physical activity?

- I really enjoy it.....
- I enjoy it sometimes.....
- I dont enjoy it at all.....

**Q8** How important do you think it is to exercise?

- Very important.....
- Quite important.....
- Not very important.....

**Q9** How many hours a week do you spend watching TV or playing on your computer?

- None at all.....
- 1-10 hours.....
- 10-20 hours.....
- 20-30 hours.....
- 30+ hours.....

**Q10** Are you a member of a sports team?

- Yes.....
- No.....

**Q11** Apart from P.E lessons do you take part in any extra curricular activities involving exercise?

- Yes.....
- No.....

**Q12** Do you take part in any extra curricular activities that dont involve exercise?

- Yes.....
- No.....

**Q13** Do your parents take part in any form of physical activity?

- Not at all.....
- Sometimes.....
- Often.....

Thank you for your time

# **APPENDIX**

## **C**

# Dietary Intake Questionnaire

Please answer all the questions as honestly as you can

**Q1. Please List any food you have consumed in the past 24 hours:**

	Time	Place	What and how much?
Breakfast/1st Meal			
Snack			
Lunch/2nd meal			
Snack			
Evening/3rd meal			
Snack			

**Q2. Please state any other food you consumed in the past 24 hours:**

Other food	Time	How much?

**Q3. Please list any beverages you consumed in the past 24 hours:**

Beverages	Time	How much?

**Thank you for your time**

# **APPENDIX**

## **D**

**Physical Activity Readiness Questionnaire (PAR-Q)**

Please circle the answers to the following questions:

1. Will this be the first time you have participated in a Multi stage fitness test (Bleep test)? Yes / No
2. Do you suffer from a heart condition or have you ever had a problem with your heart? Yes / No
3. Do you feel pains in the chest when you do physical activity? Yes / No
4. Have you ever lost consciousness (Fainted)? Yes / No
5. Do you have any injuries that could be made worse by physical activity?  
Yes / No
6. Are you currently taking any medication? Yes / No
7. Do you know of any other reason why you should not do physical activity?  
Yes / No

If you have answered yes to any of these questions, please add details below.  
Similarly, if there are any situations which will prevent you from exercising write them here

Signed.....

Date.....

# **APPENDIX**

## **E**

3 Lon Llys Havard  
Betws  
Ammanford  
Carmarthenshire  
SA18 2HT  
30<sup>TH</sup> November 2007

Amman Valley School  
Margaret Street  
Ammanford  
Carmarthenshire  
SA18 2NW

Dear Headmaster,

I am a final year student studying sport and physical education at University of Wales, Institute Cardiff. I am in the process of researching my dissertation project which is 'How diet and physical activity relates to children's Body Mass Index (BMI)'. My research looks at the amount of physical activity undertaken and the dietary habits in relation to a child's body mass index (BMI). I am also looking at the fitness levels of a child in relation to the results obtained.

I am looking at year 10 pupils in particular and would appreciate your schools participation in my study.

The study will include about 40 pupils from year 10, completing 2 short questionnaires on their physical activity patterns and dietary habits. Children will undergo a multi stage fitness test (Bleep test); also measurements of body height and weight will be recorded. Names will not be written on the questionnaires and all the information will be dealt with confidentiality. Copies of the questionnaires are enclosed.

Both the child and his/her parent or guardian will need to sign a consent form to confirm their participation in the research and also fill out a physical activity readiness questionnaire (par-q) to determine whether they are fit enough to participate.

If you give your consent, please contact me to arrange an appropriate time to come into the school to undertake my research at your convenience.

Thank you for your time

Yours Sincerely

Lucy Anthony

# **APPENDIX**

## **F**

**Predicted  $\dot{V}O_2$  max for the multistage fitness test, developed by the Department of Physical Education and Sports Science Loughborough University, 1987**

<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>	<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>
4	2	26.8	5	2	30.2
4	4	27.6	5	4	31.0
4	6	28.3	5	6	31.8
4	9	29.5	5	9	32.9

<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>	<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>
6	2	33.6	7	2	37.1
6	4	34.3	7	4	37.8
6	6	35.0	7	6	38.5
6	8	35.7	7	8	39.2
6	10	36.4	7	10	39.9

<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>	<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>
8	2	40.5	9	2	43.9
8	4	41.1	9	4	44.5
8	6	41.8	9	6	45.2
8	8	42.4	9	8	45.8
8	11	43.3	9	11	46.8

<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>	<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>
10	2	47.4	11	2	50.8
10	4	48.0	11	4	51.4
10	6	48.7	11	6	51.9
10	8	49.3	11	8	52.5
10	11	50.2	11	10	53.1
			11	12	53.7

<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>	<b>Level</b>	<b>Shuttle</b>	<b>VO2 Max</b>
12	2	54.3	13	2	57.6
12	4	54.8	13	4	58.2
12	6	55.4	13	6	58.7
12	8	56.0	13	8	59.3
12	10	56.5	13	10	59.8
12	12	57.1	13	13	60.6