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*'An investigation into the  
correlation between breakfast  
consumption and physical fitness levels  
in children'*

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## **Abstract**

The main aim of this study was to establish whether there was a correlation between breakfast consumption and fitness levels in school children. In order to carry out this study and to determine if a correlation did in fact exist, questionnaires regarding breakfast consumption were distributed to sixty three Primary 6 children. These children also participated in a series of fitness tests over five disciplines namely speed, agility, endurance, flexibility and strength. The fitness test results were compiled and analysed in Microsoft Excel, subjects were given an overall fitness rank. These were then correlated with the subjects' breakfast consumption in four categories: no breakfast; unhealthy breakfast; carbohydrate breakfast and recommended breakfast. It was then found that while there was a correlation between type of breakfast eaten and subjects' fitness levels, there were exceptions to this. Despite those who ate a recommended breakfast being the overall fittest of all subjects, one subject who ate an unhealthy breakfast ranked fifth overall. It is essential that children eat breakfast to provide them with the necessary nutrients and energy needed to participate fully in both academic tasks and physical activity on a daily basis.

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# *Chapter One*

## *Introduction*

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## **1.0 Introduction**

### **1.1 Background to the study**

Recently there has been much research and debate on the topic of childhood obesity which Okie, (2005) states is better prevented than cured. Childhood obesity is linked to many factors including participation in physical activity and the position of health and nutrition within the curriculum. It has now been proven through research that breakfast consumption plays a major role in determining whether a child is likely to develop childhood obesity. Arora et al, (2012) state that regular breakfast consumption is inversely associated with excess weight and directly associated with better dietary and improved physical activity behaviours. It is clear that most children are now aware of the importance of eating breakfast not only to help them perform better academically - “ Those with poor nutrition scored lower on tests of vocabulary, reading comprehension, arithmetic and general knowledge.” Gross and Cinelli (2004) - but also the importance a balanced diet has in promoting overall health and well-being. Physical fitness is also a major area that is to be recognised when educating children on the importance of overall health. A child’s participation in physical activity is something which recently has become somewhat neglected within the curriculum (Youngstedt, 2012) and it is of essential importance that children are taught the benefits of participating in physical activity instead of spending time participating in sedentary activities such as playing computer games and watching television. This research is to be carried out to establish whether there is a link between a child’s breakfast consumption and their physical fitness levels. It is noted that not in all cases will breakfast consumption affect fitness levels, however, this study will provide further evidence into whether or not there is a substantial link.

### **1.2 Need for Study**

Within Northern Ireland there has been very little research carried out into whether or not breakfast consumption will affect a child’s physical fitness levels. There have been few studies carried out in European countries such as Italy, Germany and Greece and these studies have proven that there is in fact a link between the two. This would indicate that not eating breakfast will cause fatigue which in turn will lead to lack of enthusiasm and concentration and therefore a lack of willingness to participate in physical activity. This will then subsequently lead to a rise in childhood obesity and other health issues associated with poor diet, nutrition and lack of exercise. This study will aim to establish whether there is a



significant link between breakfast consumption and physical fitness levels of children in Northern Ireland. It will also look at the pattern of what children are consuming for breakfast and whether or not it is recommended. Although most people are now aware of the importance of eating breakfast before school and participation in physical activity, the findings of this study could be used to highlight to parents and educationalists the importance of proper nutrition and physical fitness.

### **1.3 Aims and Objectives**

This research investigation aims to establish whether a correlation exists between a child's breakfast consumption and their physical fitness levels. The physical fitness aspect of the study will be carried out in the Primary School using standardised fitness tests for five main areas; strength, agility, speed, flexibility and endurance. The information on breakfast consumption will be gathered through the use of a questionnaire which will ask does the child eat breakfast and if so, what do they have. In order to determine whether there is a link the results from both the fitness tests and the questionnaires will be entered into Excel. Results and statistical analysis will then be analysed and a conclusion reached.

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# *Chapter Two*

## *Review of Literature*

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## **2.1 Physical Fitness and Physical Activity in Children**

It is important to first define what physical activity and physical fitness are. Physical fitness has been defined by Harris (2007) as “a set of attributes that people have or achieve that relates to their ability to perform physical activity”. While, according to Casperson (1985) physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure and can be categorised into occupational, sports, conditioning or household. However, as Biddle and Mutrie (2008) state, trying to develop an accurate assessment of this area is problematic as there are reliability issues and variables such as the intensity of or type of activity. Casperson (1985) also states that physical fitness is a set of attributes that are either health or skill related and the degree to which people have these attributes can be measured with specific tests. Erikssen (2001) believes that physical fitness describes maximal aerobic capacity adjusted for body size and composition and is an integrated measure of cardio respiratory and neuromuscular-skeletal function, oxygen transport and delivery and psychological drive. Physical activity has numerous beneficial physiologic effects. Most widely appreciated are its effects on the cardiovascular and musculoskeletal systems, but benefits in the functioning of metabolic, endocrine and immune systems are also considerable.

Boreham and Riddoch (2001) argue that it is clear to see that children have become less physically active in recent decades and that they expend 600 kcal per day less than their counterparts fifty years ago. Children seem inclined to a sedentary lifestyle as society and the environment make remaining active difficult and increasingly children are electing sedentary leisure time activities such as TV, video games and computers (McElroy 2002; Kelly and Melograno, 2004). It is also a common thought among parents and teachers that children today are less fit and less active than in the past. However, there is little direct evidence linking sedentariness with health in children with Cale and Harris (2005) stating that we cannot categorically say whether children’s physical activity levels have declined in recent years as such studies are virtually non-existent. Despite this however, there are other studies that have been carried out such as Roberts and Foehr (2004) that suggest that children are in fact physically less active and it is highlighted that the average child now spends five to six hours each day playing video games, working or playing on the computer or watching television. Another worrying side to this argument is the fact that childhood obesity has more than tripled in the last thirty years (Centre for Chronic Disease Prevention and Health Promotion 2010). There has been an increase in the prevalence of obesity among children

from 6.5% in 1980 to 19.6% in 2008. Linking these findings with studies that have investigated physical activity and its effects on obesity and health, it shows that regular physical activity combined with a balanced diet reduces the risk of obesity and improves overall health, thus suggesting that physical activity levels have dropped, explaining the increase in obesity.

Participating in physical activity benefits children not only physiologically, but psychologically and socially. It improves self-esteem, reduces anxiety and depression. Peterson (2004) cited in Beaulieu (2008) highlights the fact specific social skills such as teamwork, leadership and conflict resolution can be learnt directly through physical activity. Physical Education has become one of the core elements of the curriculum in Northern Ireland since 2007 with, the Department of Education encouraging schools to give pupils at least two hours of quality curricular PE per week (DENI 2012). Despite this however, many children are still not getting the required amount of physical activity. The World Health Organisation (2011) state that children between the ages of five and seventeen should be accumulating sixty minutes of moderate to vigorous intensity of physical activity a day. However, research has shown that many children are not even participating in sixty minutes of physical activity per week.

## **2.2 Breakfast consumption**

Bianca Parau, Senior Paediatric Dietician at Bupa Cromwell Hospital has commented “It is so important that children have a nutritious, balanced breakfast before they go to school. They need a lot of energy to get them through a morning of learning, concentrating and playing.” This statement is backed up by numerous other studies that have been carried out on the importance and benefits of breakfast. Breakfast has been described as the most important meal of the day, contributing to daily nutrient intake and energy needs (Mahoney et al 2005). According to reports from the American Dietetic Association, students who eat breakfast have better problem solving abilities, recall, memory, verbal fluency and creativity. It has been shown that children who eat a well-balanced diet, including breakfast perform better academically and have better test scores than those who are malnourished. A study carried out by Murphy et al (1999) found that children who are malnourished and at risk of being hungry were twice as likely to have impaired functioning. Kellogg’s conducted research in England in 2008 which highlighted that many children are not having breakfast and are starting school on an empty stomach. It also reported that four out of five teachers

asked have noticed a significant increase in the amount of pupils arriving to school hungry and not having had any breakfast. Teachers also reported higher levels of hyperactivity, absenteeism and tardiness among malnourished children.

As well as academic achievement being affected, regular breakfast consumption can have a multitude of positive health benefits, yet young people are more likely to skip breakfast than any other meal. Research supports the fact that starting a child's day with a healthy meal will combat obesity with breakfast playing a significant role in regulating appetite, hormone levels and the amount of calories that are burnt throughout the day. According to the Centres for Disease Control and Prevention, 25% of all children aged two to eighteen now meet the criteria for being overweight and those who skip breakfast are three times more likely to be overweight than those who do not. A study carried out by Sandercock et al (2010) showed that habitual breakfast consumption is associated with healthy BMI and higher physical activity levels in children and this also contributed to the higher cardiorespiratory fitness observed. Liu (2013) has also suggested that children who eat breakfast regularly are less likely to start other bad habits as teenagers such as cigarette smoking, lack of exercise and drug and alcohol abuse. These positive health outcomes support the encouragement of regular breakfast consumption.

Teaching and informing children about the importance of having a balanced diet and having good nutrition habits is paramount in making sure that children do not become overweight at a young age. The World Health Organisation (2000) defines nutrition as "...the fundamental pillar of human life, health and development...proper food and nutrition is essential for survival, physical growth, mental development, performance and productivity, health and well-being." Despite the growing efforts of many in highlighting the importance of good nutrition as a means to good health, many in society are still unaware of what good nutrition is.

Research carried out by the Public Health Agency in Northern Ireland (2003) found that in Northern Ireland there are over half a million adults overweight and a further 250,000 are obese and they have warned that poor eating habits and choices made by adults are affecting the health of children. It is therefore essential that both children and their parents are made aware of what foods are good for them. Pearson (2009) has suggested that the family environment is an important influence on the dietary behaviours of young people and so parents should be encouraged to provide a healthy and balanced diet, including breakfast for

their children. In many cases however, parents may not be able to provide breakfast and so this is where the idea of school breakfast programmes comes into play. It has been found that schools play a significant role in stressing the importance of eating breakfast by allowing children to profit from the cognitive benefits of eating breakfast before class begins.

While eating any type of breakfast is better than skipping breakfast altogether, many choices are somewhat better than others. Carbohydrate only breakfasts, such as bagels and toast will only give a child energy for one to two hours, while complete breakfasts that contain a balance of protein, fat and carbohydrates will keep blood sugar levels steady for hours. It is important to avoid sweet treats for breakfast that are loaded with refined sugar such as pastries, breakfast bars, muffins and some cereals. These will cause blood sugar levels to drop quickly and so causing children to tire, become irritable, moody and unable to concentrate on tasks. Murphy et al (1999) reiterated this by saying those children who do eat breakfast are more likely to have improvements in attentiveness and test scores.

### **2.3 Breakfast consumption and physical fitness in children**

There has been very little research carried out on the effects of breakfast consumption and fitness levels among children. There have however, been studies conducted that look at the link between breakfast consumption and obesity among children. They have found that globally there has been an increased intake of energy dense foods that are high in fat, salt and sugars but low in vitamins, minerals and other micronutrients and there has been a decrease in physical activity thus leading to rising levels of obesity. There have also been many studies that have looked at the effect breakfast consumption has on academic achievement and these found that eating breakfast has a positive effect on how well a child does at school due to increased concentration and the ability to memorise and recall information (Murphy, 2000).

The only way in which a link between breakfast consumption and physical fitness in children can be found is to carry out research using questionnaires and fitness tests. However, this can prove quite difficult. Firstly, the accurate measurement of physical activity among children is fraught with problems as they have 'complex and multi-dimensional activity patterns' (Livingstone et al, 2003) which makes it hard to ascertain levels of fitness for children. On the other hand, a common form of assessing fitness levels of an individual is through fitness testing, with Howley and Franks (2007) identifying four main components of fitness testing namely cardio respiratory function, muscular strength, muscular endurance and flexibility.

Although there are many ways to perform these tests, care must be taken when choosing which to use for children as they can be demeaning, embarrassing, uncomfortable and low in validity and reliability (Harris 2007). With this in mind, it is important to remember that fitness testing should be treated delicately and sensitively within the school setting to avoid categorising children.

In conclusion, this chapter has identified that there are many concerns surrounding the issue of childhood obesity and the rising figures presented in terms of the lack of physical activity that children are now participating in. It has also been identified, that while there has been some carried out, there is no substantial research or data into the effects that breakfast consumption has on physical fitness levels in children. There is however, an abundance of research of the importance of eating breakfast as it provides children with the necessary nutrients and energy. Bogden (2000) states, that when children's basic nutritional and fitness needs are met, they have the energy and a greater ability to achieve.

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# *Chapter Three*

## *Methodology*

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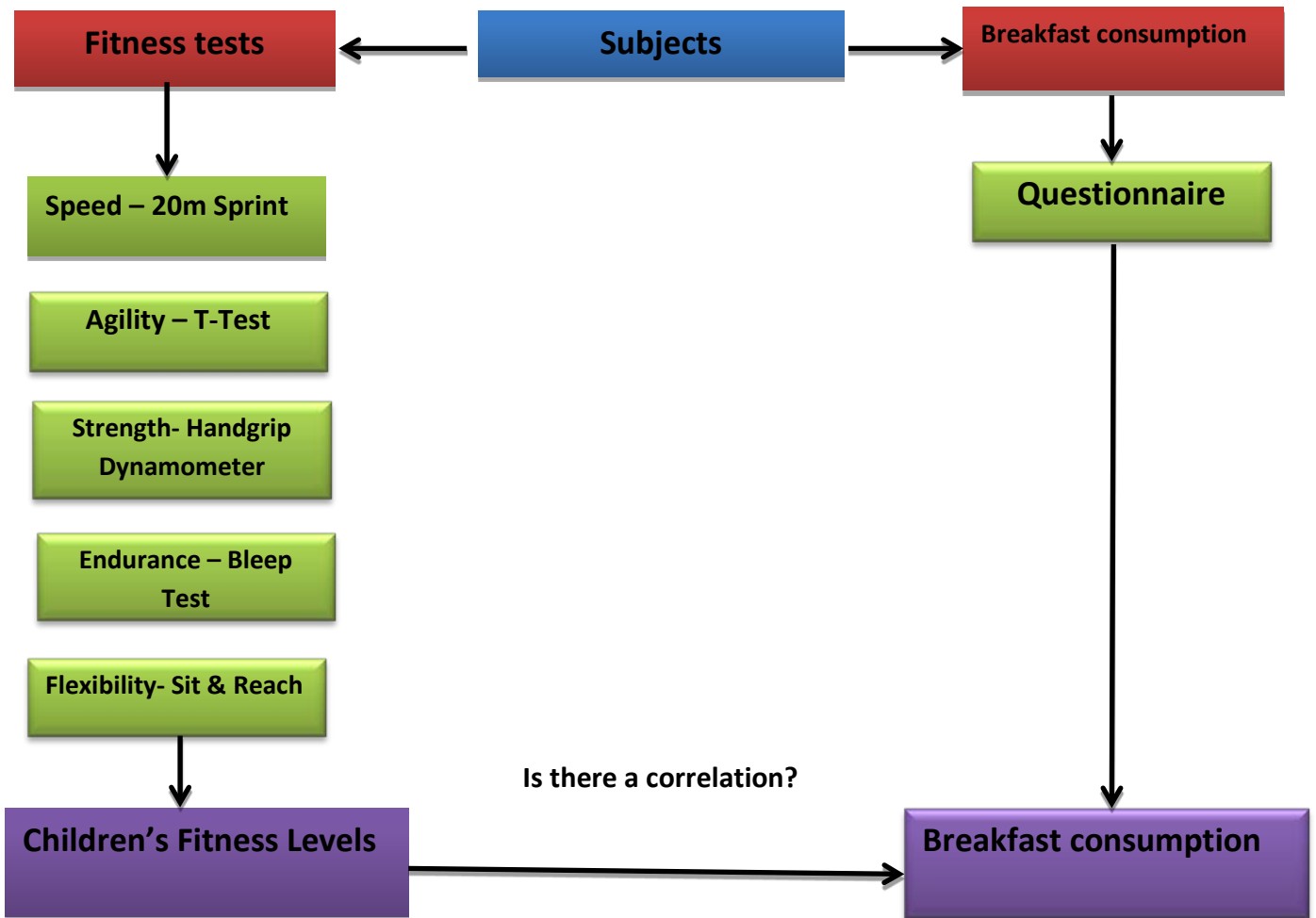
### **3.1 Research design**

The main objective of this study is to investigate whether or not breakfast consumption plays a part in the fitness levels of children. Carrying out research is an integral part of any study and to engage in research, a basis of knowledge regarding the study is needed. Choosing the correct research techniques and methods is essential to ensure reliable and accurate results are achieved. This study will involve both qualitative research in the form of fitness testing and quantitative research in the form of a questionnaire.

Ultimately, the study is aimed at determining whether a child eats breakfast and which breakfast type contributes the most in determining their fitness levels. In order to establish a child's overall physical fitness, they must be tested in the five main areas of fitness that Rahl (2010) acknowledged as the central components of physical fitness – Speed, Agility, Strength, Endurance and Flexibility – using a series of tests. This will provide all the relevant information and scores needed to carry out an accurate investigation into the child's overall fitness level.

In order to determine whether a child eats breakfast and what they have for breakfast, a questionnaire will be used. This will ensure that the information will not have any influence by other parties and that the child can give clear and correct information about what they eat on a daily basis before they come to school.

**Figure 3.1**



*Figure 3.1* – is a graphical representation of the Research Design for the study and the process that the subjects will undertake

### **3.2 Subjects**

The subject participants for the purpose of this study attend a Catholic Maintained School in Co. Armagh. There are a total of sixty three subjects from four Primary 6 classes. These include twenty nine male subjects and thirty four female subjects all aged between nine and ten. The school has a strong tradition of Gaelic Games and sporting activities within the school. The school provides a wide range of extra-curricular sporting activities that are open and accessible to all pupils that attend the school.

### **3.3. Procedure**

Before beginning any fitness testing or distributing questionnaires, it is first crucial to gain permission from both the school and their Principal. A letter (Appendix A) was sent to each of the Principals to ensure that full consent is given before proceeding with the study. The letter included details on the nature and the intentions of the investigation to be carried out and what was required of both the school and the pupils. As the study included an investigation of the children's fitness levels and their breakfast consumption, it was also therefore essential that parent's permission was given for their child to take part in the study. Parents of the children who would be involved were sent a letter (Appendix B) which, similarly to the Principal's letter, included the nature and the intentions of the investigation. It also included the identity of the person conducting the research and for what purpose this research was being undertaken. The letter to parents included what was required of their children and if they chose to participate in the study that confidentiality and anonymity would be held for all subjects. Each letter had an attached consent form which had to be signed and returned to the school by the parents/guardians in order for a child to be able to take part in the research. Once authorisation from the school Principal was given and all consent forms returned, the research and testing procedures could begin.

### **3.4 Testing**

#### **3.4.1 Physical Fitness**

In order to assess the fitness levels of the children taking part in the research, they had to complete a series of fitness tests which will examine their speed, agility, strength, flexibility and cardiovascular endurance. Each element of fitness required a different test.

- Speed was measured by a straight 20m sprint test
- Agility was assessed using the T-Test run
- Strength was determined by the handgrip dynamometer
- Flexibility results were gathered by the Sit and Reach test
- Cardiovascular endurance was assessed by the completion of the Bleep Test

Results were collected and compiled using a pre-planned Excel Spreadsheet. Each child was given a unique number to keep the results anonymous and the results of the questionnaire could also be recorded on the same Spreadsheet. Before beginning the fitness testing, an explanation and demonstration was given allowing the subjects to gain an understanding of what was required of them as outlined in Appendix C.

#### **3.4.2 Breakfast Consumption Questionnaire**

Prior to or after the fitness testing was completed; the children were given the opportunity to complete a short questionnaire on their breakfast consumption (Appendix D). This included the question asking whether or not they take breakfast every morning before they come to school and depending on their answer, what they have for breakfast. The results from the questionnaire were then added to the Spreadsheet along with the fitness test results so both sets of results could be compared and analysed. The children were not made aware of the precise reasoning behind the questionnaire, but were encouraged to answer as truthfully as possible while also giving maximum effort during the fitness tests.

#### **3.5 Statistical Analysis**

In order to determine if there was any correlation between breakfast consumption and the fitness levels of the children, the fitness rank for each child was determined using Microsoft Excel. Standard Deviation was used in order to determine the average score for each of the tests.

In summary, the methods used to gather and analyse the data have been documented and justified and deemed the most suitable ways in which to fulfil the aims of this particular investigation.

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# *Chapter Four*

## *Results and Discussion*

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## **4.1 Introduction**

The results of the fitness testing for this study are detailed and discussed in the following chapter. This study investigates the fitness levels of sixty three subjects and how this is linked with the subjects' consumption of breakfast and whether or not there is a correlation between the two. The information that has been collected has been gathered from subjects who participated in the fitness tests and answered questions on what they ate for breakfast on a daily basis. In order to determine if there is any correlation between the subjects' fitness levels and their breakfast consumption, each element of fitness will be examined individually and also collectively through fitness ranking. Rahl (2010) has acknowledged that the areas of fitness which have been tested are the central components of health related physical fitness.

## **4.2 Breakfast consumption**

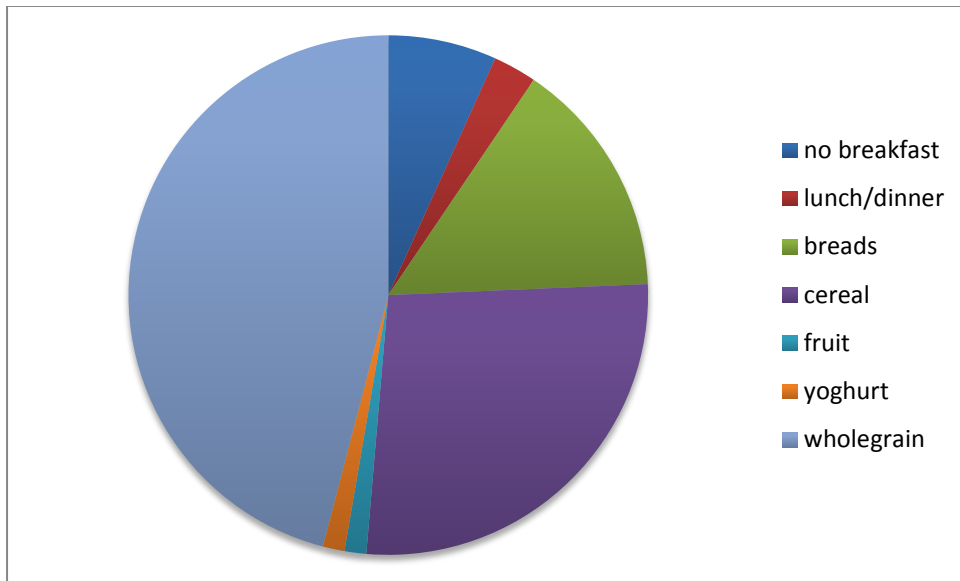
	Number of subjects	% of subjects
No breakfast	5	8
Unhealthy breakfast	2	3
Carbohydrate breakfast	33	52
Recommended breakfast	23	37

**Table 4.1: Represents the various categories that breakfasts were broken into**

Table 4.1 shows the how the subjects' breakfasts were broken down into categories. There are four categories that the different types of breakfasts were split into – no breakfast, unhealthy breakfast, carbohydrate breakfast and recommended breakfast.

Breakfast consumption was gathered from the subjects through a questionnaire. The children either selected 'yes' or 'no' as to whether or not they ate breakfast and then had to elaborate, if applicable, on what they ate most mornings before they came to school. According to Munn and Drever (1999), using questionnaires and allowing children to give their own perspective is a reliable way of obtaining data without interference from other parties.

**Figure 4.2**



**Figure 4.2: Represents the type of breakfast that the subjects ate**

Figure 4.2 represents the type of breakfast that each of the subjects ate. From the pie chart it is clear to see that the majority of subjects ate a breakfast that was wholegrain based. Twenty three out of sixty three subjects ate wholegrain cereals for breakfast. This included things such as Weetabix, Porridge and Special K. The results for the number of subjects eating wholegrain cereals for breakfast may be explained by the fact that wholegrain cereals are a rich source of many essential vitamins, minerals and phytochemicals. The typical wholegrain cereal is low in saturated fat, cholesterol free, an excellent source of carbohydrates, a significant source of protein, a source of Vitamin B, iron, magnesium, zinc and a food source of antioxidants and phytochemicals that can help lower blood cholesterol levels. Wholegrain cereals are constantly being recommended as part of a healthy diet. It can be seen from the data though that less than half of subjects who consumed wholegrain cereals for breakfast ranked in the top thirty.

The second largest category was cereal. The cereals included in this category were Coco Pops, other chocolate cereals, Rice Krispies, Cornflakes and Cheerios. Eighteen subjects ate this type of breakfast. Although these types of cereals are not as highly recommended as wholegrain cereals, they are a typically low fat, nutrient dense food with many essential vitamins and minerals. (Albertson, 2009) From the results however, there does not seem to be any correlation between eating these types of cereal and fitness results as one subject who ate cereal ranked second in the class, while another ranked sixty third out of sixty three subjects.

The third largest category was breads, with this category including foods such as toast, pancakes and muffins. Thirteen out of sixty three subjects had bread based breakfasts. Jordan (2004) conducted a survey of 37, 000 people and found that eating toast for breakfast may lead to lethargy, weight gain and an inability to concentrate. Simon and Schuster (2003) state that foods such as toast and pancakes contain high levels of carbohydrates, which are rapidly converted into glucose which will in turn produce a short energy boost followed by an energy slump and sugar craving. This may explain the results collected as they show that ten out of thirteen subjects ranked in the lower thirty.

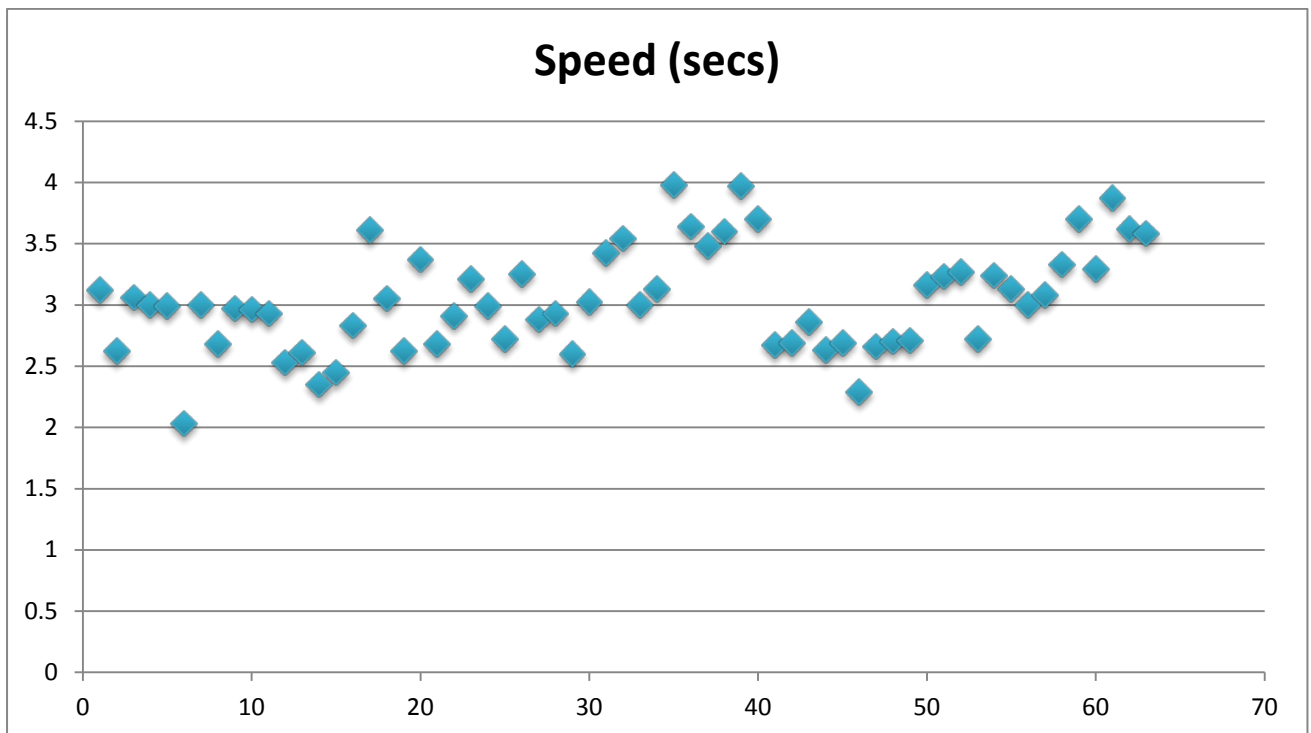
Two subjects had fruit or yoghurt for breakfast. Both of these are not a substantial or balanced breakfast and these subjects are more than likely going to feel hungry a short while after eating these types of food. While eating fruit is a healthy option as it contains Vitamin C and potassium, it is not recommended to eat only fruit as it is unlikely to keep you full for long as fruit does not contain protein and fat to supply lasting energy. This may also lead to a mid-morning slump as blood sugar levels drop.

Two subjects consumed lunch/dinner products for breakfast including chicken and ham pie and another eating a sandwich. This would be classified as an unhealthy breakfast. Five subjects did not eat any breakfast at all. There are many consequences to eating an unhealthy breakfast or none at all which are both work and health related. Especially as the subjects are in school for the majority of the day, not eating breakfast will increase tiredness and lead to fatigue and an inability to focus early on in the day. Their alertness will also be decreased along with less memory capacity and a higher chance of irritability and restlessness. Eating an unhealthy breakfast or not having anything before coming to school will also lead to the subject having a greater chance of weight gain due to unhealthy snacking linked to hunger, a higher risk of developing diabetes, a possibility of high cholesterol and a potential for high blood pressure.



### 4.3 Fitness results

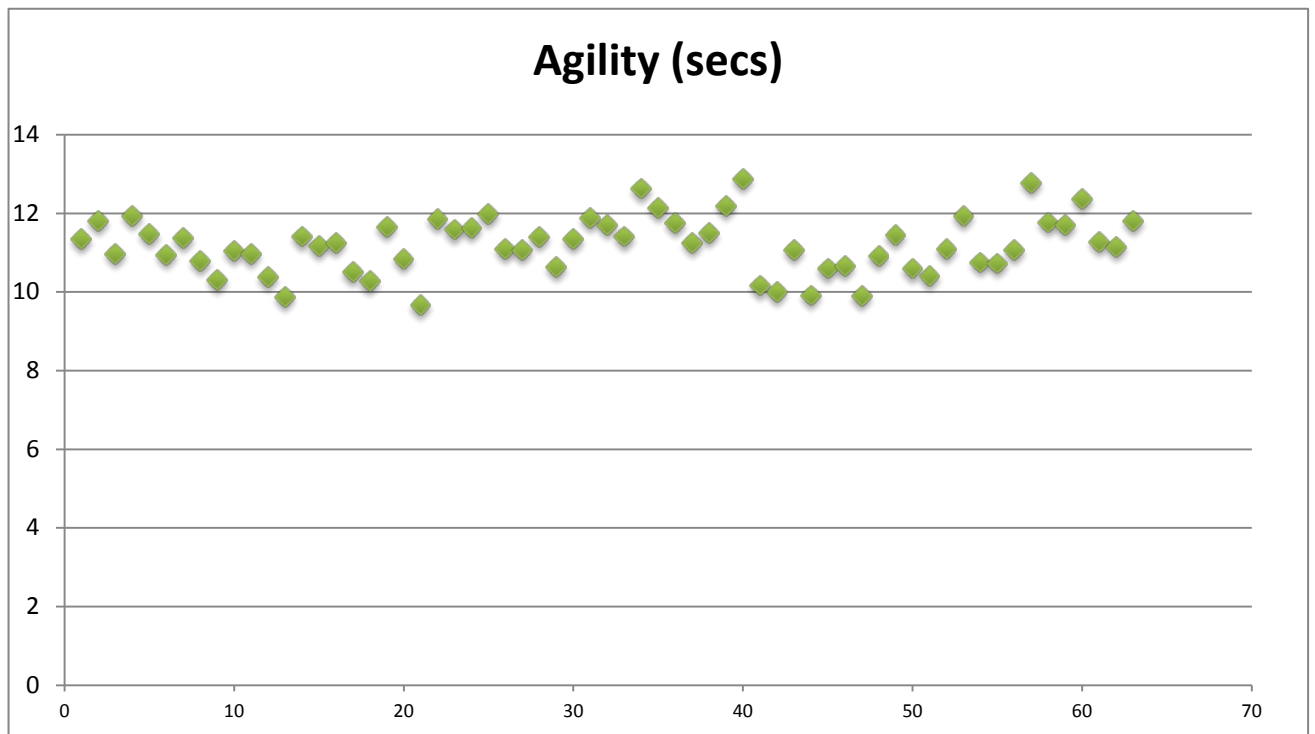
#### Speed



**Figure 4.3: Represents the subjects' speed results from the 20m sprint test**

Figure 4.3 represents the subjects' speed results from the 20m sprint test. In this test, the lower the score, the better the subject is. The fastest time recorded for the 20m sprint was 2.03 seconds. This then meant that the range from the fastest to the slowest was 1.95 seconds. The average for these speed sprint test results was 3.04 ( $\pm 0.42$ ). The top score was recorded by a female subject who did consume breakfast; however it was an unhealthy breakfast consisting of lunch/dinner products. The lowest score recorded was 3.98 seconds which was also recorded by a girl who ate a carbohydrate breakfast consisting of toast and cereal. There is very little research on whether or not breakfast consumption affects a person's speed, however it has been found that sprinting primarily uses the fuels phosphocreatine and carbohydrate which would explain how a subject who ate a carbohydrate based breakfast preformed the best in this test.

## Agility



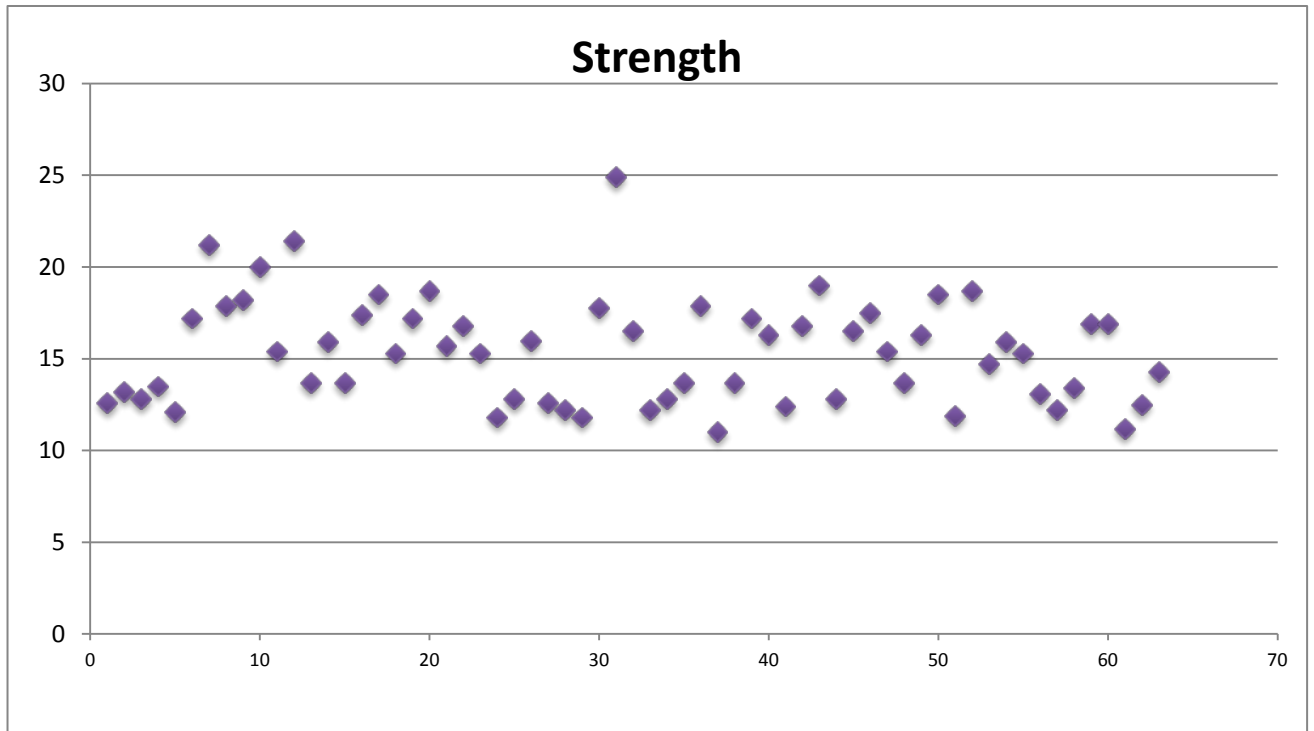
**Figure 4.4: Represents the subjects' agility test results**

Figure 4.4 represents the subjects' agility test results. The subjects carried out the 'T-test' for agility and the top score for agility was recorded by a female with a time of 9.66 seconds. This subject also ate a carbohydrate breakfast consisting of toast. However, this subject ranked thirteenth in the twenty metre speed test and so a slight anomaly occurred. Coulson and Archer (2009) stated that subjects should wear appropriate footwear, such as training shoes, when completing fitness test and this may have caused the anomaly by the subject's lack of technique or inappropriate footwear for changing direction quickly. The difference between the top score and the lowest score recorded was 3.21 seconds with the lowest score being recorded by a male. This subject also recorded a score ranked fifty ninth in the 20m sprint test which would coincide with Butcher and Eaton's (1989) findings that there is a significant relationship between running speed and agility in relation to participation in physical activity.

The average score for agility was 11.2s ( $\pm 0.7$ ) with twenty eight subjects scoring below average. Out of these twenty eight subjects, twenty seven ate breakfast with one eating an unhealthy breakfast, twelve eating a carbohydrate based breakfast and thirteen subjects eating

a recommended breakfast. This shows that the majority of those subjects who recorded high scores ate breakfast, however, whether it was a carbohydrate based breakfast or a recommended did not seem to have any significant bearing on the results.

### Strength

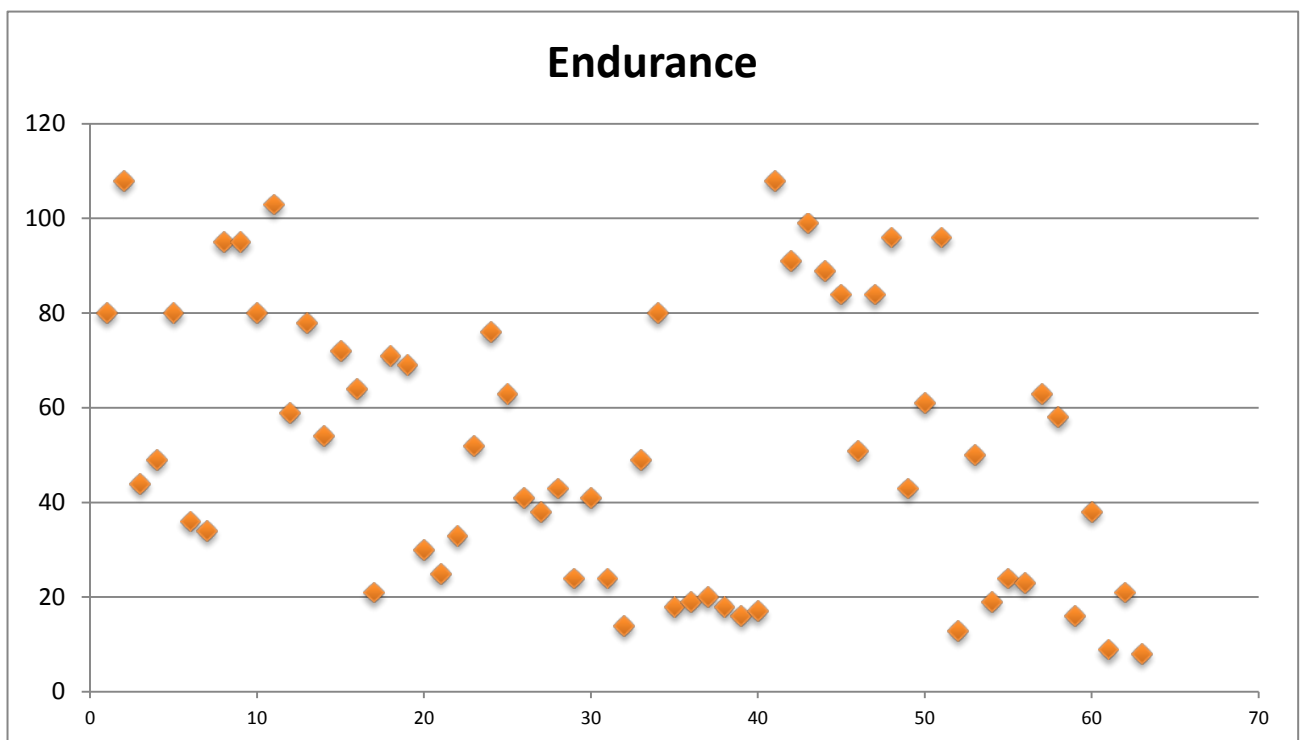


**Figure 4.5: Represents the subjects’ strength results collected from the Dynamometer grip test**

Figure 4.5 represents strength results collected from the Dynamometer grip test. The graph illustrates the results recorded for all subjects and the higher the subject’s score, then the stronger they are. The average score for the Dynamometer grip test was 15.4 ( $\pm 2.84$ ) Newtons. The highest score recorded was 24.9 Newtons which was given by a female subject who ate a carbohydrate based breakfast. The lowest score recorded was also given by a female who ate a carbohydrate based breakfast with a result of 11 Newtons. As breakfast type does not seem to indicate how strong a person is here, it is therefore important to look at more subjects to try and find any correlation and obtain more accurate information. After examining the top thirty results two subjects consumed unhealthy breakfasts, eighteen subjects had carbohydrate based breakfast and only ten subjects had a recommended

breakfast. This therefore would indicate that those subjects who had a carbohydrate based breakfast were in fact stronger than those subjects who had a recommended breakfast. Once again, there is very little research on whether or not breakfast consumption plays a part in whether or not a person is strong however according to Benaroot, (2000) the single most important factor for muscle development is a sufficient energy intake (60% from carbohydrate).

### Endurance

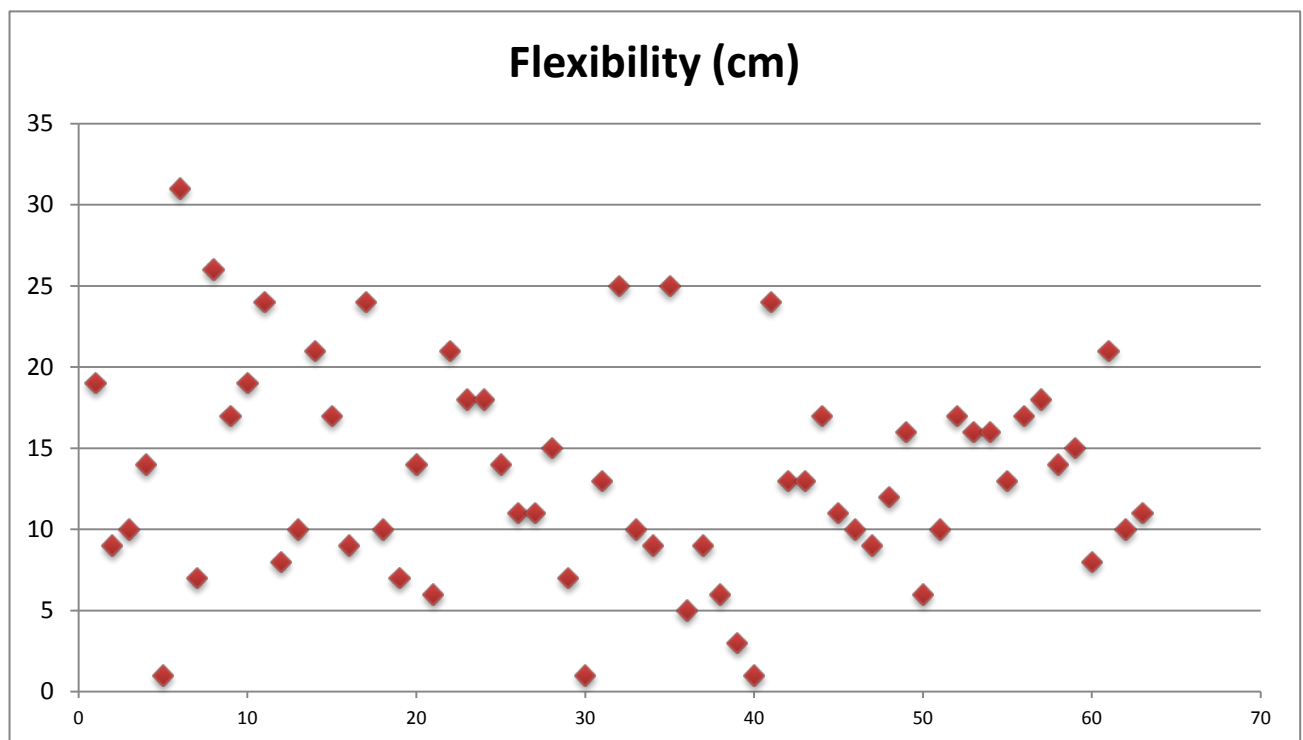


**Figure 4.6: Represents the subjects’ endurance levels collected through the Bleep Test**

Figure 4.6 represents the results compiled from the subjects’ participation in the Bleep Test. The graph above depicts the number of completed ‘20m shuttle run’ by each subject which represents endurance levels. The bleep test is used to find children’s fitness levels as it measures VO2 max. The average score recorded was 52.01 ( $\pm 29.46$ ). The top score was recorded by two males who scored 108 runs, however, one did not eat any breakfast and the other ate a recommended breakfast. The lowest score was 8, recorded by a female who ate a recommended breakfast. It is crucial, however, to take a deeper look at the results and examine the top and bottom twenty scores in order to determine whether or not there is a

definite link between breakfast consumption and fitness levels and providing a broader and more accurate view. Of the top twenty results, which range from 108 runs to 71 runs, three subjects did not eat any breakfast, eleven subjects ate a carbohydrate based breakfast and nine ate a recommended wholegrain based breakfast. Of the bottom twenty results, which range from 8 runs to 33 runs eight subjects ate a recommended wholegrain based breakfast and twelve ate a carbohydrate based breakfast. These results show that there is no direct correlation between type of breakfast eaten by subjects and their endurance levels. This contradicts Sandercock's (2010) findings that those children who eat a recommended breakfast with wholegrain based foods are substantially fitter than those children who skip breakfast on a daily basis.

### Flexibility



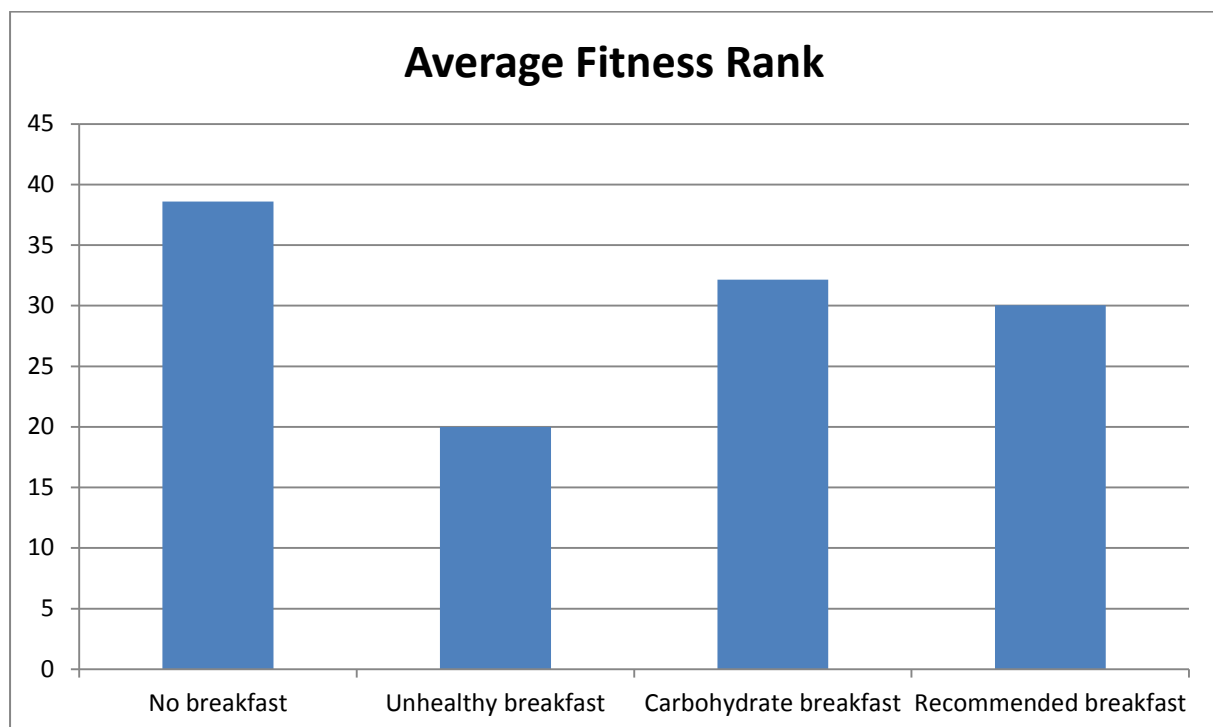
**Figure 4.7: Represents the subjects' flexibility 'Sit and Reach test' results**

Figure 4.7 represents the flexibility results of the 'Sit and Reach Test' that the subjects completed. In this test, the higher the score in centimetres, the better flexibility that the subject has. The average score was 13.36 ( $\pm 6.5$ ). The highest flexibility score recorded was 31cm given by a female who ate an unhealthy breakfast. This subject also recorded the

highest speed score. The lowest flexibility score was 1cm which was produced by a three males, all of whom ate carbohydrate based breakfasts. The low scores for males in the ‘Sit and Reach test’ can be directly linked to the age and body composition of the subjects involved. At this age, males’ change in body composition is more dramatic as they hit puberty and start to add muscle. This has an adverse effect on flexibility as their bones are growing but the muscles and tendons are unable to stretch and keep up with this growth.

#### **4.4 Fitness levels relative to breakfast consumption**

The fitness levels of the subjects across the five areas of Speed, Agility, Strength, Flexibility and Endurance were recorded in Microsoft Excel and the subjects were then ranked in accordance with the best scores and times for each test. A sum of ranks was then completed to establish which type of breakfast the fittest subjects belonged to. This information gives the most complete picture regarding the findings in this investigation.



**Figure 4.8: Represents the average fitness ranks for the subjects and their breakfast consumption**

Figure 4.8 represents the average fitness ranks for the subjects against the type of breakfast they ate. The lower the ranking, the fitter the subject was. In order to establish whether or not

there was any correlation between breakfast consumption and fitness levels, a fitness rank was recorded for each group. The lowest category was 'Unhealthy breakfast', however, there were only two subjects in this category and one subject scored very highly in each of the fitness tests while the other subject scored below average resulting in an anomaly within the results. The next category was that of 'Recommended Breakfast'. As expected, the overall ranking of the subjects who ate a recommended breakfast was better than those who ate a carbohydrate based breakfast or no breakfast at all. Also, as expected, those subjects who ate no breakfast at all were ranked the least fit from all the subjects.

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# *Chapter Five*

## *Conclusions*

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### 5.1 Conclusions



In conclusion, after all five fitness test categories are examined and the fitness ranks of each subject are established, it is evident that a correlation does exist between breakfast consumption and physical fitness levels, however, some subjects proved different.

As expected, those subjects who ate a recommended, wholegrain based breakfast performed well in each of the five fitness tests and therefore had a better average fitness rank. This can be linked to research carried out by Mahoney et al (2005) who state that breakfast is the most important meal of the day, contributing to daily nutrient intake and energy needs. The energy that breakfast provides will allow children to get through the morning being able to concentrate on learning and playing.

The results provided by the category classified 'Carbohydrate breakfast' provided mixed results. Many subjects performed very well over the five fitness tests with one subject in this category ranking 1<sup>st</sup> overall, while other subjects performed below average with another subject ranking 63<sup>rd</sup>. Carbohydrate based breakfast such as toast and bagels have been proven to only give children energy for one to two hours. Because of their carbohydrate nature, they will cause blood sugar levels to rise quickly but then to drop quickly as well causing children to tire and unable to concentrate (Murphy et al, 1999).

There were only two subjects who were categorised into 'Unhealthy breakfast' with both consuming lunch or dinner products for breakfast. One of these subjects performed very well in each of the fitness tests and ranked 5<sup>th</sup> overall, causing an anomaly with the results. The other subjects as would be expected scored below average in all of the five fitness tests.

As expected those subjects who ate no breakfast at all, had the lowest average fitness ranks. This can be backed up by the mass of research that states that breakfast is in fact the most important meal of the day not only providing children with the energy to concentrate on academic tasks, but with the energy to participate fully in physical activity. Chiarella et al (2004) stated that physical activity is one of the most important factors for the prevention of obesity in young children also stating that physical education in school played a vital role in this prevention.

## **5.2 Recommendations**

After completing this study, it would be recommended that children are given a better insight and education into the importance of eating breakfast and what is recommended to eat for breakfast. From analysing the results, it was established that while many children were eating breakfast before school, they were not eating a healthy and substantial breakfast. This would also mean that parents too need to be educated on the same issues. While studying the results for this research, it was clear to see that many of the subjects were very unfit and this would indicate that a lot of them were not getting the recommended sixty minutes a day of physical activity. This is an issue that would also need to be dealt with, as neglecting physical activity as well as an unhealthy diet, will in many cases lead to childhood obesity. Physical activity within school has a major role when it comes to increasing the participation rates of children and it is the role of the teacher to provide an enriched programme of learning where the children are not only being educated about the importance of physical activity and exercise but also enjoying themselves.

It may also have been beneficial to the study if fitness tests were initially carried out and the subjects were then asked to change their breakfast habits and eat a wholegrain based breakfast. After a period of time, fitness tests could have been carried out again to see if, with the change in breakfast type, there was any improvement in physical fitness.

### **5.3 Limitations**

Having reviewed this study, it is evident that there were in fact a number of limitations that may have restricted research and in turn have impacted on the outcome. This was a small scale study that was carried out over a short period of time with a limited number of subjects. The subjects who participated in the study were all from the one school, which was situated in a town and were all Primary 6 children. The small scale nature of this study means it is not representative of the whole population and only a small minority.

The physical fitness testing of the subjects also provided limitations. This was, for the majority of the subjects, the first time they had participated in fitness tests. This then meant that they were unsure of procedures, techniques and may not have had the right motivation to complete the tests to the best of their ability.

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# *Appendices*

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**APPENDIX A**

**Consent letter to Principal**





Dear Principal,

I am a 4<sup>th</sup> year Physical Education student at St. Mary's University College, Belfast. As a component of my final year project I am investigating the impact of breakfast consumption on physical fitness in Primary School children. A requirement of such a study would be to research the current fitness levels of a selection of Primary School pupils. With your permission I would greatly appreciate the opportunity to use a sample of Key Stage 2 pupils from your school to participate and assist in my investigation.

Completing this section of the investigation in your school would involve speaking with the pupils in question for approximately 10 minutes at the start of the day and explain the process of fitness testing and the various elements and methods which will be included. Pupils will understand the reasons why fitness tests occur and how they are beneficial in the lives of athletes and indeed in their own lives. In order to complete the fitness tests it is likely that a morning or afternoon will be required as there are 5 physical fitness tests. The use of your sports hall would be fantastic also as the tests involve running and movement as well as a spacious area to operate in which is not dependent upon the weather.

Your co-operation would mean a great deal and would be greatly appreciated. The assistance of the school would ensure the completion of a successful and reliable study which may provide some valuable findings for the school to consider in future in striving for excellence.

Yours Sincerely,

Fionnuala Rodgers

## **APPENDIX B**

### **Consent letter to parent**



Dear Parent/Guardian,

I am a 4th year Physical Education student at St. Mary's University College, Belfast. As a component of my final year project I am investigating the impact of breakfast consumption on physical fitness in Primary School children. A requirement of such a study would be to research the current fitness levels of a selection of Primary School pupils. With the permission of the school, your child has been selected to partake in the study and your consent would be greatly appreciated as the participation of your child is of huge benefit to the investigation.

If your child were to partake, there are three factors that will be involved. As well as a brief initial talk the main element of the study will be the testing procedure. Your child would take part in 5 tests which examine various elements of fitness, namely muscular strength, endurance, flexibility, speed and agility. I can assure you that all information gathered will be dealt with in the highest degree of confidentiality and professionalism.

I would be delighted if you could accommodate me in gathering the necessary information for the study. Please complete and return the permission slip below.

Yours Sincerely,

Fionnuala Rodgers

(Please cut along the dotted line and return the form to the school as soon as possible.)

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I do/do not give my child \_\_\_\_\_ permission to partake in this research. I am also aware that any information gathered during this study will be confidential.

Signed \_\_\_\_\_ Date \_\_\_\_\_

## **APPENDIX C**

### **Fitness test descriptions**

In total 5 elements of fitness will be tested. The following are descriptions and images explaining each test.

The 5 elements of fitness being tested include:

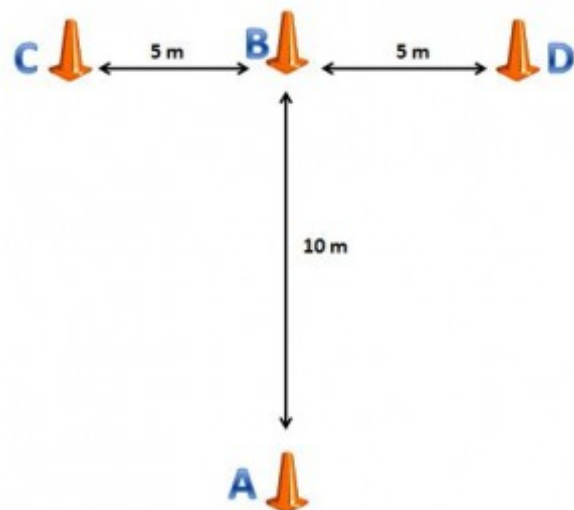
- Agility
- Endurance
- Flexibility
- Speed
- Muscular Strength

### Agility – The “T” Test

The T-Test is a test of agility for athletes, and includes forward, lateral, and backward running.

**Equipment required:** tape measure, marking cones, stopwatch, timing gates (optional)

**Procedure:** Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m). The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touch its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. The participant then shuffles back to cone B and touches it with the left hand before running backwards to cone A. The stopwatch is stopped as the individual passes cone A.

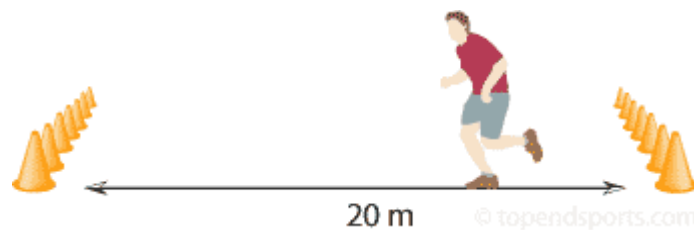


### **Endurance – 20m Multistage Fitness Test (The Bleep Test)**

The 20m multistage fitness test or Bleep Test is a commonly used maximal running aerobic fitness test.

**Equipment required:** Flat, non-slip surface, marking cones, 20m measuring tape, beep test CD, CD player, recording sheets.

**Procedure:** This test involves continuous running between two lines 20m apart in time to recorded beeps. The test subjects stand behind one of the lines facing the second line, and begin running when instructed by the cd or tape. The speed at the start is quite slow. The subject continues running between the two lines, turning when signalled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is not reached in time for each beep, the subject must run to the line turn and try to catch up with the pace within 2 more 'beeps'. Also, if the line is reached before the beep sounds, the subject must wait until the beep sounds. The test is stopped if the subject fails to reach the line (within 2 metres) for two consecutive ends.



**Scoring:** The athlete's score is the level and number of shuttles (20m) reached before they were unable to keep up with the recording. Record the last level completed (not necessarily the level stopped at).

### **Speed – The 20m Dash**

**Purpose:** The purpose of this test is to determine acceleration, maximum running speed and speed endurance, depending on the distance run.

**Equipment required:** measuring tape or marked track, stopwatch or timing gates, cone markers.

**Procedure:** The test involves running a single maximum sprint over a set distance, with time recorded. After a standardized warm up, the test is conducted over 20m. The starting position should be standardized, starting from a stationary position with a foot behind the starting line, with no rocking movements. If you have the equipment (e.g. timing gates), you can measure the time to run each split distances (e.g. 5, 10, 20m) during the same run, and then acceleration and peak velocity can also be determined. It is usual to give the athletes an adequate warm-up and practice first, and some encouragement to continue running hard past the finish line.



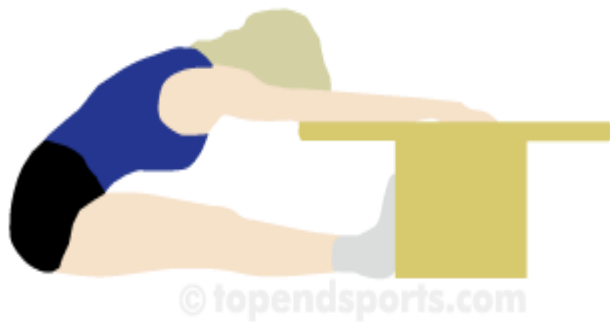
**Scoring:** The participant will be timed for their 20m run and their score recorded to the nearest 0.01 second. The best time of 2 runs will be recorded and there should be the option of a trial run beforehand also.

### **Flexibility – Sit and Reach Test**

The sit and reach test is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles.

**Equipment required:** sit and reach box (or alternatively a ruler can be used, and a step or box)

**Procedure:** This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded. Make sure there are no jerky movements.



**Scoring:** The score is recorded to the nearest centimetre as the distance reached by the hand. Some test versions use the level of the feet as the zero mark, while others have the zero mark 9 inches before the feet.

### **Muscular Strength – The Handgrip Dynamometer**

The purpose of this test is to measure the maximum isometric strength of the hand and forearm muscles. Handgrip strength is important for any sport in which the hands are used for catching, throwing or lifting. Also, as a general rule people with strong hands tend to be strong elsewhere, so this test is often used as a general test of strength.



**Equipment required:** handgrip dynamometer

**Procedure:** The subject holds the dynamometer in the hand to be tested, with the arm at right angles and the elbow by the side of the body. The handle of the dynamometer is adjusted if required - the base should rest on first metacarpal (heel of palm), while the handle should rest on middle of four fingers. When ready the subject squeezes the dynamometer with maximum isometric effort, which is maintained for about 5 seconds. No other body movement is allowed. The subject should be strongly encouraged to give a maximum effort.

**Scoring:** The best result from several trials for each hand is recorded, with at least 15 seconds recovery between each effort.

Sourced from Top End Sports: The Sport and Science Resource (2013), available at <http://www.topendsports.com/testing/tests.htm>



## **APPENDIX C**

### **Fitness test descriptions**

Please circle your answer:

Do you eat breakfast before coming into school?

Yes/ No

If your answer is yes, please describe what you have for breakfast each morning:

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