The Prevalence of Overweight and Obesity of Six to Nine year old Black African Children in a Rural Town of Mpumalanga

By

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DECLARATION

I, Hanlie Pearl Bezuidenhout & 205026834, hereby declare that the dissertation for Student’s qualification to be awarded is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

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Abstract

The aim of the study was to determine the Body Mass Index with regards to overweight and obesity of Black African children between the ages of six and nine years who were enrolled in three rural public schools within Mpumalanga Province, South Africa. The researcher used a quantitative descriptive research design. Each child’s weight and height was measured and their BMI and BMI percentile for gender and age calculated. According to the BMI percentile calculations for gender and age for the sample which consisted of 902 children, three percent were defined as being underweight, 79 percent as being normal weight, 11 percent as being overweight, and seven percent as being obese. In the sample there were also 21.3 percent children who were at risk of becoming overweight (3.5%) and obese (17.8%). Without intervention these at risk learners may in their adolescent and adult years be adversely affected by the physiological and psychosocial consequences related to their condition. Suggestion is made to utilise a Forum through which various stakeholders can pool their expertise and resources to develop a programme of intervention with the aim to prevent escalation of overweight and obesity, as well as reversing the current prevalence as identified within the research population.
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List of Acronyms
BMI  Body Mass Index
CDC  Centers for Disease Control and Prevention
IASB  International Association for the Study of Obesity
MRC  Medical Research Council
MMWR  Morbidity and Mortality Weekly Report
SCFE  Slipped Capital Femoral Epiphysis
SNAP  Supplemental Nutrition Assistance Program
WHO  World Health Organization

List of Keywords
At risk, body mass index, child, ordinary public rural school, undeveloped and developed country
CHAPTER ONE

PROBLEM IDENTIFICATION

1.1 INTRODUCTION

A vast number of studies on overweight and obesity in children have been conducted over the past decade. These studies range from single once-off surveys to longitudinal and comparative studies focusing on the prevalence, causes, consequences, and recommendations for the prevention and reduction of overweight and obesity.

While an array of research teams within the medical, paramedical, social and other sciences have contributed towards insightful understanding of the many facets relating to overweight and obesity, individual scientists, including biokineticists, have also played an important instrumental role, especially in countries such as South Africa where there is a need to increase the pool of knowledge on a phenomenon that has become a worldwide health concern, amongst other as reported by the Worldwatch Institute (2011) in their latest communique:

Lack of access to healthy food doesn’t result only in hunger. More than 1 billion people around the world are overweight, and nearly half of this population is obese. Nearly 43 million children under the age of five were considered overweight in 2010. Surging international rates of heart disease, stroke, diabetes, and arthritis are being attributed to unhealthy diets, and 2.8 million adults die each year as a result of overweight or obesity (21 December 2011).

Against the background of the aforementioned, the researcher in this chapter provides contextual understanding of the research that was undertaken on childhood overweight and obesity to give perspective on a target group consisting of rural Black African children between the ages of six to nine years and who were enrolled as learners in three public ordinary schools in Mpumalanga Province, South Africa.
1.2 RESEARCH PROBLEM

According to Benson, Baer & Kaelber (2010:153), the increase in the prevalence of overweight and obesity in children is related to costly and harmful co-morbid states. However, while there is concern that the prevalence of these conditions are likely to increase, there are researchers who are of the opinion that the prevalence has already reached its plateau in some countries (Olds, Maher, Zumin, Péneau, Lioret, Castelbon, Bellisle, de Wilde, Hohepa, Maddison, Lissner, Sjöberg, Zimmermann, Aeberli, Ogden, Flegal & Summerbell, 2011). This raises the level of concern about the message that is being conveyed to the public regarding childhood overweight and obesity, as a review of literature indicates a need for research pertaining to developing countries, and specifically on rural populations. Even a cursory review of research points to a greater volume which has been undertaken on urban populations within developed countries in comparison with rural populations and developing countries. In addition to this, research on childhood populations is required as longitudinal prevalence studies on childhood populations indicate an escalating trend with a need to prevent or reduce its stride before reaching a co-morbid state threatening the quality of life of children and adolescents (Niclasen, Petzold & Schnohr, 2006:17).

Further to this, Kimbro, Brooks-Gunn & McLanahan (2007:298) indicate that overweight children are more likely to become overweight adults, and that children who are obese in their preschool years, are more likely to be obese in adolescence and adulthood (Morbidity and Mortality Weekly Report, 2009:769). This is echoed by Discigil, Tekin & Soylemez (2009:154) when they report that severe and early onset of paediatric obesity results in a more severe obesity in adulthood.

Recent studies emphasise health risks which are associated with overweight and obesity in children and adults. While Benson et al., (2010:153) report that an elevated paediatric body mass index (BMI) is associated with high blood pressure, atherosclerosis, left ventricular hypertrophy, sleep apnea, asthma, polycystic ovarian syndrome, type 2 diabetes mellitus, gastroesophageal reflux, constipation and orthopaedic complications. Cole, Bellizzi, Flegal & Dietz (2000:1) add hyperlipidemia,
and Mollentze (2006:4) refers to hyperuricaemia, osteoarthritis and malignancies of the breasts, while Discigil et al. (2009:153) and Kimbro et al. (2007:298) report on endometrium, and colon and cardiovascular diseases in adulthood as being associated with overweight and obesity in childhood.

In a study conducted by Doolen, Alpert & Miller (2009:161) on childhood overweight and obesity, various health risks relating to overweight and obesity were grouped into three categories, namely immediate consequences (social discrimination, poor self-esteem and depression), short-termed consequences (skipped femoral epiphesis, steatohepatitis and pseudotumor cerebri), and long-termed consequences (cholelithesias and early maturation). The consequences of these conditions do not only result in negative physical health experiences for children but also for their psychosocial well-being.

Overweight and obesity has been described as a worldwide epidemic (Barlow, 2007:177), and therefore warrants research, especially in developing countries, with special emphasis on neglected populations living in rural environments.

While the researcher is of the opinion that research of this nature is important, she also maintains that grounded knowledge is required on which to base further research, policy-related decisions and timely intervention.

1.3 RESEARCH QUESTIONS
The following questions guided the research.
1.3.1 How do the findings of this research compare with those emanating from research undertaken in South Africa and elsewhere?
1.3.2 Is there a significant difference between age and gender cohorts pertaining to overweight and obesity within the respondent group of this research?
1.4 RESEARCH ASSUMPTIONS
With reference to the research, a number of assumptions were formulated; these being that there would be a significant difference
1.4.1 between age cohorts and weight of learners
1.4.2 between gender cohorts and weight of learners
1.4.3 between age cohorts and height of learners
1.4.4 between gender cohorts and height of learners
1.4.5 in gender cohorts for BMI percentile scores
1.4.6 in age cohorts for BMI percentile scores.

1.5 AIM AND OBJECTIVES OF RESEARCH
The aim of the study is to determine the Body Mass Index with regards to overweight and obesity of Black African children between the ages of six and nine years who are enrolled in three rural public schools within Mpumalanga Province, South Africa.

In order to achieve the aim of the research, the researcher
1.5.1 took anthropometric measurements (weight and height) of boys and girls between the ages of six and nine years.
1.5.2 compared the results of each learner’s anthropometric measurements with BMI for age percentiles according to charts used by the Centers for Disease Control and Prevention (2009) developed in collaboration with the National Center for Health Statistics, and which are recommended by the World Health Organization (WHO).
1.5.3 determined the prevalence of overweight and obesity within the respondent group; while also determining the prevalence of learners who are at risk for overweight and obesity.

1.6 SCOPE OF STUDY
The researcher undertook a once-off survey to determine the prevalence of overweight and obesity among 902 children between the ages of six to nine years of age. The town of Ermelo within Mpumalanga Province was selected as the researcher resided within
this geographical location. Gender and age served as temporal boundaries, with each individual learner / child being the research unit. Strict ethical guidelines were adhered to. Measurements were undertaken during the second week of the third school term of 2011.

1.7 RELEVANCE OF THE STUDY
There is much speculation regarding the high prevalence of overweight and obesity among South African childhood populations; however, an inadequate volume of research prevents a thorough comparative scrutiny. The contribution made by the researcher thus adds valuable data to provide an opportunity for comparative research analysis and assessment.

Further to this, targeting a rural population and focusing on children aged six to nine years, more so on a sample of Black African children, adds value as the research contributes to an existing pool of similar research.

Finally, the research gives opportunity for the findings to be presented in appropriate scientific journals and delivered at relevant conferences.

1.8 OUTLINE OF CHAPTERS
This dissertation comprises of five chapters. These are:

Chapter 1: Problem identification (to provide a perspective on childhood overweight and obesity, and introduce the reader to the purpose, scope and nature of the study).

Chapter 2: Literature review (to report on insights gained from relevant studies on the prevalence, nature, causes and consequences of overweight and obesity in children).

Chapter 3: Methods and procedures (to outline those methodological and ethical decisions and choices that were made during the research in order to ensure valid and reliable research outcomes).
Chapter 4: Results (to provide an account of descriptive and statistical analysis from which findings were derived).

Chapter 5: Discussion, conclusion and recommendation (to give perspective on the study in terms of its aim, purpose and limitations, while also attending to recommendations based on important findings relating to the research).

1.9 OPERATIONALISATION OF KEY CONCEPTS

The following key concepts were used in the research:

- **At risk**
  The researcher used the 83rd to 84.9th percentile to determine learners at risk of becoming overweight, and the 93rd to 94.9th percentile to determine those learners who are at risk of becoming obese.

- **Body Mass Index**
  Body Mass Index is used to assess weight relative to height and is calculated by dividing body weight in kilograms by height in meter squared (kg/m²) (Whaley, Brubaker, Otto & Armstrong, 2006:58).

- **Child**
  A child is a person under the age of 18 years as determined by The Children’s Act No 38 of 2005, as amended by the Children’s Amendment Act No 41 of 2007.

- **Ordinary Public Rural School**
  Farm, secondary and high schools were not included in the research; only primary schools. As per definition of an ordinary public rural school, such a school is located within a rural municipal location or town, whether or not the school is physically situated within the town or township. Furthermore, these schools are mainly supported by government funds, and any child may enrol as learner, as long as he/she meets the requirements of the Department of Basic Education.
• **Undeveloped and developed countries**

While the use of the terms 'undeveloped' and 'developed' denote the level to which a country is industrialised and provides for health, education and living standards for its citizenry, it is also important to take the nature of its socio-economic and political environment into account. The latter is important, as it impacts on quality of human well-being. In this research, a country is categorised as undeveloped when its level of industrial development and human well-being is low, and is mainly reliant on other countries for support measures, as well as having incurred a high HDI score on the United Nations’ Human Development Index (2011) (Addendum B).
2.1 INTRODUCTION
Historically, a child referred to as ‘fat’, ‘chubby’ or ‘plump’ was viewed as healthy, and was perceived as a person who would survive undernourishment and infections (Ebbeling, Pawlak & Ludwig, 2002:473). In some South African cultures females who are overweight are viewed as attractive and receive respect, as plumpness is associated with dignity and affluence. On the other hand, slenderness is also associated with illness, as there is the perception that those who are underweight or slender have HIV/AIDS (Kruger, Puoane, Seneka & van der Merwe, 2005:492). No matter the perception, there is concern that the global prevalence of overweight and obesity has dramatically increased over the last two decades (Mollenze, 2006; Willows, Johnson & Ball, 2007; Doolen, Alpert & Miller, 2008; Discigil, Tekin & Soylemez, 2009; Benson et al., 2010).

This chapter provides an overview of the prevalence of overweight and obesity, while paying attention to various factors that give an understanding of the nature, cause and consequence of overweight and obesity as extracted from a review of relevant literature.

2.2 PREVALENCE OF OVERWEIGHT AND OBESITY
Reporting on findings and trends that relate to overweight and obesity is a difficult task due to differences in the nature of methodology used during research; the size and composition of the target group, and when the study was conducted. However, much research has been done globally, including South Africa, on the prevalence of overweight and obesity in which children were used as respondents.
While some researchers such as Ogden & Carroll (2010) undertook longitudinal research on childhood overweight and obesity in the United States of America (USA), others used a single or once-off survey research methodology; especially to generate an information data-base within their country. Notwithstanding, such surveys do provide important preliminary or suggestive trends.

In order to provide a global perspective on research pertaining to the prevalence of overweight and obesity in children, a cross-section of these studies are tabulated and presented in Addendum A. These studies depict national and sub-national population samples, and were reported by the International Association for the Study of Obesity (IASB, 2012), while the researcher also identified additional journal sources within leading electronic databases that substantiated such findings.

In order to report on trends emanating from within the global arena, and thereafter Africa and South Africa, the researcher adapted the United Nations' guidelines for mapping that was developed by their Cartographic Section, Department of Field Support (2009).

2.2.1 GLOBAL TRENDS ON OVERWEIGHT AND OBESITY (EXCLUDING SOUTH AFRICA)
In a study (Olds et al., 2011) comparing data for the years 1995 to 2008 of 467 294 children between the age of 2 to 19 years living in Australia, China, England, France, Netherlands, New Zealand, Sweden, Switzerland and USA, these researchers claim that contra to the belief that the prevalence of overweight and obesity is increasing, their research shows that for these countries, the prevalence rate is stabilising. Nevertheless, individual studies within these and other countries indicate various trends pertaining to the prevalence of overweight and obesity amongst children. These are summarised in Addendum A but reported below.

With reference to gender, studies show that:

- More boys than girls were identified as being overweight in Canada (Shields, 2006:28-44), Brazil (de Assis, Rolland-Cachera, Grosseman, de Vasconcelos,

- **More girls than boys were defined as being overweight** in America (Lobstein & Jackson-Leach, 2007: 62-64), Mexico (Encuesta nacional de salud y nutricion 2006), Chile (Kain, Uaui, Vio & Albana, 2002), Norway (Júlíusson, Roelants, Eide, Hauppie, Waaler & Bjerknes, 2007), Sweden (Mårild, Bondestam, Bergström, Ehnberg, Hollsing & Albertsson-Wikland, 2004), England (Health Survey for England, 2007), France (Lioret, Touvier, Dubuisson, Dufour, Calmassi-Tran, Lafay, Volatière & Maire, 2009), Netherlands (van den Hurk, van Buuren, van Buuren, Verkerk & HiraSing, 2007), Saudi Arabia (Elhazmi & Warsy, 2002), Australia and Zimbabwe (Ferro-Luzzi, 2001), and **slightly more girls than boys** in Iran, Senegal and Ethiopia.

- **More boys than girls were reported as being obese** in Canada (Shields, 2006: 28-44), Mexico (Encuesta nacional de salud y nutricion 2006), Brazil (de Assis et al., 2005), Chile (Kain et al., 2002), Spain (Serra et al., 2003), Portugal (Sardinha et al., 2011), Germany (Bluher et al., 2011), Switzerland (Aeberli et al., 2010), Poland (Chrzanowska et al., 2007), Russian Federation (IASO, 2012), Iran (Kelishadi, Ardalan, Gheiratmand, Majdzadeh, Hosseini, Gouya, Razaghi, Delavari, Motaghian, Barekati, Mamoud-Arabi & Lock, 2008), India (Khadilkar et
More girls than boys were categorised as being obese in America (Lobstein & Jackson-Leach, 2007: 62-64), Norway (Júlíusson et al., 2007), Sweden (Mårild et al., 2004), Ireland (IASO, 2012), England (Craig and Shelton, 2008), France (Lioret et al., 2009), Netherlands (van den Hurk et al., 2007), Saudi Arabia (Elhazmi & Warsy, 2002), Australia, New Zealand, Egypt (Hassan et al., 2008), and Zimbabwe (Ferro-Luzzi, 2001), with slightly more girls than boys in Senegal and Ethiopia being obese.

Taking the abovementioned studies into account when comparing for overweight and obesity ratios between boys and girls (collectively calculated), it was found that a 1:2 male-female ratio existed for Mexico, Chile, Ireland and Egypt, with an increasing ratio trend ranging from 1:3 for Portugal, India, Japan and Australia; 1:4 for Norway, France and Russian Federation; 1:5 for China, and the highest, a 1:6 ratio for Sweden and Poland.

The United Nation’s Human Development Index (HDI) (2011) categorises countries into those that are very highly, highly, medium and poorly developed, and lists them numerically from most to least in their achievements in providing for health, education and living standards; thus the Index serves as a useful tool through which to extract trends relating to the prevalence of overweight and obesity in children (Addendum B). Using the same references as for the abovementioned studies, the following trends can be suggested:

- In very highly developed countries [Australia (HDI=3 with 46% prevalence of overweight and obesity), Canada (HDI=9 with 54.3% prevalence of overweight and obesity), Chile (HDI=10 with 55.7% prevalence of overweight and obesity), Germany (HDI=18 with 40.2% prevalence of overweight and obesity) Ireland (HDI=23 with 54% prevalence of overweight and obesity), Japan (HDI=26 with
40.9% prevalence of overweight and obesity), Netherlands (HDI=33 with 43.7% prevalence of overweight and obesity), New Zealand (HDI=34 with 45% prevalence of overweight and obesity), Portugal (HDI=37 with 45.4% prevalence of overweight and obesity), Spain (HDI=42 with 55.8% prevalence of overweight and obesity), Sweden (HDI=43 with 36.5% prevalence of overweight and obesity), United Kingdom (HDI=46 with 49.3% prevalence of overweight and obesity), and United States of America (HDI=47 with 70.9% prevalence of overweight and obesity)] and relative to highly developed countries [Brazil (HDI=56 with 55.2% prevalence of overweight and obesity), Iran (HDI=65 with 29.4% prevalence of overweight and obesity), Mexico (HDI=73 with 57.1% prevalence of overweight and obesity), Russian Federation (HDI=80 with 44% prevalence of overweight and obesity), and Saudi Arabia (HDI=84 with 44.4% prevalence of overweight and obesity)] a high overweight and obesity level in childhood samples are noticeable.

- **In medium developed countries** [Algeria (HDI=95 with 18.2% prevalence of overweight and obesity), China (HDI=101 with 10.74% prevalence of overweight and obesity), Egypt (HDI=104 with 35.4% prevalence of overweight and obesity), India (HDI=113 with 38.9% prevalence of overweight and obesity)], and those that are poorly developed [Ethiopia (HDI=156 with 0.6% prevalence of overweight and obesity), Senegal (HDI=177 with 0.5% prevalence of overweight and obesity), and Zimbabwe (HDI=187 with 3.7% prevalence of overweight and obesity)] a lower prevalence was noticeable.

2.2.2 OVERWEIGHT AND OBESITY TRENDS IN SOUTH AFRICAN CHILDREN

Whether or not childhood overweight and obesity is viewed as a significant health condition that warrants urgent attention, a statement by the South African Society for Obesity and Metabolism (2011) claims that 22 percent of South African children between the ages of one to nine years have a BMI of >25 and this in itself requires the attention of researchers.
Monyeki, Lenthe & Steyn (1999) undertook a study to ascertain the prevalence of obesity in a South African sample. Findings from their sample size comprising of 1 336 children three to 10 years of age showed that at the age of seven and eight, the mean BMI was statistically significantly higher in boys than in girls, while 0-2.5 percent of the boys and 0-4.3 percent of the girls had BMI values above the 85th percentile. This indicates a low prevalence of overweight in young children. However, approximately 15 percent of the males presented over-fatness at three to four years of age.

The THUSA-Bana (Transition and Health during Urbanisation of South Africa; BANA meaning children) research was conducted in 2000 in North-West Province of South Africa. A sample of 1 257 children between the age of 10 and 15 years were surveyed; stratified according to age, gender, type of school and ethnic group. They found that 92.1 percent of these children fell within the range of normal weight, whereas 7.8 percent of the respondents were defined as overweight or obese. These results also indicated a 1:2 gender ratio, with girls (10%) being more likely than boys (5.6%) to be defined as being overweight or obese.

In a study that was conducted by Somers, Hussan, Rusford & Erasmus (2006) on 338 children respondents between the ages of 10 to sixteen who attended school in Belhar, Delft and Mfuleni in the Western Cape Province, it was found that while 15.7 percent of the learners were overweight, and 6.2 percent were defined as obese; overweight was significantly higher in females (21.1%) than males (8.4%), and significantly higher in African (21.8%) than Coloured children (13.7%). Further to this, almost 50 percent of African females were found to be overweight by the time they reached 16 years of age.

Armstrong, Lambert, Sharwood & Lambert (2006) conducted research, throughout all nine provinces, on the prevalence of overweight and obesity in primary school children who were between the ages of six to 13 years. The data was collected over a period of three years from 2001 to 2004 on 10 283 children. These researchers found that girls (17.5%) more than boys (10.9%) were found to be overweight, whereas only 2.4 percent of boys in comparison to 4.8 percent of girls were defined as being obese.
Finally, Reddy, Resnicow, James, Kambaran, Omardien & Mbewu (2008) conducted a national research study to determine underweight, overweight and obesity among South African adolescents. In a sample of 9 224 Grade 8 to 11 learners who were enrolled in 207 schools across nine provinces, it was found that nine percent of the learners were defined as being underweight, whereas 16.9 percent and four percent were identified as being overweight and obese respectively.

An analysis of these South African studies indicate that overweight and obesity is prevalent in South African childhood populations; that a higher prevalence is more likely to be found amongst girls than boys, and that ethnicity may attribute towards a difference in prevalence outcomes.

2.3 CAUSES OF OVERWEIGHT AND OBESITY

According to the Centers for Disease Control and Prevention Adult Obesity Report (2010:2), people who eat too much, and spend too little time exercising or participating in physical activity, will gain weight. While this statement may be true, it should be kept in mind that there are also numerous physical mechanisms, like maintaining a balance between energy intake and energy expenditure that regulate body weight. (Ebbeling et al., 2002:474). However the increase of overweight and obesity in a population is only partially understood, as generic factors, often labelled “genetics”, “environment” and “energy balance” do not individually explain the proportion of inter-individual variances in adiposity (Cope & Allison, 2008: 595). Therefore, taking these and other variables into consideration, the researcher herein provides an overview of salient factors that influence body weight in the sections that follow to provide a greater understanding of their relation to overweight and obesity in children.

2.3.1 GENETIC AND ENVIRONMENTAL VARIABLES

A vast pool of research has been undertaken to give insight into genetic mechanisms that influence overweight and obesity within children and adults that range from studies focusing on the thrifty genotype hypothesis (Neel, 1962), implying that gene differences cause increased energy deposits in order to sustain reproduction functioning and survival during times of famine, to recent studies reporting that when leptin is secreted
into the bloodstream the size of fat deposit via the hypothalamus is sent and then regulated by the melanocortin 4 receptor (MC4R) to effect overweight and obesity (Hinney, Vogel & Hebebrand, 2010).

In spite of genetic research outcomes as cause for overweight and obesity, much still needs to be done to isolate the exact genetic cause or causes while excluding the influence of environmental and psychosocial factors that have been mentioned in the aforementioned sections.

At best it can be concluded that in the midst of on-going research environmental and other mechanisms will continue to play a role in the aetiology of overweight and obesity. However, the crucial permission role of genetics, as it interacts with other non-genetic factors cannot be ignored (Miller, Rosenbloom & Silverstein, 2004:4211; Speiser, Rudolf, Anhalt, Camacho-Hubner, Chiarelli, Eliakim, Freemark, Pescovitz, Pinhas-Hamiel, Rogol, Shalitin, Sultan, Stein, Vardi, Werther, Zadik, Zuckerman-Levin & Hochberg, 2005:1875). Viewed from this point genetic predisposition for overweight and obesity cannot be ruled out, and neither can factors, such as increased caloric intake and too little or no physical activity be ignored (Speakman, 2004:2092).

2.3.2 PHYSICAL ACTIVITY

Physical activity is a broadly used term, as it is heterogeneous in nature and difficult to characterise and measure. However, Goran (1998:509) defines it as any physical movement that is a result of skeletal muscle contraction, while Thompson, Buchner, Piña, Balady, Williams, Marcus, Berra, Blair, Costa, Franklin, Fletcher, Gordon, Pate, Rodriguez, Yancey & Wegner (2003:42) confirm and expand this definition by stating that physical activity is body movement produced by skeletal muscles, which results in energy expenditure beyond resting energy expenditure.

In the case of children, physical activity is likely to include numerous behaviours such as play, organised sport, exercise or walking to school (Goran, Raynolds & Linquist, 1999:20). However, when describing and quantifying physical activity, it is important to
consider that type and purpose, intensity, efficiency, duration, frequency and specific energy cost of the activity performed should be taken into account (Goran, 1998:509).

It must be kept in mind that concepts such as physical activity and exercise may not be used synonymously (Goran, 1998:509). Exercise is a subset of physical activity that is planned, structured, repetitive and purposefully aimed at improvement or maintenance of the human body. Physical fitness is the objective achieved through physical activity (Thompson et al., 2003:43).

While physical fitness includes cardiovascular fitness, muscles strength, body composition and flexibility; and refers to the fact that it is dependent on a set of attributes people have or achieve relative to their ability to perform physical activity (Thompson et al., 2003:42), Goran et al. (1999:18) adds balance, agility, speed and endurance to the repertoire of physical fitness.

Regular physical activity using large muscle groups produce cardiovascular adaptations and increases exercise capacity, endurance and skeletal muscle strength (Thompson et al., 2003:1). In children, regular physical activity results in better aerobic capacity and higher levels of motor functioning and better endurance; especially during fast running (Bukara-Radujkovic & Zdravkovic, 2009:111). Physical activity also benefits body weight regulation, improves body composition, and the psychosocial well-being of the individual (Robinson, 1999:1561; Goran et al., 1999:18). Physical activity is therefore an important factor in the prevention of overweight and obesity in children and adolescents. This is noticeable in both inactive girls and boys who have a higher percentage of body fat (Bukara-Radujkovic & Zdravkovic, 2009:111-112).

Physical activity prevents established atherosclerotic risk factors, such as elevated blood pressure (Torrance, McGuire, Lewanczuk & McGavock, 2007), insulin resistance (Bell, Watts, Siafarikas, Thompson, Ratnam, Bulsara, Finn, O'Driscoll, Green, Jones & Davis, 2007), glucose intolerance, elevated triglyceride concentration (Steinberger & Daniels, 2003), low high-density lipoprotein cholesterol (HDL-C) and obesity (Thompson et al., 2003:2). Associated with lack of physical activity and leading to health problems are, smoking, drug use, sexual activity and academic performance, suggesting that lack
of physical activity plays a role in obesity, negative health consequences, poor quality of life and is a threat to the psycho-social well-being of an individual (Goran et al., 1999:18).

However, connected to the benefits of regular physical activity, there are risks involved when not executed in a proper mode. According to Bukara-Radujkovic & Zdravkovic (2009:111), children younger than 10 years of age, regardless of gender, can only slightly increase their aerobic capacity during intensive physical activity. This being the case, powerful intense physical activity or training sessions are not recommended before puberty, as there can be a high risk of musculoskeletal injury and sudden cardiac death (Thompson et al., 2003:7-8). It is therefore important to realise that excessive and uncontrolled physical exercise can be harmful even if the child attempts such activity as a means to control his/her weight.

2.3.3 DIETARY HABITS
There has been a shift from traditional foods that are low in fat and rich in fibre, towards meat and dairy products which contain high levels of saturated fats and refined fibre. Kruger, Puoane, Senekal & van der Merwe (2005:492), with reference to Black South Africans specifically, attributes this shift to the fact that members of this ethnic group are now more able than in the past to live and work where they deem fit, while also being exposed to the influence of globalisation and therefore utilise an array of food outlets. In a similar vein, different eating patterns also contribute to body weight; and the change in eating patterns, together with the availability of choice of food, are amongst other things influenced by the fact that there are less stores from which to purchase healthy and affordable foods, in contrast to those that are easily accessible and in which are often unhealthy but affordable foods for purchase (Evans, Blitstein, Lynch, de Villiers, Draper, Steyn & Lambert, 2009:25; CDC, 2010). Furthermore, there is evidence that culinary in restaurants, snacks bought at easy to access outlets, and foodstuffs purchased at vending machines are higher in calories, fat and sugar than homemade food (CDC Adult Obesity Report 2010).
Marketing, promotions and advertisements also contribute to eating habits, with most in-store advertisements displaying “unhealthy” foods to entice the purchaser (Evans et. al., 2009:25; CDC, 2010).

Television advertisements have the same affect contributing to weight gain. In the USA and Britain children are exposed to 10 advertisements per hour of television time during which fast foods, soft drinks, sweets and sugar-sweetened cereals are promoted (Ebbeling et. al., 2002:475). In a study by Borzekowski & Robinson (2001:42-46) it was found that if three to five year olds were exposed to a 30-second commercial, they would select the food they were exposed to even when presented with alternatives to choose from.

Commercial trends are also towards dishing large portions. Although research on this phenomenon is lacking, a study undertaken to measure voluntary energy consumption found that when children were given small, medium, and large portions of macaroni and cheese, resulted in younger children eating the same amount irrespective of the size of the portion, whereas older children consumed their portion. The conclusion was drawn that the older the child, the less responsive he or she is to internal hunger and satiety cues (Rolls, Engell & Birch, 2000).

2.4 HEALTH-RELATED RISKS TO OVERWEIGHT AND OBESITY

Important risks of overweight and obesity, specifically with children, are discussed below.

2.4.1 CARDIOVASCULAR RISK

The progression and severity of atherosclerosis occurs not only with the presence of cardiovascular risk factors but also with their persistence (Berenson, Srinivasan, Bao, Newman, Tracy & Wattigney, 1998). Metabolic syndrome is characterised by a disturbed glucose and insulin metabolism, overweight and abdominal fat distribution, mild dyslipidemia and hypertension, can subsequently lead to cardiovascular disease (Lakka, Laaksonen, Lakka, Niskanen, Kumpusalo, Tuomilehto & Salonen, 2002). In the
section that follows, cardiovascular risks involved with overweight and obesity in children are discussed, as these conditions can lead to a poorer quality of life or even premature death.

2.4.1.1 HYPERTENSION
Hypertension is clinically defined as an elevation in arterial blood pressure equal to or exceeding a systolic blood pressure of 140 mmHg and/or a diastolic blood pressure of 90 mmHg (Whatley, Brubaker, Otto & Armstrong, 2006:213). According to the National Institute of Health (2005:4) on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents, hypertension in children is defined as the average systolic blood pressure and/or diastolic blood pressure that is greater or equal to the 95th percentile for sex, age and height measured on three or more occasions.

In contrast to earlier reasoning that hypertension in children was primarily caused by renal disease, Sorof & Daniels (2002:1-2) found that obese children have a higher prevalence than leaner children to become hypertensive, and that excess body fat predisposes an elevation of blood pressure and hypertension (Virdis, Ghiadoni, Masi, Versari, Daghini, Giannarelli, Salvetti & Taddei, 2009:1065). In a similar vein, Durstine & Moore (2003:76) mentions that at any level of high blood pressure, risk of cardiovascular diseases is increased several-fold for persons with target-organs disease (Durstine & Moore, 2003:76).

According to Griannarelli et al. (2009:1065), hypertension is the most significant cardiovascular risk factor linking obesity to cardiovascular disease; and obesity is directly responsible for effects on the heart and vasculature. These authors are also of the opinion that visceral fat depositions could have a mechanical and paracrine effect on vascular and cardiac structures, as intra-abdominal and intra-thoracic fat is quantitatively related to the height of blood pressure (2009:1066).

Research indicates that weight reduction lowers blood pressure in obese individuals (Boa, Mori, Burke, Puddey & Beilin, 1998; Stevens, Obarzanek, Cook, Lee, Appel,
West, Milas, Mattfeldt-Beman, Belden, Bragg, Millstone, Raczynski, Brewer, Singh & Cohen, 2001; Neter, Stam, Kok, Grobbee & Geleijnse, 2003), and also have a positive effect on insulin resistance (Esposito, Pontillo, Palo, Giugliano, Masella, Marfella & Giugliano, 2003), diabetes (Hamman, Wing, Edelstein, Lachin, Bray, Delahanty, Hoskin, Kriska, Mayer-Davis, Pi-Sunger, Regensteiner, Venditti & Wylie-Rosett, 2006), hyperlipidemia (Gleysteen, 1992), left ventricular hypertrophy and obstructive sleep apnea (Virdis, et al., 2009:1065). A reduction in 5 – 20 mmHg systolic blood pressure can be achieved with a weight loss of 10 kg (Whatley, et al., 2006:214).

2.4.1.2 DYSLIPIDEMIA
Dyslipidemia, or abnormalities in blood lipid and lipoprotein concentrations, is a major modifiable cause of coronary heart disease and is a widespread problem (Whaley et al., 2006:211) that is caused by obesity in children and adults (Ebbeling et al., 2002:473). In a relatively recent study, high-density lipoprotein cholesterol (HDL-C) was associated with changes in body- and fat mass, reducing in concentration, as body- and fat mass increases (Whatley et al., 2006:212).

There are a variety of environmental (diet rich in saturated fats or sedentary lifestyle), genetic (genetic defect in the lipid metabolism), medicinal (thiazide diuretics, progestine or anabolic steroids) and pathologic factors (diabetes, hyperthyroidism, obstructive liver disease) that can alter cholesterol and triglyceride transport. However, when these combine to yield elevated blood lipid and lipoprotein concentrations dyslipidemia occurs (Durstine & Moore, 2003:143).

2.4.2 PULMONARY RISK
The following section provides a discussion on the influence of overweight and obesity on sleep apnea and asthma.

2.4.2.1 SLEEP APNEA
Compared with the past, the body mass of humans have increased, while their average time of sleeping has decreased (Gangwisch, Malaspina, Boden-Albala & Heymsfield, 2005:1289; Patel & Hu, 2008:643).

Stranges, Cappuccio, Kandala, Miller, Taggart, Kumari, Ferrie, Shipley, Bunner & Marmot (2007:321) report an inverse association between the number of hours of sleep and body weight or body mass index.

In their research Touchette, Petit, Tremblay, Boivin, Falissard, Genolini & Montplaisir (2008:1507) mention that the percentage of overweight and obesity in five to 10 year old children was three and a half times higher in those who slept for eight to 10 hours, as compared with those who slept for 12 to 13 hours. These researchers also hold that changes in sleep patterns are amongst other factors due to a change in the circadian rhythm of humans.

With reference to children, there are other reasons for change in sleep patterns, when comparing the past with the present. These are that their sleeping time is less strictly supervised and that they are spending more time engaging in sedentary activities such as watching TV and interacting with electronic media. Must & Parisi (2009:82-84) indicate that the situation of longer waking hours and less sleep is aggravated by artificial lighting; adding that children who have a television set in their bedroom get less sleep. In addition to this, Gangwisch et al. (2005:1289) direct attention to the fact that many children today are overloaded with extramural activities and therefore, have less time to sleep.

Must & Parisi (2009:84) report that sleep affects body weight through metabolic affects and indirect pathways; evidencing that 76% of parents who were interviewed reported that they are unhappy about their child’s sleeping habits. Also, half the adolescents interviewed reported they felt tired and sleepy during the day. Less sleeping hours were also mentioned by five respondents in this sample when it was reported that they only managed nine hours of sleep on weekdays and one hour in addition to this on weekends.
It is important to realise that during normal sleep, growth hormones become active while others, such as the corticotrophin-releasing hormone are inhibited. As growth hormones are secreted during sleep, sleep deprivation over a long period of time causes insulin activity to decrease resulting in an adverse effect on glucose tolerance (Bayer, Rosario, Wabirsch & Kries 2009:1187). In line with this, Bayer et al. (2009:1187) report that growth hormone inhibits adipose tissue lipoprotein lipase activity. Therefore, subjects with higher body mass (having higher amounts of this enzyme) show greater response to sleep-induced growth hormone changes (Bayer et al., 2009:1187).

In addition, sleep deprivation has been linked to alterations in leptin and ghrelin levels, and as mentioned, impaired glucose tolerance (Taheri, Lin, Austin, Young & Mignot 2004:210; Lumeng, Somashekar, Appugliese, Kaciroti, Corwyn & Bradley, 2007:1021; Nixon, Thompson, Han, Becroft, Clark, Robinson, Waldie, Wild, Black & Mitchell, 2008:71). Leptin is an adipocyte-derived hormone which suppresses appetite, and ghrelin is a predominantly stomach-derived peptide that stimulates appetite. Therefore, when sleep deprived appetite increases it is likely to decrease the leptin levels while increasing the ghrelin levels in the human body (Taheri et al., 2004:211). Thus, sleep deprivation causes a child to become tired throughout the day, resulting in them being less likely to engage in active play and instead spend more time on sedentary activities. Subsequently, over a period of time, fatigue increases and the child is at risk to become overweight or obese (Patel & Hu, 2007:643; Yu, Lu, Wang, Wang, Yang, Li, Wang, Liu, Tang, Xing, Xu, Zee & Wang, 2007:1696).

2.4.2.2 ASTHMA

Asthma is a syndrome characterised by reversible obstruction of airflow, and the increase of bronchial responsiveness to a variety of allergic (pollen or dust) and environmental (cool or dry air) stimuli (Dursteine & Moore, 2003:105).

Bronchial asthma (including exercise induced asthma) is the most commonly occurring chronic pulmonary and allergenic disease among children (Dursteine & Moore, 2003:21; Kusunoki, Morimoto, Nishikomori, Heike, Ito, Hosoi & Nakahaka 2008:527), and
according to Malina, Bouchard & Bar-Or (2004:611) asthma manifests as periods of shortness of breath, wheezing and coughing caused by inflammation of the respiratory airway mucosa and sometimes excessive contraction of the bronchial muscles. Over the past decades, the prevalence of asthma has rapidly increased, along with the increase of childhood overweight and obesity in economically developed societies (Gilliland, Berkane, Islam, McConnell, Gauderman, Gilliland, Avol & Peters, 2003:406; Bender, Fuhlbrigge, Walders & Zhang, 2007:805; Kusunoki et al., 2008:527; Sithole, Douwes, Burstyn & Veugelers, 2008:473). In some communities the prevalence of asthma has exceeded 25% of the population (Gilliland et al., 2003:406).

Children and adolescents with asthma vary in their levels of physical activity. There are those who are as active as their peers and who participate in high level competitive sport, whereas others are inactive (Malina et al., 2004:613). There is a continuing debate as to whether asthma is the cause of obesity or vice versa (Speise et al., 2005:1877). Gilliland et al. (2003:406) are of the opinion that obesity can be caused by asthma if individuals avoid physical activity due to the difficulty of breathing. Bender et al. (2007:805) adds to this argument by stating that obesity is found to be more prevalent in children with asthma, and in those who are both asthmatic and overweight. They also mention that children who have a severe and complicated asthmatic condition are likely to be obese.

Speiser et al. (2005:1877) explain that obesity may have a direct effect on the mechanical behaviour of the respiratory system, altering compliance or elasticity recoil which results in reduced effective lung function, airway calibre and respiratory muscle strength. According to Kusunoki et al. (2008:527), obesity may influence the occurrence of bronchial asthma by decreasing lung function and modulation of immunologic factors (enhancement of proinflammatory cytokines). Gilliland (2003:406) also found that obesity is associated with the risk of acquiring asthma. When a child becomes overweight or obese during the ages of six to 11 years, the risk of developing asthma or bronchial responsiveness during adolescence is increased. Research shows that an increase of five units of BMI decreases the ratio of forced expiratory volume at 1 second
to forced vital capacity of > 1% indicating that weight has a detrimental impact on changes in pulmonary function (Bender et al., 2007:805).

Socio economic factors are also believed to have an impact on the development of asthma, as individuals who are from a low socio-economic background are more prone to developing asthma. When testing the relationship between asthma and each individual factor that causes asthma Sithole et al. (2008:476) found that there is a positive monotonic association between body weight and asthma, independent of socio-economic factors.

In conclusion, evidence presented indicates that although overweight and obesity is a risk for developing asthma, and vice versa, it is not the main cause of these conditions.

2.4.3 MUSCULOSKELETAL CONDITIONS

Mechanical (orthopaedic) and metabolic (Type 2 diabetes mellitus) complications are two medical conditions often cited that relate to obesity (Lee, 2009:76). Overweight children are more susceptible to develop bony deformities which may predispose them to other orthopaedic diseases later in life (Speiser, et al., 2005:1878).

The two most serious disorders affecting overweight and obese children are slipped capital femoral epiphysis (SCFE) and Blount’s disease. According to Kaur, Kapil & Singh (2005:1054), between 50 to 80% of children suffering from Blount’s disease are obese. Other skeletal abnormalities associated with obesity are genu valgum and genu varum deformities of the knees, flat kneecap pressure or pain, flat feet, spondylolisthesis, scoliosis, increase susceptibility to ankle sprain and osteoarthritis (Speiser, et al., 2005:1878; Lee, 2009:76).

2.4.3.1 SLIPPED CAPITAL FEMORAL EPIPHYSIS

Slipped Capital Femoral Epiphysis (SCFE) usually occurs in younger children between the ages of nine to 16 years who are overweight or obese (Barlow, 2007:178). According to the Choudhary, Donnelly, Racadio & Strife (2007:1119) and Docquier,
Mousny, Jouret, Bastin & Rombouts (2004:303) studies conducted in Michigan USA, 37 percent of the general population suffers from bilateral slippage and this condition is associated with increased body weight.

SCFE occurs when there is a displacement of the capital femoral epiphysis of the femoral neck due to a weakening of the physeal plate (Choudhary et al., 2007:1119; Klish 2010:7). This condition (SCFE) can occur in both genders; however research shows that it is more common in males than females (Barlow, et al., 2007:178; Choudhary, et al., 2007:1119).

Risk factors for SCFE are obesity (Puri, Smith, Malhotra, Williams, Owen & Harris, 1985:14; Brenkel, Dias, Davies, Iqbal & Gregg, 1989:33; Barlow & Dietz, 1998:3; Raman, 2002:135; Docquier et al., 2004:303; Barlow, 2007:178; Choudhary et al., 2007:1119; Klish, 2010:7) coupled with rapid growth spurts (Brenkel et al., 1989:33; Docquier et al., 2004:303). Obesity may cause slow maturation of the skeleton which increases the risk of SCFE when the “immature” skeleton is placed under stress by excess weight and rapid growth (Puri et al., 1985:15).

Symptoms of SCFE are pain at the affected hip, pain while walking, and a non-radiating, dull, aching pain in the hip, groin, thigh and/or knee (Puri et al., 1985:15; Barlow & Dietz, 1998:3; Barlow, 2007:178; Choudhary et al., 2007:1119; Klish, 2010:7), as well as limited range of motion in the affected hip (Barlow, 2007:178; Barlow & Dietz, 1998:3).

Specialists recommend that x-rays should be taken to determine the severity of the slippage, and surgery is used to correct SCFE. A weight loss program is also recommended to prevent recurrence of SCFE and other associated orthopaedic disorders (Barlow & Dietz, 1998:3).

2.4.3.2 BLount’S DISEASE

Blount’s disease is a condition believed to result from abnormal stress on the posteromedial proximal tibial physis which causes suppression of growth of the lower
limbs (Cook, Lavernia, Burke, Skinner & Haddad, 1983:449; Cheema, Grisson & Harcke, 2003:874; Choudhary et al., 2007:1119).

Sabharwal, (2009:1795) describes Blount’s disease as a developmental condition characterized by disordered endochondral ossification of the medial part of the proximal tibial physis resulting in multiplanar deformities of the lower limbs.

According to Giwa, Anetor, Alonge & Agbedana (2004:1203) the exact prevalence of this condition is not known. However, the observation is made that this disease is more prevalent among certain populations within a country (Sabharwal, 2009; Giwa et al., 2004). Interestingly, there are two opinions about the cause of stresses that result from Blount’s disease: one is the slowing or cessation of growth that occurs at the medial epiphysis resulting in various deformities of the proximal tibia and the other is the stimulated growth of the lateral epiphysis that worsens the deformity (Cook et al., 1983:449; Choudhary et al., 2007:1119).

Blount’s disease can be of early (infantile) onset or later onset depending whether or not the condition occurs before the age of four (Cook et al., 1983:229; Sabharwal, 2009:1795). A child with Blount’s disease, who had no apparent abnormality at birth and appears healthy showing signs of early leg growth within normal limits, may later develop Blount’s disease (Giwa et al., 2004:1203). Late-onset of this disease may develop between the 4th and 10th years of a child’s life or from the child’s 11th year and onwards (Sabharwal, 2009:1758).

From a review of literature on Blount’s disease, two major risk factors are indicated that are associated with this condition (Cook et al., 1983:449; Raman, 2002:135; Giwa et al., 2004:1203; Barlow, 2007:178; Choudhary, 2007:1119), namely a child who learns to walk too early in life and who may also be overweight or obese. However, a third risk factor seems to be associated with predisposition, as there is reference to this disease being associated with children of Scandinavian decent and particularly with black

As burnt-out Rickets presents similar characteristics as Blount’s disease, care should be taken not to misdiagnose this condition for Blount’s disease. Burnt-out Rickets is a vitamin D deficiency, caused by overproduction and deficient calcification of osteoid tissue, and is also associated with skeletal deformity (Giwa et al., 2004:1203).

A child with Blount’s disease should be referred to an orthopaedic surgeon, who will prescribe the correct treatment plan, correct the bowing of the legs and prevent progression of the disease (Choudhary et al., 2007:1119).

2.4.4 ENDOCRINE FACTORS
Endocrine factors also play a role in overweight and obesity. These are discussed in the section below.

2.4.4.1 TYPE 2 DIABETES MELLITUS
Research indicates that Type 2 diabetes mellitus is typically considered an ‘adult disease’ (Malina et al., 2004:597; Kaur, et al., 2005:1053) but as its rapidly becoming more prevalent as a condition amongst children and adolescents, it is believed to be related to the phenomenon of increased childhood obesity (Speiser et al., 2005:1876; Choudary et al., 2007:1118; Tam, Ma, Yang, Ko, Tong, Cockram, Sahota, Rogers & Chan, 2008:1229; Lee, 2009:76).

Various researchers refer to childhood obesity as a global epidemic, with Type 2 diabetes mellitus emerging as a second epidemic (Kaur et al., 2005:1053; Speiser, et al., 2005:1876; Barlow, 2007:177). It is estimated that one in every five newly diagnosed Type 2 diabetes mellitus cases in children are of American, European, Japanese and Australian origin (Speiser, 2005:1876).
Lee (2009:76), Tam et al. (2008:1229), Hannon et al. (2005:473) and Durstine & Moore (2003:133) all agree that childhood obesity is associated with insulin resistance, which results from impaired fasting glucose, impaired glucose tolerance and diabetes mellitus.

During absorption (feeding state) insulin is secreted in response to rising blood glucose concentration and hepatic glucose production is inhibited in order to stimulate glucose disposal; primarily to the skeletal muscles. However, during postabsorption (fasting state), insulin secretion decreases to basal levels. Hepatic glucose production to a lesser degree is also reduced to maintain normal fasting blood glucose concentrations (Hannon et al., 2005:473). With Type 2 diabetes mellitus, the capacity of insulin to stimulate the uptake of blood glucose into the skeletal muscles becomes reduced. This is known as insulin resistance (Malina et al., 2004:592). In response to the elevation of blood glucose levels, the beta cells in the pancreas secrete more insulin in the attempt to maintain normal blood glucose concentration; this however, is ineffective to lower blood glucose concentration, which may also contribute to insulin resistance (Durstine & Moore, 2003:133).

From the above it is noticeable that the pathophysiology of type 2 diabetes mellitus is a complex developmental process. Its nature is characterised by the presence of multifactor risks (Kaur et al., 2005:1053) such as family history (recordings of where 1\textsuperscript{st} and 2\textsuperscript{nd} generation relatives were diagnosed with Type 2 diabetes mellitus patients), ethnicity-related observations (i.e. the prevalence of diabetes mellitus Type 2 within specific ethnic groups such as Native-American, African-American, Japanese and Asian and Pacific Islanders), and in the signs that are associated with insulin resistance (hypertension, dyslipidemia, acanthosis nigricans and polycystic ovarian syndrome) (Malina et al., 2004:598; Speiser et al., 2005:1876; Barlow, 2007:177).

While visceral fat appears to influence insulin secretion and resistance (Raman, 2002:135), research indicates that gestational diabetes mellitus is also prevalent in children of those parents who themselves were diagnosed with obesity, impaired
glucose intolerance and Type 2 diabetes mellitus in their childhood (Hillier, Pendula, Schmidt, Mullen, Charles & Pettitte, 2007:2287; Tam, et al., 2008:1229).

Furthermore, where the BMI is greater than the 85th percentile for age, this is considered to be an indicator for development of Type 2 diabetes mellitus (Malina, et al., 2004:598; Kaur, et al., 2005:1053; Barlow, 2007:177). Therefore, the American Academy of Pediatrics and the American Diabetic Association recommend that children who are overweight and who also present at least two risk factors (family history or have signs associated with insulin resistance) should be tested for Type 2 diabetes mellitus when turning 10 years of age or at onset of puberty, and thereafter every second year (Barlow, 2005:177; Speiser, et al., 2005:1876), as children are considered diabetic if their fasting glucose levels are ≥ 126 mg/dL and prediabetic if their fasting glucose levels are ≥ 100mg/dL (Barlow, 2005:177).

While early onset of obesity is a risk factor for significant morbidity and mortality later in life, it may also result in diabetes mellitus, coronary artery disease, artherosclerosis and gout (Lee, 2009:80). Paediatric patients with early onset Type 2 diabetes mellitus have a greater risk to develop cardiovascular diseases, retinopathy, nephropathy, neuropathy, impaired quality of life and even premature death (Gahagan & Silverstein, 2003:328; Choudhary, et al., 2007:1119).

2.4.5 PSYCHOSOCIAL
In light of the extensive research discussed, it is apparent that obesity is an undesirable state for the child to be in. Hilde Bruche (in Strauss, 2000:15) calls attention to a further reality that “overweight and obese children, in addition to [the] negative effects of these conditions, have to cope with a number of psychosocial conditions”.

2.4.5.1 DEPRESSION AND LOW SELF-ESTEEM
Childhood obesity has an immediate impact on a child’s physical appearance and may have detrimental psychosocial consequences (Strauss, 2000:15; Horton, 2008:5). Chronically obese children display significantly higher rates of oppositional defiant

Overweight or obese children tend to be more socially isolated, liked less or even rejected by their normal weight peers, and may even fall victim to peer aggression like bullying (Janssen, Craig, Boyce & Pickett, 2004:1187; Sjöberg, Nilson & Leppert, 2005:389; Ludwig, 2007:2325). In addition, overweight and obese children regularly experience degradation and ridicule during social interaction. This can lead to shame and shyness which is hypothesized to lead to depression (Janssen et al., 2004:1193; Sjöberg et al., 2005:389).

Concerningly, symptoms of depression in children may not be recognised, as children are more likely to display symptoms than verbalise their emotion. These symptoms are anxiety (phobias, separation anxiety), somatic complaints (“my tummy hurts”, “I don’t feel good”) and auditory hallucinations (Horton, 2008:13).

In clinical settings, clinicians look for symptoms such as: flat affect, anxiety, body dissatisfaction, excess eating, fatigue and sleeping difficulty (Barlow, 2007:178). The conclusion can be made, that if obesity is associated with depression (Sjöberg et al., 2005:392), negative self-esteem and body image (Strauss, 2000:851) then losing weight in turn results in a positive effect on depression that is associated with overweight and obesity.

2.5 SUMMARY

Overweight and obesity affects the child physically and socio-emotionally and in most cases, these conditions negatively impact on the child’s self-perception and esteem. Therefore, parents and guardians should have sufficient knowledge about the nature and consequences of overweight and obesity, as well as be enabled to read behavioural symptoms related to these conditions. More attention is given to
preventative and reductive measures in Chapter five where recommendations based on the research findings are discussed and made.

In Chapter three, attention is given to the methods and procedures used during the research study.

CHAPTER THREE

METHODS AND PROCEDURES

3.1 INTRODUCTION
Overweight and obesity are not ‘new’ phenomena; however, overweight and obesity in childhood is. An extensive review of literature by means of leading electronic journal databases amongst others, EBSCOHost, Emerald, Google Scholar and Science Direct all indicate a growing volume of research by various disciplines around the globe on overweight and obesity in childhood; South Africa not being the exception with extensive research done by Monyeki, van Lenthe & Steyn (1999), Mollentze (2000) and Armstrong, Lambert, Sharwood & Lambert (2006).

The purpose of this study was to establish the BMI for age percentiles of children between the ages of six to nine years, and to ascertain the prevalence of overweight and obesity within this cohort out of a sample of three public ordinary schools in Ermelo, a rural town in Mpumalanga Province. The reader should note that due to confidentiality (discussed in the ethics section) names of schools must be withheld. Although not the aim of the research, an analysis of the data created an opportunity to briefly focus on the prevalence of underweight within the research target group as well.

In this chapter, to enable an understanding of the methodology used by the researcher, and for the reader to assess for reliability and validity of the research outcomes, the motivation underlying the research is provided; the research objectives are outlined; the
choices pertaining to the research design and process is explained; the target group is described, and the choice of measurement is presented. Attention is also given to ethical considerations related to research of this nature.

3.2 MOTIVATION FOR RESEARCH
In comparison with international research, the phenomenon of South African childhood overweight and obesity is under-researched, especially with regards to children younger than 10 years of age. It is for this reason that the researcher chose to undertake research on children between the ages of six and nine years, as this would contribute towards a much needed knowledge on the prevalence of overweight and obesity in childhood within the South African context. A further motivation for the research focus stemmed from the need to gain knowledge about the phenomenon of children who are at-risk for underweight, overweight and obesity, and more specifically, a traditionally disadvantaged group who live in a rural environment.

The researcher was stationed in a rural town as a biokinetic intern, and this afforded her the opportunity to network with school principals who were willing to give her permission to undertake research within their schools.

3.3 RESEARCH DESIGN
In order to contribute to the knowledge-base about South African children who are underweight, overweight and obese, and who are or might be at risk for these conditions, the researcher chose a quantitative descriptive research design.

Neuman (2000), Babbie (2010), and Mathews & Ross (2010) indicate that researchers may choose a quantitative research design when there is a need to explore new or under-researched phenomena with the aim to describe its nature and to enhance their understanding thereof. More specifically, by using a quantitative research design this enabled statistical analyses of the relationship between age, gender, weight and height of the target group, as these are important variables in determining whether or not
children are of normal weight or can be defined as underweight, overweight, obese or at risk.

In choosing a quantitative research design, data by means of a once-off survey of anthropometric assessment of weight and height of children aged six to nine years was distributed and collected.

3.4 RESEARCH SAMPLING FRAME

In order to define the sampling frame, the researcher first defined the sampling unit (i.e. individual learner), then identified the geographical location of the target group (i.e. three ordinary public rural primary schools in a rural town within Mpumalanga Province), and finally delineated the temporal boundaries of the population was (i.e. learners between the ages of six to nine years at time of study) (Neuman, 2000).

According to the Department of Basic Education, there were 12 260 099 learners in ordinary public schools in South Africa in 2010 who attended 25 850 schools, (2010).

Within Mpumalanga Province (the geographic area in which the research was undertaken), 1 035 432 learners attend 1 933 schools. Of these learners, 1 013 760 were enrolled at 1 838 ordinary public schools and 22 672 were enrolled at 101 ordinary independent schools respectively (2010).

The results released by the Department of Basic Education for Mpumalanga Province (2010) for 2010 indicate a change in statistics mainly due to closing down of schools and the opening of new schools, some within the Gert Sibande Education District in which the research was undertaken. At the start of the research, there were 364 primary schools within the Gert Sibande Education District with a learner corps of 115 017.

SNAP Statistics taken on the 10th day of the school year during 2007 and the information released in 2009 by the Department of Basic Education for Mpumalanga
indicated that there were 69,968 learners who were in Grades one to three in public and independent schools in the Gert Sibande Education District. Of these learners, 12,742 were boys and 12,052 were girls who were enrolled for Grade one; 11,527 were boys and 10,671 were girls who were enrolled for Grade two, and 11,799 were boys and 11,177 girls who were enrolled for Grade three. In total, there were 36,068 (51.5%) boys and 33,900 (48.5%) girls enrolled in Grades 1 to 3 in public and independent schools in this district.

The Ermelo 1 Education Circuit (within the Gert Sibande Education District) currently has 18 primary schools with approximately 7,621 learners in total who either attended one of nine schools that were situated on various farms that surrounds the town Ermelo or one of six schools situated within Ermelo township or one of three schools situated within the town of Ermelo itself.

In order to study the prevalence of overweight and obesity in children within the rural districts of Mpumalanga Province, and specifically in the Ermelo 1 Education Circuit sutured within the boundaries of the Gert Sibande Education District, the sampling frame included both girls and boys between the ages of six and nine years, and who at the time of fieldwork attended Grades one to three. With a few exceptions, older or younger children attending these grades were also measured, so as not to differentiate between learners who were measured. However, their data was not included into the eventual statistical analysis.

Also, as school demographic data of rural towns include farm and township schools, it is important to note that the three primary schools selected for the research did not include farm schools. Due to lack of parental support for the research in one of the schools with a predominantly White learner enrolment, and that the remaining two schools have a predominantly Black African learner enrolment, the researcher selected a school from Ermelo Township to replace the school with few assenting parents. As a result note should be taken that of the other two schools that were surveyed in Ermelo, learner data from White, Coloured and Indian learners who enrolled in these schools was excluded.
after consultation with a statistician, as there were too few to warrant statistical inclusion and analyses. However, not to differentiate between learners, all learners were measured. By default the target group for the research consisted of Black African rural ordinary primary school learners.

### 3.5 SAMPLING TECHNIQUES

In order to determine the eventual size of the target group the three selected schools were visited during the second term of 2011. After a meeting with each of the principals of the schools, it was decided to survey only those learners who were enrolled for Grades one to three, as the majority of learners who fell within the six to nine year age group were enrolled for these grades (see Table 3.1).

Purposive sampling thus ensured maximum number of learners that met the criteria of age and gender, and were able to participate unassisted in the assessment of body weight and height.

### 3.6 RESEARCH SAMPLE

Anthropometric assessment of Grade one to three learners took place two weeks after the schools reopened for the third term of 2011.

As a control mechanism for learners who might be absent during the time of measurement, the daily school attendance register was used as a checklist. As learners were measured, their data was documented on an assessment form (Addendum C) that was developed by the researcher.

From a total of 1 090 learners enrolled for Grades one to three in three ordinary public schools, a total of 1 024 respondents were measured.

After the assessment of all learners was completed, 122 learners were excluded from the total respondent group as they either fell within the White, Coloured and Indian ethnic grouping or were younger than six and older than nine years of age. Thus from a
total of 1,024 respondents, the data of a purposive sample of 902 Black African learners was used.

While Table 3.1 provides an overview of the groups of learners who were enrolled at a particular school for Grades one to three, and thus formed part of the study. Table 4.3 in Chapter four goes on to provide information about the age and gender of the eventual respondent group.

**Table 3.1: Total Number of Learners Enrolled for Grades 1 to 3 between 6 to 9 years in Three Ordinary Public Schools**

<table>
<thead>
<tr>
<th>Enrolled Grade 1 Learners</th>
<th>Aged 6 to 9* Measured</th>
<th>Enrolled Grade 2 Learners</th>
<th>Aged 6 to 9 Measured</th>
<th>Enrolled Grade 3 Learners</th>
<th>Aged 6 to 9 Measured</th>
<th>Total Enrolled Learners</th>
<th>Total Learners Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>School 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>122</td>
<td>118</td>
<td>11.5%</td>
<td>125</td>
<td>119</td>
<td>11.6%</td>
<td>112</td>
<td>103</td>
</tr>
<tr>
<td><strong>School 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>46</td>
<td>4.5%</td>
<td>59</td>
<td>51</td>
<td>5.0%</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td><strong>School 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>238</td>
<td>228</td>
<td>22.3%</td>
<td>150</td>
<td>143</td>
<td>14.0%</td>
<td>176</td>
<td>169</td>
</tr>
<tr>
<td><strong>TOTAL NUMBER OF LEARNERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>416</td>
<td>392</td>
<td>38.3%</td>
<td>334</td>
<td>313</td>
<td>30.6%</td>
<td>340</td>
<td>319</td>
</tr>
</tbody>
</table>

* During measurement of respondents some learners were either older or younger than their peers within the same Grade.
3.7 **ANTHROPOMETRIC ASSESSMENT**

3.7.1 **WEIGHT**

The body weight of each respondent was measured using a platform-beam scale to ensure accuracy of measurement. The researcher ensured that the beam of the platform scale was graduated to allow measurement reading from both sides of the scale. The calibration of the scale was done for a period of three months at regular intervals with different weightings using the same set of barbells each time. This also ensured that measurements of learners would be accurate. As the researcher had to travel to each school to undertake measurements, the scale was calibrated prior to each day’s measurement and twice during the day using the same set of barbells as was done for the period three months prior to fieldwork.

3.7.2 **HEIGHT**

Learners’ height (statue or skeletal height) was measured with a stadiometer which implied that each learner’s measurement was taken from the sole of both feet with heels together to the vertex, which is the highest point of the head (Kent, 2005:484).
3.8 TESTING PROTOCOL

3.8.1 WEIGHT AND HEIGHT

The anthropometric measurements (weight and height) were undertaken in accordance with the protocol and standards of the American College of Sports Medicine’s (ACSM) guidelines for exercise testing and prescription (2006).

On the day of testing, participants were dressed in their normal school clothes. Boys wore trousers and a shirt, and girls wore a dress. In all the schools surveyed, school clothes were of similar design and material; however, of different colour. This being the case, clothing had no influence on the data. However, during testing, blazers and school shoes had to be taken off, as well as any other heavy clothing such as scarves, gloves, and/or jerseys.

Weight was measured with the participant standing in the middle of the scale platform with body weight evenly distributed between both feet. Weight was recorded to the nearest 100 grams (Frisancho, 2004:11).

The height was then measured with the participant standing with heels together and back as straight as possible; the heels, buttocks, shoulders and head had to touch the stadiometer. The researcher ensured that each child stood with weight evenly distributed between both feet, while the head was in the Frankfurt horizontal plane.

The moveable arm of the stadiometer was then gently brought down while pressure was applied to sufficiently compress the hair before the measurement was taken. The measurement was recorded to the nearest 0.1 cm (Frisancho, 2004:11).

A data recorder assisted during the period of measuring a child’s height and weight. The recorder was trained prior to the data collection and was therefore familiar with using the assessment form on which data was recorded.
3.8.2 BODY MASS INDEX

BMI has an established record for being the preferred method of measuring adiposity in epidemiological studies, as it enables correlation between BMI and percentage body fat for all ages and sexes for most populations (Mollentze, 2006:4). It is therefore the most commonly used indicator to assess for overweight and obesity in a wide variety of settings (Himes, 2009:3), while also enabling the measurement of fatness in children and adolescents (Dietz & Bellizzi, 1999:125). However, the interpretation of BMI in children requires cut-off points to be applied within the BMI distribution (Reilly, 2002:838).

After the data was captured and sorted into age and gender respondent groupings, the researcher calculated the BMI by dividing body weight in kilograms by height in metres, square. The BMI was then used to determine if the respondent was underweight, normal weight, overweight or obese.

Table 3.2 presents the BMI categories that were used for the purpose of this study.

<table>
<thead>
<tr>
<th></th>
<th>The BMI Category Norms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Underweight</strong></td>
<td>&lt; 18.5 kg/m²</td>
</tr>
<tr>
<td><strong>Normal Weight</strong></td>
<td>18.6 – 24.9 kg/m²</td>
</tr>
<tr>
<td><strong>Overweight</strong></td>
<td>25 – 29.9 kg/m²</td>
</tr>
<tr>
<td><strong>Obese</strong></td>
<td>≥ 30 kg/m²</td>
</tr>
</tbody>
</table>

*Source: Adapted from WHO, 1995, WHO, 2000 and WHO, 2004*

During computation of each learner’s BMI, results indicated that most of the learners were underweight. The researcher was concerned about this outcome, as this did not correspond to the observation made of the physique of the learners during the period of fieldwork.
The researcher then decided to use the BMI for Age Percentile Charts for boys and girls in order to establish whether or not the same results would surface. In addition, Percentile Charts are recommended by the Center for Disease Control and Prevention to determine underweight, normal weight, overweight and obesity (2009). Further to this, these charts were developed by the National Center for Health Statistics in collaboration with CDC from a series of percentile curves that illustrate the distribution of selected body measurements in children (WHO, 1995, WHO, 2000, WHO, 2004).

Table 3.3 presents the BMI age percentile categories that were used for the purpose of this study.

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Weight</td>
<td>&lt; 5th percentile</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>5th - 85th percentile</td>
</tr>
<tr>
<td>Overweight</td>
<td>85th - 95th percentile</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 95th percentile</td>
</tr>
</tbody>
</table>


Interestingly, after computation using the BMI for Age Percentile Charts for boys and girls, findings more in line with the casual observations the researcher made when measuring the learners during the period of fieldwork were discovered. In order to validate this, the researcher plotted the data (weight and height) on the charts, and extrapolated the BMI percentile for each learner. The researcher then used HealthWatch Pro version 3.1. Build No. 20091118 to recalculate the data for each learner in order to ensure validity and reliability of result.
3.9 ETHICAL CONSIDERATIONS

Ethical principles during research were applied to guide the conduct of the researcher and data recorder to prevent learners being harmed or wronged in any way (Morrow, 2008:52). In order to ensure this, the researcher was guided by the answers to the five questions formulated by Keddie (2000:74) to determine whether or not to include children as research subjects. These are: (1) Why is the study important? (2) What is the relationship between the researcher and participants? (3) Who will benefit from the study? (4) Who is at risk within context of the study? (5) Should the researcher intervene on behalf of those who are at risk? Barring the latter, which does not directly relate to the research objectives, answers to the former four questions are addressed in Chapters one, two and four of this dissertation describing, amongst other things, the purpose of the research and its importance for the health of children in South Africa amidst the growing number of children worldwide who are overweight and/or obese.

Edmonds (2003) also refers to special ethical considerations when using children as research subjects; these being that all children who are used as respondents should be informed of the possible and anticipated outcomes of the research by their school and parents. In order to achieve this, the researcher presented a letter (Addendum F and G) to each child in Grade one to three explaining the research and parents and guardians of the children were provided with a similar letter (see Addendum D and E) prior to commencement of fieldwork. Children were also made aware that they have the right to refuse to participate at any time during the course of the research. Each child with the guidance of their parent or guardian signed an assent form (Addendum F and G). In order to prevent children from signing their assent form without parental guidance, the parent or guardian of the child was required to sign a consent form (Addendum H, I and J), specifically because children are implicated in the study and as children between six and nine years of age are regarded as incompetent to give consent.

The Medical Research Council (2004) also provides guidelines for research of this nature. Their point of view is that if relevant knowledge can be directly obtained from an
adult child participation should be avoided. In the case of the research it was the decision of the researcher to measure each child to ensure reliability and validity of research outcomes. The research therefore necessitated the involvement of children respondents. In addition it was ethically vital that no child, parent or guardian felt pressured or bribed into participating in the research. It was for this reason that the researcher first sought permission from the Mpumalanga Department of Basic Education through the Director of Education for Gert Sibande Educational Circuit (Addendum K) and the principals of the schools (Addendum L and M) in which the survey would eventually be conducted, before contacting parents or guardians for consent. This ensured that each child would have the final freedom of decision to participate or not at the exact time of being readied to be weighed and measured for height.

Furthermore, information given by the children should be treated as confidential and should be anonymised (MRC, 2004:5). Thus all names and other information that may identify a child was removed from the research. This practice is especially noticeable in Chapter four in which the data is analysed.

It is in this light that for research purposes the town of Ermelo is mentioned but not the names of the schools in which the surveys were undertaken. This was done to ensure anonymity and to adhere to guidelines of ethics associated with research using children as respondents.

All information gathered throughout the research period was safely stored in sealed envelopes in a lockable steel cabinet at the home of the researcher. Upon positive outcome of the final mark for the qualification, the researcher will submit all information to her supervisor for safe storage within the Department of Human Movement Science at Nelson Mandela Metropolitan University. No other researchers have or will have access to the data other than the researcher herself and her supervisor.
Even if the research has the potential to generate scientific understanding for improvement of human health and wellbeing, the participant’s interests must prevail over those of science and society. In order to ensure this, the proposal for the research was submitted to the Faculty of Health Sciences Research, Technology and Innovation Committee of the Nelson Mandela Metropolitan University for approval.

3.10 DATA ANALYSES
The researcher used both descriptive statistics to organise, summarise, analyse and simplify the data. Inferential statistics in the form of ANOVA was used to test for differences between age and gender cohorts. Scheffé’s test was used to determine the statistical significance and Cohen’s $d$, the practical significance of the results (Gravetter & Wallnau, 2005:6). Throughout statistical analyses the five percent (5%) level of significance was set as the confidence level. Small practical significance was observed when $0.2<d<0.5$, medium when $0.5<d<0.8$ and large when $d>0.8$.

3.11 SUMMARY
In summary, the researcher, having familiarised herself with the principles of ethics pertaining to the use of children respondents, undertook to develop a research protocol to guide the research process. This protocol also enabled the researcher to make and report on methodological decisions that would ensure valid and reliable research.

In Chapter four, the researcher presents an analysis of the data.
CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

The aim of this study was to determine the prevalence of overweight and obesity in boys and girls aged six to nine years who were enrolled in three purposefully selected ordinary public rural schools in Mpumalanga Province, South Africa. To achieve this, the researcher undertook a survey to measure the weight and height of these learners. The data enabled the researcher to determine the BMI and BMI percentile scores for each of the 902 learners, and to compare the results with the BMI for age percentiles according to growth charts used by the Centres for Disease Control and Prevention (2009).

During the analysis of each age and gender cohort, the researcher was able to ascertain the prevalence of those learners who were overweight, obese, and underweight or at risk of developing various associated chronic diseases of lifestyle. All learners enrolled at the three schools were present at the time the survey was conducted. This was ascertained by comparing the class attendance list with the list on which the researcher recorded each learner's identification and subsequent assessment measurement (Addendum C).

Furthermore, the reader should note that the BMI categories and cut-offs used in this research (Table 3.2) are those as recommended by the WHO (1995, 2000, 2004 and 2006). BMI percentiles for gender and age to determine the prevalence of obesity or overweight in a population were obtained from The Division of Nutrition, Physical Activity and Obesity at The National Centre for Chronic Disease Prevention and Health Promotion (2010). In order to compute BMI percentiles for childhood gender and age cohorts (see Table 3.3), the English Version of the BMI Percentile Calculator for Children and Teenagers (Centres for Disease Control and Prevention, 2009) was used.
to determine the prevalence of overweight and obesity amongst the learners. Collectively, these together with statistical analyses enabled the researcher to depict the results, make deductions and present findings on the respondent group that was surveyed.

4.2 RESULTS FOR AGE AND GENDER DISTRIBUTION IN THE TOTAL GROUP

Table 4.1 represents descriptive data for age and gender of all the learners included in the survey at the time of anthropometrical assessment for height and weight. Of the total of 902 learners, 88 (10%) were six years of age (n=40 girls; n=48 boys); 297 (33%) learners were seven years of age (n=127 girls; n=170 boys); 307 (34%) learners were eight years of age (n=154 girls; n=153 boys), and 210 (23%) learners were nine years of age (n=108 girls; n=102 boys). These statistics can be tabulated as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>40</td>
<td>48</td>
<td>88</td>
</tr>
<tr>
<td>7</td>
<td>127</td>
<td>170</td>
<td>297</td>
</tr>
<tr>
<td>8</td>
<td>154</td>
<td>153</td>
<td>307</td>
</tr>
<tr>
<td>9</td>
<td>108</td>
<td>102</td>
<td>210</td>
</tr>
<tr>
<td>Total</td>
<td>429</td>
<td>473</td>
<td>902</td>
</tr>
</tbody>
</table>

As graphically displayed in Figure 4.1 and diagrammatically illustrated in Table 4.1, the sample depicts that most learners surveyed were between seven and nine years of age (90%) with fewer learners falling in the six year (10%) age cohort. Within the sample there were slightly more boys (52%) than girls (48%) with most of the boys being seven years of age (19%) and most of the girls eight years of age (17%). Although there were fewer six and nine year old learners, both girls and boys were almost equally distributed within each age cohort.
4.3 WEIGHT FOR SIX TO NINE YEAR OLD LEARNERS

This section reveals results for mean weight by gender for each age cohort, using descriptive statistics, as depicted in Tables 4.2 and 4.3 and displayed in Figure 4.2. Inferential statistics are depicted in Tables 4.4 and 4.5.

Table 4.2 and Figure 4.2 present the mean weight scores for all the learners who participated in the survey according to gender for each age cohort.

Table 4.2: Mean Weight (kg) by Gender and Age for Total Group

<table>
<thead>
<tr>
<th>Gender.Age</th>
<th>Weight (kg)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 20</td>
<td>20.0-29.9</td>
</tr>
<tr>
<td>Female.6</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Male.6</td>
<td>11</td>
<td>23%</td>
</tr>
<tr>
<td>Female.7</td>
<td>21</td>
<td>17%</td>
</tr>
<tr>
<td>Male.7</td>
<td>29</td>
<td>17%</td>
</tr>
<tr>
<td>Female.8</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Male.8</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td>Female.9</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Male.9</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 4.2 and Figure 4.2 indicate that from the sample of 902 learners, 643 (71%) of the learners fell within the 20 to 29.9 kg interval, 138 (15%) within the 30 to 39.9 kg interval,
87 (10%) within the under 20 kg interval, 29 (3%) within the 40 to 49.9 kg, and 4 (0.4%) in the 50 to 59.9 kg interval, with only 1 (0.1%) learner falling within the ≥ 60 kg interval.

![Figure 4.2: Frequency Distribution of Mean Weight According to Gender and Age](image)

Table 4.3 depicts the total sample size, along with the means and standard deviations for the weight scores for each age group according to gender.

| Table 4.3: Mean Weight (kg) for Learners 6 to 9 Years of Age According to Gender |
|---------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                                | 6 Years | 7 Years | 8 Years | 9 Years |
|                                | Girls   | Boys    | Girls   | Boys    | Girls   | Boys    | Girls   | Boys    |
| n                               | 40      | 48      | 127     | 170     | 154     | 153     | 108     | 102     |
| Mean (kg)                       | 20.95   | 21.96   | 24.65   | 23.28   | 27.10   | 26.96   | 30.04   | 29.50   |
| S.D.                            | 2.98    | 3.31    | 5.90    | 3.96    | 5.46    | 5.39    | 7.32    | 6.79    |
| Minimum                         | 15.80   | 15.30   | 14.90   | 16.50   | 17.90   | 17.70   | 19.30   | 19.00   |
| Quartile 1                      | 19.23   | 20.00   | 20.55   | 20.53   | 23.10   | 23.50   | 25.08   | 25.08   |
| Median                          | 20.50   | 21.80   | 23.10   | 22.90   | 25.95   | 26.10   | 28.85   | 28.20   |
| Quartile 3                      | 22.55   | 23.35   | 26.45   | 25.40   | 29.75   | 28.70   | 32.50   | 31.30   |
| Maximum                         | 27.60   | 29.60   | 47.70   | 45.00   | 44.50   | 58.80   | 71.20   | 59.40   |

Table 4.3 indicates that while boys aged six years have a slightly higher mean weight (21.96 kg) than girls of the same age (20.95 kg), seven year old girls (24.65 kg), as well
as those eight (27.10 kg) and nine years of age (30.04 kg) have a higher mean weight than boys aged seven (23.28 kg), eight (29.96) and nine (29.50 kg) years respectively.

The results of ANOVA conducted to determine whether learners’ weight is related to gender and age is summarised in Table 4.4.

Table 4.4: ANOVA for Mean Weight by Gender and Age in Total Group

<table>
<thead>
<tr>
<th></th>
<th>D.F.</th>
<th>SS</th>
<th>MS(kg)</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1; 894</td>
<td>11.90</td>
<td>11.90</td>
<td>0.39</td>
<td>.532</td>
</tr>
<tr>
<td>Age</td>
<td>3; 894</td>
<td>6303.00</td>
<td>2101.00</td>
<td>68.88</td>
<td>.001</td>
</tr>
<tr>
<td>Gender*Age</td>
<td>3; 894</td>
<td>114.60</td>
<td>38.20</td>
<td>1.25</td>
<td>.290</td>
</tr>
</tbody>
</table>

No Statistical Significant p value / Significant p value

As indicated in Table 4.4, there is no statistical significant mean weight difference between girls and boys (p = .532), but a significant difference can be observed between the age cohorts (p < 0.0005). Table 4.5 explains the inferential statistical differences between the age groups.

Table 4.5: Post-hoc Scheffé and Cohen’s d for Mean Weight in Each Age Cohort

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight(kg)</th>
<th>Mean</th>
<th>S.D</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>21.50</td>
<td>3.18</td>
<td></td>
<td>.006</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>23.87</td>
<td>4.92</td>
<td></td>
<td>.52</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>27.03</td>
<td>5.42</td>
<td></td>
<td>1.10</td>
<td>0.61</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>29.78</td>
<td>7.06</td>
<td></td>
<td>1.34</td>
<td>1.00</td>
<td>0.45</td>
<td></td>
</tr>
</tbody>
</table>

No Significant value / Significant p value

In Table 4.5, the Post-hoc Scheffé p value indicates a statistical significant difference from age six to seven (p = .006), six to eight (p < .005), and six to nine years (p < .005). A significant difference is also seen from age seven to eight (p < 0.005), seven to nine (p < 0.005) and, eight to nine years (p < 0.005). Cohen’s d indicate a medium practical significance from eight to nine years (p = 0.45), six to seven years (p = 0.52) and seven
to eight years (p = 0.61). From six to eight (p = 1.10), six to nine (p = 1.34) and seven to nine (p = 1.00), a large practical significance is indicated.

4.4 HEIGHT FOR SIX TO NINE YEAR OLD LEARNERS

In this section, results for mean height by gender for each age cohort, using descriptive statistics, as is depicted in Tables 4.6 and 4.7 and displayed in Figure 4.3 are presented. Inferential statistics are depicted in Tables 4.8 and 4.9.

Table 4.6 and Figure 4.3 present the mean height scores as depicted according to gender and age division of all learners who participated in the survey.

Table 4.6: Mean Height (cm) by Gender and Age for Total Group

<table>
<thead>
<tr>
<th>Gender.Age</th>
<th>Height(cm)</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>103.0-109.9</td>
<td>110.0-119.9</td>
<td>120.0-129.9</td>
<td>130.0-139.9</td>
<td>140.0-150.0</td>
</tr>
<tr>
<td>Female.6</td>
<td>3 8%</td>
<td>24 60%</td>
<td>13 33%</td>
<td>0 0%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Male.6</td>
<td>4 8%</td>
<td>26 54%</td>
<td>18 38%</td>
<td>0 0%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Female.7</td>
<td>4 3%</td>
<td>48 38%</td>
<td>65 51%</td>
<td>10 8%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Male.7</td>
<td>3 2%</td>
<td>64 38%</td>
<td>93 55%</td>
<td>10 6%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Female.8</td>
<td>0 0%</td>
<td>22 14%</td>
<td>84 55%</td>
<td>47 31%</td>
<td>1 1%</td>
</tr>
<tr>
<td>Male.8</td>
<td>0 0%</td>
<td>13 8%</td>
<td>93 61%</td>
<td>45 29%</td>
<td>2 1%</td>
</tr>
<tr>
<td>Female.9</td>
<td>0 0%</td>
<td>2 2%</td>
<td>49 45%</td>
<td>52 48%</td>
<td>5 5%</td>
</tr>
<tr>
<td>Male.9</td>
<td>0 0%</td>
<td>6 6%</td>
<td>37 36%</td>
<td>49 48%</td>
<td>10 10%</td>
</tr>
<tr>
<td>Total</td>
<td>14 2%</td>
<td>205 23%</td>
<td>452 50%</td>
<td>213 24%</td>
<td>18 2%</td>
</tr>
</tbody>
</table>

Table 4.6 indicates that 452 (50%) of the learners fall within the 120 to 129.9 cm mean height bracket, with 205 (23%) learners measuring between 110 to 119.9 cm, 213 (24%) who are between 130 to 139.9 cm tall, while 14 (2%) and 18 (2%) are between 103 to 109.9 cm and 140 to 150 cm tall respectively. These findings can be displayed as follows:
Table 4.7 indicates consistently that boys are, as expected, taller than girls. This can be deduced from the six year old cohort where boys have a slightly higher mean height (117.84 cm) than girls of the same age (116.88 cm). Similarly, the seven year old boys also have a higher mean height (121.06 cm) than their female (120.91 cm) counterparts. Continuing the trend are the eight and nine year old groups with boys...
measuring 126.86 cm and 130.96 cm and the girls following close behind at 126.30 cm and 130.90 cm respectively.

The results of ANOVA conducted to determine whether learners’ height is related to gender and age is summarised in Table 4.8.

Table 4.8: ANOVA for Mean Height (cm) by Gender and Age in Total Group

<table>
<thead>
<tr>
<th></th>
<th>D.F.</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1; 894</td>
<td>32.00</td>
<td>32.00</td>
<td>0.90</td>
<td>.336</td>
</tr>
<tr>
<td>Age</td>
<td>3; 894</td>
<td>17907.00</td>
<td>5969.00</td>
<td>170.70</td>
<td>.001</td>
</tr>
<tr>
<td>Gender*Age</td>
<td>3; 894</td>
<td>19.00</td>
<td>6.00</td>
<td>0.20</td>
<td>.911</td>
</tr>
</tbody>
</table>

No Statistical Significant p value / Significant p value

As indicated in Table 4.8, there is no statistical significant mean height difference between girls and boys (p = 0.336), however a significant difference is observed between the age cohorts (p < 0.0005).

Table 4.9: Post-hoc Scheffé and Cohen’s d for Mean Height In Each Age Cohort

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Mean</th>
<th>S.D</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>117.40</td>
<td>5.21</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>121.00</td>
<td>5.65</td>
<td>0.65</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>126.58</td>
<td>6.03</td>
<td>1.57</td>
<td>0.95</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>130.93</td>
<td>6.34</td>
<td>2.24</td>
<td>1.67</td>
<td>0.71</td>
<td></td>
</tr>
</tbody>
</table>

No Significant value / Significant value

In Table 4.9, Post-hoc Scheffé p value implies a statistical significant difference in mean height from age six to seven (p < .005), six to eight (p < .005), six to nine; also age seven to eight (p < .005), seven to nine (p < .005) and, eight to nine (p < .005), reflecting a significant difference in mean height. According to Cohen’s d there is a medium practical significance between the age group six to seven (d = 0.65), and eight to nine (d = 0.71), with a large practical significance reflected in the six to eight year old
age group (d = 1.57); also six to nine years (d = 2.24) and seven to eight years (d = 0.95).

### 4.5 BMI PERCENTILE FOR GENDER AND AGE FOR SIX TO NINE YEAR OLD LEARNERS

Results for BMI percentile by gender for each age cohort, using descriptive statistics is depicted in Tables 4.10 and 4.11, and displayed in Figure 4.4. Inferential statistics are provided in Tables 4.12 and 4.13.

Table 4.10 and Figure 4.4 present the mean BMI percentile scores according to gender for each age cohort for all the learners who participated in the survey.

#### Table 4.10: Mean BMI Percentile for Gender and Age in Total Group

<table>
<thead>
<tr>
<th>Gender.Age</th>
<th>Percentile</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;5</td>
<td>5.00-84.99</td>
</tr>
<tr>
<td>Female.6</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Male.6</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Female.7</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Male.7</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Female.8</td>
<td>6</td>
<td>4%</td>
</tr>
<tr>
<td>Male.8</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td>Female.9</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Male.9</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 4.10 and Figure 4.4 indicate that 79 percent (709) of learners fall into the 5–84.99 percentile group which according to the Centre for Disease Control and Prevention (2009) is the category for normal weight (Table 3.3). Of the total sample, 11 percent (101) are overweight, seven percent (63) obese while a miniscule three percent (29) are termed underweight.
Table 4.11 indicates that six years old boys have a higher mean BMI percentile (52.98 %) than girls of the same age (45.44 %). As for girls aged seven, they have a higher BMI percentile (52.48 %) than boys aged seven (50.79 %), while the same tendency is noticeable for girls who are eight (57.91 %) and nine (55.06 %) years of age. However,
the mean BMI percentile for boys aged eight (55.90 %) and nine (54.73 %) are by comparison lower.

The results of ANOVA conducted to determine whether learners’ BMI percentile is related to gender and age is summarised in Table 4.16.

Table 4.12: ANOVA for Mean BMI Percentile by Gender and Age in the Total Group

<table>
<thead>
<tr>
<th></th>
<th>D.F.</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1</td>
<td>134.00</td>
<td>134.00</td>
<td>0.17</td>
<td>0.678</td>
</tr>
<tr>
<td>Age</td>
<td>3</td>
<td>6386.00</td>
<td>2129.00</td>
<td>2.75</td>
<td>0.042</td>
</tr>
<tr>
<td>Gender*Age</td>
<td>3</td>
<td>1687.00</td>
<td>562.00</td>
<td>0.73</td>
<td>0.536</td>
</tr>
</tbody>
</table>

No Statistical Significant p value / Significant p value

There is no statistical significant mean BMI difference between girls and boys (p = 0.678; p > 0.05), but a significant BMI difference can be observed between the age cohorts (p < 0.0005).

Table 4.13: Post-hoc Scheffé and Cohen’s d for Mean BMI Percentile in Each Age Cohort

<table>
<thead>
<tr>
<th>Age</th>
<th>Percentile</th>
<th>Mean</th>
<th>S.D</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>49.55</td>
<td>30.95</td>
<td></td>
<td>0.953</td>
<td>0.189</td>
<td>0.514</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>51.51</td>
<td>27.50</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.129</td>
<td>0.610</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>56.91</td>
<td>27.15</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.885</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>54.90</td>
<td>27.74</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td></td>
</tr>
</tbody>
</table>

No Significant p value / Significant p value

While Table 4.17 indicates that there is no statistical significant differences in BMI percentile for the six to seven year old (p = 0.953; p > 0.05), six to eight year old (p = 0.189) or the six to nine year old age cohort (p = 0.514), the BMI percentile in the six to nine year old learner cohort shows signs of approaches to statistical significance. As reflected in Table 4.17, no further statistical significant differences in the BMI percentiles
for any of the other age cohorts were found. Cohen’s d supports the aforementioned results, as no practical effect was indicated.

4.6 IMPORTANT FINDINGS

With reference to an analysis of the data gained from 902 respondents, the following findings can be listed:

4.6.1 WITH REGARDS TO WEIGHT

4.6.1.1 71 percent of the children were between 20 kg and 29.9 kg (Table 4.2 and Figure 4.2).

4.6.1.2 At age six, girls weighed less than boys but this was conversely indicated in the seven, eight and nine age groups, where the girls weighed more than the boys (Table 4.3).

4.6.1.3 There was no significant difference between the overall weight of boys and girls, but a significant weight difference was found between age cohorts (Table 4.4).

4.6.2 WITH REGARDS TO HEIGHT

4.6.2.1 50 percent of the children were between 120 cm to 129.9 cm in height, with two percent learners being between 103 cm to 150 cm of height (Table 4.6 and Figure 4.3).

4.6.2.2 When age is considered, all girls were shorter than their male counterparts (Table 4.7).

4.6.2.3 No significant difference was found for gender, but there was a significant difference between the age cohorts (Table 4.8).

4.6.3 WITH REGARDS TO BMI PERCENTILE

4.6.3.1 79 percent of the children fell within the 5 to 84.9 % (normal weight) category, with three percent in the < 5% (underweight) grouping (Table 4.10 and Figure 4.4).
4.6.3.2 At age six girls had a lower BMI percentile than boys; however, at the age of seven, eight, and nine years, their BMI percentile was higher than those of boys within the sample (Table 4.11).

4.6.3.3 Interestingly, while there was no statistical significant difference in gender BMI percentile scores, there was a significant difference between age cohorts (Table 4.12).

4.6.4 WITH REGARDS TO CHILDREN AT RISK

4.6.4.1 3.5 percent of the normal weight children are at risk of becoming overweight.

4.6.4.2 17.8 percent of the children who are overweight are at risk of becoming obese.

4.7 SUMMARY

In this chapter the researcher provided data from which an analysis was undertaken. By using both descriptive and inferential statistics, data could be depicted in tables and figures to enable knowledge and insight. A total of 1 024 respondents were surveyed who were enrolled as Grades one to three learners in three ordinary public schools in a rural town of Mpumalanga Province. The eventual sample consisted of 902 Black African learners.

In Chapter five the research results are presented with the aim to suggest recommendations.
CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATION

5.1 INTRODUCTION
In this chapter the researcher reflects on the findings of the study (Chapter 4) as well as on the aim and objectives of the research (Chapters 1 and 3). Recommendations are suggested that are aimed at prevention and reduction of overweight and obesity in children both with reference to the research target group and the rural primary school population in general, while also giving attention to recommendations for further research, amongst other motivations, those based on the limitations of the study.

5.2 DISCUSSION OF RESEARCH FINDINGS
With reference to the current study, the researcher focused on defining the prevalence of overweight and obesity within a purposive sample consisting of 902 Black African learners between the ages of six and nine years. Eleven (11%) percent of these learners was found to be overweight, whereas seven (7%) percent were identified as being obese, with a further 79 percent and three (3%) percent of the learners falling within the category of normal and underweight respectively.

Specific to research objective 1.5.5 (Chapters 1 and 3), are the 21.3 percent learners within the research sample who are at risk of becoming overweight (3.5%) or obese (17.8%). Without intervention these at-risk learners may in their adolescent and adult years be adversely affected by the physiological and psychosocial consequences related to their condition (as discussed in Chapter 2).

Statistical analysis of the data (Chapter 4) indicated that at age six, girls weighed less than boys but from age seven onwards, girls weighed more than boys. This implies a possible progression trend indicating that overweight and obesity becomes fully
entrenched in later adolescent years, especially since 21.3 percent of the sample group are at risk.

Table 5.1: Comparison between the Current and other South African Studies for Overweight and Obesity

<table>
<thead>
<tr>
<th>Age</th>
<th>Current Rural Study 2011 (n=902)</th>
<th>Mixed Urban/Rural Study of Armstrong et al. 2006 (n=10283)</th>
<th>Rural Study of Monyeki et al. 1999 (n=1336)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>6 years</td>
<td>18.0%</td>
<td>27.0%</td>
<td>15.5%</td>
</tr>
<tr>
<td>7 years</td>
<td>20.0%</td>
<td>12.0%</td>
<td>16.1%</td>
</tr>
<tr>
<td>8 years</td>
<td>21.0%</td>
<td>19.0%</td>
<td>16.5%</td>
</tr>
<tr>
<td>9 years</td>
<td>16.0%</td>
<td>18.0%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Average</td>
<td>18.75%</td>
<td>19.0%</td>
<td>16.2%</td>
</tr>
</tbody>
</table>

In order to compare the current study with those by other South African researchers (Table 5.1), namely Armstrong et al. (2006) and Moneyki et al. (1999), the same cut-off points for BMI percentiles used by these researchers were used in the current study. Remarkably, all three studies indicate that at age six, more girls than boys had a BMI percentile greater than 85th. However, when comparing these studies individually, the greatest difference was found between boys and girls within the current study (18% and 27%). A second finding is that data from the Armstrong et al. (2006) and Monyeki et al. (1999) studies indicate an increasing progression in the BMI percentile results for both boys and girls starting from six through to nine years, whereas this is not the case with the current study. A third trend is noticeable when comparing the results for boys and girls collectively within each age cohort as there is a similarity between the results indicated for children aged seven in all three studies. In reflection, the exact reasons for these similarities and differences within the studies are not known, but factors such as choice of methodology, and the composition of the sample, may have played a role.

Although a comparison is difficult when comparing prevalence studies that were conducted in Brazil (2 936 respondents aged six to 11 years), Algeria (19 263 children aged between six and 11 years), and Egypt (1 283 children six to 11 years of age)
(Addendum A) with those of the current study in which the same CDC charts to calculate BMI percentiles scores of the respondent group (Chapter 1 and 3) were used — this being that children with a BMI greater than 85th percentile were defined as overweight, whereas those children with a BMI greater than 95th percentile were identified as being obese (Chapters 3 and 4) — the following comparisons can be suggested.

When comparing the results of the current study in which 17 percent of the respondents were reported as being overweight and seven percent as being obese (Table 4.10) with those of the Brazilian study in which 33.2 percent and 22.0 percent boys and girls were identified as being overweight and obese respectively, twice as many children were found to be overweight and obese in comparison with those within the current study. With reference to the Algerian study, 10.3 percent boys and girls were defined as being overweight, whereas 7.9 percent were reported as being obese. The results indicate a greater difference in the percentage of children who were defined as being overweight, whereas an almost similar percentage of children in both studies were reported as being obese. With regards to the Egyptian study, 24 percent of the boys and girls were defined as being overweight, whereas 11.4 percent were indicated as being obese. In comparison with the current study, the Egyptian study identified slightly more children that were reported as being overweight and obese as the current study. Finally, all studies including the current research indicated a 1 in 2 ratio between obesity and overweight.

5.3 ASSESSMENT OF RESEARCH AIM AND OBJECTIVES

Irrespective of the limitations of the study, the researcher provides evidence in this section to claim that the aim and objectives of the research was achieved.

The aim of the study was to determine the Body Mass Index with regards to overweight and obesity of Black African children between the ages of six and nine years and who were enrolled in three public rural schools within Mpumalanga Province, South Africa.
With reference to the research objectives, the following evidence is provided.

A. THE RESEARCHER UNDERTOOK ANTHROPOMETRIC MEASUREMENTS (WEIGHT AND HEIGHT) OF BOYS AND GIRLS BETWEEN THE AGES OF SIX AND NINE YEARS.

The following evidence is provided:
- In alignment with ethical considerations that guided the research using children as respondents (Chapter 3, Section 3.9), a purposive sample of 902 Black African learners (473 boys and 429 girls) aged between six and nine years (Chapter 3, Section 3.6) were permitted to participate in the research (Chapter 4, Section 4.2: Table 4.1).
- Anthropometric measurements (weight: Chapter 4, Section 4.3: Tables 4.2, 4.3, 4.4 and 4.5; Figure 4.2, and height: Chapter 4, Section 4.4: Tables 4.6, 4.7, 4.8 and 4.9; Figure 4.3) were taken which enabled descriptive and statistical analysis resulting in a number of findings (Chapter 4, Section 4.7.1 & 4.7.2).

B. THE RESULT OF EACH LEARNER’S ANTHROPOMETRIC MEASUREMENTS WAS COMPARED WITH BMI PERCENTILE FOR GENDER AND AGE ACCORDING TO CHARTS USED BY THE CENTRE FOR DISEASE CONTROL AND PREVENTION (2009).

The following evidence is provided:
- In order to determine the outcome of each learner’s anthropometric measurements, charts developed by the Center for Disease Control and Prevention (2009) in collaboration with the National Center for Health Statistics, and which are recommended by the World Health Organization (WHO) were used. By so doing, measurement outcomes were reached that met the criteria of reliably and validity (Chapter 3 Section 3.8.2: Tables 3.2 and 3.3).
- The results for descriptive analysis of data are presented in Chapter four in the following Tables (weight: 4.2 and 4.3; height: 4.6 and 4.7) and Figures
(4.2 and 4.3), while BMI for age percentiles are indicated in Tables 4.10 and 4.12.

- The data was also subjected to ANOVA, Cohen’s $d$, and Post-hoc Scheffé analysis (Tables 4.12 and 4.13) to ensure validity of deductions that were made.

C. THE PREVALENCE OF LEARNERS WHO ARE AT RISK OF BECOMING OVERWEIGHT AND OBESE WAS IDENTIFIED.

The following evidence serves:

- Calculations are that 21.3 percent of the research sample are at risk of becoming overweight (3.5%) or obese (17.8%) (Chapter 4; Research finding 4.7.5).

5.4 RECOMMENDATIONS

5.4.1 BACKGROUND INFORMATION

The town of Ermelo is situated within the Gert Sibande Municipality of Mpumalanga Province with a population of approximately 42 000 residents. The population is largely composed of Black African with the vast majority speaking IsiZulu and IsiSwati, and minority groupings consisting mainly of White, Coloured and Indian.

According to statistics issued on crimes perpetrated on children in Ermelo during 2011 (SAPS, 2011), eight children were kidnapped. Other crimes which may affect the safety of children are: drug trafficking and abuse (82), assault with the intent to inflict grievous bodily harm (476), and common assault (543). Collectively, these have consequences for a safe environment in which children can engage in play, recreational sport and other physical activity.

In the Draft Integrated Development Plan (IDP) for the 2011/12 to 2013/14 (Department of Co-operative Governance and Traditional Affairs, 2012) for Gert Sibande Municipality
mention is made of issues that require address which range from health and environment issues such as municipal health and environment strategies to sports, arts and culture and youth development, such as the development of community facilities.

Specific to the research are the three schools that were targeted. One of the three is situated within the Ermelo Township. In comparison with the two other schools that are situated within the town, the school in the township has limited playground space and no sport and recreation facilities of its own. Whereas the children in the township school have access to outsiders who operate informal entrepreneurial food stalls inside its premises, those who attended the two other schools have a school tuck shop on its premises, as well as sufficient playground space, and well-developed sports and recreation facilities.

5.4.2 CURRENT RESEARCH-BASED RECOMMENDATIONS

The recommendations that are presented in this section are based on a two-fold aim: (a) to suggest how the prevalence of overweight and obesity pertaining to the research sample can be reduced, while also giving attention to preventing further escalation thereof, and (b) to suggest how the same aim can be achieved by targeting learners who were not part of the research sample but who are enrolled or who in future will enrol as learners within primary schools in Ermelo.

In order to initiate and sustain a holistic quality of life health programme aimed to achieve the abovementioned aims and to encourage longitudinal research activity, it is recommended that a learner data base be developed to store and regularly update information. Information such as anthropometric measurement results (weight, height, head size and body circumference) and those that enable a healthy life style, such as learner food-intake, energy expended during free time, recreation, sport, and any other physical activity and sleeping habits form part of the data captured. These can also include a weekly activity schedule, and current and past acute illnesses, as well as chronic illnesses, also noting medication, can contribute towards an on-going definition of the nature of a holistic quality of life health programme. Alternatively, SNAP statistics
(Chapter 3) should be undertaken in collaboration with and under sponsorship of the Department of Basic Education. By so doing, this will enable on-going definition of the severity of overweight and obesity within the school population, and enable a fit-for-purpose quality of life health programme for learners of all age groups enrolled within Ermelo primary schools.

In order to enable a coherent and sustainable quality of life health programme for school-going children within Ermelo, it is suggested that schools collaborate with Gert Sibande Municipality Health Department and other relevant private and non-private stakeholder organisations (the latter including religious and non-religious community volunteers) to establish a Forum for such a programme.

Specifically aimed at the focus of the research, aligned with its findings, and bearing the location and its population in mind, are recommendations envisaged through the Forum. These are:

5.4.2.1 DIET

Based on the fact that various researchers maintain that children, who have a healthy balanced diet, concentrate better in school (Taras, 2005; Vermeersch and Kremer, 2006), struggle less with illness or disease conditions, and have a healthy body weight. It is recommended that children should regularly receive healthy meals. This can be achieved through health professionals (dieticians, community and school health nurses) who provide educators and parents or guardians, as well as community volunteers with information about:

- what constitutes as a healthy meal
- how to ensure these meals can be made possible within the budgets of those who have to prepare them for members of their family or for learners at school
- what the nature of overweight and obesity is, as well as its causes and consequences for childhood and later in adult life
• what healthy snacks and beverages can be sold or distributed amongst learners whether the source is a school tuck shop, volunteers or informal entrepreneurs who operate on school premises.

It is also recommended that volunteers in collaboration with educators, parents / guardians and learners, set up and maintain a vegetable garden for those schools in which learners do not have access to regular healthy meals. Such gardens can either be sustained on the premises of schools or on a location set aside for this purpose by Gert Sibande Health Authorities. Besides this, projects of this kind will amongst other things enable educators to use gardening within the scope of the school curriculum practice for subjects such as life orientation, mathematics and reading and writing, and to promote within learners the application of values such as health, ownership, responsibility, accountability and sharing, while also providing learners with an understanding of the principles of collaboration, entrepreneurship, and team work. From a health point of view and with overweight and obesity in mind, gardening encourages volunteers, educators and learners to work together to plant and harvest vegetables that ensure healthy eating habits.

5.4.2.2 SCHOOL FACILITIES

A main contributing factor in overweight and obesity amongst children is an imbalance between energy consumption and expenditure (Thompson et al., 2003:1), mainly caused by factors such as pre-occupation with passive free-time activities such as watching TV and playing on the internet, and the absence of community amenities that encourage active play, recreation, sport and participation in other physical activities, as well as a lack of safe amenities due to an array of reasons, especially relating to life within a township. However, eating healthy must coexist with being active. In line with the Draft Integrated Development Plan (IDP) for Gert Sibande Municipality, as mentioned in Section 5.5.1, it is recommended that the Muncipality enable a safe environment within schools and the community that enables children the freedom to participate in informal physical activity and play, and as partner in the Forum, assist in the development of structured sport programmes that can be attended after school, on
weekends and during school recess periods, which can be maintained by volunteers (such as sports coaches and administrators, sportsman, older youth, biokineticists) in which both non-school and school-going children can participate in order to encourage healthy constructive play and recreation, exercise and sport development. Thought should also be given by the Forum to train and involve high school learners to assist with recreational and sport programmes for primary school children, while also involving various professional interns like biokineticists, dieticians and educators.

5.4.2.3 TRAINING AND EDUCATIONAL OPPORTUNITIES
During the time the researcher spent in Ermelo, she became aware of several opportunities in which students registered for distance learning tertiary educational programmes, amongst others students in education and nursing science of whom the latter who also receive training in community health nursing. It is recommended that research should be undertaken on how to meaningfully enable or co-opt such interns into the activity of the Forum in order for them to help achieve the Forum's quality of health goals. Volunteer educators, biokinetic interns and other budding professionals should be encouraged to collaborate and work alongside professionals and volunteers to develop, initiate and sustain programmes that focus on play, recreation and sport as well as focus on healthy dietary habits. Nursing science students should present health educational programmes focusing on overweight and obesity. In addition, student interns can also be enabled to train community and youth volunteers in various types of health outreaches to create awareness about overweight and obesity.

5.4.2.4 COMMUNITY FACILITIES
As it is the aim of the Gert Sibande Municipality IDP to enable viable strategic partnerships with relevant stakeholders, the facilitation of efficient use of existing facilities, the upgrading of existing facilities, as well as the construction of new facilities, the researcher recommends that the Forum should give serious thought to how the Municipality can be motivated towards taking ownership to upgrade the defunct swimming pool situated within Ermelo. This facility can be used by collaborating sports coaches and volunteers to encourage children to participate in water recreation and
sports, and biokineticists, amongst other professionals, to provide a variety of water exercise and therapy programmes; all aimed to prevent and reduce overweight and obesity within children.

5.4.2.5 SAFETY OF COMMUNITY AND CHILDREN

Safety of children is an important social issue within South Africa, and this is no less the case for Ermelo. Such community features limit the child’s freedom to play and/or to participate in outdoor activities. In the long run, this together with unhealthy eating habits and ‘forced’ in-door activity which enhances passivity may amongst other things result in an imbalance between energy consumption and expenditure. Therefore, it is recommended that the South African Police Service also become involved in the Forum to educate parents and members of the community at large on safety issues relating to children. The police need to become proactive in training and involving parents and/or guardians, as well as responsible volunteers within the community in neighbourhood watch teams in which to take “shifts” at the community and school playgrounds, as well as recreational and sport facilities to ensure supervision, and the safety of children, especially those whose parents are in employment.

5.4.2.6 RECOMMENDATIONS PERTAINING TO FURTHER RESEARCH

Against the background of the limitations that have been identified in the current research, as well as envisaged for future research activity, the following is recommended:

- It is suggested that when anthropometric measurements are undertaken with the aim to develop a coherent holistic quality of life health plan that is aimed at prevention and reduction of overweight and obesity in rural schools within a specific rural location, all schools should be targeted to ensure a clear definition of these conditions.

- It is also suggested that time be negotiated at a school’s first Parent-Teacher Association meeting to inform parents of the importance of research on overweight and obesity, what such research entails, and how results can serve them and the school. It can be deduced from this study that written
communication does not always serve to motivate participation of parents and guardians. This would also enable researchers to draw comparisons between ethnic groups which are required when making recommendations for quality of health programmes.

5.5 CONCLUSION
Having assessed the research objectives, discussed the limitations of the research, reflected on the research findings, and proposed recommendations, the researcher is of the opinion that the aim of the study, which was to determine the body mass index with regards to overweight and obesity of Black African children between the ages of six and nine years and who were enrolled in three ordinary public rural schools within Mpumalanga Province, South Africa, was achieved.
REFERENCE


Email communiqué. Document obtained directly from Department from Ms Mfanwenkosi Malaza on 27 September 2010 titled: Schools and Learners Statistics (2010).


Morrow, V. 2008 Ethical dilemmas in research with children and young people about their social environment. Children’s Geographies, 6(1): 49-61


## LIST OF ADDENDUMS

<table>
<thead>
<tr>
<th>Addendum A</th>
<th>Global trends pertaining to adult and childhood overweight and obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addendum B</td>
<td>Human Development Index (HDI) rank per Developed / Developing Country indicating Childhood Overweight and Obesity Percentages</td>
</tr>
<tr>
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<td>Assessment Form</td>
</tr>
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</tr>
<tr>
<td>Addendum E</td>
<td>Information Letter for Parents or Guardians (Afrikaans)</td>
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<td>Assent Form for Children (English)</td>
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<td>Consent Form for Parents or Guardians (English)</td>
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<td>Addendum I</td>
<td>Permission Letter to the Department of Education</td>
</tr>
<tr>
<td>Addendum J</td>
<td>Permission Letter to Primary School Principal (English)</td>
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<tr>
<td>Addendum K</td>
<td>Permission Letter to Primary School Principal (Afrikaans)</td>
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# ADDENDUM A

## GLOBAL TRENDS PERTAINING TO ADULT AND CHILDHOOD OVERWEIGHT AND OBESITY

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<td>2,613</td>
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<td>21.9% boys; 22.3% girls</td>
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Research pertaining to Canada and America

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Research pertaining to Canada and America

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<th>% Female</th>
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<th>% Male</th>
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## Research pertaining to Middle and Southern Europe

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<td>Obese</td>
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<tr>
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<td>5-16</td>
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<tr>
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<td>20.8% men; 23.8% women</td>
<td>2003-2007</td>
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Research pertaining to Middle and Southern Europe

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<th>Sample</th>
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<th>Date of Survey</th>
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<tr>
<td>Switzerland</td>
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<td>35-74</td>
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Research pertaining to Eastern Europe and Arabian States

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<th>Poland</th>
<th>Sample</th>
<th>Age Range</th>
<th>Overweight</th>
<th>Obese</th>
<th>Date of Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland</td>
<td>14 403</td>
<td>≥20</td>
<td>40.3% men; 28.4% women</td>
<td>20.8% men; 23.8% women</td>
<td>2003-2007</td>
</tr>
<tr>
<td>Poland</td>
<td>3 911</td>
<td>7-17</td>
<td>13.5% boys; 11.4% girls</td>
<td>2.8% boys; 1% girls</td>
<td>2000</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>9 006</td>
<td>19-55</td>
<td>30.7% male; 27% female</td>
<td>10.3% male; 21.6% female</td>
<td>2000</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>3 142</td>
<td>5-17</td>
<td>19.5% boys; 16.3% girls</td>
<td>4.7% boys; 3.5% girls</td>
<td>1992</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Iran</th>
<th>Sample</th>
<th>Age Range</th>
<th>Overweight</th>
<th>Obese</th>
<th>Date of Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran</td>
<td>89 404</td>
<td>15-64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iran</td>
<td>21 111</td>
<td>6-18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Sample:</td>
<td>Age:</td>
<td>Overweight:</td>
<td>Obese:</td>
<td>Date of survey:</td>
</tr>
<tr>
<td>--------------</td>
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<td>-------------</td>
<td>--------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>17 223</td>
<td>≥30</td>
<td>42.4 percent of men; 31.8 percent of women</td>
<td>26.4 percent of men; 44 percent of women</td>
<td>1995-2000</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>12 698</td>
<td>5-17</td>
<td>10.2 percent of boys; 11.5 percent of girls</td>
<td>5.9 percent of boys; 6.8 percent of girls</td>
<td>1994-1998</td>
</tr>
</tbody>
</table>

**Research pertaining to Asia**

<table>
<thead>
<tr>
<th>Country</th>
<th>Sample:</th>
<th>Age:</th>
<th>Overweight:</th>
<th>Obese:</th>
<th>Date of survey:</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>181 912</td>
<td>15-49</td>
<td>8% male; 9.8% female</td>
<td>1.3% male; 2.8% female</td>
<td>2005-2006</td>
</tr>
<tr>
<td>India</td>
<td>20 243</td>
<td>2-17</td>
<td>15.2% boys; 14.4% girls</td>
<td>5.4% boys; 3.9% girls</td>
<td>2003-2005</td>
</tr>
<tr>
<td>China</td>
<td>221 044</td>
<td>≥18</td>
<td>16.7% male; 15.4% female</td>
<td>15.4% male; 3.4 female</td>
<td>2002</td>
</tr>
<tr>
<td>China</td>
<td>44 880</td>
<td>7-17</td>
<td>4.9% boys; 3.9% girls</td>
<td>1.1% boys; 0.6% girls</td>
<td>2002</td>
</tr>
<tr>
<td>Japan</td>
<td>15 000</td>
<td>≥20</td>
<td>24.5% male; 17.8% female</td>
<td>2.3% male; 3.4% female</td>
<td>2000</td>
</tr>
<tr>
<td>Japan</td>
<td>6 079</td>
<td>6-14</td>
<td>2.4% boys; 11.5% girls</td>
<td>3.8% boys; 2.9% girls</td>
<td>1996-2000</td>
</tr>
</tbody>
</table>

**Research pertaining to Oceania**

<table>
<thead>
<tr>
<th>Country</th>
<th>Sample:</th>
<th>Age:</th>
<th>Overweight:</th>
<th>Obese:</th>
<th>Date of survey:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>16 601</td>
<td>≥18 years</td>
<td>42.1% male; 30.9% female</td>
<td>25.6% male; 24% female</td>
<td>2007-2008</td>
</tr>
<tr>
<td>Australia</td>
<td>4 487</td>
<td>2-16</td>
<td>17% boys; 18% girls</td>
<td>5% boys; 6% girls</td>
<td>2007</td>
</tr>
<tr>
<td>New Zealand</td>
<td>12 488</td>
<td>&gt;15</td>
<td>40.7% male; 29.4% female</td>
<td>18% boys; 23% girls</td>
<td>2007-2008</td>
</tr>
<tr>
<td>New Zealand</td>
<td>74 2300</td>
<td>5-14</td>
<td>20.1% boys; 8.1% girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Sample:</td>
<td>Age:</td>
<td>Overweight:</td>
<td>Obese:</td>
<td>Date of survey:</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
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<td>-----------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Algeria</td>
<td>4 112</td>
<td>15 to 64</td>
<td>27.5% males and 32% females</td>
<td>8.8% males and 21.4% female</td>
<td>2003</td>
</tr>
<tr>
<td>Egypt</td>
<td>11 528</td>
<td>15 to 49</td>
<td>34.4% male; 28.3% female</td>
<td>18.2% male; 39.5% female</td>
<td>2008</td>
</tr>
<tr>
<td>Senegal</td>
<td>4 170</td>
<td>15 to 49</td>
<td>17.7%</td>
<td>10.1%</td>
<td>2008</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>5 901</td>
<td>15-49</td>
<td>3.7 percent of women; 0.7 percent of women</td>
<td>14.4% male; 23.9% female</td>
<td>2005</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>3 000</td>
<td>&gt;25</td>
<td>14.4% male; 23.9% female</td>
<td>3.9% male; 18.2% female</td>
<td>2004</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>2 341</td>
<td>5-17</td>
<td>1.3% boys; 2% girls</td>
<td>0.4% boys and girls collectively</td>
<td>1990-1994</td>
</tr>
</tbody>
</table>

### ADDENDUM B

Human Development Index (HDI) Rank per Developed / Developing Country indicating Childhood\(^1\) Overweight & Obesity Percentages

<table>
<thead>
<tr>
<th>Country</th>
<th>HDI(^2)</th>
<th>Overweight</th>
<th>Obesity</th>
<th>Country</th>
<th>HDI</th>
<th>Overweight</th>
<th>Obesity</th>
<th>Country</th>
<th>HDI</th>
<th>Overweight</th>
<th>Obesity</th>
<th>Country</th>
<th>HDI</th>
<th>Overweight</th>
<th>Obesity</th>
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</thead>
<tbody>
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<td>Australia</td>
<td>3</td>
<td>35.0</td>
<td>11.0</td>
<td>Brazil</td>
<td>56</td>
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<td>22.0</td>
<td>Algeria</td>
<td>95</td>
<td>10.3</td>
<td>7.9</td>
<td>Ethiopia</td>
<td>156</td>
<td>.05</td>
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<tr>
<td>Canada</td>
<td>9</td>
<td>37.0</td>
<td>17.3</td>
<td>Iran</td>
<td>65</td>
<td>22.6</td>
<td>5.8</td>
<td>China</td>
<td>101</td>
<td>8.6</td>
<td>1.7</td>
<td>Senegal</td>
<td>177</td>
<td>.05</td>
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<td>Chile</td>
<td>10</td>
<td>38.4</td>
<td>17.3</td>
<td>Mexico</td>
<td>73</td>
<td>38.9</td>
<td>18.2</td>
<td>Egypt</td>
<td>104</td>
<td>24.0</td>
<td>11.4</td>
<td>Zimbabwe</td>
<td>187</td>
<td>3.3</td>
<td>0.4</td>
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<td>France</td>
<td>17</td>
<td>22.4</td>
<td>5.6</td>
<td>Russian Federation</td>
<td>80</td>
<td>35.8</td>
<td>8.2</td>
<td>India</td>
<td>113</td>
<td>29.6</td>
<td>9.3</td>
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<td>Germany</td>
<td>18</td>
<td>31.4</td>
<td>8.8</td>
<td>Saudi Arabia</td>
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<td>21.7</td>
<td>12.7</td>
<td>South Africa</td>
<td>131</td>
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<td>7.2</td>
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<td>Ireland</td>
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<td>17.0</td>
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<td></td>
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<tr>
<td>Japan</td>
<td>26</td>
<td>23.9</td>
<td>6.8</td>
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<td>Netherlands</td>
<td>33</td>
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<td>Norway</td>
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<td>5.1</td>
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</tr>
<tr>
<td>Poland</td>
<td>36</td>
<td>24.9</td>
<td>3.8</td>
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<tr>
<td>Portugal</td>
<td>37</td>
<td>34.7</td>
<td>10.7</td>
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</tr>
<tr>
<td>Spain</td>
<td>42</td>
<td>41.0</td>
<td>14.8</td>
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</tr>
<tr>
<td>Sweden</td>
<td>43</td>
<td>30.7</td>
<td>5.8</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Switzerland</td>
<td>44</td>
<td>21.2</td>
<td>8.6</td>
<td></td>
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</tr>
<tr>
<td>United Kingdom</td>
<td>46</td>
<td>36.6</td>
<td>12.7</td>
<td></td>
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</tr>
<tr>
<td>United States of America</td>
<td>47</td>
<td>44.2</td>
<td>26.7</td>
<td></td>
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</tr>
</tbody>
</table>

\(^1\) The sum of childhood overweight and obesity percentages are presented calculated from studies reported in Chapter 2

## ADDENDUM C

**ASSESSMENT FORM**

<table>
<thead>
<tr>
<th>School *</th>
<th>Grade</th>
<th>Age **</th>
<th>Gender ***</th>
<th>Race ****</th>
<th>Weight ***</th>
<th>Height ***</th>
<th>BMI kg/m²</th>
</tr>
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</tr>
</tbody>
</table>

* School names remained anonymous

** B = Boy & G = Girl

*** B = Black Children, W = White Children, I = Indian Children, O = Other Ethnic Groups
ADDENDUM D

INFORMATION LETTER FOR PARENTS or GUARDIANS (ENGLISH)


Dear Parent / Guardian

The World Health Organization reports an annual increase in the prevalence of childhood overweight and obesity. These conditions can lead to life threatening health problems.

I am currently enrolled as a Masters student in the Human Movement Science Department of the Health Sciences Faculty at the Nelson Mandela Metropolitan University. I am conducting research on the prevalence of overweight and obesity among South African children. Data on the prevalence of overweight and obesity in South African children is substantially limited and this research will make an important contribution to our understanding of these health conditions.

At a time designated by the Principal, measurements will be taken of your child’s height and weight. No invasive methods will be performed. Your child’s safety and dignity is of utmost importance and will be respected. Measurement results will be treated as confidential, although research results may be presented at research conferences. The name of a child or school will never be mentioned in any oral or written communiqué. I intend to meet with all parents at a time arranged by the Principal prior to data collection to explain my research and how I will undertake to do the measurements.

If you have any questions pertaining to the study prior to this meeting or at any other time, please do not hesitate to contact me either telephonically or by email. My contact details are:

Cell phone: 073 942 7921
Email: hanliebez@hotmail.com

Thank you for your time and I hope that you will assist me in my research.

__________________________  ________________
Miss Hanlie Bezuidenhout     Dr Maryna Baard
Researcher                   Supervisor

• PO Box 77000 • Nelson Mandela Metropolitan University
• Port Elizabeth • 6031 • South Africa • www.nmmu.ac.za

Geagte Ouer / Voog

Die Wêreld Gesondheidsorganisasie rapporteer ’n groeiende jaarlikse voorkoms van oorgewig en vetsug onder kinders. Hierdie toestande kan ’n gesondheidsrisiko vir kinders inhou.

Ek is ‘n geregistreerde Meestersgraad student aan die Nelson Mandela Metropolitaanse Universiteit in die Departement Menslike Bewegingskunde in die Fakulteit van Gesondheidswetenskappe. Ek onderneem navorsing om die voorkoms van oorgewig en vetsug onder Suid-Afrikaanse kinders te bepaal. Data oor die voorkoms van oorgewig en vetsug onder Suid-Afrikaanse kinders is uitsers onvolledig en hierdie navorsing sal ons in staat stel om meer te wete te kom oor hierdie gesondheidstoestande.

Op ‘n tyd deur die skoolhoof bepaal, sal mates van u kind se lengte en gewig geneem word. Geen ingrypingsmetodes sal gebruik word nie. U kind se veiligheid en waardigheid is vir ons van kardinale belang. Resultate van mates sal konfidensieel hanteer word, alhoewel navorsingsresultate tydens konferensies bespreek mag word. U kind se naam of skool sal nooit in enige mondelingse of geskrewe word, bekend gemaak word nie. Ek beoog om voor voltooiing van metingsopname met alle ouers te vergader op ‘n tyd deur die skoolhoofvasgestel. . Hiertydens sal ek my navorsing verduidelik en ook hoe mates van u kind se lengte en gewig gedoen sal word.

As u enige ander vrae oor die navorsing het voordat ons vergader of te enige ander tyd, kan u my kontak op my selfoon of vonkpos. . My kontakbesonderhede is:

Selfoon: 073 942 7921
Vonkpos: hanliebez@hotmail.com

Baie dankie vir u tyd en ek vertrou dat u my in hierdie navorsing sal bystaan.

Me Hanlie Bezuidenhout
Navorser

Dr Maryna Baard
Supervisor
Rephrased research title:
How tall is every child in your class and how much does he or she weigh.

Actual research title: The Prevalence of Overweight and Obesity of Six to Nine year old Black African Children in a Rural Town of Mpumalanga.

Dear Friend

I am sure you are wondering why I am writing to you. I would like to find out how tall you and your friends in your class are; also how much each of you weigh. To do this, I will visit your school to measure your height and weight. Your parents or guardian will have to give me permission to do this and, of course, you too.

To weigh you, you will have to stand on a scale barefoot and to measure how tall you are, you will need to stand with your back to a wall, also barefoot. No one will know how tall you are and how much you weigh, because this will be kept a secret. Of course you may tell your parents. As there will be many other children in your school who I will also measure and weigh I will not be able to remember yours and even when we meet each other later again, I will not be able to remember your measurements. Therefore, your measurements will be your secret.

You father and mother or guardian will receive a letter in which I will explain everything and give them a form to complete where they will indicate if you may participate in my research or not. Your Principal will also need to give permission to visit you at school.

I want you to talk to your parents or guardian about my invitation to measure your height and take you weight reading. Your parents or guardian will help you to understand why I am asking you to help me.

It is important that your parents or guardian explain to you that you need not have your height and weight measurements taken if you don’t want to. Also, even if your parents or guardian say you may participate, you can still decide for yourself not to. Because we are friends, I will not be angry with you or your parents or guardian, should you not be allowed to or you yourself decide not to participate.
I would appreciate it if you can remind your parents or guardian to sign and send their form to school in which they give permission that you may be measured or to state that you may not be measured. Without this form, I will not be able to measure you, even if they do not mind you being measured. And, if your parents or guardian decide that you must not be measured, then I will understand this. It is always best to obey your parents.

If your parents or guardian want to contact me, they may phone me on my cell on 073 942 7921 or send me an e-mail to: hanliebez@hotmail.com.

One last thing, I would like you to decide for yourself if you want to participate or not. Whether you decide or not decide to participate, I would appreciate that you give me your answer by marking the ‘Yes’ or ‘No’ block below after reading the question again. Please do not forget to give the tear-off strip to your class teacher.

Thank you very much and do enjoy your new school year.

**Hanlie Bezuidenhout** (Researcher)

---

**[Please send the portion below with your child to school]**

Dear Friend

Please draw a cross in either the ‘Yes’ or ‘No’ block to indicate your answer to the following question:

**Do you want to participate in my research?**

[ ] YES  [ ] NO

Name and surname: ____________________________________________________________

_________________________________________  __________________________

Signature of child  Date

---

**ADDENDUM G**
Aangepaste titel:
Hoe lank is elke kind in jou klas en hoeveel weeg elkeen?


Liewe Maatjie

Ek wil graag uitvind hoe lank elkeen in jou klas is en hoeveel elkeen van julle weeg. Om dit te doen, gaan ek die skool besoek om jou lengte en gewig te meet. Pappa en mamma of jou voog sal my hiervoor toestemming moet gee en natuurlik jy ook. Dis hoekom ek vir jou hierdie brief skryf.

Om jou gewig te meet sal jy sonder skoene op ‘n skaal moet staan en om jou lengte te meet moet jy regop, sonder skoene, teen ‘n muur staan. Jou lengte en gewig sal soos ‘n geheim bewaar word en slegs jy en ek en iemand wat jou lengte en gewig op ‘n vorm sal skryf, sal dit weet. Jy mag natuurlik jou ouers vertel. Raai wat? Omdat ek so baie kinders in jou skool moet meet, sal ek later nie meer kan onthou hoeveel jy weeg of hoe lank jy is nie, en as ek jou weer érens sou raakloop, sal ek dit beslis nie meer kan onthou nie. So, jou geheim sal goed bewaar word.

Pappa en mamma of jou voog gaan ook ‘n brief kry waarin ek alles verduidelik en ook ‘n vorm wat hulle moet voltooi om te sê jy mag deelneem of nie. Natuurlik moet jou skoolhoof ook toestemming gee dat ek hierdie metings in jou skool mag doen.

Dit sal ook nodig wees dat jy met pappa en mamma of jou voog bespreek of jy wil deelneem of nie. Ook dat jy sal verstaan dat jy nie hoef deel te neem as jy nie wil nie, al sê pappa en mamma of jou voog dat jy mag deelneem. Jy mag ook besluit om nie deel te neem nie op daardie oomblik net voor ons jou gaan meet. Ons is vriende en daarom sal ek verstaan dat jy nie wil deelneem nie en niemand sal vir jou kwaad wees nie.
Help asseblief om pappa en mamma of jou voog te onthou om die vorm wat hulle moet onderteken saam met jou skool toe te stuur. Daarsonder mag ek nie jou mates neem nie. En, as pappa of mamma of jou voog sê jy mag nie deelneem nie, moet nie daaroor bekommerd wees nie. My ouers het ook al geweier dat ek aan iets nie mag deelneem en ek het besluit dat dit ‘n goeie ding is om eerder gehoorsaam te wees.

Indien pappa of mamma of ‘n voog my wil kontak, is hulle baie welkom om dit te doen. My selfoonnommer is: 073 942 7921 en my posadres is: hanliebez@hotmail.com

Nou net ‘n laaste ietsie, jy moet self ook besluit om deel te neem of nie. Dan moet jy jou antwoord met ‘n kruisie in een van die blokkies hieronder trek nadat jy die vraag gelees het. Moet nie vergeet om die afskeurstrokie vir jou klas juffrou r te gee nie; selfs al wil jy nie deelneem nie.

Groete en baie sterkte met jou nuwe skooljaar.

Hanlie Bezuidenhout (Navorser)

[Stuur asseblief die onderstaande gedeelte saam met u kind na die skool]

Liewe Maatjie

Trek ‘n kruisie by ‘Ja’ of ‘Nee’ nadat jy die vraag gelees het.

Wil jy aan die studie deelneem?  

[ ] JA  [ ] NEE

Naam en Van: ____________________________________________________________

________________________________________________________

Naam / Handtekening van kind                      Datum
ADDENDUM H
CONSENT FORM FOR PARENT or GUARDIAN

Dear Parent

Firstly, I want to thank all the parents who responded and allowed their child to participate in the research study.

I do understand there was some confusion about the form, and therefore some parents were reluctant to sign their child to participate.

What is expected of you:
• Allow your child to participate

What is expected of your child:
• Stand on the scale to measure their mass
• Stand to measure their height

Your child will not be weighed and measured in front of everyone, a “barrier” will be set up between the measuring area and the rest of the class.

➢ No money is required from you, the parent or guardian, for your child to participate.
➢ No money will be paid for your child’s participation.
➢ Your child will receive a small “thank you” gift for their participation.

Would you like your child’s measurement?

Would you like a copy of the report e-mailed to you?

May your child participate in the research study?

__________________________________________  ______________________________________
Child Signature                           Parent/Guardian Signature

__________________________________________
Date
ADDENDUM I

PERMISSION LETTER TO DEPARTMENT OF EDUCATION

29 September 2010

Researcher: Ms Hanlie Bezuidenhout
15 Mayfair Avenue
Fernglen
Port Elizabeth 6045
Fax: 041 365 7747 / 041 504 2348

For attention: Mr Mr Hlatshwayo

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

Dear Mr Hlatshwayo

My name is Hanlie Bezuidenhout and I am a Masters Human Movement Science (Biokinetics) student at the Nelson Mandela Metropolitan University in Port Elizabeth. The research I wish to conduct for my Master’s Dissertation involves the prevalence of overweight and obesity in rural public schools in boys and girls aged 6- to 9- years (Grade 1 to grade 3). This research project will be conducted under the supervision of Dr. M Baard (NMMU, South Africa).

Besides seeking your Departments’ approval, I also seek your permission to approach three schools in Ermelo 1 Education Circuit. These are: Ermelo Primary School, Laerskool Ermelo and Wesselton Primary School. The fieldwork for this research will involve height and weight measurements. No invasive physical measurements will be undertaken.

Find included an abbreviated dissertation proposal which includes information and a consent form that will be addressed to the parents or guardians of the relevant children. A copy of a letter of permission addressed to Principals of the schools, in which fieldwork will be undertaken, is also attached. I would like to mention that written ethical approval for this research has been received from the NMMU Faculty of Health Sciences’ Research, Technology and Innovations Committee.
Upon completion of the study, I undertake to provide the Mpumalanga Department of Education with a bound copy of my dissertation. The results may increase the awareness of overweight and obesity among school children and their parents or guardians, and this may contribute to the prevention and intervention of overweightness or obesity in children.

Should you require any further information, please do not hesitate to contact me on:

**Cell:** 073 942 7921
**E-mail:** hanliebez@hotmail.com

I appreciate being able to provide you with this letter. Thank you for your time and consideration in this matter.

Yours sincerely,

__________________
Hanlie Bezuidenhout
Researcher: Nelson Mandela Metropolitan University
ADDENDUM J

PERMISSION LETTER TO PRIMARY SCHOOL PRINCIPAL (ENGLISH)

Name of Principal: 
Name of School: 
Address: 

Letter of Permission: Principal of School

<table>
<thead>
<tr>
<th>Title of the research project</th>
<th>The Prevalence of Overweight and Obesity of Six to Nine year old Black African Children in a Rural Town of Mpumalanga.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal investigator</td>
<td>Hanlie Bezuidenhout</td>
</tr>
<tr>
<td>Address</td>
<td>15 Mayfairlaan</td>
</tr>
<tr>
<td></td>
<td>Fernglen</td>
</tr>
<tr>
<td></td>
<td>Port Elizabeth</td>
</tr>
<tr>
<td></td>
<td>6045</td>
</tr>
<tr>
<td>Contact number</td>
<td>073 942 7921</td>
</tr>
<tr>
<td>e-mail</td>
<td><a href="mailto:hanliebez@hotmail.com">hanliebez@hotmail.com</a></td>
</tr>
</tbody>
</table>

I, ____________________________________, hereby grant permission for the above-mentioned research project to be conducted in my school as the Headmaster of Primary school______________________.

I understand that my school will simply serve as a testing venue for the participants involved in the study from Primary school ________________________________, and that further involvement by either me or my staff will not be required.

All information pertaining to the testing has been provided to me by the principal researcher and I will carry no liability for any problems that may occur. I also understand that the research has been approved by die NMMU Faculty of Health Sciences’ Research, Technology and Innovation Committee.

I understand that participant confidentiality will be maintained.

____________________________  __________________
Signature                      Date
ADDENDUM K

AFRIKAANS VERSION OF PERISSION LETTER TO PRIMARY SCHOOL PRINCIPAL

Naam van Skoolhoof:
Naam van Skool:
Adres:

<table>
<thead>
<tr>
<th>Titel van navorsingsprojek</th>
<th>Die Voorkoms van Oorgewig en Vetsug onder Ses- tot Nege-jarige Swart Afrika Kinders van 'n Dorp in Mpumalanga.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoofnavorser</td>
<td>Hanlie Bezuidenhout</td>
</tr>
<tr>
<td>Adres</td>
<td>15 Mayfairlaan</td>
</tr>
<tr>
<td></td>
<td>Fernglen</td>
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<tr>
<td></td>
<td>Port Elizabeth</td>
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<tr>
<td></td>
<td>6045</td>
</tr>
<tr>
<td>Kontaknommer</td>
<td>073 942 7921</td>
</tr>
<tr>
<td>Epos</td>
<td><a href="mailto:hanliebez@hotmail.com">hanliebez@hotmail.com</a></td>
</tr>
</tbody>
</table>

Ek,____________________________________, as die Hoof van die Laerskool____________________ gee hiermee toestemming dat die bogenoemde navorsingsprojek in my skool mag plaasvind.

Ek verstaan dat my skool slegs as 'n plek gebruik sal word waarin deelnemers aan die studie afkomstig van die Laerskool ___________________________ is en dat geen verdere betrokkenheid of van my of my personeel verwag sal word nie.

Alle inligting met verwysing na die metingsopname is aan my deur die hoofnavorser bekend gemaak en ek verstaan dat ek onder geen omstandighede aanspreeklik gehou sal word indien enige probleme mag voorkom tydens die studie nie. Ek verstaan dat die NMMU se Fakulteit Gesondheidswetenskappe se Navorsings-, Tegnologiese en Innoveringskomitee die studie goedgekeur het en aanbeveel het.

Ek verstaan dat deelnemers se inligting te alle tye met konfidentsialiteit ten alle tye handteer sal word.

____________________________________  ______________________
Handtekening                                 Datum