A STUDY OF PREVALENCE AND RISK FACTORS OF OVERWEIGHT IN LOWER SECONDARY SCHOOL STUDENTS IN KOTA BHARU DISTRICT, KELANTAN

by

DR. RUZITA BT MUSTAFFA

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ABSTRAK

Satu kajian irisan lintang yang melibatkan seramai 392 orang subjek telah dijalankan dari Jun sehingga November 2000 untuk menentukan prevalen lebihan berat badan dan faktor-faktor risiko di kalangan pelajar sekolah berumur 14 tahun di daerah Kota Bharu. Dua buah sekolah, Sekolah Menengah Ketereh dan Sekolah Menengah Kok Lanas telah dipilih untuk kajian ini yang melibatkan pelajar-pelajar Tingkatan Dua. Indeks Jisim Tubuh (IJT), amalan pemakanan, corak aktiviti fizikal, sejarah keluarga dan faktor-faktor sosiodemografi dikaji menggunakan borang soal-selidik "structured self-administered" dan ukuran anthropometri. Masalah lebihan berat badan didefinisikan sebagai Indeks Jisim Tubuh bagi umur dan jantina lebih atau bersamaan dengan 85 persentil. Prevalen bagi masalah lebihan berat badan adalah 17.3%. Prevalen bagi masalah lebihan berat badan di kalangan pelajar lelaki adalah 18.2% dan 16.4% di kalangan pelajar perempuan. Tidak terdapat perbezaan yang signifikan bagi jantina dan kumpulan etnik. Faktor-faktor penyumbang terhadap risiko yang bertambah dengan lebihan berat badan termasuklah mereka yang mempunyai sejarah keluarga dengan lebihan berat badan (OR 2.1; 95% CI:1.0-3.8), tidak mengambil sarapan (OR 9.6; 95% CI:3.5-13.6), menonton tv lebih daripada 2 jam sehari (OR 3.0 ; 95% CI:1.0-4.0), persepsi yang salah tentang berat badan (OR 6.4; 95% CI:3.0-11.4) dan yang menjalani aktiviti fizikal kurang daripada 3 kali seminggu (OR 2.8; 95% CI:1.4-5.4). Walaupun masalah ini tidaklah seteruk dengan yang berlaku di negara-negara yang maju, hasil dari kajian ini patut

diambil perhatian sebagai amaran awal kepada pihak berkuasa kesihatan terhadap seriusnya masalah ini. Dengan maklumat ini, beberapa langkah boleh diambil untuk membolehkan remaja mengamalkan tabiat pemakanan yang sihat, mempunyai persepsi yang betul tentang berat badan, mengurangkan masa menonton tv dan mempertingkatkan aktiviti fizikal.

ABSTRACT

A cross-sectional study involving 392 subjects was conducted from June to November 2000 to determine the prevalence of overweight and associated risk factors in 14 years old school students in Kota Bharu District. Two schools, Sekolah Menengah Ketereh and Sekolah Menengah Kok Lanas were selected for the study involving students in form two. Family history, sociodemographic factors, dietary practices, physical activity pattern, and body mass index were assessed using structured self-administered questionnaire and anthropometric measurements. Overweight was defined as body mass index-for-age and sex-equal or greater than 85th percentile (BMI-for-age and sex $\geq$ 85th percentile). The prevalence of overweight was found to be 17.3%. The prevalence rate was 18.2% and 16.4% in males and females, respectively. There was no significant difference across schools, gender and ethnicity. Factors contributing toward increased risk for overweight include those who have a family history of overweight (OR 2.1; 95% CI:1.0-3.8), skipped breakfast (OR 9.6; 95% CI:3.5-13.6), 2 hours or more viewing television daily (OR 3.0 ; 95% CI:1.0-4.0), misperception of bodyweight (OR 6.4; 95% CI:3.0-11.4) and physical activities less than 3 times per week (OR 2.8; 95% CI:1.4-5.4). Whilst the problem may not be as serious as that in developed countries, the findings of this study should serve as an early warning to health authorities of the seriousness of the problem. With this information, some measures can be taken to enable adolescents to adopt healthier eating habits, perceived self-bodyweight correctly, fewer hours of

viewing television and increased physical activity pattern to reduce or avoid risk factors of overweight.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

BMI	Body Mass Index
WHO	World Health Organization
SPSS	Statistical Package for Social Science
Wk	Week
Hr	Hour
No.	Number
Freq.	Frequency
RM	Ringgit Malaysia
Kg	Kilogram
m	Meter
m^2	Meter squared
h/d	Hour per day
SD	Standard deviation
df	Degree of freedom
OR	Odds Ratio

CHAPTER ONE

INTRODUCTION

Overweight is a major public health problem worldwide contributing to increased morbidity and mortality. It has been routinely described as a major problem in developed countries and in some segments of developing countries.

The nutrition scene in Malaysia has changed dramatically since the country gained independence 43 years ago. As a result of continuous socioeconomic development, the nutrition situation of the communities has improved markedly, resulting in a dramatic decline in nutrient deficiencies (Tee 2001).

Significant changes continued to take place in the lifestyles of communities, including marked changes in dietary patterns, especially in the past two decades. There appears to be an increase in the consumption of fats and oils and refined carbohydrates and a decreased intake of complex carbohydrates. This resulted in a decline in the proportion of energy from carbohydrates and a concomitant increase in the percentage contribution of fat.

Changes in meal patterns are also evident: more families eat out, busy executive skip meals, the younger generation miss breakfast and rely too much on fast food. In addition, communities have become generally more sedentary. All these changes have brought about undesirable effects, with significant proportions of the affluent segment of the population being afflicted with various non-communicable diseases associated with over nutrition, and overweight being one of the important outcomes.

Overweight is a prevalent condition in childhood and adolescence and is associated with an increased risk of becoming an obese adult. The importance of treating the overweight child and attempting to prevent this child from becoming an obese adult is based in part on the observation that treatment of obesity in adults has not been very successful. Furthermore it is not advantageous to wait until an overweight child becomes an adult and then attempt to achieve ideal weight. In addition, overweight in childhood is related to many of the same cardiovascular risk factors, as is the case in adult obesity.

1.1 Definition

Adipose tissue is a normal constituent of the human body that serves the important function of storing energy as fat for mobilization in response to

metabolic demands. Adiposity is the amount of fat in the body, expressed either as total fat mass (in kg) or the fraction (percentage) of total body fat.

The term "obesity" is often used interchangeably with "overweight", but the two are not identical.

Obesity may be defined as the excess accumulation of body fat sufficient to endanger health; it occurs when energy intake (in the form of food) exceeds energy expenditure (in the form of resting metabolism and physical activity). The excess fat accumulation is associated with increased fat cell size; in persons with extreme obesity, fat cell numbers are also increased. . Usually, anyone who is more than 20 per cent over the normal weight that is acceptable for their age, sex, build and height is considered obese.

Overweight, on the other hand, is an excess of body weight relative to height. In practice, however, these two conditions are most often treated as stages in a continuum of weight-to-height relationship. However, how much a person weighs is only part of the total picture. One very important factor is the percentage of fat in the body.

The definition of obesity in children has always been a vexed issue. A preliminary review of childhood obesity indicated that the criteria used to assess obesity in children and adolescents varied widely. Therefore, it appears essential

to determine the most appropriate measurement with which to define obesity in children and adolescents for global use and to allow classification and comparison.

Body mass index (BMI; in kg/m^2) has achieved international acceptance as a standard for the assessment of overweight and obesity and correlates with body fat ($r = 0.7\text{-}0.8$) (Bray, 1985). In children, factors such as growth make definition more complex. Therefore different methods have been used to calculate prevalence of children overweight and obesity internationally.

Anthropometry has been used during adolescence in many contexts related to nutritional and health status. Body mass index was recommended as the basis for anthropometric indicators of thinness and overweight during adolescence (WHO, 1995). Weight-for-age was considered uninformative or even misleading in the absence of corresponding information on height-for-age; conventional approaches to the combined use of height-for-age and weight-for-age to assess body mass as awkward and have yielded biased results.

Weight-for-height reference data have the advantage of requiring no knowledge of chronological age. However, the weight/height chart relationship changes dramatically with age (and probably with maturation status) during adolescence; consequently, at a given height, the weight corresponding to a particular percentile is not the same for all ages, so that the meaning of a given

weight-for-height percentile differs with age. For the same reasons, relative weights calculated within categories of height during adolescence are appropriate only when used within narrow age categories. Available distribution of weight within categories of height has not been smoothed properly, and the wide range of heights and ages required makes presentation of reference data complex (WHO, 1995).

Because of these various limitations, BMI-for-age was recommended as the best indicator for use in adolescence: it incorporates the required information on age, it has been validated as an indicator of total body fat at the upper percentile, and it provides continuity with recommended adult indicators (WHO, 1995)

BMI provides a guideline based on weight and height to determine underweight and overweight. As children grow, their body fatness changes over the years. The interpretation of BMI depends on the child's age. Additionally, girls and boys differ in their body fatness as they mature. Therefore BMI-for-age according to sex-specific is the most accurate measurement.

To define overweight an appropriate reference population and cut-off points are needed. At the moment no local reference population available. An absolute cut-off point requires an underlying criterion, such as the risk for long-term ill health. Unfortunately, little published information exists regarding specific

degrees of overweight in adolescence and current or subsequent health-related outcomes. A less satisfactory approach is to define overweight statistically by a cut-off such as percentile-for-age relative to a reference population.

The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services recommended the use of compiled and published data of total population of adolescents in the United States provided by Must et al, 1991 (Himes and Dietz 1999). These reference data should be used since it had been published and met certain requirements for appropriate analysis and presentation. These criteria included data from a nationally representative sample, appropriate use of the survey-weighting scheme, use of a reproducible mathematical method to smooth survey data across ages, and inclusion of the 85th and 95th percentiles (Must et al. 1991).

In this BMI-for-age chart, Must (1991) provide a reference population with 85th and 95th percentile since these cut-off values are frequently used to define overweight and obesity in clinical and epidemiological studies. However, the previous published reports of BMI and TSF percentiles did not include the 85th percentiles, did not reflect the complex sample, and did not include percentiles for ages beyond 50 years. Race-specific and population-based 85th and 95th percentiles of BMI and tricep skinfold thickness (TSF) for people aged 6-74 years were generated from anthropometric data gathered in the National Health and Nutrition Examination Survey I (NHANES I). NHANES I collected data

on 20 839 participants aged 6 months-74 years between April 1971 and June 1974. BMI and TSF of each participant were determined. BMI and TSF of each participant was determined. 5^{th}, 15^{th}, 50^{th}, 85^{th} and 95^{th} percentiles were calculated exactly for each age or age category, sex, and race by using FREQUENCIES procedure. For the 85^{th} and 95^{th} percentiles, the curve representing the specific percentile variation with age was smoothed by using the RS/1 version 4.0 implementation of LOWESS, an acronym for locally weighted regression scatter-plot smoothing. Race-specific and population-based curves for TSF thickness and BMI were smoothed separately (Must et al, 1991). The recommended values of BMI for identification of those who are overweight during adolescence are presented in Appendix 2 for males and females, respectively.

The recommended percentiles for BMI were modified so that the 95^{th} percentile limits separating obesity and overweight do not exceed 30. The Expert Committee recommended the 85^{th} and 95^{th} percentiles of to define overweight and obesity for adolescent in epidemiological prevalence survey. Adolescents who are BMIs are equal or greater than 95^{th} percentile ($\geq 95^{th}$ percentile) for age and sex, or whose BMIs are greater than 30 (which ever is smaller) should be considered obese. The limit of 30 for BMI was recommended because at the oldest ages of adolescence, for which the 95^{th} percentile values exceed 30 (17 or 18 to 20 years), elevated BMI is associated with early adulthood patterns of risk for obesity-related diseases and mortality. Adolescents who are BMIs are equal or greater than 85^{th} percentile ($\geq 85^{th}$ percentile) but lesser than 95^{th} percentile (<

95th percentile) for age and sex, or equal to 30 (which ever is smaller) should be considered overweight. The recommended values of BMI for identification of those who are overweight during adolescence are presented in Appendix 2 for males and females, respectively.

WHO Expert Committee (1995) concluded it is important to use a reference data for BMI that had been published and met certain requirements for appropriate analysis and presentation. The only reference data that met the requirements set were data provided by Must (1991). The Expert Committee concluded, in the absence of other data specifying optimum cut-off values for BMI in adolescence, the BMI-for-age data for US children provided by Must (1991) to be used until better data for adolescent growth are available as reference population. To assess the prevalence of overweight in a population, overweight is defined as BMI-for-age equal or greater than the 85th percentile (WHO 1995).

1.2 Methods of Assessment

In the assessment of overweight and obesity, what is important is the amount and distribution of adipose tissue an individual has, not his or her weight. It is possible to measure adipose tissue mass by various means, but most of these

require technical apparatus and time far greater than that available in most clinical practices.

Ideal measurement of body fat in populations should be reliable and correlated well with body fat in both sexes and across all ages and ethnic groups. Furthermore, because individuals of different heights or body builds may have similar fat masses yet substantially different proportion of total body fat, and because obesity connotes a condition of excess body fat, body fat expressed as a percentage of body weight (percentage body fat) is the most relevant measure against which anthropometric measurements should be corrected.

There are many techniques to quantify body fat and determine whether an individual is obese or not. It is often not possible to measure body fat and indirect anthropometric measurements are often made.

The two indices used most commonly to determine the degree of adiposity in humans are BMI, and triceps skin fold thickness. Each has advantages and limitations.

BMI is the most commonly used index of obesity and overweight. It is the most appropriate measure to use in the clinical setting (Dietz and Robinson 1998). The advantage of the BMI is that personnel who have had minimal training measure height and weight easily and reliably in a variety of settings.

Weight and height are suitable measures for field studies and are included in almost all population and epidemiological studies. BMI offers a reasonable measure of fatness in children and adolescents (Dietz and Bellizzi 1999). Other advantage is, it allows comparison between different populations. However, the BMI does not measure fatness directly. Variations in frame size as well as in fatness will increase the BMI.

The International Obesity Task Force (IOTF) was established in 1994 to address the increase in the worldwide prevalence of obesity. IOTF convened a workshop on childhood obesity to explore the strengths and limitations of existing approaches to the measurement of childhood obesity. The workshop was held in Dublin on 16 June 1997. The group concluded that BMI has high specificity, but low and variable sensitivity, as an indicator of the risk of overweight and the presence of overweight in adolescents. On the other hand, the efficiency of the BMI as an indicator of the risk of overweight and of overweight was relatively high. Although BMI is not a perfect measure in children because it covaries with height, it was selected because it is an easy measure of body fat that is reproducible and valid (Bellizzi and Dietz 1999).

Among the advantages of BMIs are BMI-for-age can be used for adolescents beyond puberty. BMI is also related to health risks. The Bogalusa heart study revealed 60% of children and teens with BMI-for-age above the 95th percentile have at least one risk factor while 20% have two or more risk factors

for cardiovascular diseases (Friedman et al. 1999). Overweight children are likely to become overweight adults (Guo et al. 1994).

The measurement of skin fold thickness is a common measure but varies with gender and age of the individuals. A skin fold caliper is used to measure skin fold thickness in at least 10 body sites. The two most common sites are the subscapular skin fold measurement, which measures truncal body fat, and triceps skin fold, which measures fat in the extremities. The tricep skin fold thickness is measured over the triceps muscle midway between the olecranon process and the acromioclavicular joint. The correlation of the triceps skin fold with total body fat measured underwater is greater than the correlation of BMI with total body fat, suggesting that the triceps skin fold thickness may be a more valid measure of body fat. Furthermore, the triceps skin fold measures body fat directly and is, therefore unaffected by frame size. However, even one who has extensive training, finds it difficult to reproduce measurements of the triceps skin fold, particularly among fatter children. Furthermore, skin folds do not track into adulthood as well as BMI (Dietz 1993).

The waist-hip circumference ratio represents the most commonly used measure of fat distribution in adults; it eventually may prove useful as an adjunct measure in adolescents. However, the waist-hip circumference ratio may be a better index of fat distribution for adolescent girls than for boys and appears to be a poor measure of fat distribution in pre pubertal children (Dietz 1993).

1.3 Prevalence of Overweight

Estimates of prevalence of overweight in childhood vary in different countries. However, it is difficult to compare the rates in different countries as not all surveys were population-based, the criteria and measurement tools vary, age range of subjects in different studies was often not similar and the period of surveys also vary.

There is evidence that obesity is a growing problem in both developed and developing countries. Often the prevalence of obesity is concomitant with increasing affluence of society, which is associated with a higher intake in calories, proteins and fat.

In the United States, according to the National Health and Nutritional Examination Survey from 1988 to 1991, the prevalence of overweight was 10.9% based on the 95th percentile and 22% based on the 85th percentile in youth aged 6-17 years (Troiano et al. 1995). The prevalence of obesity among children during 1963 to 1980 has increased 54% and 30% in 6-11 and 12-17 year-old, respectively (Gortmaker et al. 1987). Another study done showed that the prevalence of obesity during 1990-1999 has increased to 20% (Goran 2000).

It is also important to recognize that childhood obesity is not only confined to the industrialized countries, as high rates are already evident in some

developing countries. The prevalence of obesity among school children aged 6 to 13 years in Thailand rose from 12.2% in 1991 to 15.6% in1993 (Mo-Suwan 1993). In India, the prevalence of obesity among children is about 7.56% (Tiwary et al. 1992).

In Singapore, an upward trend has been observed in school children. Obesity rates have increased from 2.3% in 1976 to 16.1% in 1993 in children aged 6-8 years (Rajan 1996). In year 2000 the prevalence of obesity is 12.0% (Lee 2000).

In Malaysia, according to a study done in Sarawak among secondary school students in May-July 2000, reported the prevalence of overweight was 10.1% (Lam et al. 2000). Overweight was defined as BMI more or equal to 85 for age and gender in this study. In 1996, a study among 8-10 year-old student in Kuala Lumpur revealed the prevalence as being of overweight was 11% (Tee et al. 1997). A study was carried out in Selangor in March 1991 among primary school children and found the overall prevalence of obesity was 7.8% (Bong and Safurah 1996). Another study was conducted in 1996 showing the prevalence of overweight at 6.0% and obesity was 3.6% among 7-16 year- old children in Kuala Lumpur (Kasmini et al. 1997). The prevalence of overweight in Kuala Lumpur was 18.1% (Fatimah et al. 2000).

The prevalence of obesity in Kelantan among 16-17 year-old students was 2.2% (Zaini 1996). Another study done in the year 2000 among school children aged 9-11 years in Kota Bharu using similar definitions and measurements criteria as in our study (BMI-for age and gender $\geq 85^{th}$ percentile), found the prevalence of overweight to be 12.6% (Fatimah et al. 2000).

1.4 Consequences of Obesity

Obesity is a recognized health risk for adults. Obesity and overweight are associated with increased mortality, coronary heart disease, hypertension, dyslipidemia, diabetes mellitus, gallbladder disease, osteoarthritis, and some cancers (Pi-Sunyer 1991).

Although there is little frank disease in adolescence of the types associated with obesity in adults, overweight and obesity during this period are associated with risk factors for obesity-related diseases. Variation in body mass, subcutaneous fatness, and total body fat in adolescents are significantly associated with variations in blood pressure and blood levels of lipoproteins, glucose, and insulin in many populations of developed countries (Smoak et al, 1987 and Baumgartner , 1989).

Childhood obesity is both immediate and future health problem. In the United States, pediatric hypertension was found to be associated with obesity in children (Gortmaker 1987). Sixty percent of overweight children suffered from hypertension, hyperlipidemia, and/or hyperinsulinemia (Freedman et al. 1999). Increased obesity also has led to a new epidemic of type 2 diabetes mellitus in children and adolescents (Pinhas et al. 1996) and autopsy studies of children who died of traumatic causes show that early atherosclerotic lesions are already developing in the aortas and coronary arteries of overweight children (Berenson et al. 1998).

Obesity also confers significant cardiovascular risk for adolescents. Abnormal glucose tolerance (Freedman et al. 1987), hypertension (Clarke et al. 1986, Stallones et al. 1985) and lipid abnormalities (Freedman et al. 1985, Smoak et al. 1987) are conditions that in adulthood are associated with non-insulin-dependent diabetes mellitus, sustained hypertension and increased risk of heart attack.

Excessive overweight in puberty was associated with higher than expected morbidity and mortality in adult life (Sorensen and Sonne-Holm 1988). A population-based nested case- control study in Maryland of 13 146 persons aged 5 to 18 years from 1933 to 1945 linked childhood obesity to overall mortality (Nieto et al. 1992).

Adolescent obesity was associated with an increase in total mortality and morbidity from coronary heart disease, stroke, and colorectal cancer in men in the 55 years follow up of the Harvard Growth Study of 508 adolescents aged 13 to 18 years. These health risks persist for many years; not only increasing the long-term mortality among men but also reducing the functional status among elderly women (Must et al. 1992). Follow-up of 504 overweight Swedish children showed persistence of obesity in 47% of them 40 years later (Mossberg 1989). In comparison with the reference population, this group had significant increased risk of cardiovascular diseases, diabetes, hypertension, locomotor and digestive diseases by 1.5 to 4.0 fold.

Obesity is not without social and psychological consequences. A cohort study of 10 039 individuals aged 16 to 24 years revealed that overweight individuals were less likely to be married and completed fewer years of school (Gortmaker et al. 1993). Occasionally, an obese individual may suffer from psychological imbalances such as a disparagement of body image.

Of greatest concern and potential public health effect is the risk that overweight in adolescence will persist into adulthood. This risk appears to be associated with the onset of obesity in late childhood or adolescence and is probably directly increased by the severity of the disease (Dietz 1983). In general, the risk of overweight in adulthood is greater with higher degrees of overweight in youth and with overweight during the later adolescent years.

Because overweight youths may become overweight adults and overweight adults are at increased risk for adverse health outcomes, overweight in childhood is gaining increasing recognition as an important public health concern.

A recent investigation indicates that 18 year-old persons who are at or above the 95th percentile for BMI are at substantially increased risk of overweight at the age of 35 years, with probabilities of overweight estimated at 78% and 66% for males and females, respectively (Guo et al. 1994). Another study done in Britain suggests that the likelihood of persistence may be as much as three times greater for adolescent females than for adolescent males (Bradon et al. 1986). Incidence of obesity during adolescence may also be higher for females than males, and remission rates lower. The relationship between childhood obesity and extreme obesity in adulthood was also examined in a population-based case-control study. This study revealed a strong association between BMI in childhood with severe obesity in adulthood (Sorenson and Sonne-Holm 1988).

Overweight children and adolescents are at greater risk of adult obesity. Historical data suggests that the risk for adult overweight is primarily influenced by 2 factors. The first is age: overweight in 0 to 5 year-old is only minimally predictive of adult overweight; less than half of overweight pre pubertal children have become overweight adult, whereas as many as 70% to 80% of overweight teens have become overweight adults. The second is parental overweight:

children with overweight parents, regardless of the child's weight, are at increased risk of becoming overweight adults (Robinson 2000).

1.5 Risk Factors for Overweight

Overweight is the result of a long-term imbalance of energy intake and expenditure. A person gains weight when energy input exceeds energy output. Energy input is food. Energy output comprises the basal metabolic rate, thermal effect of food and activity. The thermal effect of food is the energy required to absorb and digest meals.

Risk factors in obesity are complex and multiple. In examining adolescent obesity, three categories of determinants, familial, dietary, lifestyle, and psychosocial factors should be considered and since they are inter-related.

1.5.1 Familial Factors

Variables within the family environment appear to be the most important determinants of childhood obesity (Dietz 1986).

Parental obesity is a well-recognized risk factor for childhood obesity. Overall, the correlation coefficient of parental fatness with the fatness of offspring

is 0.25 (Garn et al. 1976). The risk of obesity has a direct relationship to the fatness category of the parent, however. The risk is lowest when both parents are lean, greater when one parent is obese and greatest when both parents are obese (Garn et al. 1976).

The resemblance in fatness between parents and children has been interpreted as evidence that obesity is inherited (Dietz 1986). Although the exact mechanism of action has yet to be identified, twin and adoptional studies suggest that a range of 30-100% of the variance in BMI can be attributed to genetic factors (Stunkard et al. 1990, MacDonald and Stunkard 1990). In a study of adoptee (Stunkard et al. 1986), a significant trend was observed in BMI between biologic parent-child pairs, whereas no significant trend existed among adoptive parent-child pairs.

The weight status of other family members may exert an effect on childhood obesity. The proportion of family members in a 4-member nuclear family being obese if all the other family members were lean is 3.2 percent of the boys and 5.4 percent of the girls. However, if the remaining family members were all obese, then 27.5 percent of the boys and 24.1 percent of the girls were obese. The relative risk for a boy or girl being obese if all the other family members were obese versus lean was 8.6 and 4.7 for boys and girls, respectively (Garn et al. 1981).

The prevalence of obesity was inversely proportional to family size (Dietz 1986). This finding, therefore, confirms the previous observation that obesity is most prevalent among single children (Ravelli and Belmont 1979). In addition, younger children are at greater risk of obesity than older children. The level of education and socioeconomic class were related directly to the prevalence of obesity (Dietz 1986).

Previous studies revealed that parents have influence on eating behaviours in children. A study of 106 families with children 3 to 4 years old assessed nutrient intakes and possible correlations among the intakes of family members. The researchers found that in the families where both parents consumed high amounts of saturated fat, children were 5.5 times more likely to eat similar amounts than children in families where neither parent had a diet high in saturated fat (Oliveria et al. 1992).

1.5.2 Dietary and Lifestyle Factors

Physical inactivity, frequent television viewing, and high energy and fat intakes may contribute to obesity (Shannon et al. 1991). Such lifestyle factors may in turn interact with psychosocial factors. For example, an inability to make lifestyle changes, such as decreasing the consumption of high fat foods, is related to lack of self efficacy (Pratt 1994). Self-efficacy also requires that individuals perceive themselves as ready to make a change. For the adolescent, peers or family

members may dictate such readiness. Perception of overweight varies in different cultures.

In the United States in the past 30 years, important changes have occurred in family eating patterns and in the consumption of fast foods, pre-prepared meals, and fizzy drinks. Likewise, the amount of physical activity engaged in has been reduced by an increase in the use of cars, an increase in the amount of time spent watching television, and a decrease in the opportunities in many communities for physical activity on the way to school or in school (Dietz 2001).

A study done to examine the dietary intake of 10 year-old children from a small specific population group of the Bogalusa Heart Study revealed that total energy and fat intakes remained unchanged from 1973 to 1988 in each of six cross sectional surveys, whereas there was a significant decrease in the percentage of energy from dietary fat (Nicklas et al. 1993).

Physical activity plays an important role in children's health status. In 1992, the Committee on Sports Medicine And Fitness of the American Academy of Pediatrics published a paper on the fitness level of preschool children (Committee on Sports Medicine And Fitness 1992). Acknowledging that children today weigh more than children 20 years ago, the committee reported, that a low physical activity level is a primary factor contributing to excessive fat

accumulation. It recommended that pediatricians encourage physical activity in preschool children, both to help prevent weight-management problems and to enhance motor development.

Despite the academy's recommendations, additional research is warranted to assess children's physical activity levels accurately and the links between physical activity and fitness. In one of the first studies to look at this relationship (Pate et al. 1990), Pate and colleagues found that physical activity and health-related physical fitness were associated in nationally representative samples of 2352 third- and fourth-grade students. Since the results are based on cross-sectional observations, the authors were reluctant to imply a cause-and-effect relationship and suggest further evaluations using longitudinal study design.

A significant association between television-watching time and the prevalence of obesity was observed among children 6-17 year-old in the National Health And Nutrition Examination Survey (NHANES) cycle II (1963-1965) and cycle III (1966-1970). In 6, 671 children aged 12-17, the prevalence of obesity was found to increase by 2% for each additional hour of television viewed. This association persisted when controlled for prior obesity, region, season, population density, race, socioeconomic class and a variety of other family variables (Dietz and Gortmaker 1985).

Research also has suggested that television viewing may place children at risk for obesity due to reduced metabolic rates. In a 1993 study of 32 females, age 8-12 years, viewing a passive, nonviolent television program for 25 minutes significantly reduced resting metabolic rates. In normal weight girls, rates dropped by 12%; in obese girls there was a 16% reduction (Klesges et al. 1993).

1.5.3 Psychosocial Factors

The influence of body image and peer relations on obesity has been examined. Favourable body image and high self-esteem correlate with the perceived physical attractiveness and with positive peer relations. On the other hand, disturbances in self-perceived weight (perceived oneself as obese) contribute to inappropriate weight loss behaviour and may lead to body image dissatisfaction, low self-esteem, and weight regain. These perceptions and stereotypes of the obese or the becoming-obese adolescent may result in circular feedback processes that may channel such youth with different level of self-esteem and body image, into contrasting social situations that may contribute to obesity. Characterization as being overweight and obese leads to stigmatization (DeJong 1990) and undue attention to body size may increase the incidence of eating disorders among children and adolescents (Maloney et. al. 1989).

1.5.4 Physical Environmental Factors

The relationship of obesity to environmental factors such as season, region and population density was examined. Childhood obesity is more prevalent in the Northeast, followed, in descending order, by the Midwest, South and West part of America (Dietz and Gortmaker 1984). Within each geographic area, obesity is more prevalent in the winter and spring than in summer and fall and more prevalent in major metropolitan areas than less densely settled area. However, the origin of the environmental effects on childhood obesity is unclear. Region, season and the degree of urbanization may effect the availability or cost of low caloric-density food, such as fruit and vegetables, or access to or utilization of safe facilities for play or exercise. Likewise, the energy spent on discretionary activity may vary by season.

1.6 Justification

Overweight is a serious, chronic medical condition, which is associated with a wide range of debilitating and life-threatening conditions. It imposes huge financial burdens on health care systems and the community at large. Overweight develops over time and once it has done so, is difficult to treat. Therefore, the prevention of weight gain offers the only truly effective means of controlling it.