INTRODUCTION

Childhood overweight and obesity have reached epidemic proportions in the USA and according to recent surveys the prevalence of obesity in American children has tripled in the last three decades ***(Ogden et al., 2002)***.

Childhood obesity has several well recognized health and social consequences that can persist into adulthood. For example, 50% of obese children will grow up to be obese adults while 75% of obese adolescents will be obese adults ***(Lobstein et al., 2004).***

The consequences of obesity during the perioperative period in adult patients are well recognized by anesthesiologists and surgeons. In addition to a high prevalence of medical comorbidities such as type II diabetes, hypertension, obstructive sleep apnea and bronchial asthma. Obesity in adult patients is associated with increased incidence of difficult airway, perioperative myocardial infarction and postoperative wound infection ***(Oberg and Poulsen, 1996; Ogunnaike et al., 2002; Dominguez-Cherit et al., 1998).***

Obese children are more prone to comorbidities ***(Yanovski et al., 2001)*** and perioperative complications especially related to airway management and ventilation ***(Nafiu et al., 2009)*** than normal weight children. Furthermore, obesity influences the pharmacokinetics of anesthetic drugs causing difficulties in the estimation of appropriate drug doses ***(Casati and Putzu, 2005).***

Aim of the Work

This work aimed to study the relation between pediatric obesity and anesthesia.

Chapter One
DEFINITION, PREVALENCE AND ETIOLOGY OF CHILDHOOD OBESITY

Definition

Obesity is defined as a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems. Overweight is defined as corpulence (it means; the property of excessive fatness). Morbid obesity is defined as a disease in which excess weight begins to interfere with basic physiological functions such as breathing and walking ***(Wardle and Cooke, 2007).***

Obesity is an excess of body fat: a level of body fat that is harmful. This ‘‘definition’’ is expressed In terms of body fat content, but in clinical practice and epidemiology body fat content can rarely be measured with acceptable precision and accuracy so simpler alternative definitions are required ***(Cole et al., 2000)***.

There is a good deal of evidence that subjective assessment of obesity is inadequate, and that of the objective approaches the body mass index [BMI; weight in kg divided by (height In m)^2] is the best available option ***(Cole et al., 2000).***

The basis for a definition (in epidemiology) or diagnosis (in clinical practice) is therefore the BMI, but as the BMI

changes with age and differs between the sexes, it must be interpreted using centile charts that describe population reference data (**Figs 1 and 2**), or by calculation of a standard deviation or (Z score or SD score) relative to population reference data ***(Reilly et al., 2000).***

Children and adolescents with a high BMI Centile (such as BMI >98th centile on the UK 1990 charts) are highly likely to be excessively fat that is, this obesity definition has high diagnostic specificity (low false positive rate). Such definitions have a moderate sensitivity ***(Reilly, 2006)*** that is, modest false negative rate. Such definitions are also clinically meaningful: They identify children and adolescents at high risk of the comorbidities of obesity ***(Reilly, 2003).***

In the UK, the best evidence suggests that overweight and obesity should be defined as BMI >85th and >95th centiles in research and epidemiology ***(Reilly, 2006).***

Based on American reference data, the American definition of childhood obesity describes a BMI > 85th percentile as overweight and a BMI > 95th percentile as obesity ***(Kuezmarski et al., 2002).***

A number of other countries now have BMI population reference data and centile charts. Where such ‘‘national’’ reference data are available, they should be used to define / diagnose overweight and obesity ***(Reilly, 2006).***

Where national data are unavailable there is a choice of using either reference data/charts from another nation (such as the

USA whose charts are available from the Centers for disease control and Prevention) or use of newer ‘‘inter-national’’ definitions of overweight and obesity ***(Cole et al., 2000).***

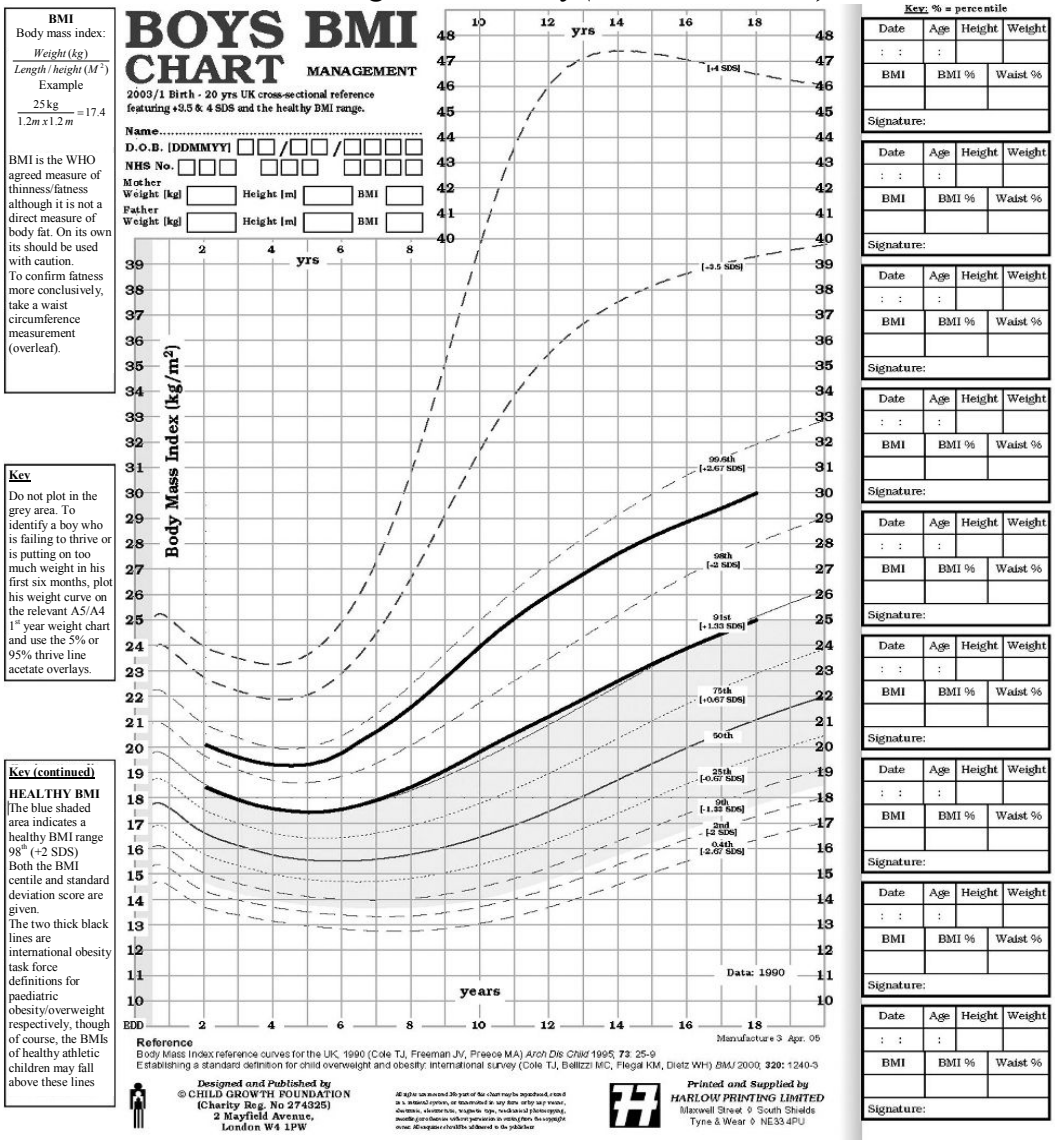

Figure (1): Body mass index centile charts for UK boys, for diagnosis and monitoring of overweight and obesity ***(Available from Child Growth Foundation, 2 Mayfield Avenue, London W4 1PW; or from Harlow Printing (http://www.harlowprinting.co.uk).***

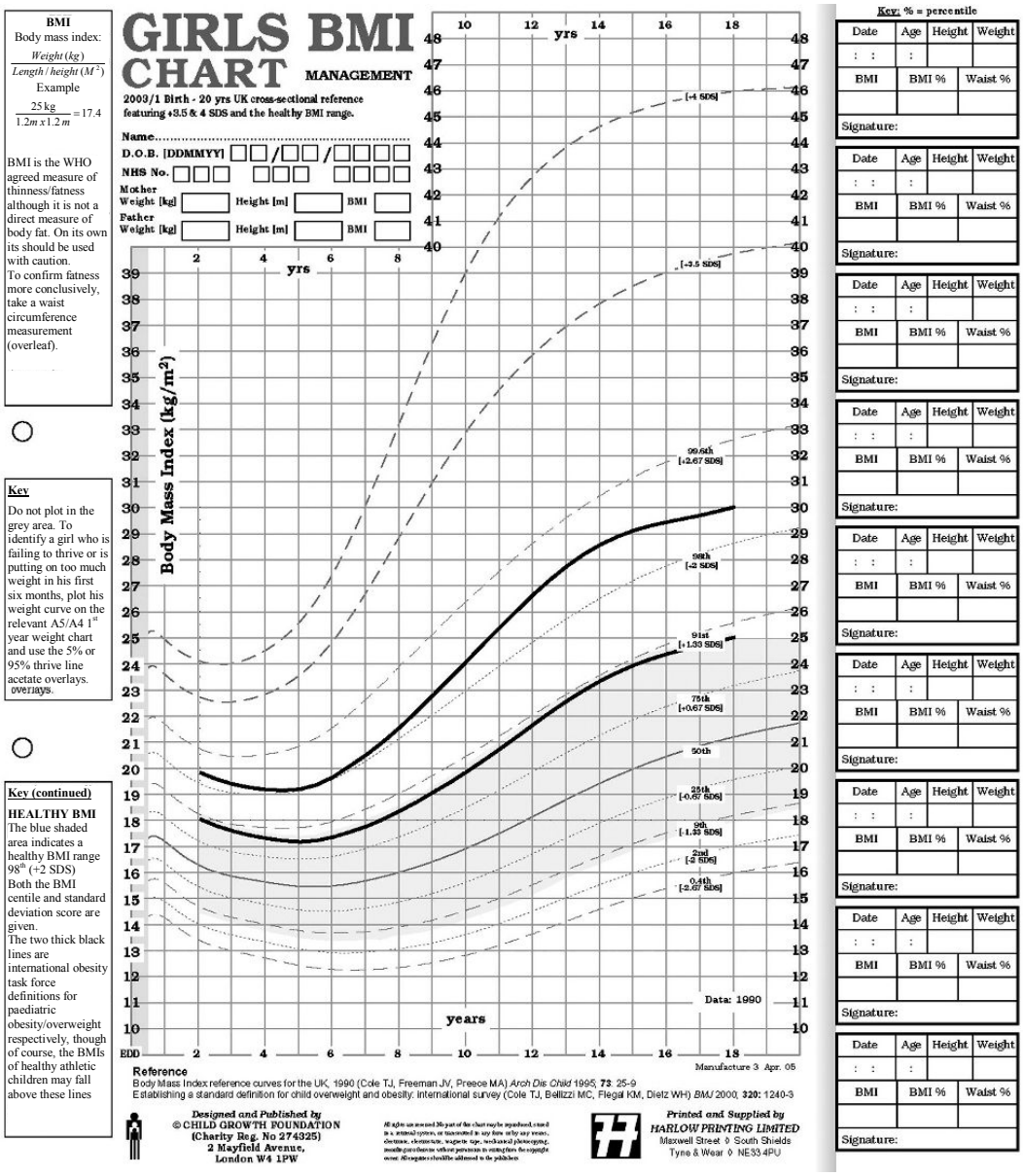

Figure (2): Body mass index centile charts for UK girls, for diagnosis and monitoring of overweight and obesity ***(Available from Child Growth Foundation, 2 Mayfield Avenue, London W4 1PW; or from Harlow Printing (http://www.harlowprinting.co.uk).***

Cole has provided an international definition of childhood overweight and obesity with age- specific and gender specific BMI cutoff points using pooled international data for BMI and linked to adult cutoff points **(Fig. 3)** ***(Cole, 2000).***

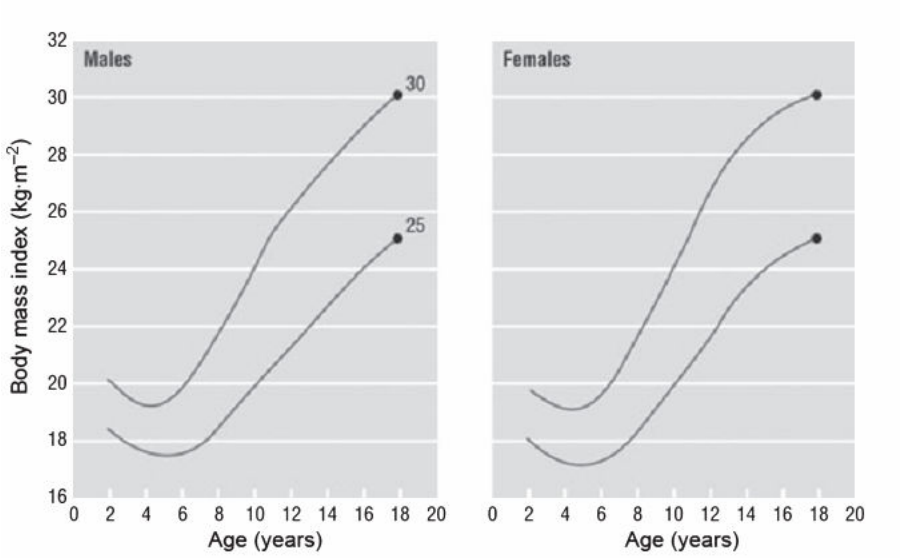

Figure (3): International cut off points for body mass index by sex for overweight and obesity, passing through body mass index 25 and 30 kg'm2 at age 18 (data from Brazil, Britain, Hong Kong pooled international data for BMI and linked to adult cutoff points (Figure 1**)** ***(Cole et al., 2000)*** Netherlands, Singapore, and United States) ***(Cole et al., 2000).***

The international approach attempts to link adult BMI based definitions of overweight (BMI>25) and obesity (BMI>30) to paediatric definitions by providing age and sex specific ‘‘equivalent’’ BMIs in childhood and adolescence. For ease of international comparisons these international definitions are practical. However, four recent studies have compared the diagnostic ability of the international definitions with that of the

more traditional national definitions based on national BMI centiles ***(Zimmerman et al., 2004).***

In all four cases diagnostic ability of the national approach was greatly superior, and so use of the International approach should be considered with caution ***(Zimmeman et al., 2004).***

Recently, the international obesity task force in collaboration with the world health organization agreed on this approach to define obesity in childhood. based on pooled data from nationally representative surveys from different countries, the age and the gender specific BMI for age-centiles will be constructed using the Cole reference curves. BMI cut-off points which have been established for obesity in adult (>25kgm-2 overweight, 30 kg.m-2 obese) will be used to identify obesity in children.

WHO defines Childhood overweight and obesity according to standard deviations (BMI Z-scores) from the mean BMI Using other reference data than ***Cole World Health Organization (2011).***

The scale of the obesity epidemic is also heavily dependent on the definition used. Using data from the same survey, prevelanc of obesity can vary two fold to seven fold depending on whether national reference data or the international approach is taken ***(Reilly, 2006).***

Prevalence

The prevalence of obesity among children has tripled in the last 20 years, paralleling the epidemic increase among adults worldwide ***(Headly et al., 2004).***

The European prevalence has tripled in the last decades Approximately 20% of European ***(WHO, 2011)*** and 32% of American ***(Ogaden et al., 2006)*** children and adolescents are currently overweight and globally 20 million children under the age of 5 are obese ***(WHO, 2010).***

This problem which affected only 4% of school age children as recently as four decades ago, now impacts on the lives of more than 16% of school age children in the USA and has become a major international pediatric "health concern ***(Brenn et al., 2005).***

The 2003-2004 National Health and Nutrition Examination Survey (NHANES), estimates that 17% of US children and adolescents ages 2-19 years are obese ***(Ogden et al., 2006).***

Using Coles cutoff points ***(Cole et al., 2000)***, the prevalence of overweight and obesity among Danish 3-year-old is 10.4% ***(Aarup et al., 2008)*** among 6-8-year-olds, the prevalence is 21% in girls and 15% in boys ***(Perason et al., 2005).***

According to ***WHO (2000)*** at least 50% of adults and 20% of children in U.K. and U.S.A. are currently overweight. Prevalence of overweight amongst Australian children has increased from 11% in 1985 to 20% in 1995. Childhood obesity has tripled in Canada in last 20 years. It has been estimated that, in 1995, the direct costs of treatment of obesity in USA accounted for $70 billion with far greater indirect costs ***(Reddy, 2002).***

The calculated global prevalence of overweight (including obesity) in children aged 5-17 years is estimated by the International Obesity Task Force (IOTF) to be approximately 10%, but this is 'unequally distributed' with prevalence ranging from over 30% in Americas to 2% in sub Saharan Africa ***(Lobstein et al., 2004).***

The problem is on increase, and US data indicate a 54% increase in obesity amongst 6_11 year-olds and a 98% increase in morbid obesity on comparing the early 1960s with the late 1970s ***(Gortmaker et al., 2006).*** Similar trends have been confirmed in studies from the UK ***(Hughes et al., 2007)*** Denmark ***(Thomsen et al., 1999)*** and Germany ***(Kromeyer-Hauschild et al., 1999).***

Girls seem to be more prone to the problem with a 45% increase in adolescent obesity in US teenagers compared to a 30% increase in boys during the early 1990s Division of health examination statistics 1994.

However, this trend does not seem to be paralleled in younger children. Within the UK, Gregory et al. carried out a national Diet and Nutrition survey of children aged 1.5_4.5 years ***(Gregory et al., 2001).***

They found there was no significant difference in the mean BMI in these children in comparison with a similar survey in 1968. Thus, there is evidence of increased prevalence and degree of obesity at least in older children and adolescents.

As prevalence of obesity depends heavily on the definition used and on a number of other factors (for example, the age and representativeness of the sample, or survey, the timing of the study or survey, whether or not height and weight are measured or self reported), summarizing recent prevalence estimates around the world is problematic. Nevertheless, in almost all countries to date that have reported on prevalence it is continuing to increase, and dramatic increases have been typical, showing rapid environmental and lifestyle changes in recent years.

For the developed world, estimates from 2000 onward using national definitions (such as BMI >95thcentile) suggest that 10%–25% of the paediatric population was obese ***(Danielzik et al., 2004).***

In England in 2003 for example, 28% of 2-11 year olds were overweight or obese (BMI>85thcentile), up from 22% in

1995, while 14% were obese (BMI>95thcentile), up from 10% in 1995 ***(Popkin et al., 2004).***

In the developing world, prevalence of overweight and obesity has also increased dramatically in recent years ***(Ebbelling et al., 2002).***

A few exceptions have been described, notably in sub-Saharan Africa and much of the former Soviet Union (where extreme economic hard ship has limited the epidemic).Using the international definitions at least 10% of school age children are overweight or obese worldwide ***(Lobsetin et al., 2004)*** and this Is highest in the Americas (32%), then Europe (20%), and the Middle East (16%).

In the developed world prevalence of paediatric obesity is generally as common in boys as girls. The picture with respect to sex differences in prevalence in the developing world is more complex and difficult to predict ***(Lobsetin et al., 2004).***

In the developed world paediatric obesity is generally more common in children and adolescents from families of lower socioeconomic status ***(Reilly, 2006)*** but the magnitude of these socioeconomic differences in prevalence is quite limited. In the developing world the picture is again more complex: higher socioeconomic status has usually been associated with higher risk of paediatric obesity, although as the epidemic

progresses in the developing world lower socioeconomic status may become more of a risk for obesity ***(Lobsetin et al., 2004).***

In the USA youth prevalence of obesity is much higher in some ethnic minorities than in the general population ***(Strauss et al., 2001)***. Evidence from outside the USA is limited at present but Suggests that some ethnic minority groups may also be at higher risk. Again, reasons for differences are complex and not entirely clear at present.

Prevalence of morbid obesity

The prevalence of morbid obesity has increased in the past few years, with serious consequences for the health care system. Approximately 7% of the world population (250 million people) world organization expert consultation 2004 and 30% of the North-American people are obese ***(Mokdad et al., 2000)***.

Sixty percent of the adults in the United States are overweight, and 1:16 North American women fulfill the criteria for morbid obesity. In Australia, the number of obese individuals more than doubled in the last 20 years ***(Cameron et al., 2003)***.

Another alarming datum is the number of obese children and adolescents (about 11%), ***(Troiano et al., 1998)*** and 60% to 85% of those will become obese adults ***(Must et al., 2002)***.

Childhood obesity has also become an international crisis in public health, with more than 22 million overweight children below the age of 5 ***(Deitel et al., 2002)***.

The increase in the prevalence of obesity in children and adolescents, associated with the knowledge that several comorbidities secondary to obesity start during childhood, makes it an important issue in health care prevention systems. An important factor regarding this increase in prevalence is that the patient becomes refractory to medical treatment and diets, and he/she cannot maintain the weight off ***(Samuels, 2006)***.

Etiology

In over 90% of the cases, overweight and obesity are caused by the combination of consuming too many calories (increased fat content in foods, high calorie drinks) and not having enough physical activities (watching TV). Environmental and genetic factors (leptin deficiency) probably play a minor role, but in rich countries, obesity is usually more prevalent in lower income social categories ***(Ross et al., 2006).***

A recent study found a clear dose-response effect for the duration of breast feeding on prevalence of obesity in children aged 5-6 years ***(Von Kries et al., 1999)***.

Breast fed babies are less likely to be obese. The possible reasons for this are considered. Lucas et al. found significantly higher levels of insulin in bottle fed compared with breast fed

infants; stimulating greater fat deposition and the early development of adipocytes ***(Lucas et al., 2000)***. In addition, breast milk contains factors that may lead to the inhibition of adipocyte differentiation in vitro ***(Hauner et al., 2005)***.

The protein intake of breast fed children is lower than the intake of infants who are fed formulas ***(Whitehead et al., 1995)***. A high intake of protein in early childhood might increase the risk of obesity later ***(Deheeger et al., 1996).***

Most investigations into the relationship between prenatal exposures and later obesity have studied associations between birth weight and attained BMI. Birth weight can be easily measured, has reference norms, is part of the routine medical record, and may be available historically. Variation in weight at birth serves as a surrogate to reflect underlying mechanisms influencing growth ***(Oken et al., 2003)***.

BMI (kilograms per meter squared), a gauge of weight for height, is the most common measure of obesity in child and adult epidemiological studies. One attraction is its simplicity of measurement; even self-report of BMI can be quite accurate ***(Goodman et al., 2000).***

BMI predicts morbidity and mortality in a strong, graded relationship ***(Willett et al., 1999)***. BMI has been used in many populations worldwide, allowing comparison among study results.