INTRODUCTION

Obesity in children and adolescents is one of the most alarming public health issues facing the world today ***(Wijnhoven et al., 2013)***.

Childhood obesity is associated with significant health problems and is an early risk factor for much of adult morbidity and mortality ***(Tirosh et al., 2011).***

Body mass index (BMI) is inversely associated with the increase in the serum 25OHD levels in response to vitamin D supplementation ***(Saliba et al., 2012).***

Some obesity-related health consequences have been correlated with vitamin D deficiency or insufficiency ***(Oliveira, 2013)***.

An inverse association exists between obesity and 25(OH) D levels, that has been attributed to the sequestration of Vitamin D in fat. Vitamin D requirements are thus higher in obese compared with normal weight children ***(Harel et al., 2011).***

Cardiovascular disease risk factors and impaired glucose homeostasis also are associated with vitamin D deficiency and are more common in overweight and obese children ***(Olson et al., 2012).***

There is increasing evidence that vitamin D deficiency is associated with risk factors of non-communicable diseases, including components of the metabolic and other cardiometabolic risk factors even in children and adolescents ***(Nam et al., 2012)***.

AIM OF THE WORK

The aim of this study to detect vitamin D status among obese children and its relation with dietary calcium intake and other parameters like lipid profile and fasting blood glucose level.

OBESITY

Background

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low- and middle-income countries, particularly in urban settings. The prevalence has increased at an alarming rate. Globally, in 2010 the number of overweight children under the age of five, is estimated to be over 42 million. Close to 35 million of these are living in developing countries ***(WHO, 2012).***

The prevalence of childhood and adolescent obesity is dramatically increasing worldwide as in U.S and in Korea, and this increased prevalence of obesity among children and adolescents may lead to increased risk of diabetes, hypertension, and cardiovascular disease ***(Emmerik et al., 2012) (Rendall, 2012).***

The World Health Organization predicts that overweight and obesity may soon replace more traditional public health concerns such as undernutrition and infectious diseases as the most significant cause of poor health ***(Loscalzo et al., 2008)***.

Definition of childhood obesity:

Childhood obesity may be defined functionally as a maladaptive increase in the mass of somatic fat stores ***(Rosenbaum, 2007b).***

Although definition of obesity and overweight has changed over time, it can be defined as an excess of Body Fat ***(Kuczmarski and Flegal, 2000)***.

In the absence of established criteria that define childhood obesity on the basis of whole-body fatness and its relationship to health outcomes, cutoff points based on distributions of anthropometric measurements generally are used ***(Krebs et al., 2007).***

Classification of childhood obesity:

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) ***(WHO, 2013).***

Table (1): The International Classification of overweight and obesity according to BMI

BMI	Grades of overweight
25-29.9 Kg/m²	Overweight (preobese)
30-34.9 Kg/m²	Obese class I
35-39.9 Kg/m²	Obese class II
≥ 40 Kg/m²	Obese class III

(WHO, 2013)

Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex. Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile ***(Barlow, 2007)*.**

In 2007, the WHO established new growth references for school-age children and adolescents depending on z scores (Standard Deviation ± 3SD), they were introduced in place of percentile scores ***(De Onis et al., 2007)*.**

BMI z score, an alternative to BMI percentile, is now widely used in research and clinical studies in youth. BMI *z* score is defined as the BMI of the child or adolescent transformed into the number of standard deviations (SDs) above or below the population mean BMI for age and sex ***(CDC, 2012)***.

BMI z scores, like BMI percentiles, allow comparison of weight change across different ages and sex, as shown in Fig (1&2) Growths charts BMI-for-age for boys and girls aged (5-19 years) but are more sensitive to quantifying changes in weight status ***(Hunt et al., 2007)***.

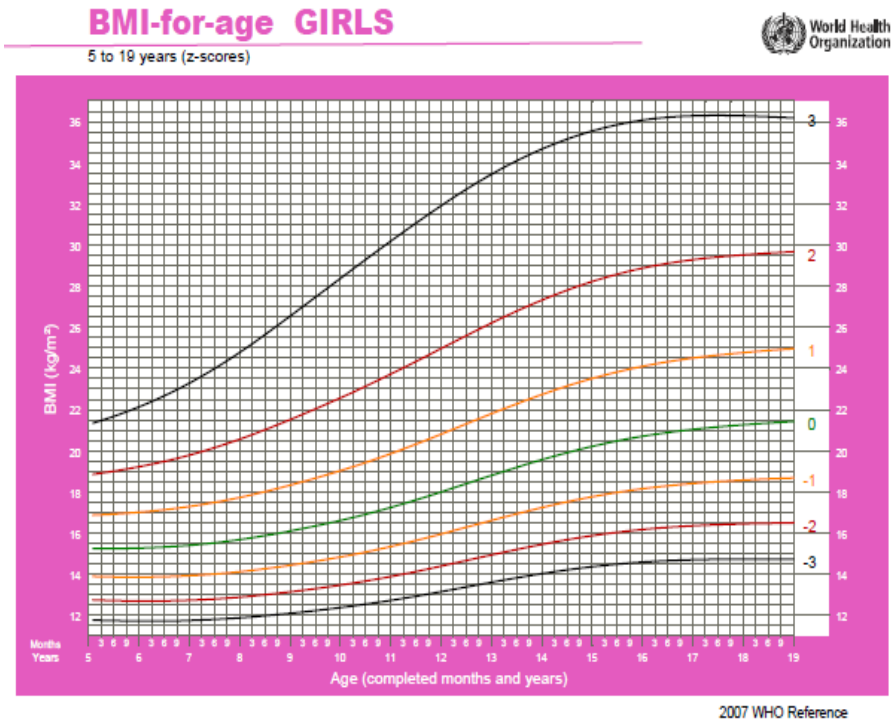

Fig. (1): BMI-for-age (5-19 years) for Girls ***(WHO, 2007)***

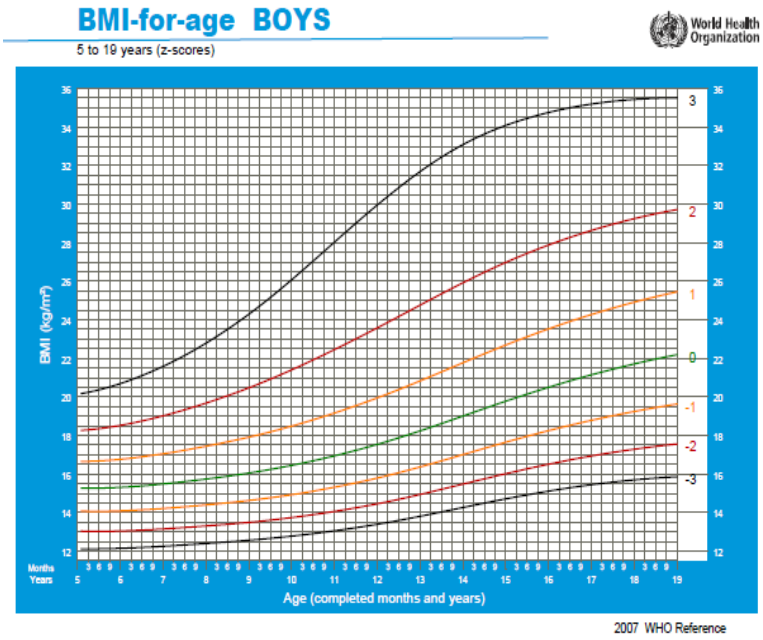

Fig. (2): BMI-for-age (5-19 years) for Boys ***(WHO 2007)***

The Pathophysiology of Obesity:

American Association of Clinical Endocrinologists (2011) reported That obesogenic environment long considered a condition due almost exclusively to poor lifestyle choices, obesity is now more accurately regarded as a chronic disease with multiple etiologies.

Basically, excess weight results from an imbalance between caloric intake and energy expended over time. Environmental influences, such as food availability, food advertising, and emotional distress **(**can add to the appeal of food and lead to increased caloric intake ***(D'Autume et al., 2012)***.

Even environmental conditions in utero and in infancy can play a role: babies with abnormal birth weights and infants who gain weight quickly or are overfed early in life have been shown to have an increased risk of becoming obese later in life ***(Lillycrop, 2011).***

The role of genetics in the pathophysiology of obesity is complex. Although rare cases of single-gene mutations can result in complex developmental disorders (eg, Bardet-Biedl and Prader-Willi syndromes) in which obesity is a symptom, at least 32 genes are now known to be linked to common forms of obesity ***(Rhee et al., 2012)***.

Prevalence:

Global trends of childhood obesity show huge shifts in recent times ***(Raj, 2012).*** Over the past several decades, the prevalence of overweight and obesity has increased dramatically in U.S. children and adolescents with notable disparate trends among African- American and Hispanic youth ***(Rendall et al., 2012).***

Although the increasing prevalence of excess adiposity in children was first reported almost two decades ago, childhood obesity continues to increase at an alarming rate ***(Nathan and Moran, 2008).***

Surveys from 144 countries (in 2010) suggested that 43 million preschool children (35 million in developing countries) are overweight and obese and 92 million are at risk of overweight ***(De Onis et al., 2010)*.**

The worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010. This trend is likely to continue and the prevalence is expected to reach 9.1%, or 60 million, in 2020. The estimated prevalence of childhood overweight and obesity in Africa in 2010 was 8.5% and is expected to reach 12.7% in 2020. The prevalence is lower in Asia (4.9% in 2010) than in Africa, but the number of affected children (18 million) is higher in Asia ***(De Onis et al., 2010)*.**

Obesity in children has increased dramatically to approximately 10 % in ages 4 to 5 years old, the largest increase in the prevalence of obesity was seen in the most overweight classifications and in certain ethnic groups, such as African American and Mexican American children of whom more than 20% are overweight ***(Berman, 2007)*.**

- **Regionally in Egypt:**

(Salaza et al., 2006) found in a recent study that 12.1% of Egyptian adolescents (7% boys and 18% girls) were overweight, and 6.2% (6% boys and 8 % girls) were obese.

Statistics issued by the Egyptian Medical Association for the Study of Obesity in early 2010 estimate that 15 percent of Egyptian (school-age) children are obese, in comparison with its 1990 estimate of only six percent. Being overweight or obese is determined according to Body Mass Index--with varying measurements for the different age groups and genders ***(WHO, 2010).***

Among Egyptian school children aged 8 to 12 years, the prevalence of overweight and obese students were 12.3 % and 15.1% respectively in private schools and were 13.4% and 6.7% in public schools ***(Shaalan et al., 2002).***

Hafez et al. (2000) studied children of primary school living in Greater Cairo, the prevalence of overweight and obesity were 14.3 % and 6.4% for boys, 13.8 % and 7.6 % for girls.

There have been few reviews on the prevalence of childhood obesity. As shown in **(Fig 3)** the Prevalence of overweight/obesity in boys and girls aged 6–18 years in developing countries ***(Kelishadi et al., 2007).***

In a study in Bahrain, among adolescents aged 12-17 years, the overall prevalence of obesity was higher (21% in males and 35 % in females) ***(Al-Sendi et al., 2003).***

In Lebanon a study among prepubescent children (ages 6-8 years), the prevalence of overweight and obesity based on the International Obesity Task Forces cutoff points were 26% and 7 %, respectively, in boys and 25% and 6 %, respectively, in girls ***(Al-Hourani et al., 2003)***.

In Saudi Arabia, the prevalence of overweight and obesity were 20% and 11% respectively in primary and preparatory schools in Elkobar city. The prevalence of overweight was higher among schoolchildren with father in private work ($p<0.01$) and the prevalence of overweight and obesity was higher among school children with highly educated mothers ***(Al Saeed et al., 2007).***

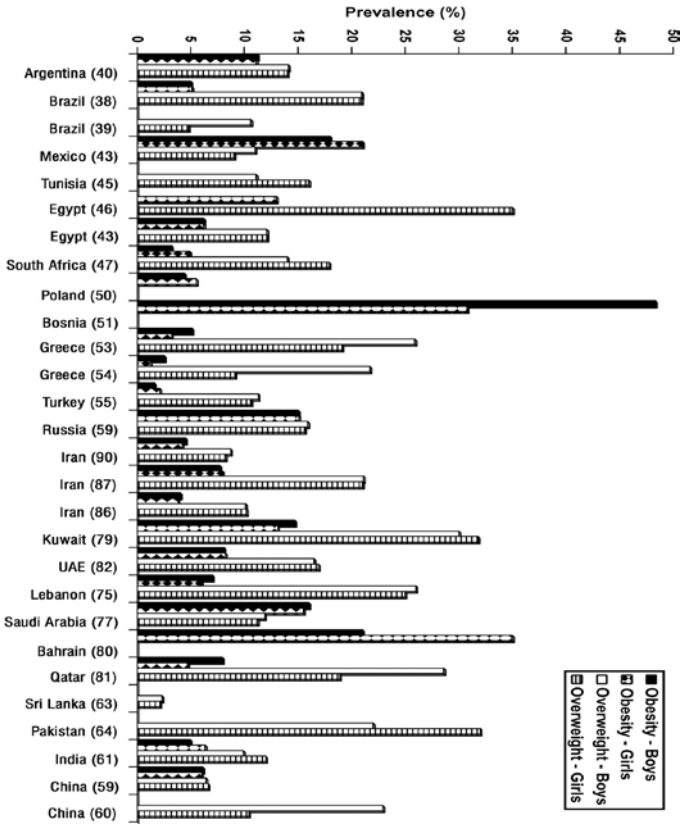

Fig. (3): Prevalence of overweight/obesity in boys and girls aged 6–18 years in developing countries ***(Kelishadi et al., 2007)***.

Causes of obesiy**:**

Only a small percentage of childhood is associated with a specific cause. An endogenous cause of obesity can be either suspected or eliminated from the differential diagnosis in virtually ill children based on a careful history and physical examination ***(Kumanyika, 2001)*****.**

Exogenous causes of childhood obesity:

Exogenous obesity is a multifactorial disease, which is independently related to cultural, economic and social parameters; no single factor can be incriminated and in most cases more than one factor coexist, a vicious circle may occur as obese children may not share in physical activities with other children and more weight gain occurs ***(Hassink et al. 2007).***

Simple obesity is the most common type of obesity. It may arise as a result of increased energy intake, decreased energy expenditure or increased partitioning of nutrients into fat, either alone or in combination, It occurs when energy intake exceeds energy expenditure ***(Farooqi and O'Rahilly 2003).***

Social and life style factors:

There have been societal changes over the past few decades that place children at increased risk for being overweight and obese. When the physiologic basis of weight gain is considered, the current lifestyle trends that children at greatest risk for obesity are clear: decreased physical activity and increased caloric consumption. In twin studies, environmental differences throughout childhood accounted for nearly 30% of the variance in body weight ***(Strauss, 2002).***

a) **Fast food:**

The rise in consumption of fast food, in developed and developing nations, might have particular relevance to the childhood obesity epidemic ***(Cara et al., 2002)***.

Fast food typically incorporates all of the potentially adverse dietary factors, including saturated fat, high glycaemic index, high energy density, and, increasingly, large portion size. Additionally, these foods tend to be low in fiber, micronutrients, and antioxidants; dietary components that affect risk of cardiovascular disease and diabetes ***(Hu et al., 2001).***

b) **TV watching**:

According to the American Academy of Pediatrics, children who view television for more than 4 hours daily have significantly greater BMIs than their counterparts who watch television less than 2 hours daily ***(Noller and Paulk, 2005).***

Many studies suggested that watching television is associated with inactivity and obesity ***(Taveras et al., 2006).***

Moreover, an enormous amount of television advertising for sugary cereals, fast foods, candy, and soda targets children. The increased consumption of these high-density foods further contributes to the epidemic of childhood obesity ***(Noller and Paulk, 2005).***

c) **Inactivity and patterns of physical activity**:

Many children in urban areas lack a safe area outdoors in which they can run, ride bicycles, and play, so they stay inside near the temptations of television and video games ***(Noller and Paulk, 2005)*.**

Changes in lifestyle and socioeconomic status have had a significant effect on physical activity. With the availability of cars, the increase in electrical home appliances and more involvement in office work, life has become more sedentary, and the pattern of practicing exercise is the activity least done during leisure time in a typical day ***(Musaiger, 2004)*.**

- **Family factors:**

Family life has changed a lot over the past two decades, with trends towards eating out and greater access to television than previously. Children consume more energy when meals are eaten in restaurants than at home, possibly because restaurants tend to serve larger portions of energy dense foods ***(Zoumas-Morse et al., 2001)*.**

Moreover, social support from parents and others correlates strongly with participation in physical activity ***(Sallis et al., 2000)*.**