

Obesity and Type 2 Diabetes in Childhood and Adolescence

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Obesity and diabetes have grown steadily worldwide with ominous implications for the health and prosperity of mankind.

The looming human dilemmas resulting from multifaceted problems of obesity, diabetes, insulin resistance, hyperlipidemia and their consequences, form one of the major health tragedies worldwide. Enormous health, economic, societal, and psychological consequences have emerged as serious challenges to the general public as well as health and social authorities in the so called developed and underdeveloped nations.

In the past, obesity and diabetes were looked upon as dilemmas affecting mainly the adult population. More recently, however, childhood obesity, and its consequences, has emerged as a threatening health danger associated with major morbidities and mortalities as the young generations proceed into adulthood.

Scientific evidence points towards lifestyle changes, including behavioral and environmental influences, as the fueling factors of this pandemic.

Faulty eating habits, "westernization", commercialization, and lack of physical exercise are all cornerstone factors.

The first reports came from Pima Indian studies in US, and from other native populations, which revealed a prevalence of type 2 diabetes in adolescents at 10-20% of new cases of diabetes in the youth. The female to male prevalence in these initial studies was around 5:1. The prevalence of type 2 diabetes progressed steadily over the years in US minorities, and escalated up to 31% of youth with type 2 diabetes in Mexican Americans of California.

Among Japanese school children, the incidence of type 2 diabetes increased from 0.2 to 7.3:100.000 from 1976 to 1995.

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This increase was noted more among junior high school-aged youngsters, who have 13.9:100.000 incidences. This is nearly seven times that for type 1 diabetes in this age group.

Japanese investigators have associated this escalating incidence of youngsters' type 2 diabetes with obesity and changing food patterns.

In UK, data from a nationally representative sample of 2630 English children show the frequency of overweight children ranged from 22% at age 6 years, to 31% at age 15 years, and that of obesity ranged from 10% at age 6 to 17% at age 15 years.

In Middle Eastern countries, pediatricians, endocrinologists and other health workers have recognized a rising epidemic of type 2 diabetes and obesity in childhood and adolescents during the past 10-15 years. Gradually, epidemiological data from several Middle Eastern countries were reported in local and international literature.

In a major analysis from 71 national nutrition surveys since 1986 from developing countries, levels and trends in overweight and obesity in children 12-60 months of age were outlined. Factors analyzed included mothers' educational levels, economic standards, region, gender and residence status (urban vs rural). In Middle Eastern and North African countries, levels of overweight and obesity were as high as in the United States.

In a published report from Saudi Arabia, the overall prevalence of overweight was 10.7% and 12.7% in boys and girls, respectively. In the two age groups, the prevalence of obesity was 6% and 6.4%, respectively. Maximum prevalence of obesity was in the 2-3 year old age group.

A study on Lebanese children 3 to 19 years of age, prevalence rates of overweight and obesity were higher for boys than girls (22.5% vs 16.1%, and 7.5% vs 3.2%, respectively).

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Subsequently, several reports indicated steady increases in overweight and obesity in US and in some developing countries, including the Middle East

Causes of Pediatric Obesity

Many pediatric studies have demonstrated significant associations between fat consumption and adiposity. In children, when energy balance is positive, a proportion of dietary fat is deposited directly into adipose tissue without oxidation. The efficiency of nutrient utilization is higher for fat than for carbohydrates or proteins.

The prevalence of pediatric obesity could be significantly decreased by diets restricted in sweetened sodas and high-glycemic carbohydrates, and to largely substitute them for diets containing whole grains, vegetables and fruits.

Sedentary lifestyles, such as prolonged TV viewing and playing video games, are usually associated with exposure to more food advertising, and increased snacking and food consumption.

Children involved in less TV watching usually have parents who are slimmer and more educated.

This tendency of in-door lifestyle patterns, is markedly compounded by the increasing lack of safety associated with out-door activities. Lack of safety on the roads, and concerns about children safety, may be limiting factors that curtail open sports, scouting and physical activities.

Longitudinal studies in US children showed increased obesity rates associated with increased TV-video watching, and playing computer games.

Adolescents who watched more than 2 hours of TV a day were twice as likely to be overweight than those who watched less than 2 hours.

Obesity, and its consequences, is not limited to developed countries. Rising incomes in developing (third world) countries, and increased "westernization" of food intake, have led to increased prevalence of (childhood and adult) obesity.

"Western" diets, which are high in saturated fats, sugars and refined foods, including fast food, high calorie drinks and sweets, in larger portion sizes, have spread all over the world, and their impact has involved countries with limited economies. Modern food production and marketing have led to low-cost abundance of soda drinks, ice cream, snack cakes, chips and high fat and carbohydrate sandwiches.

Genetics

Obesity and overweight result from the interaction of several factors including genetics, metabolic, behavioral and environmental influences.

In view of rapidity with which obesity is widely increasing over the past few decades, it was suggested that behavioral and environmental factors, rather than genetic ones, have caused this epidemic. Genetic factors, alone, could not explain the epidemic, since they need longer periods to evolve.

Genetics of obesity and type 2 diabetes are polygenic, and have their impacts in susceptible individuals, where adverse lifestyle changes take place, demonstrating the interaction between genes and environment.

Twin and adoption studies have shed more light on genetics of obesity.

The importance of heredity on body size has been demonstrated in studies on monozygotic and dizygotic twins. Higher concordance for body size among monozygotic than dizygotic twins was clearly demonstrated.

Twin analysis indicated a heritability of fat mass of 40-70%.

Adopted children have BMI^S that correlate with those of their biological parents, but not with their adoptive parents.

The thrifty genotype hypothesis was presented over 40 years ago, to explain the new emergence of obesity and type 2 diabetes.

This hypothesis postulates that during famines, or prolonged food scarcity, humans survived by genetic selection of those whose metabolic storage capabilities permitted survival during such periods, by taking advantage of episodic periods of food plenty. Later in time, when food becomes abundant all the time, this genetic selection results in obesity and type 2 diabetes, thereby becomes detrimental!

On the other hand, there is a proposed thrifty phenotype hypothesis, to explain epidemiological evidence that metabolic programming can occur as a result of in-utero environmental exposures. Small-for-gestational age babies were shown to have more insulin resistance, type 2 diabetes, and obesity, as they grow older.

There are observations that breastfeeding in humans may be protective against childhood obesity. Possible explanations may include metabolic programming or early learned self-regulation of food intake. Infants' bottlefed before 3 months of age consistently had higher BMI^S and skinfold thickness during early childhood, than those who were breastfed longer than 3 months.

Childhood Obesity: A Threatening Risk.

Does an obese child become an obese adult?

The literature suggests that the influence of obesity in childhood on adult status rises as children age.

In one report, the risk of adult obesity was 2.0 – 2.6 times greater in obese than in non-obese preschool children, but increased to 3.9 – 6.5 times greater for the same comparison among older children.

At 1-2 years of age, obesity was not found to significantly increase incidence of adult obesity. But it did become a significant predictor at 3-5 years of age, and even a stronger predictor of adult obesity, when obesity is present over 5 years of age.

In general terms, an obese child prior to age of 6 years, has a chance of being an obese adult of 25%. While an obese child at age 12 years, the chance rises to 75%! All these data and observations indicate the vital importance of initiating preventive and curative measures to combat obesity at early age.

Type 2 Diabetes: A parallel dilemma: The increase in incidence of type 2 diabetes in children and adolescents parallels the increase in prevalence and severity of pediatric obesity.

Type 2 diabetes in youth is more common in girls than in boys, with one study showing that up to 80% of children with type 2 diabetes are females⁶².

In addition to millions of children with type 2 diabetes around the world, there are millions with insulin resistance, or prediabetes, associated with obesity.

The Metabolic Syndrome: Includes type 2 diabetes, hypertension, dyslipidemia, and a prothrombotic inflammatory vascular environment. Obesity plays a central role in its development in childhood, youth and adults, and puts all of them at increased risk for cardiovascular disease. Lipid profile shows hypertriglyceridemia, reduced HDL cholesterol, and elevated small, dense LDL cholesterol.

Childhood Obesity and Cardiovascular Disease: Childhood obesity and the metabolic syndrome are risk factors for development of cardiovascular disease in adulthood. There are several lines of evidents that link cardiovascular risk in adults to childhood obesity.

Postmortem studies in obese children revealed that 50% of children aged 2-15 years had fatty streaks in their coronary arteries. These studies reveal the extent and severity of vascular lesions correlated with BMI and lipoprotein levels in childhood.

Endothelial dysfunction is one of the earliest signs of increased risk for cardiovascular disease. This has been shown to develop in obese children, and to run in parallel with severity of obesity as well the degree of insulin resistance.

Obesity, even of mild-to-moderate degrees, is independently associated with abnormal arterial function and structure in otherwise healthy young children.

Psychosocial Considerations: Few studies revealed significant social and emotional disorders that influence childhood and adolescent well-being, and may compound other complications. Expectations of rejection, withdrawal,

depressive symptoms and lower self esteem were reported.

Prevention Strategies: In 2003, the American Academy of Pediatrics (AAP) issued a policy statement on prevention of pediatric overweight and obesity. Following are the main highlights:

- Pediatricians should become adept in recognizing children at risk for obesity.
- They should encourage, support and protect breastfeeding, promote healthy eating habits, promote physical activity, educate and recommend limitation of television viewing.
- Pediatricians should become advocates for prevention of obesity at the proper early age.
- They should be influential in public awareness and education on childhood obesity.
- They should campaign for directing government and other funding parties towards prevention of obesity in children.

As seen from this and other evidence, the mainstay of prevention of this serious pandemic is:

Modification of lifestyle patterns, including dietary, behavioral and exercise factors.

Favorable dietary modifications need proper counseling and education, with sound involvement of dietitians and other educators.

Exercise is vital for weight loss. At least 30 minutes of moderate exercise, 7 days per week should be recommended. 60 minutes of exercise per day is recommended to achieve acceptable weight loss.

Exercise is a pillar in obesity prevention, but once obesity is well established, the main problem becomes how to maintain weight loss. Psychological intervention may be needed to bolster effects of lifestyle adjustments.

A multidisciplinary approach, with public awareness, education of parents as early as the preschool periods, and through the elementary school years, which includes curriculum of early and carefully planned dietary education and exercise programs, are instrumental in prevention strategies. Health care authorities and the media should be properly involved.

In our local societies, we have a valuable wealth of Islamic heritage and education derived from the Qur'anic and Prophetic guidance pertaining to food habits and exercise, which are clearly underutilized. Such heritage should be an integral part of public education, and should be adopted by our school system.

Suggested Readings

1. National Center for Health Statistic 1999 Health E-stats 1999. Prevalence of overweight among children and adolescents: United States. <http://www.cdc.gov/nchs/products/pubs/pubed/hestats/overwight99.htm>
2. Martorell R, Kettel Khan L, Hughes ML, & et al. Overweight and obesity in preschool children from developing countries: Int'l J. Obesity 2000; 24: 959-967.
3. Kiess W, Galler A, Reich A, et al. Clinical aspects of obesity in childhood and adolescence. Obesity Review, 2001; 2(1), 29-36

آفاق طبية

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وقد بينت الدراسات أن التدخل المبكر أكبر أثراً. فالتدخل الوقائي قبل سن السادسة أكثر فعالية من الانتظار حتى سن الثانية عشرة حيث تتفاقم احتمالات استمرار السمنة وتبعاتها في الكبر لتطال حوالي 75% من الحالات. هذه المعضلة العالمية المتنامية تحتاج إلى تطبيق القاعدة الأصيلة: الوقاية خير من العلاج. ولا بد من تضامن وتضافر جهود المهنة الطبية وصانعي القرار الصحي الرسمي، والأسرة، والنظم التعليمية، ووسائل الإعلام لمواجهة المعضلة مبكراً قبل استفحالها. ولا بد أن نذكر هنا أن تراثنا الديني غني بالهدي القرآني والنبوي الذي يحث على اتباع أنماط الطعام واللياقة البدنية السليمة، وأن هذا التراث بالغ التأثير والفائدة إذا أحسن تفهمه استعماله.

تتزايد نسبة الإصابة بمرض السكري من النوع الثاني والسمنة بين الأطفال والبالغين باضطراد خلال العقود الماضية. وقد ابتدأت المشكلة بين الأقليات في البلدان الغربية ثم انتشرت إلى المجتمعات الأخرى، ووصلت إلى البلدان النامية ومن بينها مجتمعاتنا في منطقة الشرق الأوسط. وقد كان الاعتقاد سائداً أن مرض السكري لدى الأطفال والبالغين هو من النوع الأول (المعتمد على الأنسولين)، غير أن الدراسات أظهرت أن نسبة كبيرة قد تصل إلى الثلث، من مرضى السكري لدى الأطفال والبالغين، هي من النوع الثاني المرتبط ارتباطاً وثيقاً بالسمنة. كما بينت الدراسات أن هذا المرض ترافقه آثار مبكرة لاعتلال الشرايين والقلب منذ الطفولة، وأن هذه الاعتلالات تتفاقم بالتدرج لتؤدي إلى اختلالات ومضاعفات بالغة الخطورة في الكبر.