

## **Obesity and Adolescents: Time for Increased Physical Activity!**

Obesity is a monumental dilemma affecting the health and well-being of the world's population(1-3). This is not a new problem, but rather a rapidly increasing one among children, adolescents and adults(4-6). The reasons for this escalation are multifactorial; each must be appreciated and precisely addressed before solutions to obesity are practical(7). The National Health and Nutrition Examination Surveys (NHANES cycles I, II & III) have been surveying the prevalence of obesity in American children and youth since 1971. The 1988-91 NHANES cycle III study identified 21% of adolescents 12-19 years of age as being overweight (using BMI or body mass index as criteria)—up from 15% in the 1966-80 NHANES II study(8).

Over the past 25 years the prevalence of overweight or obesity doubled in American children ages 6 to 11 years of age and tripled in American adolescents ages 12 to 17 years(4). A 75% relative increase in obesity in adolescents is noted from 1970 to the present and currently 25% of American adolescents are identified as being obese(9). The increase in childhood and adolescent obesity has resulted in increases in obesity or overweight in adults. At least one-third of American adults (ages 20 and above) are overweight. Overweight 10 to 14 year olds are 20 times more likely to be overweight in their third decade of life than if they were of normal weight as young adolescents(10). Approximately 80% of overweight adolescents

become overweight adults(4). Recent research notes that the prevalence of obesity among Americans 18 to 29 years of age is 14%, up to 21% if they had some college education; perhaps 35% of American college students are now overweight(11). Though more studies are needed to understand the precise prevalence of overweight and obesity in India, school-based data demonstrates an obesity range of 5.6% to 24% for the children and adolescents in India(12-14).

Obesity compounds a common adolescent problem of low self-esteem and can disrupt psychosocial development, interfering with the normal process of adolescence, a timeless journey that prepares the child for adulthood. An obese young person may have difficulty dealing with peers and this communication problem can seriously disrupt normal adolescent development. Psychological complications have been associated with obesity in adolescents, including depression, poor self-image, and difficulties in both the home and social environment (including school). Potential medical complications of obesity noted in adolescence and especially in adulthood, include hypertension, coronary artery disease, diabetes mellitus, dyslipidemia, cholecystitis, premature joint destruction, arthritis, stroke, some cancers, premature death and many others(15-22).

Exogenous obesity is usually caused by a variety of complex factors, including genetics, excess food intake, and reduced exercise lifestyle. Depression can play a primary or secondary role in many cases. Obesity remains a complex disturbance which causes frustration for patients, their families, and health care professionals. Recent research in

genetics is focusing on leptin, the ob gene substance, neuropeptide Y(NPY), proopiomelanocorticotropin POMC, melanocyte concentrating hormone receptors and other neurobiological factors(6,23).

Perhaps half of obese individuals have inherited a tendency to be overweight.

In a few instances, the cause may be medical, such as being secondary to Cushing's Syndrome, prolonged use of corticosteroids, hypothalamic lesions (trauma, tumor, tuberculosis, sarcoidosis), Prader-Willi syndrome, Lawrence-Moon-Biedl syndrome, and various other endocrine disorders (hypopituitarism, hypothyroidism, hyperinsulinemia, hypercortisolism). Other medications that can induce weight gain include anticonvulsants, neuroleptics, depomedroxyprogesterone acetate and tricyclic antidepressants. A careful medical evaluation will distinguish the common idiopathic or exogenous type of obesity from conditions that are secondary to primary endocrinological or other organic disorders(7).

There are many environmental factors that contribute to obesity in our modern culture (24,25) They are diverse in origin and applicability to individual patients, but collectively tend to explain many of the reasons we have an increasing problem in obesity. There are calories of culture and cuisine that are particularly a dilemma in many places (J Rowlett, Personal Communication, 1999). Quite simply, food is a way of life. Moreover, the food that comprises that way of life tastes very good, yet is often quite unhealthy. For example, American Southern cooking simply tastes wonderful to Americans because it is high in unhealthy lipids as saturated fats and cholesterol. Such sustenance, however, has a magnificent taste as well as smell and its consumption is a very important part of life for many individuals. In

many parts of the world, the dinner table remains a central gathering place for the family. Since meals serve many critical functions in addition to nourishment, it is a very difficult area in which to intervene if obesity is an issue.

There are calories of cost that are also significant. Fatty foods and those that are high in starch are frequently inexpensive compared to leaner cuts of meat, fresh fruit, and vegetables. Over the past few hundred years, obesity has evolved from a status of wealth (as characterized in oil paintings of the Flemish artist Rubens [1577-1640]) to a condition frequently found in those of lower socioeconomic status. These costs also become important when we look at treatment plans that not only involve diet, but also involve increasing activity. There are calories of community that are produced when children are not allowed to play; neighborhoods are simply not safe enough or appropriate facilities do not exist for the encouragement of physical activity among youth. Calories of convenience are found in the single serving foods, prepackaged, and frequently high in fat; these are meals that make up a significant portion of particularly young children's and school-aged children's diet. Calories of complacency occur when a parent simply concedes to "may I have a sweet". That is, it is easier in that instance to give the cookie or other sweet than to say no. The calories of chronic disease may be seen in children who have physical limitations yet continue to eat in a normal fashion and thereby become overweight. The calories of computers, televisions, and video games are generated in the snacks that frequently accompany these activities as well as the loss of physical exertion such activities will replace. The calories of commercialism are generated by adolescents and younger children responding to sales pitches. Fast foods have taken the calories of capacity to a new level by

marketing the “super-size” of french fries, soft drinks, and other assorted food products. Calories of competition refer to eating habits, and may involve both weight gain and weight loss associated with competitive sports. The calories of chaos occur in situations where there is simply not adequate control and supervision over the dietary process (Rowlett, 1999, Personal Communication).

The correction of obesity is associated with an improvement of risk factors, most notable are those related to cardiovascular- and diabetes-related events(34,35). It is critical that obesity be addressed early in childhood and adolescence because it is clear from adult studies that outcomes are better for those people who are not obese when they are young adults. Further, it is during the adolescent years (if not sooner) that most people develop lifestyle habits that will likely be a foundation of their adult behaviors. Effective treatment strategies for obesity in adolescence must consider the possibility of other medical disorders and these must be treated. For example, a 16-year-old obese adolescent female with polycystic ovary syndrome (PCOS) will need treatment for her PCOS with an oral contraceptive and an antiandrogen medication in addition to management efforts directed at her obesity. She needs an evaluation (and possible treatment) for Type II diabetes mellitus as well.

Treatment of exogenous obesity is difficult and should start with the concept that one is dealing with a chronic, non-curable condition. Sensible reduction in caloric intake with an increase in physical activity will result in slow, steady weight reduction. The precise role of behavioral modification therapy in adolescents is not clear and needs more study(25). Pharmacotherapy has been shown to be effective in the treatment of obesity in some adults and is recommended if they have a body-mass index of at least 27 and a medical disorder

associated with obesity or a BMI of at least 30 without any such medical condition (26-28). There is no current evidence-based medicine to tell us which if any of these medications are appropriate for children or adolescents. Amphetamines can lower weight, but lead to severe cardiac and mental health problems, including addiction. Such adrenergic drugs as phenylpropanolamine and ephedrine have been banned by the United States Federal Drug Administration (FDA) because of the risk of severe side effects. For example, ephedrine has been related to reports of sudden death along with some abuse potential. The previously popular “Phen-Fen” diet (phentermine and fenfluramine) had great success in adults at weight loss induction as long as the medications were used, but discontinuation of the medication was frequently associated with a relapse in weight. Therefore, these drugs were used for longer periods of time, and at least in some studies, were associated with cardiac valvulopathy. Significantly, fenfluramine and dexfen-fluramine have both been associated with pulmonary hypertension, albeit rare. The FDA removed fenfluramine from the market in 1997 to allow more study of these potential side effects. However, there are currently no studies clearly demonstrating the safety and efficacy of other medications (*i.e.*, sibutramine, orlistat, ephedrine-caffeine, metformin) in the adolescent that are used to treat obesity in adults(29-31). Also, the safety, efficacy and indications for bariatric surgery in obese adolescents are not established at this time (10,32,33).

Current management of obesity in adolescents focuses on the difficult task of reduction in excess caloric intake and increase in physical activity, as noted by the IAP National Task Force on Childhood Prevention of Adult Diseases(14,34,35). There has been a significant decrease in the average amount of physical activity over the past 30 years,

especially for youth. The advent of video games, computers, cable television, VCR's, public transportation systems, and employment opportunities that do not require great amounts of physical exertion are but some of the reasons that activity has declined. Since total weight gain is simply the excess calories, it is inevitable that those who eat similar amounts of food as generations prior, but expend less energy, will gain weight. Such weight gain can be gained quickly, such as overeating during holiday family celebrations, or slowly over months to years(36).

In addition to helping our youth eat properly, considerable time must be spent by the clinician helping the youth find activities that increase his energy expenditure over past experiences. The obese youth can be taught how to decrease caloric intake by approximately 500 calories a day and increase physical activity as tolerated. Increased physical activity can be used as part of a comprehensive plan to treat and, in some cases, prevent obesity in children and adolescents(37-44). General recommendations to increase physical activity in obese children and adolescents often fail because inappropriate activity may be offered, opportunities for physical activities for obese children and adolescents are usually lacking in the school environment, pain may be encountered with some physical activity, and emotional problems of these children may encourage isolated, sedentary, activities. However, these youth can be taught that various activities are fun as well as healthy—such as walking, dancing, aerobics, cycling, swimming and many others. The youth can be encouraged to try various activities to see which activities are self-selected at a particular time; selections often change over time. Water-sports may be preferred by many obese youth, since the excess adipose tissue allows excellent buoyancy and thermal insulation while water

may hide the youth's overweight appearance. Recommended activity guidelines for obese individuals are available, focusing on the severity of the obesity(41). As indicated by the IAP National Task Force for Childhood Prevention of Adult Diseases, those of us privileged to care for children and youth must be strong and persistent advocates for our children and adolescents to help them prevent and control the expanding phenomenon of overweight and obesity in the world's children (14,34,35,45-47). Increasing levels of physical activity is a vital component in this struggle.

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*Funding:* None.

*Competing interests:* None stated.

## REFERENCES

1. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Geneva, Switzerland: World Health Organization, 1997.
2. Seidell JC. Obesity: A growing problem. *Acta Paediatr* 1999; 88: S46-S50.
3. Livingstone MB. Epidemiology of childhood obesity in Europe. *Eur J Pediatr* 2000; 159: S14-S34.

4. Dietz WH. Overweight in childhood and adolescence. *N Engl J Med* 2004; 350: 855-857.
5. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among U.S. children and adolescents, 1999-2000. *JAMA* 2002; 288: 1728-1732.
6. Kiess W, Boettner A. Obesity in the adolescent. *Adolesc Med* 2002; 13: 181-190.
7. Hofmann AD. Obesity. In: Hofmann AD, Greydanus DE, editors. *Adolescent Medicine*, 3rd ed., Stamford, CT, Appleton & Lange, 1997: p. 663-682.
8. Prevalence of overweight among adolescents-United States, 1988-1991. *MMWR* 1994; 43: 818-821.
9. Stice E, Cameron RP, Killen JD, Hayward C, Taylor CB. Naturalistic weight-reduction efforts prospectively predict growth in relative weight and onset of obesity among female adolescents. *J Consult Clin Psychol* 1999; 67:967-974.
10. Robinson TN, Dietz WH. Weight gain: Overeating to obesity. In: Rudolph CD, Rudolph AM, editors. *Rudolph's Pediatrics*, 21st ed., NY McGraw-Hill, 2003:p. 476-481.
11. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS *et al*. Prevalence of obesity, diabetes and obesity-related health risk factors. *JAMA* 2003; 289:76-79.
12. Yadav S. Obesity: An increasing problem in the developing countries. *Indian J Practical Pediatr* 2001; 4: 293-299.
13. Kapil U, Singh P, Pathak P, Dwivedi SN and Bhasin S. Prevalence of obesity amongst affluent school children in Delhi. *Ind Pediatr* 2002; 39: 449-452.
14. Bhave S, Bavdekar A, Otiv M. IAP National Task Force for Childhood Prevention of Adult Diseases: Childhood obesity. *Indian Pediatr* 2004; 41: 559-575.
15. Bhargava SK, Sachdev HPS, Fall CH, Osmond C, Lakshmy R, Barker DJ *et al*. Relation of serial changes in childhood body-mass index to impaired glucose tolerance in young adulthood. *N Engl J Med* 2004; 350: 865-875.
16. Guide to Clinical Preventive Services. Report of the U.S. Preventive Services Task Force. 3rd Edition, International Medical Publishers, Inc.. 2002: p. 219- 229.
17. Pradeepa R, Mohan V. The changing scenarios of the diabetes epidemic. Implications for India. *Indian J Med Res* 2002; 116:121-132.
18. Must A, Jacques PF, Dallal GE, Bajema CJ and Dietz WH. Long-term morbidity and mortality of overweight adolescents: a follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med* 1992; 327:1350-1355.
19. Hill JO & Trowbridge FL(eds). Symposium on the causes and health consequences of obesity in children and adolescents. *Pediatrics* 1998; 101: S497-S574.
20. Sorof JM, Lai D, Turner J, Poffenbarger T and Portman RJ. Overweight, ethnicity, and the prevalence of hypertension in school-aged children. *Pediatrics* 2004; 113:475-482.
21. Calle EE, Rodriguez C, Walker-Thurmond K and Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med* 2003; 348:1625-1638.
22. Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB. Years of life lost due to obesity. *JAMA* 2003; 289: 187-193.
23. Clément K, Ferré P. Genetics and the pathophysiology of obesity. *Pediatr Res* 2003; 53:721-725.
24. Hill J, Peters J. Environmental contributions to the obesity epidemic. *Science* 1998; 280:1371-1374.
25. Strauss RS, Knight J. Influence of the home environment on the development of obesity in children. *Pediatrics* 1999;103(6):e85.
26. Jensen MD. Medical management of obesity. *Sem Gastrointest Dis* 1998; 9:156-162.
27. Bray GA, Tartaglia L. Medicinal strategies in the treatment of obesity. *Nature* 2000; 404:672-677.
28. Yanovski SZ, Yanovski JA. Obesity. *N Engl J Med* 2002; 346: 591-602.
29. Sibutramine for obesity. *Med Lett Dr Ther* 1998; 40: 32.

30. Berkowitz RI, Wadden TA, Tershakovec AM, Cronquist JL. Behavioral therapy and sibutramine for the treatment of adolescent obesity. A randomized controlled trial. *JAMA* 2003; 289:1805-1812.
  31. Donohoue PA. Obesity In: Behrman RE, Kliegman RM, Jenson HB. editors. *Nelson Textbook of Pediatrics*, 17th ed., Philadelphia, PA: Saunders (Elsevier Science), 2004: p. 173-177.
  32. Sugeran HJ, Sugeran EL, DeMaria EJ, Kellum JM, Kennedy C, Mowery Y, *et al.* Bariatric surgery for severely obese adolescents. *J Gastrointest Surg* 2003; 7: 102-108.
  33. Mattison R, Jensen MD. Bariatric surgery for the right patient, procedure can be effective. *Postgrad Med* 2004; 115: 49-58.
  34. Kurpad AV, Swaminathan S, Bhat S. IAP National Task Force for Childhood Prevention of Adult Diseases: The effect of childhood activity on prevention of adult diseases. *Indian Pediatr* 2004; 41:37-62.
  35. Bhatia V. IAP National Task Force for Childhood Prevention of Adult Diseases: Insulin resistance and type 2 diabetes mellitus in childhood. *Indian Pediatr* 2004; 41: 443-457.
  36. Yanovski JA, Yanovski SZ, Sovik KN, Nguyen TT, O'Neil PM, Sebring NG. A prospective study of holiday weight gain. *N Engl J Med* 2000; 342: 861-867.
  37. Bar-Or O, Baranowski T. Physical activity, adiposity and obesity among adolescents. *Pediatric Exerc Sci* 1994; 6: 348-360.
  38. Bar-Or O. The juvenile obesity epidemic: Is physical activity relevant? *Sports Sci Exchange* 2003; 16:1-6.
  39. Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: Recommendations from an expert committee. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. *Am J Clin Nutr*. 1994; 59: 307-316.
  40. Epstein LH, Goldfield G. Physical activity in the treatment of childhood overweight and obesity: Current evidence and research issues. *Med Sci Sports Exerc* 1999; 31: S553-S559.
  41. Sothorn MS. Childhood and adolescent obesity: exercise as a modality in the treatment of childhood obesity. *Pediatr Clin N Amer* 2001; 48: 1-17.
  42. Berkey CS, Rockett HR, Gillman MW, Colditz GA. One-year changes in activity and inactivity among 10- and 15-year old boys and girls: Relationship to change in body mass index. *Pediatrics* 2003; 111: 836-843.
  43. Amisola RB, Jacobson MS. Physical activity, exercise, and sedentary activity: relationship to the causes and treatment of obesity. *Adolesc Med* 2003; 14: 23- 35.
  44. Lee IM. Physical activity in women: How much is good enough? *JAMA* 2003; 290:1377-1379.
  45. Yanovski JA, Yanovski SZ. Treatment of pediatric and adolescent obesity. *JAMA* 2003; 289:1851-1853.
  46. Rivara FP, Whitaker R, Sherman PM, Cuttler L. Influencing the childhood behaviors that lead to obesity: Role of the pediatrician and health care professional. *Arch Pediatr Adolesc Med* 2003; 157:719-720.
  47. Prevention of pediatric overweight and obesity. Committee on Nutrition. American Academy of Pediatrics. *Pediatrics* 2003; 112:424-430.
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