ENCYCLOPEDIA
on Early Childhood
Development

[Archived] Preventing Obesity in Children from Birth to Five Years

Connie L. VanVrancken-Tompkins, MA, Melinda S. Sothern, PhD

Louisiana State University Health Sciences Center, USA

April 2006

Introduction

The prevalence of pediatric overweight and obesity has steadily increased over the last few decades. For children between the ages of two and five, the National Health and Nutrition Examination Survey (NHANES) (1999 to 2000) reported the prevalence of obesity (body mass index (BMI) ≥95th percentile) was 10.4%, while three decades ago it was 5.0%.[1] More disconcerting was the prevalence of obesity among low-income preschool children – 14.3%.[2] Including children at risk for obesity (BMI of 85th to 94th percentile), overall prevalence increased to 20%.[3] Not only has the prevalence of obesity increased, but the distribution of BMI has also shifted toward the upper end.[2] These figures are troubling, since overweight preschoolers are more likely to become overweight adults.[4]

Subject

Pediatric obesity prevention has traditionally been implemented in school-aged youth[5,6] and more recently in preschool children.[7-9] And, although these interventions show promise, emerging

research suggests that factors associated with obesity present much earlier. Recent research identifies infancy and the intrauterine environment as potential high-risk periods.[10] Lucas[11] and Jackson et al[12] suggest that there exists a programming response established by the interaction of the infant with his or her early environment.[13-15] During this sensitive period of early life, long-term changes in physiology and metabolism may take place, resulting in biochemical, metabolic and neurological disorders later in postnatal life.[11,12,15-18] Impaired growth and development during fetal life and infancy are linked to obesity in both childhood and adult life.[19,20] During early infancy, breastfeeding may have a protective effect.[21]

Problems

Problems that may lead to overweight in children from birth to five years include the following:

1. low birth weight and catch-up growth;[22]

2. maternal smoking;[23,24]

3. maternal diabetes;[25]

4. maternal overweight prior to and during pregnancy[26,27] (large for gestational age infants);[14,28]

5. lack of breastfeeding.[21]

Research Context

During the prenatal, early infancy and preschool years, several factors play a role in increasing or decreasing a child’s risk for overweight. Both low birth weight and rapid catch-up growth during infancy are strong predictors of obesity, hypertension, non-insulin-dependent diabetes and coronary heart disease.[13,16,29] Maternal smoking during pregnancy is also associated with low birth weight, as well as an increased risk of overweight in children before the age of eight.[23,24] Both intrauterine restraint of fetal growth and maternal smoking are associated with catch-up growth, which in turn relates significantly to both obesity and central fat distribution in children at five years of age.[22,23] Maternal overweight is a major contributing factor to the most common medical complication of pregnancy, diabetes. Maternal overweight prior to and during pregnancy, as well as maternal pre-gestational and gestational diabetes, are associated with adverse birth outcomes, including low birth weight and large-for-gestational-age infants.[28] These rapid and inadequate rates of intrauterine and fetal growth increase the risk for overweight during childhood and adult

life.[19,20] Recent research has associated breastfeeding with providing a protective effect against overweight during childhood.[21,30] Moreover, increased duration of breastfeeding is also associated with lower risks of overweight.[31,32]

Key Research Questions

Most research identifies variables that have a persistent effect on overweight children from birth to five years, rather than prevention efforts, in this age group. Recently, however, the focus has shifted to prevention of overweight in children.[7] The following studies concentrate on prevention of overweight in children by targeting mothers as well as preschool children.

Recent Research Results

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) includes interventions that target low-income, nutritionally at-risk infants, children, pregnant and postpartum women.[2] WIC provides supplemental foods, nutrition education and health-care referrals.[2] Participation in WIC is associated with improved birth outcomes, particularly among single high-school dropouts and teen mothers, as well as increases in initiating breastfeeding.[33,34] Moreover, longer prenatal participation in WIC maintains this significant positive effect on birth weight.[35] Participation in WIC has been shown to promote a positive effect on preschoolers' diets as well.[8]

In a study by Harvey-Berino et al,[36] mothers of preschool Native-American children enrolled in a WIC program were recruited to participate in a home-visiting intervention for four months. The goal of the intervention was to provide additional parenting support in order to reduce the prevalence of obesity in preschool-aged offspring. The additional support focused on changing lifestyle behaviours, including obesity prevention, and improving parenting skills. Children in the home-visiting program gained less weight over the four months than those not receiving the intervention.[36]

Two programs, Healthy Start[37] and Hip Hop to Health, Jr.,[38] targeted children already enrolled in preschool Head Start programs. The goal of the Healthy Start program was to increase preschoolers' health awareness and knowledge. The curriculum integrated age-appropriate risk reduction activities to provide an opportunity to practice positive health behaviours. The lessons, which were held three times per week, taught healthy behaviours through stories, games, crafts, demonstrations and discussions.[37] The Hip Hop to Health Jr. program was also implemented in

preschool Head Start programs. It was a randomized, controlled trial program that sought to reduce increases in BMI through dietary/physical activity intervention. Children received lessons regarding healthy habits, including nutritious eating as well as physical activity. Parents were also sent weekly newsletters that mirrored the children's curriculum. Both one- and two-year follow-up visits demonstrated success in significantly reducing increases in BMI as the children developed and matured.[38]

Conclusions

Effective programs that target the prevention of early childhood overweight are needed for prenatal and postpartum women, and for preschool children.[39] Pregnancy and the postpartum period are times when women are more open to counselling about their own risks of overweight, as well as their child's risks.[28] Pregnant women should also be provided with help to cease smoking at the very minimum during pregnancy.[23] To prevent cases of maternal overweight and gestational diabetes, women should be encouraged to maintain a healthy weight, not only during pregnancy but also over their lifetimes.[28] Weight management programs to assist women of child-bearing age are needed. Because studies have shown an association between breastfeeding and decreased risk of overweight, programs that address the importance of breastfeeding are needed.[39] Weight states are shown to persist across time; therefore, it is crucial that pediatricians and primary care physicians actively participate in the diagnosis and prevention of childhood obesity.[3] Very early monitoring of children's weight status is imperative. A child who reaches his or her second birthday at a healthy weight is less likely to become overweight at a later age. Thus, intensive preventive strategies should be employed before an unhealthy weight pattern becomes established.[40]

Implications

Several obesity prevention measures should be adopted now to prevent even higher rates of obesity in future generations. Dietetic and exercise professionals should provide services that support appropriate weight gain before and during pregnancy, as well as in childhood. Policies that deter tobacco use and limit exposure to second-hand smoke for expectant mothers should be promoted. Hospitals and physicians' offices should establish educational courses for expectant mothers to promote initiation and duration of breastfeeding. Public-health professionals should also advocate for policies in communities, schools and worksites that support breastfeeding.[28] Health-care professionals should routinely provide families of preschool children with education

and encouragement to eat healthy, nutrient-dense foods in appropriate portions and to provide safe environments inside and outside to promote active play.[9] Both parents and policy- makers should advocate for child-care and school environments that support healthful eating and encourage physical activity throughout the toddler's day. As the child enters grade school, parents, school and community leaders should promote active transportation to and from school, recess time and high-quality physical education.[19]

References

1. Ogden CL, Flegal KM, Carroll MP, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA -Journal of the American Medical Association* 2002;288(14):1728-1732.
2. Edmunds LS, Woelfel ML, Dennison BA, Stratton H, Pruzek RM, Abusabha R. Overweight trends among children enrolled in the New York State Special Supplemental Nutrition Program for Women, Infants, and Children. *Journal of the American Dietetic Association* 2006;106(1):113-117.
3. O'Brien SH, Holubkov R, Reis EC. Identification, evaluation, and management of obesity in an academic primary care center. *Pediatrics* 2004;114(2):154-159.
4. Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: The Bogalusa Heart Study. *Pediatrics* 2005;115(1):22-27.
5. Robinson TN. Reducing children's television viewing to prevent obesity: A randomized controlled trial. *JAMA - Journal of the American Medical Association* 1999;282(16):1561-1567.
6. Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. *Archives of Pediatrics and Adolescent Medicine* 1999;153(4):409-418.
7. Gunner KB, Atkinson PM, Nichols J, Eissa MA. Health promotion strategies to encourage physical activity in infants, toddlers, and preschoolers. *Journal of Pediatric Health Care* 2005;19(4):253-258.
8. Siega-Riz AM, Kranz S, Blanchette D, Haines PS, Guilkey DK, Popkin BM. The effect of participation in the WIC program on preschoolers' diets. *Journal of Pediatrics* 2004;144(2):229-234.
9. Passehl B, McCarroll C, Buechner J, Gearring C, Smith AE, Trowbridge F. Preventing childhood obesity: establishing healthy lifestyle habits in the preschool years. *Journal of Pediatric Health Care* 2004;18(6):315-319.
10. Sothern MS. Obesity prevention in children: physical activity and nutrition. *Nutrition* 2004;20(7-8):704-708.
11. Lucas A. Programming by early nutrition in man. *Ciba Foundation Symposium* 1991;156:38-50, discussion 50-55.
12. Jackson AA, Langley-Evans SC, McCarthy HD. Nutritional influences in early life upon obesity and body proportions. *Ciba Foundation Symposium* 1996;201:118-129, discussion 129-137, 188-193.
13. Hales CN, Barker DJP, Clark PMS, Cox LJ, Fall C, Osmond C, Winter PD. Fetal and infant growth and impaired glucose tolerance at age 64. *British Medical Journal* 1991;303(6809):1019-1022.
14. Barker DJP, Bull AR, Osmond C, Simmonds SJ. Fetal and placental size and risk of hypertension in adult life. *British Medical Journal* 1990;301(6746):259-262.
15. Barker DJP, Osmond C, Rodin I, Fall CHD, Winter PD. Low weight gain in infancy and suicide in adult life. *British Medical Journal* 1995;311(7014):1203.

16. Barker DJP, Osmond C, Simmonds SJ, Wield GA. The relation of small head circumference and thinness at birth to death from cardiovascular disease in adult life. *British Medical Journal* 1993;306(6875):422-426.

17. Ravelli GP, Stein ZA, Susser MW. Obesity in young men after famine exposure in utero and early infancy. *New England Journal of Medicine* 1976;295(7):349-353.

18. Law CM, Barker DJP, Osmond C, Fall CHD, Simmonds SJ. Early growth and abdominal fatness in adult life. *Journal of Epidemiology and Community Health* 1992;46(3):184-186.

19. Johnson DB, Gerstein DE, Evans AE, Woodward-Lopez G. Preventing obesity: A life cycle perspective. *Journal of the American Dietetic Association* 2006;106(1):97-102.

20. Forsen T, Eriksson J, Tuomilehto J, Reunanen A, Osmond C, Barker D. The fetal and childhood growth of persons who develop type 2 diabetes. *Annals of Internal Medicine* 2000;133(3):176-182.

21. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity - a systematic review. *International Journal of Obesity* 2004;28(10):1247-1256.

22. Ong KK, Dunger DB. Birth weight, infant growth and insulin resistance. *European Journal of Endocrinology* 2004;151(Suppl 3):U131-U139.

23. Chen AM, Pennell ML, Klebanoff MA, Rogan WJ, Longnecker MP. Maternal smoking during pregnancy in relation to child overweight: follow-up to age 8 years. *International Journal of Epidemiology* 2006;35(1):121-130.

24. Centers for Disease Control and Prevention. Maternal and infant health: Smoking during pregnancy. Available at: http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/related/SmokingPregnancy.htm. Accessed April 4, 2006.

25. Ray JG, Vermeulen MJ, Shapiro JL, Kenshole AB. Maternal and neonatal outcomes in pregestational and gestational diabetes mellitus, and the influence of maternal obesity and weight gain: the DEPOSIT study. *QJM – An International Journal of Medicine* 2001;94(7):347-356.

26. Linne Y. Effects of obesity on women's reproduction and complications during pregnancy. *Obesity Reviews* 2004;5(3):137-143.

27. Whitaker RC, Dietz WH. Role of the prenatal environment in the development of obesity. *Journal of Pediatrics* 1998;132(5):768-776.

28. Rosenberg TJ, Garbers S, Lipkind H, Chiasson MA. Maternal obesity and diabetes as risk factors for adverse pregnancy outcomes: differences among 4 racial/ethnic groups. *American Journal of Public Health* 2005;95(9):1545-1551.

29. Langley-Evans SC. Developmental programming of health and disease. *Proceedings of the Nutrition Society* 2006;65(1):97-105.

30. Gillman MW, Rifas-Shiman SL, Berkey CS, Frazier AL, Rockett HRH, Camargo CA, Field AE, Colditz GA. Breast-feeding and overweight in adolescence. *Epidemiology* 2006;17(1):112-114.

31. Grummer-Strawn LM, Mei Z. Does breastfeeding protect against pediatric overweight? Analysis of longitudinal data from the Centers for Disease Control and Prevention Pediatric Nutrition Surveillance System. *Pediatrics* 2004;113(2):81-86.

32. Toschke AM, Koletzko B, Slikker W, Hermann M, von Kries R. Childhood obesity is associated with maternal smoking in pregnancy. *European Journal of Pediatrics* 2002;161(8):445-448.

33. Bitler MP, Currie J. Does WIC work? The effects of WIC on pregnancy and birth outcomes. *Journal of Policy Analysis and Management* 2005;24(1):73-91.

34. Chatterji P, Brooks-Gunn J. WIC participation, breastfeeding practices, and well-child care among unmarried, low-income mothers. *American Journal of Public Health* 2004;94(8):1324-1327.

35. Lazariu-Bauer V, Stratton H, Pruzek R, Woelfel ML. A comparative analysis of effects of early versus late prenatal WIC participation on birth weight: NYS, 1995. *Maternal and Child Health Journal* 2004;8(2):77-86.

36. Harvey-Berino J, Rourke J. Obesity prevention in preschool Native-American children: A pilot study using home visiting. *Obesity Research* 2003;11(5):606-611.

37. Williams CL, Squillace MM, Bollella MC, Brotanek J, Campanaro L, D'Agostino C, Pfau J, Sprance L, Strobino BA, Spark A, Boccio L. Healthy Start: A comprehensive health education program for preschool children. *Preventive Medicine* 1998;27(2):216-223.

38. Fitzgibbon ML, Stolley MR, Schiffer L, Van Horn L, KauferChristoffel K, Dyer A. Two-year follow-up results for hip-hop to health jr.: a randomized controlled trial for overweight prevention in preschool minority children. *Journal of Pediatrics* 2005;146(5):618-625.

39. Bogen DL, Hanusa BH, Whitaker RC. The effect of breast-feeding with and without formula use on the risk of obesity at 4 years of age. *Obesity Research* 2004;12(9):1527-1535.

40. Salsberry PJ, Reagan PB. Dynamics of early childhood overweight. *Pediatrics* 2005;116(6):1329-1338.