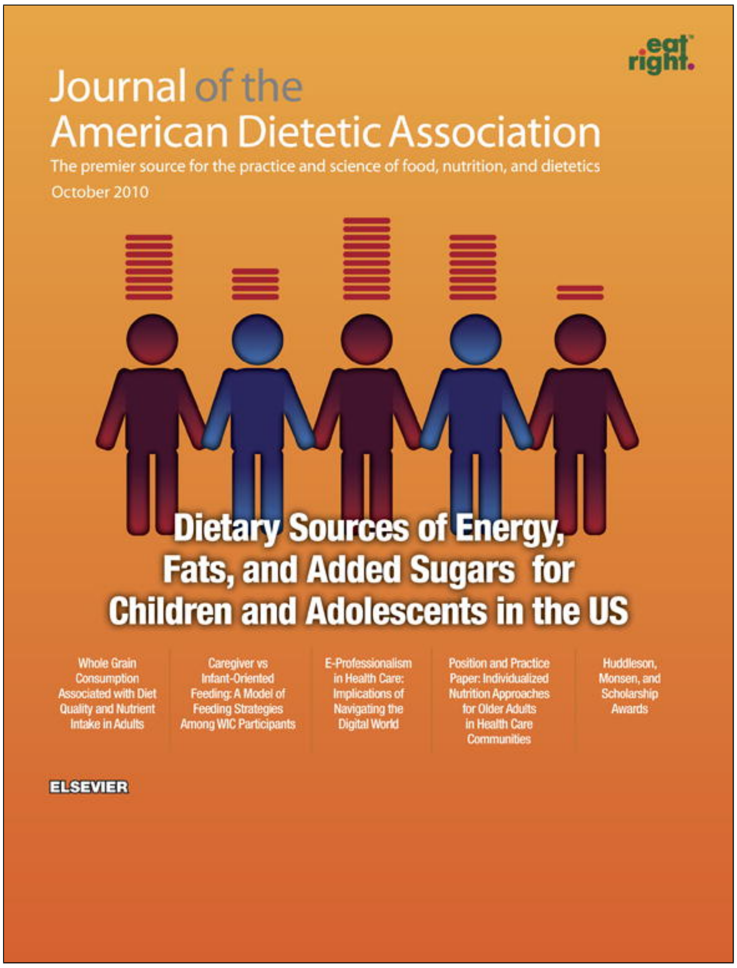
Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

http://www.elsevier.com/copyright

Author's personal copy

eat right. American Dietetic Association

Determinants of Childhood Obesity and Association with Maternal Perceptions of Their Children's Weight Status: The "GENESIS" Study

YANNIS MANIOS, PhD; GEORGE MOSCHONIS, MSc; EVANGELIA GRAMMATIKAKI, MSc; ANASTASIA ANASTASIADOU, MSc; THEODOROS LIARIGKOVINOS, MSc

ABSTRACT

Prevention of early childhood obesity requires a clear understanding of its determinants. This study examined perinatal, parental, and lifestyle determinants of childhood obesity and how these factors are associated with maternal misperceptions of their children's weight status. The current work presents a cross-sectional analysis of 2,374 children, age 1 to 5 years, living in Greece (April 2003 to July 2004). The 2000 Centers for Disease Control and Prevention growth charts were used to classify children as overweight (≥85th and <95th body mass index [BMI]–for-age percentile for children older than 24 months) and obese (≥95th weight-for-length percentile for children younger than 24 months and ≥95th BMI–for-age percentile for children older than 24 months). Maternal perceptions about their children's weight status were assessed via interviews with the mothers. Early infancy growth data were obtained from pediatric medical records. The present study showed that the prevalence of overweight and obesity was 16.2% and 17.5%, respectively. Each unit increase of maternal and paternal BMI significantly increased the likelihood of childhood obesity by a factor of 1.03 (95% confidence interval [CI]: 1.01 to 1.07) and 1.15 (95% CI: 1.10 to 1.20), respectively. Furthermore, children with a rapid weight gain in infancy were 1.9 (95% CI: 1.3 to 2.7) times more likely to be overweight and 1.5 (95% CI: 1.2 to 1.9) times more likely to have their weight status underestimated by their mother. In conclusion, rapid infancy weight gain and higher parental BMI were the main determinants of obesity in preschool years. Maternal underestimation of children's weight status was more likely for children with rapid weight gain in infancy.

J Am Diet Assoc. 2010;110:1527-1531.

Y. Manios is an assistant professor, G. Moschonis is a dietitian-clinical nutritionist, E. Grammatikaki is a dietitian-public health nutritionist, A. Anastasiadou is a clinical dietitian, and T. Liarigkovinos is a clinical dietitian, Department of Nutrition and Dietetics, Harokopio University of Athens, Greece.

Address correspondence to: Yannis Manios, PhD, Department of Nutrition and Dietetics, Harokopio University, 70, El.Venizelou Ave, 176 71 Kallithea, Athens, Greece. E-mail: manios@hua.gr

Manuscript accepted: April 13, 2010.

Copyright © 2010 by the American Dietetic Association.

0002-8223/$36.00
doi: 10.1016/j.jada.2010.07.004

Unhealthy eating habits and lack of physical activity are the key environmental contributors to the childhood obesity epidemic (1). However, the etiology of childhood obesity is complex because several factors, including energy imbalance, have been attributed to this public health epidemic. The escalation of childhood obesity during recent decades has led to the development of theories that underscore the importance of certain early childhood factors on the degree of adiposity during childhood through adulthood (2,3). Some of these factors include maternal smoking during pregnancy (4), gestational diabetes (5), size at birth (6), breastfeeding (7), and postnatal growth rate (8). These factors are believed to bear permanent physiological and metabolic adaptations that may be detrimental over the course of the lifespan.

On the other hand, young children's energy balance–related behaviors are mostly influenced by family and physical environmental cues without involving conscious decision-making (9). In that context, parental perceptions about children's diet, physical activity levels, and weight status are highlighted as the major determining factors of children's actual behaviors (10,11). Many recent studies have examined the ability of parents to correctly perceive their children's weight status or body image (10-21). According to the findings of these studies, many parents with overweight children underestimate the problem by perceiving their children's weight as normal.

Although the aforementioned studies have indicated a clear association between parental misperceptions of their children's weight status and, hence, childhood obesity, no study has yet examined the association between parental perceptions and some of the most important determinants of childhood obesity. Thus, the aims of the present study were first to identify certain perinatal, parental, and lifestyle determinants of childhood overweight and obesity in preschool children, and second to examine the associations between these determinants and maternal misperceptions of their children's weight status.

METHODS

The "Growth, Exercise, and Nutrition Epidemiological Study in preSchoolers" (GENESIS study) was conducted from April 2003 to July 2004. A representative sample of randomly selected public and private child day-care cen-

© 2010 by the American Dietetic Association

Author's personal copy

ters within municipalities of urban, semiurban, and rural locality in five Greek counties was invited to participate in the study. An extended letter explaining the aims of the current study and a consent form was given to parents of children at these day-care centers. Signed parental consent forms were collected for 2,518 children, age 1 to 5 years (75% response rate). Full data and measurements were obtained from 2,374 children. More information on the sampling procedures is presented elsewhere (22). Approval to conduct the study was granted by the Bioethics Committee of Harokopio University, Athens, Greece.

For all participants, body weight, recumbent length, and height were measured using standard procedures (22). Body mass index (BMI) was calculated as kg/m^2. The Nutstat module of EpiInfo version 3.5.1 (2008, Centers for Disease Control and Prevention, Atlanta, GA) (23) was used to estimate children's age- and sex-specific percentiles for weight, recumbent length, and BMI. The 2000 Centers for Disease Control and Prevention growth charts for the United States and relative thresholds were used for the definition of childhood overweight and obesity (24). The weight-for-length percentiles were used to classify children up to age 24 months as obese (≥95th percentile), whereas the BMI–for-age percentiles were used to classify children older than 24 months as overweight (≥85th and <95th percentile) or obese (≥95th percentile). Pediatric medical records were used to obtain data about children's birth weight, recumbent length, and body weight at age 6 months. Birth weight was used to identify children that were born small-for-gestational age (<10th percentile), appropriate-for-gestational age (10th to 89th percentile), and large-for-gestational age (≥90th percentile).

The differences in weight-for-length *z* scores from birth to 6 months of age were used to categorize children's weight gain during infancy as: "poor" (<-1 *z* score difference), "average" (-1 to $+1$ *z* score difference), and "rapid" ($>+1$ *z* score difference). Finally, paternal and maternal BMI were calculated from self-reported data (ie, weight and height reported by parents).

Dietary intake data were obtained for 2 consecutive weekdays and 1 weekend day, using a combination of techniques that comprised weighed food records and 24-hour recalls or food diaries as described in details elsewhere (22). Dietary intake data were analyzed using the Nutritionist V diet analysis software (version 2.1, 1999, First Databank, San Bruno, CA), which was extensively amended to include traditional Greek foods and recipes (25). Fifty-seven children whose dietary intake was found to be underreported (26) by their parents were excluded from further analysis. Daily energy intake was expressed as percentage of Estimated Energy Requirements (27). Children's physical activity levels were assessed by asking parents to provide information about the type, duration, and intensity of all typical outdoor organized or nonorganized physical activities engaged in by their children. A trained research team member (ie, a dietitian or a physical education instructor) recorded this information using a valid, structured proxy questionnaire (28). Emphasis was placed on light to vigorous physical activities with intensity higher than four metabolic equivalents. Typical light to vigorous physical activities for the younger age groups were playground recreational activities and taking walks with parents, whereas sports participation, such as soccer, swimming, ballet, and gymnastics were more commonly reported for the older age group. More information about the type of activities comprising light to vigorous physical activities is presented elsewhere (22).

Parents were also asked to provide information about: (a) their educational level, (b) maternal medical history during pregnancy, (c) maternal smoking during pregnancy, (d) maternal age when the child was born, (e) parity, and (f) infant's feeding practices from birth to 6 months of age (ie, exclusive breastfeeding, exclusive formula feeding, and mixed feeding [combination of formula and breast milk]), based on categorization criteria provided by the World Health Organization (29). Furthermore, maternal perception of their children's weight status was assessed by asking each mother to complete the statement "I feel my child's weight is . . .", by choosing one of the following five responses: "much higher than normal," "higher than normal," "normal," "lower than normal," or "much lower than normal." Underestimation errors occurred when children who were actually overweight, obese, or normal weight were perceived by their mothers as having "normal," "lower than normal," or "much lower than normal" body weight, respectively.

Associations with overweight and obesity were assessed using univariate and multivariate logistic regression analyses via the estimation of crude and adjusted odds ratios (OR), respectively, and 95% confidence intervals (CI). To evaluate any possible interaction effect between the factors under investigation, two-way interaction terms were tested using the likelihood ratio test. However, no interaction term was found to be significant. Finally, univariate logistic regression analyses were done to examine the associations between maternal underestimation of children's weight status (dependent variable) and each factor that was significantly related to childhood overweight and obesity (independent variables). All reported *P* values were based on 2-sided tests and compared to a significance level of 5%. All statistical analyses were conducted with the SPSS 13.0 (2004, SPSS Inc, Chicago, IL).

RESULTS AND DISCUSSION

The prevalence of overweight and obesity observed in the present study was 17.5% and 16.2%, respectively. These rates reveal that preschool obesity in Greece is among the highest in the world, comparable or even higher to the United States, where the rates reported for preschool population range from 11.6% at 6 to 23 months to 12.4% at 2 to 5 years of age (30,31). However, none of the public health initiatives attempted so far has prevented the problem from expanding; in both countries childhood overweight has doubled during the previous 2 decades (32,33).

In sight of these unfavorable trends and bearing in mind that environmental factors seem to increase the risk of obesity in later life (34), the current study identified several perinatal, parental, and lifestyle determinants of childhood overweight and obesity. More specifically the univariate logistic regression analyses (ie, crude OR in Table 1) showed that rapid infancy weight gain,

Author's personal copy

Table 1. Likelihood for being overweight[a] and obese[b] for preschool children in day-care centers in Greece (n=2,317)

	Overweight[a]		Obese[b]	
	Crude OR[c] (95% CI[d])	Adjusted[e] OR (95% CI)	Crude OR (95% CI)	Adjusted[e] OR (95% CI)
Independent variables				
Age (mo)	1.00 (0.99-1.02)	0.99 (0.98-1.01)	1.02 (1.01-1.03)*	1.03 (1.02-1.05)*
Maternal education (y)	0.99 (0.95-1.03)	0.99 (0.93-1.06)	0.96 (0.92-0.99)*	0.97 (0.91-1.04)
Paternal education (y)	0.99 (0.96-1.03)	0.99 (0.94-1.05)	0.97 (0.94-0.99)*	0.98 (0.92-1.04)
Maternal BMI[f]	1.02 (0.99-1.05)	1.03 (0.99-1.08)	1.05 (1.02-1.08)*	1.03 (1.01-1.07)*
Paternal BMI	1.05 (1.01-1.09)*	1.05 (0.99-1.10)	1.12 (1.09-1.16)*	1.15 (1.10-1.20)*
Daily energy intake (% of EER[g])	1.03 (1.01-1.05)*	1.00 (0.98-1.03)	1.005 (1.001-1.009)*	1.003 (0.995-1.010)
Maternal smoking during pregnancy				
Not smoking	Referent	Referent	Referent	Referent
Passive smoking	0.97 (0.72-1.31)	0.91 (0.62-1.32)	1.09 (0.81-1.46)	0.88 (0.59-1.31)
Active smoking	1.24 (0.91-1.68)	1.42 (0.96-2.10)	1.31 (1.11-1.76)*	1.44 (0.96-2.15)
Birth weight-for-gestational age				
Appropriate (10th-89th percentile)	Referent	Referent	Referent	Referent
Small (<10th percentile)	0.70 (0.46-1.07)	0.57 (0.32-1.02)	0.45 (0.27-0.75)*	0.60 (0.33-1.10)
Large (>90th percentile)	0.86 (0.51-1.45)	0.91 (0.49-1.68)	1.29 (0.83-1.99)	1.37 (0.77-2.43)
Weight gain in the first 6 months				
Average (−1 to +1 *z*-score difference)	Referent	Referent	Referent	Referent
Poor (<−1 *z*-score difference)	0.88 (0.58-1.34)	0.88 (0.54-1.43)	1.03 (0.70-1.52)	0.87 (0.55-1.39)
Rapid (>+1 *z*-score difference)	2.48 (1.84-3.34)*	2.55 (1.81-3.61)*	2.09 (1.56-2.79)*	1.88 (1.32-2.68)*
Time spent in light to vigorous physical activities				
<3 h/wk	Referent	Referent	Referent	Referent
≥3 h/wk	0.81 (0.57-1.15)	0.83 (0.54-1.30)	0.72 (0.50-0.93)*	0.50 (0.30-0.85)*

[a]Overweight category includes children 2 to 5 years old with BMI-for-age ≥85th and <95th percentile.
[b]Obesity category includes children age 1 to 2 years and 2 to 5 years with weight-for-length and BMI-for-age ≥95th percentile, respectively (23,42).
[c]OR=odds ratio.
[d]CI=confidence interval.
[e]Adjusted for all independent variables included in the table as well as for sex, region of residence, maternal age at birth, parity, postnatal feeding patterns (ie, breast vs formula vs mixed feeding), and gestational diabetes.
[f]BMI=body mass index.
[g]EER=Estimated Energy Requirement.
*Statistically significant odds ratios ($P \leq 0.05$).

higher paternal BMI, and higher dietary energy intake were the main perinatal, parental, and lifestyle determinants, respectively, of childhood overweight. Regarding determinants of childhood obesity, the univariate logistic regression analyses revealed that maternal smoking during pregnancy, rapid weight gain in infancy, higher parental BMIs, and older age of children were significantly associated with an increased likelihood of childhood obesity. On the contrary, small size at birth, higher parental education, and higher physical activity levels of children (3 or more hours per week) were found to be protective against manifestation of obesity in preschool years.

Still, only certain of the aforementioned univariate associations with overweight and obesity remained statistically significant when multivariate regression analyses were done. Specifically, the multivariate analyses showed that rapid weight gain in the first 6 months of life was the main perinatal determinant of both overweight and obesity (OR: 2.5; 95% CI: 1.8 to 3.6 and OR: 1.9; 95% CI: 1.3 to 2.7, respectively) in preschool years (Table 1). Although significant associations between early weight gain and weight among children from birth through 5 years of age might be expected, a stratified analysis by age group revealed that rapid infancy weight gain was significantly associated with obesity in both the 12- to 36-month and the 37- to 60-month age groups (OR: 1.6; 95% CI: 1.1 to 2.8 and OR: 1.9; 95% CI: 1.3 to 2.5, respectively). This observation indicates that rapid weight gain in infancy is a strong determinant of obesity not only in younger but also in older children. Consistent with these findings, two other studies reported similar significant associations between rapid infancy weight gain and obesity in 4- and 7-year-old children (OR: 1.4; 95% CI: 1.2 to 1.6 and OR: 1.4; 95% CI: 1.3 to 1.4, respectively) (35,36).

Furthermore, the multivariate logistic regression analysis in the present study revealed that each unit increase of maternal and paternal BMI significantly increased the likelihood for childhood obesity by a factor of 1.03 (95% CI: 1.01 to 1.07) and 1.15 (95% CI: 1.10 to 1.20), respectively. Parental overweight could indicate a genetic predisposition toward childhood obesity (37,38). However, it could also indicate that overweight parents are responsible for creating and sustaining an obesogenic home environment that can also negatively affect their young chil-

Author's personal copy

Table 2. Associations between maternal perceptions of their children's weight[a] and determinants of childhood obesity for preschool children in day-care centers in Greece (n=2,317)[b]

Independent variables	Crude OR[c] (95% CI[d])
Age (mo)	1.01 (1.01-1.02)*
Maternal education (y)	0.96 (0.93-0.99)*
Maternal BMI[e]	1.04 (1.02-1.09)*
Daily energy intake (% of EER[f])	1.006 (1.002-1.011)*
Maternal smoking during pregnancy	
Not smoking	Referent
Passive smoking	0.98 (0.76-1.26)
Active smoking	1.07 (0.84-1.38)
Birth weight for gestational age	
Appropriate (10th-89th percentile)	Referent
Small (<10th percentile)	0.59 (0.42-0.83)*
Large (>90th percentile)	0.97 (0.67-1.40)
Weight gain in the first 6 months	
Average (−1 to +1 *z*-score difference)	Referent
Poor (<−1 *z*-score difference)	1.12 (0.83-1.51)
Rapid (>+1 *z*-score difference)	1.53 (1.21-1.93)*
Time spent in light to vigorous physical activity	
<3 h/wk	Referent
≥3 hr/wk	0.72 (0.55-0.96)*

[a]Dependent variable: Underestimation of children's weight.
[b]Adjustments were made for sex, region of residence, and paternal education.
[c]OR=odds ratio.
[d]CI=confidence interval.
[e]BMI=body mass index.
[f]EER=Estimated Energy Requirement.
*Statistically significant odds ratios ($P \leq 0.05$).

dren (39,40). Furthermore, it has been reported that preschool children of obese parents show an increased preference for energy-dense foods (41). Even so, the present study showed that physical activity level was a stronger correlate of childhood obesity than was dietary energy intake; the multivariate regression analysis highlighted time children were engaged in light to vigorous physical activities as the only lifestyle/behavioral factor that was significantly associated with childhood obesity.

According to the findings presented in Table 2, children who were more likely to have their current weight status underestimated by their mothers (35.9% of children) were those with higher dietary energy intakes, those with a rapid infancy weight gain, and those born to mothers with higher BMIs and lower educational levels. However, children born small-for-gestational age and those engaged in light to vigorous physical activities for more than 3 hours per week were less likely to have their body weight underestimated by their mothers. These findings suggest that overweight and less-educated mothers may be more reluctant to admit that their children are overweight or could be unable to understand the meaning of overweight (42). Alternatively, overweight and less-educated mothers may also believe that young children may outgrow their weight problem or that being overfat is "healthy" (43). This could possibly provide an explanation for the current study's observation of a direct association between rapid weight gain in infancy and the increased likelihood of maternal underestimation of their children's weight status. Data from previous studies suggested that mothers who perceived their infants as small were more likely to feed them with formula, nonmilk liquids, and solid foods earlier and more frequently than usual (44).

The current work had certain limitations. First, a cause-and-effect relationship could not be identified because of the cross-sectional design of the study. Moreover, parental anthropometric data (ie, weight and height) were self-reported and children's perinatal data were collected retrospectively by asking parents and by using pediatric medical records. Finally, the estimation of dietary intake and physical activity levels can be a source of bias not only in the present study but in all studies that attempt to collect data on behavioral indexes. Nonetheless, the methodological aspects of the current work suggest enhanced reliability of the diet and physical activity data (ie, combination of weighed food records and 24-hour recall, and the use of a valid physical activity questionnaire).

CONCLUSION

The current study showed that rapid weight gain during infancy, children's lower physical activity levels, and higher parental BMIs were the most important factors that significantly increased the likelihood for obesity in preschool children. In addition, among all determinants of early childhood overweight and obesity presented in Table 1, specific maternal characteristics (ie, higher BMI, lower educational level), children's behaviors leading to a positive energy balance (ie, higher energy intake and lower levels of physical activity), and rapid weight gain in infancy were found to be associated with an increased likelihood of maternal underestimation of their children's weight status. These findings have important public health implications, given that maternal perception might be an indirect determinant of their children's body weight (45). Although perceptions are strongly influenced by culture, the fact that we live in an era of globalization makes the findings of the present study relevant to public health experts who deal with childhood obesity in almost all developed countries worldwide. The current findings might be even more relevant to minority groups and populations of lower socioeconomic level living in developed countries, for whom insufficient health knowledge makes the risk of body weight underestimation even greater.

Thus, before designing and implementing any obesity prevention program, future research should also focus on detecting mothers who are more likely to misperceive their children's weight status. Educating these mothers to correctly classify their children's weight status might be a key factor for the implementation of successful childhood obesity prevention policy.

STATEMENT OF POTENTIAL CONFLICT OF INTEREST: Y. Manios also works as a science and nutrition consultant for Friesland Hellas. The study sponsor had no role in the study design; the collection, analysis, or interpretation of the data; the writing of the manuscript; or the submission and revision of the paper. None of the other authors have any potential conflict of interest.

FUNDING/SUPPORT: The study was supported by a research grant from Friesland Hellas.

Author's personal copy

ACKNOWLEDGEMENTS: The authors thank Evdokia Oikonomou, Vivian Detopoulou, Aikaterini Kondaki, Christine Kortsalioudaki, Elina Ioannou, Margarita Bartsota, Elina Dimitropoulou, Nikoleta Vidra, Theodoros Athanasoulis, Pari Christofidou, Lilia Charila, Sofia Tzitzirika, and Christos Vassilopoulos for their contribution to the completion of the study.

References

1. Caprio S, Genel M. Confronting the epidemic of childhood obesity. *Pediatrics*. 2005;115:494-495.
2. Hales CN, Barker DJ. The thrifty phenotype hypothesis. *Br Med Bull*. 2001;60:5-20.
3. Lucas A. Programming by early nutrition: An experimental approach. *J Nutr*. 1998;128(suppl):S401-S406.
4. Power C, Jefferis BJ. Fetal environment and subsequent obesity: A study of maternal smoking. *Int J Epidemiol*. 2002;31:413-419.
5. Langer O, Yogev Y, Most O, Xenakis EM. Gestational diabetes: The consequences of not treating. *Am J Obstet Gynecol*. 2005;192:989-997.
6. Sorensen HT, Sabroe S, Rothman KJ, Gillman M, Fischer P, Sorensen TI. Relation between weight and length at birth and body mass index in young adulthood: Cohort study. *BMJ*. 1997;315:1137.
7. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity—A systematic review. *Int J Obes Relat Metab Disord*. 2004;28:1247-1256.
8. Ong KK, Ahmed ML, Emmett PM, Preece MA, Dunger DB. Association between postnatal catch-up growth and obesity in childhood: Prospective cohort study. *BMJ*. 2000;320:967-971.
9. Davison KK, Birch LL. Childhood overweight: A contextual model and recommendations for future research. *Obes Rev*. 2001;2:159-171.
10. Eckstein KC, Mikhail LM, Ariza AJ, Thomson JS, Millard SC, Binns HJ. Parents' perceptions of their child's weight and health. *Pediatrics*. 2006;117:681-690.
11. Huang JS, Becerra K, Oda T, Walker E, Xu R, Donohue M, Chen I, Curbelo V, Breslow A. Parental ability to discriminate the weight status of children: Results of a survey. *Pediatrics*. 2007;120:e112-e119.
12. Genovesi S, Giussani M, Faini A, Vigorita F, Pieruzzi F, Strepparava MG, Stella A, Valsecchi MG. Maternal perception of excess weight in children: A survey conducted by paediatricians in the province of Milan. *Acta Paediatr*. 2005;94:747-752.
13. Harnack L, Lytle L, Himes JH, Story M, Taylor G, Bishop D. Low awareness of overweight status among parents of preschool-aged children, Minnesota, 2004-2005. *Prev Chronic Dis*. 2009;6:A47.
14. Jansen W, Brug J. Parents often do not recognize overweight in their child, regardless of their socio-demographic background. *Eur J Public Health*. 2006;16:645-647.
15. Jeffery AN, Voss LD, Metcalf BS, Alba S, Wilkin TJ. Parents' awareness of overweight in themselves and their children: cross sectional study within a cohort (EarlyBird 21). *BMJ*. 2005;330:23-24.
16. Manios Y, Kondaki K, Kourlaba G, Vasilopoulou E, Grammatikaki E. Maternal perceptions of their child's weight status: The GENESIS study. *Public Health Nutr*. 2009;12:1099-1105.
17. Maynard LM, Galuska DA, Blanck HM, Serdula MK. Maternal perceptions of weight status of children. *Pediatrics*. 2003;111:1226-1231.
18. Muhammad NA, Omar K, Shah SA, Muthupalaniappen LA, Arshad F. Parental perception of their children's weight status, and its association with their nutrition and obesity knowledge. *Asia Pac J Clin Nutr*. 2008;17:597-602.
19. Rhee KE, De Lago CW, Arscott-Mills T, Mehta SD, Davis RK. Factors associated with parental readiness to make changes for overweight children. *Pediatrics*. 2005;116:e94-e101.
20. Tschamler JM, Conn KM, Cook SR, Halterman JS. Underestimation of children's weight status: Views of parents in an urban community. *Clin Pediatr*. 2010;49:470-476.
21. Warschburger P, Kroller K. Maternal perception of weight status and health risks associated with obesity in children. *Pediatrics*. 2009;124:e60-e68.
22. Manios Y. Design and descriptive results of the "Growth, Exercise and Nutrition Epidemiological Study In preSchoolers": The GENESIS study. *BMC Public Health*. 2006;6:32.
23. EpiInfo-Database and Statistics Software for Public Health Professionals. Atlanta, GA: Division of Public Health Surveillance, Centers for Disease Control and Prevention; 2008.
24. CDC Growth Charts 2000. National Center for Health Statistics and the National Center for Chronic Disease Prevention and Health Promotion. Centers for Disease Control and Prevention Web site. http://www.cdc.gov/GrowthCharts/. Accessed July 1, 2009.
25. Food composition tables. University of Crete Web site. http://nutrition.med.uoc.gr/GreekTables/. Accessed July 1, 2009.
26. Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA, Prentice AM. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. *Eur J Clin Nutr*. 1991;45:569-581.
27. Torun B, Davies PS, Livingstone MB, Paolisso M, Sackett R, Spurr GB. Energy requirements and dietary energy recommendations for children and adolescents 1 to 18 years old. *Eur J Clin Nutr*. 1996; 50(suppl 1):S37-S80; discussion S80-S81.
28. Manios Y, Kafatos A, Markakis G. Physical activity in 6-year-old children: Validation of two proxy reports. *Pediatr Exerc Sci*. 1998;10: 176-188.
29. World Health Organization. Indicators for Assessing Breastfeeding Practices. Geneva, Switzerland: World Health Organization; 1991.
30. International Obesity Task Force Prevalence Data. Global childhood overweight. International Obesity Task Force Web site. http://www.iotf.org/database/index.asp. Accessed July 5, 2009.
31. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003-2006. *JAMA*. 2008;299: 2401-2405.
32. Magkos F, Manios Y, Christakis G, Kafatos AG. Secular trends in cardiovascular risk factors among school-aged boys from Crete, Greece, 1982-2002. *Eur J Clin Nutr*. 2005;59:1-7.
33. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA*. 2002;288:1728-1732.
34. Koletzko B, Girardet JP, Klish W, Tabacco O. Obesity in children and adolescents worldwide: Current views and future directions—Working Group Report of the First World Congress of Pediatric Gastroenterology, Hepatology, and Nutrition. *J Pediatr Gastroenterol Nutr*. 2002;35(suppl 2):S205-S212.
35. Dennison BA, Edmunds LS, Stratton HH, Pruzek RM. Rapid infant weight gain predicts childhood overweight. *Obesity (Silver Spring)*. 2006;14:491-499.
36. Stettler N, Zemel BS, Kumanyika S, Stallings VA. Infant weight gain and childhood overweight status in a multicenter, cohort study. *Pediatrics*. 2002;109:194-199.
37. Locard E, Mamelle N, Billette A, Miginiac M, Munoz F, Rey S. Risk factors of obesity in a five year old population. Parental versus environmental factors. *Int J Obes Relat Metab Disord*. 1992;16:721-729.
38. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med*. 1997;337:869-873.
39. Campbell KJ, Crawford DA, Ball K. Family food environment and dietary behaviors likely to promote fatness in 5-6 year-old children. *Int J Obes (Lond)*. 2006;30:1272-1280.
40. Dubois L, Girard M. Early determinants of overweight at 4.5 years in a population-based longitudinal study. *Int J Obes (Lond)*. 2006;30: 610-617.
41. Fisher JO, Birch LL. Fat preferences and fat consumption of 3- to 5-year-old children are related to parental adiposity. *J Am Diet Assoc*. 1995;95:759-764.
42. Baughcum AE, Chamberlin LA, Deeks CM, Powers SW, Whitaker RC. Maternal perceptions of overweight preschool children. *Pediatrics*. 2000;106:1380-1386.
43. Baughcum AE, Burklow KA, Deeks CM, Powers SW, Whitaker RC. Maternal feeding practices and childhood obesity: A focus group study of low-income mothers. *Arch Pediatr Adolesc Med*. 1998;152:1010-1014.
44. Boyington JA, Johnson AA. Maternal perception of body size as a determinant of infant adiposity in an African-American community. *J Natl Med Assoc*. 2004;96:351-362.
45. Kroke A, Strathmann S, Gunther A. Maternal perceptions of her child's body weight in infancy and early childhood and their relation to body weight status at age 7. *Eur J Pediatr*. 2006;165:875-883.