The Journal of the Oklahoma State Medical Association

SCIENTIFIC

# Early Childhood Nutrition in an American Indian Community: Educational Strategy for Obesity Prevention

Heather Hoffhines, MS, RD/LD; Kelleigh Dean Whaley, MS, RD/LD; Piers R Blackett, MB, ChB FAAP, FNLA; Karen Palumbo, M.Ed; Dana Campbell-Sternloff; Stephen Glore, PhD; Elisa T Lee, PhD

**ABSTRACT**

Prevailing infant and toddler feeding practices in an American Indian community were assessed to explore the feasibility of improvement by implementation of a maternal education program. A survey of prevailing nutritional practice was the basis for design of an instruction program on infant nutrition for mothers during pregnancy. Follow-up assessments provided information on feasibility, and requirements for an effective program. Failure to sustain breast-feeding, low fruit and vegetable intake, low fiber intake, consumption of sweetened beverages, low milk consumption and low vitamin D intake were identified as persisting problems. We conclude that infant and toddler feeding practices are comparable to national trends, but suboptimal and conducive to promoting early obesity and diabetes in a susceptible community. A successful education-based intervention strategy beginning in pregnancy appears feasible if psychosocial, environmental, and economic barriers can be addressed.

**INTRODUCTION**

High prevalence of obesity has been observed among the American Indian populations, even at ages 2 to 4 years of age, since 12 percent of this age group were found to be between the 85th and 95th percentiles.[1] At ages 5 and 6 years, children were more than twice as likely to be above the 95th percentile than U.S. children,[2] and 48.9 percent of 7-year-old school children in predominantly Indian schools were above the 85th percentile.[3] The associated increase in incidence of obesity and diabetes in children and adolescents,[4,5] especially in the American Indian population including school-age populations,[6] is indication for assessment of causative factors and planning corresponding prospective intervention.

The study provided the potential to reduce the high prevalence of diabetes through intervention. Previous observation of a high prevalence of obesity and dyslipidemia in school-age children,[7] supported the idea that it would be informative to conduct a nutritional assessment to serve as a basis for determining prevailing nutritional practices and to use the information to plan and test the effect of maternal education beginning in pregnancy.

Correspondence to: Piers R Blackett MB ChB FAAP, FNLA, University of Oklahoma Health Sciences Center, Oklahoma City, OK 73104, Oklahoma City Oklahoma 73104. Telephone: 405 271 6764, Fax: 405 271 3093, E-mail: piers-blackett@ouhsc.edu

**METHODS**

The surveyed population included toddlers aged 12 to 36 months visiting pediatric local clinics for minor illnesses or routine health evaluations. Toddlers with tribal affiliation aged 12 to 36 months, including siblings, were eligible for recruitment. Recruitment at the health facilities continued until the study included 100 participants. Subsequently six toddlers who had eaten at least one meal a day at a daycare institution were excluded resulting in a final number of 94 participants. All participants received verbal and written information about the study, understood that study participation was voluntary, and were assured of their confidentiality. Each parent or caregiver gave informed consent approved by the Institutional Review Boards of the University of Oklahoma Health Sciences Center and the Oklahoma City Area Indian Health Service and the participating tribes represented by the Southwest Intertribal Health Board. The study was conducted from 2006-2008.

The survey was based on methods used by the national Feeding in Infants and Toddlers Study (FITS Mathematica Policy Research Inc.).[8,9] Nutrient analysis software (FoodWorks, The Nutrition Company, Long Valley, NJ) was used to analyze the 24-hour dietary recalls, and has a comprehensive food and nutrient database including known micro- and macronutrients. In addition, manual analyses of the types and quantities of foods eaten were performed for comparison with the most recent national data. For toddlers who consumed both breast milk and other forms of milk, the amount of other forms of milk was subtracted from 600 milliliters to estimate the quantity of breast milk consumed.[10] The amounts of food reported for the 24-hour dietary recall were approximate estimates from the interviewees and possible variability of recall among individuals was recognized.

**Description of Intervention:**

The study coordinator, a certified lactation specialist, conducted a class for the pregnant mothers covering the benefits of breast-feeding, common breastfeeding myths and problem-solving, latching techniques, breast-feeding positions, use of breast pumps (provided free of charge) and healthy feeding practices for toddlers. The infants were seen with their mothers for educational follow-up and support at 2 weeks, 6 weeks, 4 months, 6 months, 9 months, 12 months, 15 months, 18 months and 24 months and mothers were provided with nutritional guidance at the visits.

**Maternal Demographics:**

The recruited mothers ranged in age from 13 to 39 years (13-18 years 18%, 19-24 years 40%, 25-30 years 23%, 31-35 years 13% and 36-39 years 5%). 40% of the mothers were married and 60% were unmarried. Maternal education assessment showed that 13% had graduated from college, 21% had post-secondary education, 42% graduated from High School and 25% had attained the 11th grade or less. Yearly household dollar income assessment showed that 41% earned < $10,000, 14% $10,000-14,999, 17% $15,000-24,999, 8% $25,000-34,999, 8% $35,000-$49,999, 8% $50,000-74,999, 1% $75,000-99,999, 3% > $100,000. The distribution of maternal BMI by age was 2% < 18.5, 40% 18.5-24.9, 22% 25-29.9, 30% >30.

## RESULTS

**Breastfeeding:**

The breastfeeding initiation rate was 59%, lower than the Healthy People 2010 goal of 75%. The breastfeeding duration rate was 23% at 6 months and 13% at 12 months. According to the FITS data, the national breastfeeding duration rates at 6 and 12 months are 43% and 7%, respectively; whereas the Healthy People 2010 goal for the United States is 50% and 25% at 6 and 12 months.

The breast-feeding initiation rate was successfully increased to 89% in the intervention group compared to the prevailing rate of 59%. However, it was sustained in only 35% at 6 months and 12% at 12 months. The national Healthy People 2010 goals for population breastfeeding rates are >75% for initiation, >50% at 6 months and >25% at 12 months; thus we exceeded the goal for initiation but not for continuation at 6 and 12 months. Furthermore, there were higher prevailing rates at 6 and 12 months in the survey, an observation which we attribute to strong advocacy for breastfeeding by medical staff at regional health facilities at the time of delivery.

Reasons for early breastfeeding termination were attributed to lack of social support (15%), low milk flow (14%), latching problems (10%), work or school-related issues (4%), choosing not to breast-feed (4%) and a medical condition (2%). The remaining reasons were categorized as other (10%) and no response (40%).

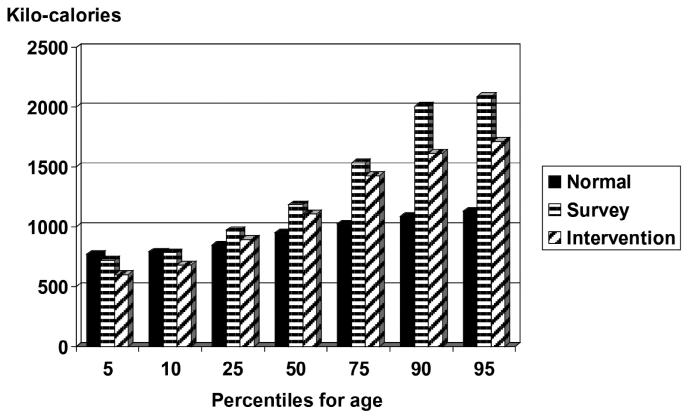
**Estimated Energy Requirements (EER):**

The distribution of the toddlers' 24-hour caloric intake for age was compared to the distribution of the normal or estimated energy requirements for their respective percentiles, each matched individually for age **(Figure 1)**.

The 5th percentile of energy intake was lower than the 5th percentile of EERs, 721 kcal and 768 kcal respectively. This is also true for the 10th percentile, but the caloric intake is more comparable to normal. However, for the 25th percentile to the 95th percentiles, the caloric intake of the toddlers is above that of the EERs. The mean toddler caloric intake was 1305 kcal in the survey and 1176.6 in the intervention cohort compared to the mean EER of 945 kcal. This is a significant excess in the amount of calories needed for normal weight gain and growth.

The maternal education program was not successful in substantially changing the EER. The mean and median EER values were less than those for the surveyed toddlers representing the prevailing intake **(Figure 1)**, indicating partial success of the intervention, however the values were still higher than the EER for age.

**Figure 1. Normal Estimated Energy Requirements matched individually with Energy Intakes of Intervention and Survey groups aged 12 to 36 months for their respective percentiles for age-appropriate energy intake.**




**Carbohydrate:**

The cohort and survey groups exceeded the estimated average requirement (EAR) for carbohydrate by 66.8 and 51.2 grams, and by 36.8 and 32.8 grams for protein. Sweetened beverages were the most commonly consumed sweet/dessert of the toddler sample. Among 12 to 14 month-olds, 40% consumed cake, pie, cookies, or pastry at least once in the 24-hour period. Among toddlers aged 19 to 24 months, 70% consumed some kind of sweetened beverage, 30% consumed a carbonated beverage, and 19% consumed some type of candy. Among toddlers aged 25 to 29 months, 43% consumed at least one salty snack, 86% consumed at least one sweetened beverage, and 43% consumed at least one type of dessert or candy in the 24-hour period. The majority of toddlers from every age group consumed at least one dessert or sweetened beverage in the 24-hour period. Baby food desserts were only eaten by a small percentage of 12 to 18 month-olds. Food choices high in sugar persisted despite education.

**Fiber:**

Fiber intake was much less than the recommended intake in the survey group and failed to improve with intervention. Adequate intake (AI) is used as a reference in place of EAR for fiber because there is no EAR value for dietary fiber. The American Indian toddlers consumed 42% of that recommended. This observation has previously been observed in the national

sample of toddlers who consumed 44% of that recommended. The fiber content was 38% of recommended compared to 42% in the survey.

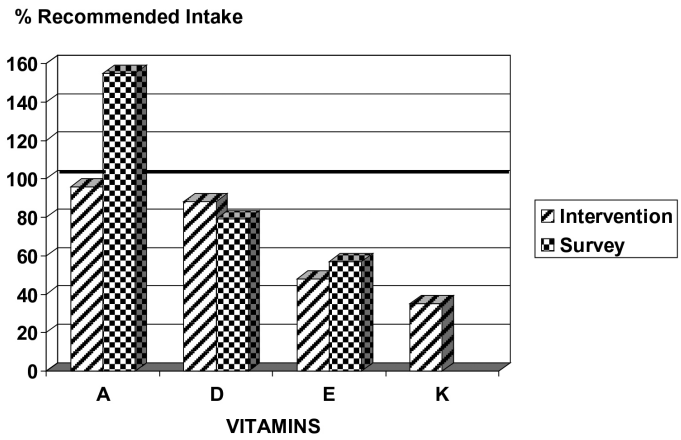
**Fat:**

High fat meat products such as bacon, hot dogs, sausage and bologna were frequent items of choice. 60% of 15 to 18 month old toddlers, 56% of 19 to 24 month olds, and 36% of 12-14 month olds consumed one of these products at least once during the day of recall. There were 20 servings of fried foods in the 12 to 14 month old toddlers, 80 in the 15 to 18 month olds, and 26 in the 19 to 24 month olds. The choices often appeared to be selected for their convenience and low cost, which we perceived as the most significant barriers to education.

**Fat Soluble Vitamins (Figure 2):**

The fat soluble vitamin intake in surveyed control and intervention groups were adequate for vitamin A (96% and 155% of the dietary recommended intake), but were notably higher in the national Feeding in Infants and Toddlers survey (330.5%). Deficiency was notable for vitamin D (88% and 79% of recommended) compared to 174% in the national survey. Vitamin E intake was also low; 48% and 56.8% of recommended compared to 100% in the national survey. Vitamin K was only 35% of recommended in the intervention but was not assessed in the survey.

**Figure 1. Percent of the daily recommended intake for the fat soluble vitamins, A,D,E and K in the intervention and non-intervention groups.**




**Vitamins B and C:**

Both groups consumed well over the dietary recommended intake for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12 and vitamin C.

**Minerals:**

The survey and intervention groups exceeded the dietary recommended intakes for iron (332 & 160%), zinc (251 & 220%), calcium (130 & 133%), phosphorus (223 & 180%), and magnesium (218 & 173%) respectively.

## DISCUSSION

The concept of conducting a pilot study for assessing and improving infant and toddler nutrition practices, with the goal of offsetting the onset of obesity and subsequent diabetes was supported by abundant information that American Indians including mothers and their offspring are known to be susceptible to type 2 diabetes and cardiovascular disease. More recently this has been emphasized by data from the Strong Heart Study.[11,12]

The developing hypothesis that obesity and subsequent insulin resistance may begin by programming metabolic processes at vulnerable periods during gestation and early childhood,[13] provided rationale for early reversal of risk. However, the sample population of infants and toddlers did not appear to have been exposed to gestational diabetes, a known primer;[14] possibly because the young maternal average age of the participants, which generally precedes the age at which they are likely to develop gestational diabetes or overt type 2 diabetes. However, we did observe significant problems with attaining optimal infant and toddler nutritional standards, despite educational intervention beginning in pregnancy and follow up education during the first two years of life.

A major emphasis of the intervention was to evaluate, initiate, sustain and improve breast-feeding during the first year based on supportive evidence that breast-feeding, in addition to other benefits such as increased infant immunity, maternal-infant bonding, and protection against maternal estrogen-related cancers,[15] may offset obesity in childhood[16] and diabetes in adults.[17] We were able to improve the prevailing breastfeeding initiation rate to above the Centers of Disease Control Healthy People Goal of 75%, however, mothers frequently found it difficult to sustain breast feeding during the first year. We attribute slightly better continuation rates prevailing in the community before than during the intervention, to concerted advocacy for breastfeeding by the local medical staff. However, significant barriers included young maternal age and lack of resources for lactation education and maternal support during breast-feeding continuation. Since classic reasons were given for early discontinuation, they could potentially be remediable by education and increasing availability of social support and trained personnel with sensitivity to the needs for optimizing infant nutrition over the long term.

Our evaluation of prevailing infant feeding practice revealed excessive 24-hour caloric intake and nutrient composition consisting of a high proportion of energy-dense foods, which unfortunately is likely to offset any effects of breastfeeding on preventing obesity. Daily food consumption exceeded the estimated energy requirement for age, as has been described previously in the national Feeding in Infants and Toddlers Survey.[18] Nutrient analysis attributed the excess calories mainly to the large amounts of sweetened beverages and refined carbohydrates. However, energy consumption in the Feeding in Infants and Toddlers Survey showed similar

excess energy intake[18] indicating the problem is pervasive in the United States and may reflect prevailing available food choices and marketing strategy. Furthermore, corporate vendors in the rural townships of Oklahoma tend to stock and sell the foods most preferred by the local population, which tend to be of low nutritional value. Especially concerning is the number of toddlers consuming sucrose-containing carbonated beverages since they have become associated with obesity in older children.[19] The intake of macronutrients in grams and percentages of total calories was consistently above the recommended amounts and comparable to the national toddlers' intake, indicating again that the problem is pervasive, but particularly relevant for a population at high risk for type 2 diabetes. It is also likely that the food selection for the toddlers shapes long term food preferences for the growing children and adolescents.[8]

The observation that vitamin D consumption is low can be attributed to low milk consumption, and may relate to the over-consumption of concentrated fruit juice and sweetened beverages, a problem nationally,[20] but especially in the American Indian toddlers, because it replaces the needed daily consumption of milk. When combined with a lack of vitamin D and relatively low calcium, bone health could be compromised, particularly if the problem is allowed to persist until adolescence and early adulthood when maximal bone accretion occurs. Also calcium deficiency has been associated with increased lipogenesis[21] potentially leading to obesity, and to type 2 diabetes.[22]

The remarkably low intake of fiber is attributed to the low intake of fruits, vegetables, and whole grains. The American Academy of Pediatrics recommends a toddler diet consisting of adequate fruit, vegetable, meat, and grain intake in order to insure proper nutrition and foster good eating practices at a young age. Furthermore, low fiber intake has been associated with increased risk for type 2 diabetes when associated or substituted with increased intake of rapidly absorbed refined carbohydrates with a low glycemic index.[23,24] It is also possible that dietary fiber lowers inflammatory markers that cause insulin resistance.[25]

American Indian participants in this study originated from Oklahoma which is a predominantly rural state. Thus it is likely that effects are a result of rural living and available dietary options and not selections attributable to being American Indian. We observed that infant and toddler feeding practices were suboptimal when compared to the American Academy of Pediatrics recommendations, the Centers for Disease Control Healthy People 2010 goals, and the national Feeding in Infants and Toddler Survey,[26] indicating that poor feeding practices were found to be pervasive throughout the United States. Also similar to the national survey, predisposition to become overweight was increased in the toddlers since they had known risk factors such as low socioeconomic status, low breastfeeding initiation and duration rates, low milk and vitamin D consumption, high consumption of sweetened beverages, and a high consumption of energy-dense foods.

During the study we identified provision of high quality services by the staff at local offices for the national Special Supplemental Nutritional Program for Women, Infants and Children (WIC) which provides targeted intervention by supplying healthy foods and nutrition education. Since 73.4% and 79% of mothers were WIC recipients in the survey and intervention, it is disappointing that participating mothers were not inclined to follow the WIC recommendations, which have been based on American Academy of Pediatrics guidelines, and our own educational efforts at follow-up study visits were not significantly additive. It is possible that the 2009 WIC package revisions may improve healthy food choices since they have had a positive influence on access.[27] However, socioeconomic factors are likely to have influenced access in our study because we consistently observed problems with transport, daytime family support and prevailing health beliefs, which could in part account for higher obesity rates in American Indian and Hispanic WIC preschool participants documented throughout Oklahoma[28] and may present significant barriers to effective education. We found that the annual household income was less than ten thousand dollars in 38% and more than fifty thousand dollars in only 12% and that the maternal age was often very young; 57% were under age 24 years and 53% were unmarried and often dependent on parents. Participants lived at significant distances from WIC centers and with rising gasoline prices during the study, closer convenience stores provided a logical alternative, since using benefits (food stamps) provided by the Supplemental Nutrition Assistance Program (SNAP) was often an available option. This is a cause for concern since the latter program has permitted purchase of sugar-sweetened beverages.[29] Since corn-syrup and sugar-derived fructose has become a national focus of investigation and intervention owing to its role in the pathogenesis of fatty liver disease and the metabolic syndrome,[30,31] our observations support targeted intervention in "at risk" populations and identification of barriers to effective education on beverage choices.

Maternal nutritional concepts and practice, although partly determined by socioeconomic factors, requires a planned long term approach targeting maternal education. We propose that the immediate focus should be on attainable goals pertaining to improving maternal knowledge and implementation of infant and toddler nutrition. The educational focus should address breastfeeding initiation and continuation, and inappropriate feeding of toddlers with sweetened beverages and energy-dense foods with low fiber content. Increased consumption of fruits, vegetables, and whole grains, as well as milk and vitamin D needs emphasis and appropriate support. However, inherent problems with food availability and purchasing appeared to account for persistence of prevailing feeding practices despite intervention. Although the nutritional excesses and deficits are similar to the findings in the national survey,[32] their detection in toddlers growing up in a diabetes-susceptible community such as the south-western Oklahoma Indian tribes, makes risk identification and effective intervention an urgent priority.

**ACKNOWLEDGEMENTS**

We would like to acknowledge unfailing support of health

workers based at Indian Health facilities. We are grateful to Everett Rhoades MD who provided helpful advice and support throughout the study. The data was collected by Heather Hoffhines and Kelleigh Dean Whaley during preparation for their Master's Theses from 2006-2008. The study was supported by a Native American Center of Excellence in Partnerships for Community Outreach on Health Disparities and Training (EXPORT, 5P20MD000528, National Institutes of Health) grant awarded to Elisa T. Lee PhD.

## REFERENCES


1. Crawford PB, Story M, Wang MC, Ritchie LD, Sabry ZI. Ethnic issues in the epidemiology of childhood obesity. *Pediatr Clin North Am*. Aug 2001;48(4):855-878.
2. Zephier E, Himes JH, Story M. Prevalence of overweight and obesity in American Indian School children and adolescents in the Aberdeen area: a population study. *Int J Obes Relat Metab Disord*. Mar 1999;23 Suppl 2:S28-30.
3. Caballero B, Himes JH, Lohman T, et al. Body composition and overweight prevalence in 1704 schoolchildren from 7 American Indian communities. *Am J Clin Nutr*. Aug 2003;78(2):308-312.
4. Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL. Overweight prevalence and trends for children and adolescents. The National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med*. Oct 1995;149(10):1085-1091.
5. Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. Increased incidence of non-insulin-dependent diabetes mellitus among adolescents. *J Pediatr*. May 1996;128(5 Pt 1):608-615.
6. Fagot-Campagna A, Pettitt DJ, Engelgau MM, et al. Type 2 diabetes among North American children and adolescents: an epidemiologic review and a public health perspective. *J Pediatr*. May 2000;136(5):664-672.
7. Blackett PR, Taylor T, Russell D, Lu M, Fesmire J, Lee ET. Lipoprotein changes in relation to body mass index in Native American adolescents. *Pediatr Res*. Jul 1996;40(1):77-81.
8. Mennella JA, Ziegler P, Briefel R, Novak T. Feeding Infants and Toddlers Study: the types of foods fed to Hispanic infants and toddlers. *J Am Diet Assoc*. Jan 2006;106(1 Suppl 1):S96-106.
9. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding infants and toddlers study: overview of the study design. *J Am Diet Assoc*. Jan 2004;104(1 Suppl 1):s8-13.
10. Heinig MJ, Nommsen LA, Peerson JM, Lonnerdal B, Dewey KG. Energy and protein intakes of breast-fed and formula-fed infants during the first year of life and their association with growth velocity: the DARLING Study. *Am J Clin Nutr*. Aug 1993;58(2):152-161.
11. Howard BV, Lee ET, Cowan LD, et al. Rising tide of cardiovascular disease in American Indians. The Strong Heart Study. *Circulation*. May 11 1999;99(18):2389-2395.
12. Lee ET, Howard BV, Wang W, et al. Prediction of coronary heart disease in a population with high prevalence of diabetes and albuminuria: the Strong Heart Study. *Circulation*. Jun 27 2006;113(25):2897-2905.
13. Armitage JA, Taylor PD, Poston L. Experimental models of developmental programming: consequences of exposure to an energy rich diet during development. *J Physiol*. May 15 2005;565(Pt 1):3-8.
14. Pettitt DJ, Nelson RG, Saad MF, Bennett PH, Knowler WC. Diabetes and obesity in the offspring of Pima Indian women with diabetes during pregnancy. *Diabetes Care*. Jan 1993;16(1):310-314.
15. Meyer R. Infant feed first year. 1: Feeding practices in the first six months of life. *J Fam Health Care*. 2009;19(1):13-16.
16. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity--a systematic review. *Int J Obes Relat Metab Disord*. Oct 2004;28(10):1247-1256.
17. Pettitt DJ, Forman MR, Hanson RL, Knowler WC, Bennett PH. Breastfeeding and incidence of non-insulin-dependent diabetes mellitus in Pima Indians. *Lancet*. Jul 19 1997;350(9072):166-168.
18. Fox MK, Reidy K, Karwe V, Ziegler P. Average portions of foods commonly eaten by infants and toddlers in the United States. *J Am Diet Assoc*. Jan 2006;106(1 Suppl 1):S66-76.
19. Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. Feb 17 2001;357(9255):505-508.
20. Perrine CG, Sharma AJ, Jefferds ME, Serdula MK, Scanlon KS. Adherence to vitamin D recommendations among US infants. *Pediatrics*. Apr 2010;125(4):627-632.
21. Zemel MB. The role of dairy foods in weight management. *J Am Coll Nutr*. Dec 2005;24(6 Suppl):537S-546S.
22. Pittas AG, Lau J, Hu FB, Dawson-Hughes B. The role of vitamin D and calcium in type 2 diabetes. A systematic review and meta-analysis. *J Clin Endocrinol Metab*. Jun 2007;92(6):2017-2029.
23. Hodge AM, English DR, O'Dea K, Giles GG. Glycemic index and dietary fiber and the risk of type 2 diabetes. *Diabetes Care*. Nov 2004;27(11):2701-2706.
24. Schulze MB, Liu S, Rimm EB, Manson JE, Willett WC, Hu FB. Glycemic index, glycemic load, and dietary fiber intake and incidence of type 2 diabetes in younger and middle-aged women. *Am J Clin Nutr*. Aug 2004;80(2):348-356.
25. Wannamethee SG, Whincup PH, Thomas MC, Sattar N. Associations between dietary fiber and inflammation, hepatic function, and risk of type 2 diabetes in older men: potential mechanisms for the benefits of fiber on diabetes risk. *Diabetes Care*. Oct 2009;32(10):1823-1825.
26. Briefel R, Ziegler P, Novak T, Ponza M. Feeding Infants and Toddlers Study: characteristics and usual nutrient intake of Hispanic and non-Hispanic infants and toddlers. *J Am Diet Assoc*. Jan 2006;106(1 Suppl 1):S84-95.
27. Andreyeva T, Luedicke J, Middleton AE, Long MW, Schwartz MB. Positive influence of the revised Special Supplemental Nutrition Program for Women, Infants, and Children food packages on access to healthy foods. *J Acad Nutr Diet*. Jun 2012;112(6):850-858.
28. Weedn AE, Ang SC, Zeman CL, Darden PM. Obesity prevalence in low-income preschool children in oklahoma. *Clin Pediatr (Phila)*. Oct 2012;51(10):917-922.
29. Andreyeva T, Luedicke J, Henderson KE, Tripp AS. Grocery store beverage choices by participants in federal food assistance and nutrition programs. *Am J Prev Med*. Oct 2012;43(4):411-418.
30. Lim JS, Mietus-Snyder M, Valente A, Schwarz JM, Lustig RH. The role of fructose in the pathogenesis of NAFLD and the metabolic syndrome. *Nat Rev Gastroenterol Hepatol*. May 2010;7(5):251-264.
31. Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988-2004. *Pediatrics*. Jun 2008;121(6):e1604-1614.
32. Briefel RR, Reidy K, Karwe V, Devaney B. Feeding infants and toddlers study: Improvements needed in meeting infant feeding recommendations. *J Am Diet Assoc*. Jan 2004;104(1 Suppl 1):s31-37.