Television Watching, Energy Intake, and Obesity in US Children

Results From the Third National Health and Nutrition Examination Survey, 1988-1994

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Objectives: To examine the relationship between television watching, energy intake, physical activity, and obesity status in US boys and girls, aged 8 to 16 years.

Methods: We used a nationally representative cross-sectional survey with an in-person interview and a medical examination, which included measurements of height and weight, daily hours of television watching, weekly participation in physical activity, and a dietary interview. Between 1988 and 1994, the Third National Health and Nutrition Examination Survey collected data on 4069 children. Mexican Americans and non-Hispanic blacks were oversampled to produce reliable estimates for these groups.

Results: The prevalence of obesity is lowest among children watching 1 or fewer hours of television a day, and highest among those watching 4 or more hours of television a day. Girls engaged in less physical activity and consumed fewer joules per day than boys. A higher percentage of non-Hispanic white boys reported participating in physical activity 5 or more times per week than any other race/ethnic and sex group. Television watching was positively associated with obesity among girls, even after controlling for age, race/ethnicity, family income, weekly physical activity, and energy intake.

Conclusions: As the prevalence of overweight increases, the need to reduce sedentary behaviors and to promote a more active lifestyle becomes essential. Clinicians and public health interventionists should encourage active lifestyles to balance the energy intake of children.

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More US adults are overweight now than 20 years ago and the prevalence of overweight among American children and adolescents is also increasing.1-5 Troiano et al3 reported on the trends of overweight status using data from several national cross-sectional surveys of US children. Overweight was defined by age-and sex-specific 85th and 95th percentiles of body mass index (BMI) using data from cycles 2 (1963-1965) and 3 (1966-1970) of the National Health Examination Survey (NHES). Using data from phase 1 (1988-1991) of the Third National Health and Nutrition Examination Survey (NHANES III), they reported that the prevalence of overweight was 22% when defined by the 85th percentile and 11% when defined by the 95th percentile. A subsequent update using the data from both phases of NHANES III (1988-1994) suggested that the increase in overweight prevalence had continued between 1991 and 1994.8

It is clear that obesity is detrimental to the health of adults, and an increasing number of studies show that overweight children are at higher risk of developing dyslipidemia, hypertension, diabetes mellitus, and other weight-related morbidities.7-12 Behavioral, environmental, and social factors in addition to a genetic predisposition may be associated with a child becoming overweight. Other factors associated with childhood obesity include time spent in front of a television or computer monitor, availability of facilities for participation in physical activities, and the opportunities to safely engage in sports, play, and exercise.13-20

Since children are in a continuous state of physical growth, their energy needs in relation to body weight are difficult to study in large epidemiologic studies. Changes in energy intake in 2 large population-based studies show that even though the reported total energy and fat intake has not increased substantially in England or the United States in the last decade, the number of overweight persons has in-
PARTICIPANTS, MATERIALS, AND METHODS

The NHANES III was conducted by the National Centers for Health Statistics of the Centers for Disease Control and Prevention, Atlanta, Ga. This survey, as in previous NHES and NHANES, was designed to provide national reference data for a variety of diseases, chronic conditions, and health indicators of the population of the United States and selected subpopulations. A detailed explanation of NHANES III has been previously described. Briefly, NHANES III is a nationally representative sample of the civilian, noninstitutionalized population of the United States. It oversampled the very young and the very old, blacks, and persons of Mexican ancestry to produce reliable estimates of their health conditions.

The NHANES III consisted of a home interview and a detailed clinical examination conducted in a mobile examination center. Our analytic sample consists of 4069 children, aged 8 to 16 years, who completed the physical activity questionnaire and the body measurement component at the mobile examination center, and who also responded to a home interview. Those children who had a proxy answer to the physical activity and television questions in the mobile examination center were excluded from our analyses (N=9). Interviewing staff consisted of experienced persons, many of whom were of Hispanic origin and/or were bilingual in English and Spanish. All staff attended yearly training sessions to ensure maintenance of effective interviewing and body measurements skills. Information on the respondent’s race and ethnicity was used to classify persons as non-Hispanic white, non-Hispanic black, or Mexican American. Age was defined as the age in years at the time of the household interview.

Participating children were asked: “How many times per week do you play or exercise enough to make you sweat or breathe hard?” These activities did not exclude school-related involvements such as physical education. The interview also included a question on the number of hours of television watched the previous day. We estimated the percentage of children who reported being active most days of the week as children who reported participating in physical activity at least 5 times per week as recommended by the Surgeon General’s Report on Physical Activity and Health. Participants were classified into 7 categories of physical activity from 1 or less time per week to 8 or more times per week.

Assessment of hours of television watched the previous day was obtained during the home interview and again during the mobile examination center visit. These 2 interviews were approximately 1 to 3 weeks apart. Television watching may vary from day to day (2-day agreement: \( \kappa = 0.10 \)). We therefore used the average of the 2-day television-watching recall to estimate the percentage of children watching television for 1 hour or less, 2 hours, 3 hours, 4 hours, and 5 or more hours per day.

Body composition was estimated using BMI, which is calculated as weight in kilograms divided by the square of height in meters, since this is significantly and positively related to percentage of body fat and total body fat in boys and girls. We used data from cycles 2 and 3 from the NHES to establish age- and sex-specific cutoff points for the definition of obesity. Cycle 2 was conducted from 1963 to 1965 and examined children aged 6 to 11 years, while cycle 3 was conducted from 1966 to 1970, and examined adolescents between the ages of 12 and 17 years. These 2 cycles of NHES provide the earliest national data for height and weight between children and adolescents. We defined obesity as the 95th percentile of BMI from data obtained during the NHES (1963-1970), which has a high specificity for excess body fat in children.

As part of the examination, a trained diet technician obtained information on food intake using a 24-hour dietary recall. The dietary interviewers used the Dietary Data Collection system, which is an automated standardized interactive dietary interview and coding system, and was specifically designed for NHANES III by the Minnesota Nutrition Coordinating Center. Participants were asked to report all foods and beverages consumed, excluding plain drinking water, during the previous 24 hours, from midnight to midnight. The food database for this system was linked to the US Department of Agriculture’s (USDA) Survey Nutrition Database and produced total energy intake.

Statistical analyses were carried out using SAS, SUDAAN, and STATA. For NHANES III, sampling weights were calculated taking into account the unequal probability of selection resulting from the cluster design and from planned oversampling of certain subgroups. All analyses incorporated the sampling weights. We used the sysestimation procedure in the STATA software to calculate the prevalence, SEs and 95% confidence intervals, and the PROC RLOGIST from SUDAAN to calculate estimated relative risk and the 95% confidence intervals.

Table 1 presents the cross-sectional prevalence estimates of hours of television watched per day by sex, age, and race/ethnicity among US children. Overall, almost half of US children aged 8 to 16 years watched more than 2 hours of television a day. More boys than girls watched more than 2 hours of television (38% and 48%, respectively). Among race/ethnicity groups, a higher percentage of non-Hispanic black (65%) and Mexican American (53%) children watched television for 3 or more hours than non-Hispanic white children (37%). On the average, 17% of non-Hispanic black children watched 5 hours
or more a day, whereas only 9% of Mexican American and 6% of non-Hispanic white children watched television for 5 or more hours a day.

Table 2 shows the prevalence of obesity, total energy intake, and percentage of time participating most days of the week (≥5 days) in physical activity among US children aged 8 to 16 years, 1988 to 1994.

<table>
<thead>
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<th>Race/ethnicity</th>
<th>Boys' age, y</th>
<th>Girls' age, y</th>
<th>Boys' age, y</th>
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<td>Non-Hispanic whites</td>
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CI indicates confidence interval.
Our findings provide estimates of the distribution of television-watching habits in US children aged 8 to 16 years and how television watching relates to obesity. We found that increased television watching is associated with a higher prevalence of obesity among girls, but not among boys. Children who watched the most number of hours of television a day had the highest prevalence of obesity; this held true after controlling for age, race/ethnicity, and family income (Figure 1) (Table 3).

Boys (12.4%) exhibit a somewhat higher prevalence of obesity than girls (10.9%). More alarming is the fact that the prevalence of obesity has more than doubled in less than 1 generation. Using the age- and sex-specific 95th percentile of BMI as the cutoff point from data collected between 1963 and 1970 NHES, our results indicate prevalence estimates of obesity to be greater than 10%. If in 1963 through 1970, the top 5% were classified as obese, we now have approximately 12% of US children in this category.

We found that energy intake has a tendency to increase with increased television watching, especially when comparing those watching 1 hour or less of television with those watching 5 or more hours a day.

**Table 3** shows the estimated relative risk of obesity by hours of television watching after adjusting for several correlates (eg, age, race/ethnicity, family income, energy intake, physical activity). A higher prevalence of obesity was significantly associated with higher television watching among girls. We found no consistent association between prevalence of obesity and weekly bouts of vigorous physical activity.

**COMMENT**

Our findings provide estimates of the distribution of television-watching habits in US children aged 8 to 16 years and how television watching relates to obesity. We found that increased television watching is associated with a
of the unreliability of these measures.\textsuperscript{31,42} In addition, the ability to accurately measure both physical activity and television-watching habits are influenced by 2 factors. First, how well does self-report of physical activity reflect what children and adolescents are actually performing over the time frame that the question is being asked? Second, can a single report of physical activity accurately represent the usual physical activity patterns of children and adolescents? It may be that multiple days of observation during the year, over several years, are needed to reliably estimate the usual physical activity and television-watching patterns of young children.

Boys reported engaging in more physical activity (66.7% are active \( \geq 5 \text{ d/wk} \)) than girls (46.1% are active \( \geq 5 \text{ d/wk} \)), and they consume more kilojoules (10 506 kJ/d [2511 kcal/d]) than girls (7945 kJ/d [1899 kcal/d]).Boys and girls may be different in how they deal with weight gain. For example, we found more girls than boys, aged 12 to 16 years, reporting that they had attempted to lose weight in the past 12 months (22.6% and 9.9%, respectively). Our findings are similar to those of Steen et al,\textsuperscript{33} who found that the prevalence of overweight was not substantially different between boys and girls. Other researchers have also found that despite the high prevalence of obesity in boys, few of them reported trying to lose weight.\textsuperscript{34-36} The boys perceived themselves as significantly less overweight and were happier with their “looks” than girls. Also, girls seem to be less likely to think of themselves as exercisers. More research is needed to understand how weight loss practices and body image perceptions are related to energy intake, television watching, and physical activity in boys and girls.

Previous studies have found an indirect association between these 2 behaviors (physical activity and television watching). DuRant et al\textsuperscript{42} assessed television watching and physical activity by direct quantitative observation and its association with body composition in 5- to 6-year-old children. As expected, children were less active during their longest bout of television watching, while physical activity increased in periods of low television watching. Correspondingly, the authors concluded that children engage in more physical activity when they are not watching television. We conducted a regression analysis to examine the relationship between daily hours of television watching and weekly bouts of physical activity. We found an inverse association between television watching and physical activity for both boys (\( \beta \) coefficient, \( -0.06; P = .02 \)) and girls (\( \beta \) coefficient, \( -0.075; P = .01 \)). Although small, this correlation has been confirmed in other validity studies among children.\textsuperscript{37}

Our study is also limited to television watching and does not include time spent on the computer. More research is needed to develop better tools to assess physical activity and to assess time spent on the computer or playing computer games in addition to just watching television. Another limitation of our study is that our findings are cross-sectional and cannot distinguish if high television watching causes obesity or if being obese causes children to watch too much television. Our findings do confirm that the prevalence of obesity has increased since 1963, and that energy intake in conjunction with excess television watching and little physical activity may play a role.

Our results show that the prevalence of obesity is greater among children who watch 4 or more hours of television a day. Our findings also show that girls report engaging in less physical activity than boys, and provide support for a major national campaign to promote reductions in sedentary behavior, such as television watching, and to increase the opportunities for both boys and girls to participate in lifetime physical activities. Sound dietary practices and reductions in sedentary behavior may help in preventing further increases in the prevalence of obesity of US children.

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REFERENCES