Sports Participation and Child Overweight: 1997-2002

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Introduction

Child obesity has become an increasingly important public health issue as the percent of children who are overweight has tripled from 30 years ago (Ogden, Flegan, Carroll & Johnson, 2002). While the causes of the marked increase are not fully understood, it is obvious that a higher percentage of American children are consuming more energy (calories) than they need given their current amount of physical exertion. Frequently cited as one of the causes of increased childhood obesity is the broad shift over the last 30 years to more sedentary leisure activities (Popkin, 2001). These include television viewing, playing video games, and using the computer. In addition to a more sedentary lifestyle, the diets of today's children consist of more fast and convenience foods and larger portion sizes, resulting in greater overall energy intake (Harnack, Jeffrey & Boutelle, 2000).

Much of the literature has focused on the increase in children's sedentary activities, particularly television viewing. Overweight children tend to watch more television than their normal weight counterparts, according to many of the studies (Anderson, Crespo & Bartless, 1998; Jeffrey & French, 1998; Wake, Hesketh & Waters, 2003; Janz, et al., 2002; Lowry, Wechsler & Galuska, 2002; Tucker & Bagwell, 1991; Crawford, Jeffrey RW & French SA, 1999; Dietz & Gortmaker, 1985). It is unclear, however, whether increased TV viewing contributes to child overweight or whether overweight children just prefer to watch more television.

Fewer studies have examined aspects of children's physical activity and their relation to child overweight. Sports participation is one extracurricular activity in which children are physically active for sustained periods of time. In general, sports

participation is a positive experience for children and is associated with higher grades in high school and a greater likelihood of completing schooling and attending college later on (Eccles & Barber, 1999). These benefits are particularly strong for low achieving male athletes from blue-collar backgrounds (Eccles & Barber, 1999; Mahoney & Cairns, 1997; Mahoney, 2000). These children also enjoy better health in adulthood such as lower adult obesity and are more physically active as an adult (Alfano, Klesges, Murray, Beech & McClanahan, 2002). As with television viewing, most studies are not able to distinguish whether sports participation is selective for those children who would have done better in adulthood anyway, or whether sports participation actually contributes to the more favorable outcomes for these children. Only a longitudinal analysis that examines changes in children's sports participation and their health can establish whether a causal relationship exists.

Using information from the 1997 Child Development Supplement and its 2002 follow-up, this study will examine whether participation in sports has a protective effect against child overweight as children enter their adolescent and teenaged years. Are children who participate in sports in middle childhood less likely to become overweight as they grow older compared with children who never participated in sports or stop participating as they get older? Using multivariate analysis, data on children 6-12 years in the 1997 CDS are combined with follow-up data in the 2002 CDS to examine this question. Also included in the analysis is health information on the parents of the child from the 1999 PSID.

Background and Theoretical Considerations

We first examine individual, family, and community factors associated with children's sports participation. We then discuss how these and other factors are linked to overweight and BMI.

Factors Influencing Children's Sports Participation

Whether children are likely to participate in sports is linked to physical development and gender (Sallis, Prochaska & Taylor, 2000). First of all, there is typically a decline in physical activity as children move from middle childhood into adolescence. This may result both from increased barriers to physical activity and the increased alternatives available as children mature. One study found that between ages 9-10 and 18-19, girls' activity levels measured by an activity diary dropped 35% (Kimm, et al., 2000). In a focus group of adolescent boys, the competing demands of homework, part time jobs, relationship and family responsibilities were listed as barriers to physical activity (Allison, et al., 2005). We expect sports participation to decline as a natural result of this activity decline and as a result of increasing specialization and selectivity of sports participation by skill as children grow older. Thus activity levels will be associated with age. Second, although participation of girls has risen dramatically as a result of Title IX legislation equalizing cross-gender opportunities in sports in high school, boys are typically more likely than girls to participate in sports (Hofferth & Sandberg, 2001) and spend more time playing sports. Gender may be a key factor affecting the link between sports and obesity.

Parents play an important role in children's involvement in organized sports. It is argued that children's activity patterns and preferences are shaped within the context of the family. Thus, we expect that children living in a family in which the mother is highly active herself are more likely to develop a preference for being active and more likely to be involved in sports. However, one study found that fathers' (not mothers') explicit modeling of activity was linked to the child's physical activity. Because of the time and expense of extracurricular activities, parents must be involved. Parents can facilitate children's participation by supporting their children's activities financially, by providing transportation, and by accommodating their schedules within the family. A study that examined the physical activity of 9-year old girls found that the girls were more likely to be highly active if at least one of their parents was supportive and even more so if both were (Davison, Cutting & Birch, 2003). It is likely that education is linked to a preference for greater physical activity. Environmental factors such as the safety of the neighborhood as well as the availability of playgrounds, community centers, and playground programs can serve as barriers or facilitators of physical activity (Davison & Birch, 2001). Insofar as parental education affects neighborhood choice, it is likely to be linked to the quality of the local environment for facilitating physical activity.

Physical Activity and Child Overweight

Research clearly shows that physical activity and exercise are associated with lower likelihood of being overweight and with decreased BMI (Goran, Reynolds & Lindquist, 1999; U.S. Department of Health and Human Services, 1996). However, few studies have examined this relationship over time. In the cross-section it is impossible to

identify which comes first, exercise or overweight. Over time children who become overweight will find it more difficult and uncomfortable to exercise, regardless of how they became overweight in the first place, and this will reinforce lower activity. The present study examines overweight and BMI status for adolescents who were interviewed six years earlier. It controls for earlier weight status; thus examines change in overweight status and BMI as a function of change in exercise and other factors.

Other Contextual Conditions and Child Overweight

Other changes may occur over time that would lead to increased overweight. It has been suggested that stressful events may lead to overeating or to less time for exercise and, therefore, to weight gain. For example, the stresses and strains occasioned by marital dissolution or by a remarriage of the mother might lead to children gaining weight. Adding a new brother or sister may also be stressful and contribute to children gaining weight. Having a mother with a high level of education is likely to be protective and to reduce the chance of gaining weight, as better-educated parents are likely to monitor children's eating and exercise habits more closely than less-educated parents. In addition, they are likely to live in a better environment for physical activity.

Methods

The 1997 Child Development Supplement to the Panel Study of Income Dynamics

The study sample was drawn from the 1997 *Child Development Supplement* (CDS) to the *Panel Study of Income Dynamics* (PSID), a 30-year longitudinal survey of a representative sample of U.S. men, women, children, and the families in which they

reside. In 1997, the PSID added a refresher sample of immigrants to the United States so that the sample represents the U.S. population in 1997. When weights are used, the PSID has been found to be representative of U.S. individuals and their families (Fitzgerald, Gottschalk & Moffitt, 1998a).

With funding from the National Institute of Child Health and Human Development (NICHD), data were collected in 1997 on up to two randomly selected 0 to 12-year-old children of PSID respondents both from the primary caregivers and from the children themselves. The CDS survey period began in March 1997 and ended in December 1997 with a break from mid-June through August; thus the study took place only during the school year. Interviews were completed with 2,380 child households containing 3,563 children. The response rate was 88 percent. Post-stratification weights based upon the 1997 Current Population Survey were used to make the data nationally representative. Sample characteristics reflect the characteristics of the population of children under age 13 in the United States in 1997. The sample used in this study consists of boys and girls between 6 and 12 years of age, from first grade through about grade 6 or 7, and who have a mother in the household.

The 2002 Child Development Supplement to the Panel Study of Income Dynamics

In 2002, the participants of the 1997 Child Development Supplement were contacted again and another supplement was administered. The response rate to the follow-up survey was 91%. In this study we included those children who participated in both the 1997 and 2002 Supplements and who were 6 years or older in 1997. In 2002 they ranged from 10.8 to 19 years of age. The interviewing period also occurred during

the school year. It began in October 2002 and extended through June 2003. A total of 978 children were eligible and 771 children with data present on all analytic variables were included in the present analysis.

Child Overweight Status

In 1997 the CDS asked primary caregivers to report their child's current weight. If they did not know their child's weight, they were asked to provide an estimate and they were then asked when the child was last weighed. The interviewer measured the child's height. This information was used to compute a body mass index (BMI), calculated as weight in kilograms divided by the square of height in meters. Children whose BMIs were at or above the 95th percentile for their age and sex, according to the Centers for Disease Control and Prevention's (CDC) Year 2000 growth charts, were classified as overweight (Kuczmarski, Ogden & Guo, 2002). In 2002, the CDS computed the child's BMI based on measured height and weight. The determination of child overweight was the same as in 1997. Because we use a strict definition of overweight, we also examine BMI as a continuous indicator of overweight.

Children's Sports Participation

The 1997 and 2002 Child Development Supplements collected a complete time diary for one weekday and one weekend day for 79 percent (2,818) of the 3,563 sample children aged 0 to 12. Comparisons between children who provided a diary and those who did not showed no significant differences on demographic characteristics. The time diary, which was interviewer-administered either to the parent or to the parent and child,

asked questions about the child's flow of activities over a 24-hour period beginning at midnight of the randomly designated day. These questions ask the primary activity that was going on at that time, when it began and ended, and whether any other activity was taking place. Children's activities were first assigned to one of 10 general activity categories (e.g., sports and active leisure) and then coded into 3-digit subcategories (e.g., playing soccer). Coding was conducted by professional coders employed by the data collection organization; the level of reliability exceeded 90 percent. Time spent traveling for the purpose of engaging in a specific activity was included in that category.

Time diary data in 1997 and 2002 were used to determine participation in sports on either the weekday or weekend day of the time diary. Sports participation included both organized and unorganized sports, as well as team and individual sports. Examples of traditional team sports that are included are football, basketball, baseball, volleyball, hockey, soccer, and field hockey. The children could have been attending practices or playing in organized games or they could have been playing "pick up" games in their neighborhood. Individual sports such as golf, tennis, racketball, and squash are also included. Sports such as winter sports (skiing, sledding, snow boarding), participation in the martial arts, playing frisbee, and bowling are also included. Some activities that are usually thought of as exercise, such as running, weight lifting, and bicycling, were also considered to be sports in this analysis. For a complete, exhaustive list of all the activities considered to be sports in this analysis contact the authors.

If any time was attributed to any of the codes corresponding to either team or individual sports on either the time diary weekday or weekend day then the child was considered to have participated in sports regardless of the amount of time. We coded

four categories of sports participation: No sports in 1997 or 2002, sports participation in 1997 and 2002, sports in 1997/no sports in 2002 (the child ceased to participate), and no sports in 1997/ sports in 2002 (the child started participating).

Measurement of the Demographic Variables

Data from the 1997 CDS, the 1997 PSID, the 1999 PSID, the 2001 PSID, and the 2002 CDS were combined to analyze the impact of sports participation on child overweight. Following is a description of the each of the variables used in the analysis.

Race/ethnicity. Race/ethnicity were combined into a single set of categories: nonHispanic white and other, nonHispanic Black, and Hispanic.

Maternal education. The mother's completed years of education were drawn from the 2001 PSID. The values ranged from 0 to 17. A high school graduate had 12 completed years of schooling, a college graduate had completed 16 years, and any mother with a year or more of graduate work was top-coded at 17. Although some mothers may have completed additional schooling, this was unlikely given that their children were adolescents.

Family structure. The child's family structure was derived from the 1997 and 2001 PSID Child Development Supplements and compared across the two years. The following categories were coded: the child was in a two-parent family in both years, the child was in a one-parent family in both years, the child's family changed from a one to two-parent family (if the parent marries or remarries), or the child's family changed from a two to one-parent family (by divorce or death of the other parent).

Family size. The child's family size was also compared across 1997 and 2001. The family size is based on the number of children under 18 years of age in the family. We considered a large family to be any in which there were 3 or more children under 18 years of age and a small family to have fewer than 3 kids. The categories we coded were: small family in both 1997 and 2001, large family in both 1997 and 2001, small in 1997/large in 2001 (when children were added to the family), large in 1997/ small in 2001 (when children left the family).

Maternal Overweight, Obesity, and Physical Activity

Detailed supplemental information on the parents' health status was included on the 1999 PSID. Because we did not want to drop single mother families, we focused only

upon mothers health. We extracted information on the mother's height and weight as well as the frequency of her heavy physical exercise. The mother's height and weight were reported by the mother and used to compute her BMI. The mother was classified as overweight if her BMI exceeded 25 but was less than 30 and she was classified as obese if her BMI exceeded 30. Heavy physical activity was defined as the number of times in a month that the parent engaged in activities such as running or heavy lifting.

Analytic Methods

Average BMI and the percent child overweight in 2002 were computed for selected variables. Logistic regression was used to control for other covariates to see whether sports participation had an independent effect on child overweight and BMI. Finally, separate models were computed for males and females.

Results

Mean BMI and Percent Overweight

The percent of children that were overweight in 2002 varied widely by the independent variables in the analysis. A striking difference was that only 11.5% of children who were normal weight in 1997 became overweight in 2002 compared with 46.0% of children who were overweight in 1997. In our sample, boys were more likely to be overweight than girls—21.0 versus 13.2%. About 27% of Non-hispanic black children were overweight, compared with 23.1% of Hispanic children and 15.3% of non-Hispanic white children. Children whose mothers had earned a college diploma were about half as likely to be overweight (9.2%) as children of mothers with less education

(17.9-19.8%). Children in two-parent families in both 1997 and 2002 were least likely to be overweight (15.7%) while those in one-parent families in both years were most likely (21.2%). Children in families that reduced in size between 1997 and 2002 were most likely to be overweight (22.3%) while those in families that grew were least likely (5.0 percent%). Children with overweight mothers were somewhat more likely to be overweight than children with mothers that were normal weight (14.6 versus 10.5%), while children with obese mothers were much more likely to be overweight (36.1%). Children who did not participate in sports in either 1997 or 2002 were much more likely to be overweight (31.7%) than children who participated in one or both years (12.5-16.2%). In general, the variations in the BMI across groups were consistent with the percent overweight.

(Table 1 about here)

Multivariate analysis

Table 2 shows the results of the logistic regression. Being overweight in 1997 was strongly associated with overweight in 2002. Children were more than six times as likely to be overweight in 2002 if they were overweight in 1997 (odds ratio = 6.62) and four times more likely to be overweight if their mothers were obese (odds ratio = 4.51). Boys were 74% more likely to be overweight than girls (odds ratio = 1.74). Children in families that become larger over the period, from fewer than 3 children in the family to 3

or more, were less likely to be overweight in 2002 (odds ratio = .22). Although children in families where the mother was highly active were less likely to be overweight, that coefficient was not statistically significant. Children who participated in sports were significantly less likely to be overweight than children who did not regardless of the year in which the participation took place. Compared with children who did not participate in sports either year, the odds ratios were as follows: children who participated in both years (0.29), children who participated in 2002 only (.23), and children who participated in 1997 only (.27).

(Table 2 about here)

Gender Differences

Because of the differences between boys and girls in sports participation and physical activity as they age, we also examined the predictors of child overweight in 2002 separately for boys and girls. Here we see that for both boys and girls, their own overweight status in 1997 is strongly linked to child overweight in 2002. However, most striking is the contribution of maternal weight. Boys of obese mothers are three times as likely as children of non-obese mothers to be overweight in 2002; however, girls of obese mothers are 10 times as likely to be overweight in 2002 as those of mothers who are not obese. In addition, we see that the relationship between sports participation and overweight holds for girls and not for boys. Apparently boys are active enough without sports participation. Girls who are active in sports through their middle childhood and adolescent years are significantly less likely to become overweight than those who are never active. In addition, non-Hispanic black girls are significantly more likely to

become overweight by their adolescent years than are other race/ethnic groups. There is not such association for boys.

(Table 3 about here)

Discussion

This study shows that there is an undeniable association between sports participation and child overweight, even when other important factors are considered. Children who participated in sports in 2002, whether they were continuing from 1997 or just beginning in 2002, were about 80 percent less likely to be overweight than their counterparts who never participated. What is even more striking is that the 34 percent of the children in the study who participated when they were younger but had quit by the time they were 12-18 were still significantly less likely to be overweight than their counterparts who never participated. This is evidence for a protective effect of both current sports participation on child overweight but also of *former* participation. Part of the protection may be because participation helped protect the children when they were younger, but we also controlled for former overweight status. The analyses conducted separately for boys and girls show that the protective effect is strongest for girls. The effect for boys is negative but not statistically significant. In addition, we see the very strong effect that living with an obese mother has on both girls and boys, but it is especially harmful for girls.

The results show that sports participation in the middle childhood and adolescent years is protective of girls' health as measured by proportion overweight. The results also show the very strong influence of the home environment, in particular maternal obesity. Future research needs to examine the influence of paternal overweight and physical activity as well as the influence of cultural and environmental differences on child and adolescent obesity.

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