

## Soft Drinks Consumption Is Associated with Behavior Problems in 5-Year-Olds

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**Objective** To examine soda consumption and aggressive behaviors, attention problems, and withdrawal behavior among 5-year-old children.

**Study design** The Fragile Families and Child Wellbeing Study is a prospective birth cohort study that follows a sample of mother-child pairs from 20 large US cities. Mothers reported children's behaviors using the Child Behavior Checklist at age 5 years and were asked to report how many servings of soda the child drinks on a typical day.

**Results** In the sample of 2929 children, 52% were boys, 51% were African-American, 43% consumed at least one serving of soda per day, and 4% consumed 4 or more servings per day. In analyses adjusted for sociodemographic factors, consuming one (beta, 0.7; 95% CI, 0.1-1.4), 2 (beta, 1.8; 95% CI, 0.8-2.7), 3 (beta, 2.0; 95% CI, 0.6-3.4), or 4 or more (beta, 4.7; 95% CI, 3.2-6.2) servings was associated with a higher aggressive behavior score compared with consuming no soda. Furthermore, those who consumed 4 or more (beta, 1.7; 95% CI, 1.0-2.4) soda servings had higher scores on the attention problems subscale. Higher withdrawn behavior scores were noted among those consuming 2 (beta, 1.0; 95% CI, 0.3-1.8) or 4 or more (beta, 2.0; 95% CI, 0.8-3.1) soda servings compared with those who consumed no soda.

**Conclusion** We note an association between soda consumption and negative behavior among very young children; future studies should explore potential mechanisms that could explain this association. (*J Pediatr* 2013;163:1323-8).

Americans buy more soda per capita than people in any other country worldwide.<sup>1</sup> Even very young children consume soft drinks. For example, national surveys of US children aged 4-5 years from the mid-1990s found that, on average, they consumed 11 g of added sugar per day from regular (ie, nondiet) soft drinks alone, which corresponds to 25% of a 12-oz can.<sup>2</sup> In California, a 2005 survey found that more than 40% of children aged 2-11 years drank at least 1 serving of soda per day.<sup>3</sup>

Among adolescents, consuming soft drinks is associated with aggression,<sup>4,5</sup> as well as with depression and suicidal thoughts, and withdrawal behavior (Hemenway et al, unpublished data, 2013).<sup>5-7</sup> Previous studies using data from national high school surveys found a dose-response relationship between the amount of soft drinks consumed and both self-harm and aggression toward others. Despite the fact that young children also are consuming soft drinks, the relationship between soda consumption and behavior has not been evaluated in this age group.

Numerous factors may affect both soda consumption and problem behavior in children. Poor dietary choices, such as high soda consumption, in young children may be associated with other parenting practices, such as excessive television (TV) viewing and high consumption of other sweets. Furthermore, parenting practices may be associated with social factors known to be associated with child behavior. The relationship between a stressful home environment and child behavior is well known; for example, children who are victims of violent acts or who witness violence have been found to have more externalizing and internalizing behavior problems and more aggression problems, and to show signs of posttraumatic stress disorder.<sup>8-10</sup> Moreover, caretaker mental health can be a strong contributor to problems in children through its effects on parenting quality and overall home environment.<sup>11</sup> Children of depressed mothers have been shown to develop more social and emotional problems during childhood, including internalizing and externalizing problems.<sup>12</sup> Thus, it is possible that observed associations between behavior and soda consumption in adolescents can be attributed to unadjusted social risk factors.

In the present study, we investigated the effect of soda consumption on behavior, specifically aggression, attention, and withdrawal behaviors, in a sample of almost 3000 5-year-old children from urban areas across the US. Considering that other dietary factors may be associated with both soda consumption and behavior, we adjusted our analyses for other dietary components as well as for social risk factors that may be associated with parenting practices as well as child behavior.

BMI	Body mass index
CBCL	Child Behavior Checklist
IPV	Intimate partner violence
TV	Television

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## Methods

Analyses were conducted using public-use data available from the Fragile Families and Child Wellbeing Study, a prospective birth cohort study that follows a sample of mother-child pairs from 20 large US cities. Nonmarital births were oversampled relative to marital births at 3:1. The study is a joint effort by Princeton University's Center for Research on Child Wellbeing and Center for Health and Wellbeing, Columbia University's Social Indicators Survey Center, and the National Center for Children and Families. Details of the study design have been published previously.<sup>13</sup> In brief, 4898 women were recruited at delivery from 75 hospitals in 20 US cities with a population exceeding 200 000 between 1998 and 2000. Mothers completed a baseline interview at delivery and participated in follow-up interviews when the children were approximately 12, 36, and 60 months of age.

In the present analysis, we focused on data collected at the 60-month follow-up. A total of 3001 mothers completed the in-home assessment at the 60-month follow-up; the 2929 children included in final analyses had complete information on soda consumption and behavior. Those who did not participate in the 60-month in-home assessment differed significantly by race/ethnicity from those who participated (African Americans, 46% nonparticipants vs 50% participants [ $P < .0001$ ]; Hispanics, 28% nonparticipants vs 24% participants [ $P < .0001$ ]).

### Child Behavior

To assess child behavior, mothers were asked to complete the Child Behavior Checklist (CBCL) based on their child's behavior during the previous 2 months.<sup>13-15</sup> The validity and reliability of the CBCL have been documented.<sup>14,15</sup> The CBCL measures a series of constructs including withdrawal, attention problems, and aggressive behaviors. Items assessing specific behaviors were read to the mother, who was asked to indicate whether the statement was (0) not true, (1) sometimes or somewhat true, or (2) very true or often true. In the present analysis, we focused on the CBCL aggression (20 items), withdrawal (includes 9 items), and attention (11 items) subscales. Raw scores were converted to age-standardized scores (T scores, mean  $50 \pm 10$ ) that can be compared with scores obtained from normative samples of children in the same age range.

### Soda Consumption

To assess beverage consumption, mothers were asked: "On a typical day how many servings of soda does your child drink?" Possible answers were none, 1, 2, 3, 4, and 5 or more sodas in a typical day. In our analysis, the "4" and "5 or more" categories were collapsed into a single group; thus, soda consumption was categorized as 0, 1, 2, 3, or 4 or more servings of soda per day.

### TV Viewing

Mothers were asked to report the amount of hours that the child watched TV on a typical weekday, as well over a typical

weekend. We calculated the average daily hours of TV the child watched during the week and categorized hours spent watching TV as <2 hours, 2-4 hours, or >4 hours per day.

### Other Dietary Factors

To assess whether other dietary factors had similar effects on behavior, we included 2 measures of diet: candy/sweets consumption and fruit juice consumption. The frequency of candy or sweets consumption was assessed by asking mothers: "On a typical day, how many servings of candy or sweets does the child eat?" Possible answers were 0, 1, 2, 3, 4, or 5 or more servings per day. In the analysis, eating candy or sweets was categorized as none, once or twice per day, or 3 or more times per day. To assess fruit juice consumption, mothers were asked: "On a typical day, how many servings of fruit juice does the child drink?" Possible answer were 0, 1, 2, 3, 4, or 5 or more servings per day.

### Social Risk Factors

To characterize the home environment, which may be correlated with parenting practices and child behavior, we included 3 social risk factors obtained from the 60-month assessment in our analysis: probable maternal depression, intimate partner violence (IPV), and paternal incarceration.

**Probable Maternal Depression.** Mothers completed the Composite International Diagnostic Interview-Short-Form,<sup>16</sup> a screening tool for depression.<sup>17</sup> To ascertain probable depression, mothers were initially asked if they experienced dysphoria (depression) or anhedonia (lack of enjoyment of things typically experienced as pleasurable) for at least 2 weeks during the past year, and if so, whether such symptoms lasted most of the day and occurred every day. Mothers reporting persistent symptoms were asked about 7 other symptoms, including losing interest in hobbies, work, or activities, trouble sleeping, and thinking about death. A probable depression score ranging from 0 to 8 was calculated by adding the affirmative answers to questions about these 7 symptoms plus the initial symptom of dysphoria, if present. A score of  $\geq 3$  was considered to indicate probable maternal depression. In addition, a report of antidepressant use was considered probable depression. The presence of probable maternal depression was classified as either yes or no.

**IPV.** Maternal IPV was assessed using previously validated questions.<sup>18,19</sup> Mothers were asked to consider their relationship with their child's father or current partner and to answer the following questions: (1) "How often does he slap or kick you?"; (2) "How often does he hit you with a fist or object that could hurt you?"; (3) "How often does he try to make you have sex or do sexual things you don't want to?"; and (4) "Were you ever cut or bruised or seriously hurt in a fight with the baby's father or current partner?" Mothers who responded "often" or "sometimes" as opposed to "never" to any of the first 3 questions or who responded "yes" to the last question were considered to have IPV.

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