

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 Higher withdrawn behavior scores were noted among those consuming 2 (beta, 1.0; 95% CI, 0.3-1.8) or 4 or more (beta, 2.0; 95% CI, 0.8-3.1) soda servings compared with those who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.¹ 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.² 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.³

Among adolescents, consuming soft drinks is associated with aggression,^{4,5} as well as with depression and suicidal thoughts, and withdrawal behavior (Hemenway et al, unpublished data, 2013).⁵⁻⁷ Previous studies using data from national high school surveys found a dose-response relationship between the amount of soft drinks consumed and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.⁸⁻¹⁰ Moreover, caretaker mental health can be a strong contributor to problems in children through its effects on parenting quality and overall home environment.¹¹ Children of depressed mothers have been shown to develop more social and emotional problems during childhood, including internalizing and externalizing problems.¹² 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.¹³ 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.¹³⁻¹⁵ The validity and reliability of the CBCL have been documented.^{14,15} 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 ± 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,¹⁶ a screening tool for depression.¹⁷ 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 ≥ 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.^{18,19} 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.

Paternal Incarceration. Mothers were asked whether the father of the child was currently incarcerated. This variable was dichotomized as yes or no.

Sociodemographic Factors

Data on the mother's (but not the child's) race/ethnicity were collected during the baseline survey. Race/ethnicity was classified as white non-Hispanic, African American, or Hispanic/other race/ethnic group. Other explanatory variables were collected from the most recent survey, including parents' marital status (married/cohabitating or not married at child's birth), maternal education (less than high school, high school graduate, or some college/college graduate), and receipt of public assistance during the previous year (yes or no). The children's body mass index (BMI) was calculated from height and weight measurements obtained at the 60-month follow-up. The Centers for Disease Control and Prevention's BMI growth reference²⁰ was used to determine age- and sex-specific BMI percentiles. Obesity was defined as BMI $\geq$ 95th percentile at the 5-year assessment.

Data Analyses

We used bivariate ANOVA to examine the associations between the aggression, withdrawal, and attention subscales of the CBCL and each level of soda consumption. We then used linear regression models to estimate the association between soda consumption and these child behavior subscales. Analyses were first adjusted for sociodemographic factors: child sex, maternal race/ethnicity (white, Hispanic/other, or African American), maternal education (less than high school, high school graduate, or some college/college graduate), maternal marital status (married/cohabitating or single), and current receipt of public assistance (yes or no). A second set of models was further adjusted for sociodemographic factors, TV watching (<2 hours, 2-4 hours, or >4 hours), and 2 dietary factors, fruit juice consumption (0, 1, 2, 3, 4, or 5 or more servings), and candy/sweets consumption (none, once, twice, or 3 times per day). Finally, models were further adjusted for 3 additional social risk factors—probable maternal depression (yes or no), mother's report of IPV (yes or no), and father's incarceration (yes or no)—in participants with available social risk data ($n = 2597$). BMI information was missing for more than 25% of the children; thus, we ran a separate regression for the 1868 children with complete information.

Given that previous studies of adolescents have identified a relationship between soft drink consumption and physical aggression (eg, fights), we also examined the adjusted association between soda consumption and 3 specific items from the aggressive behavior subscale that we selected a priori for being the strongest indicators of physical aggression toward others: (1) destroys things belonging to family or others; (2) gets in many fights; and (3) physically attacks peo-

ple. For ease of exposition, we collapsed "sometimes" and "very" together into a single category and compared these children with children without these reported indicators. All analyses were conducted using SAS version 9.0 (SAS Institute, Cary, North Carolina).

Results

Table I shows the distribution of demographic data, soda consumption, and study covariates. Forty-three percent of the children consumed at least 1 serving of soda per day, and 4% consumed 4 or more servings per day. In bivariate analyses (data not shown), children's aggressive and withdrawn behaviors, as well as attention problems, were associated with sociodemographic factors, maternal depression, IPV, and paternal incarceration (all $P < .05$).

Table I. Demographic data, soda consumption, and other characteristics, Fragile Families and Child Wellbeing Study cohort ($n = 2929$)

Variable	Value
Sex, n (%)	
Male	1527 (52.1)
Female	1402 (47.9)
Maternal race/ethnicity, n (%)	
White	624 (21.3)
African American	1483 (50.6)
Hispanic/other	822 (28.0)
Maternal highest educational attainment, n (%)	
Less than high school	1121 (38.3)
High school graduate	760 (26.0)
Some college/college graduate	1048 (35.8)
Maternal marital status married or cohabitating, n (%)	1729 (59.0)
Income from public assistance, n (%)	700 (23.9)
Probable maternal depression, n (%)	337 (11.5)
Maternal report of IPV, n (%)	316 (11.1)
Father incarcerated, n (%)	168 (6.5)
Soda consumption, servings per day, n (%)	
0	1667 (56.9)
1	730 (24.9)
2	293 (10.0)
3	129 (4.4)
4+	110 (3.8)
Candy/sweets consumption, servings per day, n (%)	
0	699 (23.6)
1	1353 (46.2)
2	497 (17.0)
3+	409 (14.0)
Fruit juice consumption, servings per day, n (%)	
0	164 (5.6)
1	562 (19.0)
2	781 (26.4)
3	682 (23.1)
4	327 (11.1)
5+	440 (14.9)
TV watching, hours per day, n (%)	
<2	1108 (37.8)
2-4	1220 (41.7)
>4	601 (20.5)
Obesity >95th percentile ($n = 1868$), n (%)	367 (17.3)
CBCL attention subscale score, mean $\pm$ SD	51.5 $\pm$ 3.5
CBCL withdrawal subscale score, mean $\pm$ SD	54.5 $\pm$ 6.0
CBCL aggression subscale score, mean $\pm$ SD	57.0 $\pm$ 7.8

In unadjusted analysis, the overall aggression score was significantly higher with increasing levels of soda consumption, rising from 56 for none to 62 for 4 or more servings per day ($P < .05$; **Table II**). Higher levels of soda consumption also were associated with significantly higher scores on the withdrawal and attention subscales (both $P < .05$).

In analyses adjusted for sociodemographic factors, soda consumption was associated with the global measure of aggressive behavior in a dose-response manner (P for trend $< .05$) (**Table III**, model 1). Children who consumed at least 1 soda per day had a 0.74-point higher mean aggressive behavior score (95% CI, 0.1-1.4) compared with children who consumed none. Those who consumed 4 or more sodas had a 4.74-point (95% CI, 3.2-6.2) higher aggressive behavior score, a 1.70-point (95% CI, 1.0-2.4) higher attention problem score, and a 1.95-point (95% CI, 0.8-3.0) higher withdrawal score compared with those who consumed no soda (**Table III**, model 1; $P < .05$ for all 3 comparisons). A statistically significant trend also was noted for the relationship between soda consumption and attention problem subscale score (P for trend $< .05$), but not for the relationship between soda consumption and withdrawal subscale score (P for trend $> .05$). Interaction between sex and soda consumption were not statistically significant. Adjusting for fruit juice consumption, TV watching, and candy/sweets consumption (**Table III**, model 2) did not substantially change the results. We found associations between watching TV for 2-4 hours and ≥ 4 hours per day and higher scores in the attention (0.4 point [95% CI, 0.1-0.7] vs 0.6 point [95% CI, 0.2-1.0]), aggression (1.0 point [95% CI, 0.4-1.6] vs 2.2 points [95% CI, 1.4-2.0]), and withdrawal (0.7 point [95% CI, 0.2-1.2] vs 1.1 points [95% CI, 0.5-1.7]) subscales (all $P < .05$; not shown in tables). Consuming candy/sweets ≥ 3 times per day was associated with a 1.4-point higher aggression subscale score (95% CI, 0.4-2.4; $P < .05$; data not shown). Consuming 1 serving of fruit juice per day was associated with a 0.7-point lower attention subscale score (95% CI, -1.3 to -0.05 ; $P < .05$). Further adjustment for probable maternal depression, IPV, and paternal incarceration had no significant effect on the results (**Table III**, model 3).

In a separate analysis, we adjusted for all the following factors, as well as for obesity ($n = 1868$). The results were slightly attenuated: those who consumed 4 or more soft drinks daily had a 2.62-point (95% CI, 0.7-4.5) higher aggression subscale score, a 1.75-point (95% CI, 0.9-2.6) higher attention prob-

lem subscale score, and a 0.88-point (95% CI, -0.6 to 2.3) higher withdrawal subscale score compared with those who consumed no soda (data not shown in tables).

Logistic regression analyses, adjusted for sociodemographic factors, for 3 specific aggressive behaviors revealed a dose-response relationship between soda consumption and destroying other people's possessions, getting into fights, and physically attacking people. Children who consumed 4 or more servings of soda per day were more than twice as likely to destroy things belonging to others (OR, 2.54; 95% CI, 1.7-3.8), to get into fights (OR, 2.12; 95% CI, 1.3-3.5), and to physically attack people (OR, 2.28; 95% CI, 1.3-3.9) compared with children who did not drink soda (data not shown in tables).

Discussion

In this sample of nearly 3000 5-year-old children from cities across the US, 43% consumed at least 1 serving of soda per day, and 4% consumed 4 or more servings daily. Soda consumption was associated with higher aggression subscale scores in a dose-response pattern. These results remained significant after adjusting for: (1) the child's sex; (2) maternal race, education, and marital status; (3) receipt of public assistance; (4) fruit juice consumption; (5) candy/sweets consumption; (6) TV watching; (7) probable maternal depression; (8) maternal reported IPV; and (9) paternal incarceration. We found significant relationships between soda consumption with the overall measure of aggression and with the 3 specific behaviors that we consider most indicative of aggression: destroying things belonging to others, getting into fights, and physically attacking people. Children who consumed the highest quantities of soda also were more likely to exhibit higher scores on the attention problems and withdrawal subscale, both in simple comparisons and when controlling for the aforementioned factors.

In this study, we were not able to characterize the nature of the associations between soda consumption and the problem behaviors. One possibility is a direct cause-and-effect relationship. Soft drinks are highly processed products containing carbonated water, high-fructose corn syrup, aspartame, sodium benzoate, phosphoric or citric acid, and often caffeine, any of which might affect behavior. Unfortunately, few previous studies have focused on the impact of any of these ingredients on behavior in young children. Caffeine has been linked to insufficient sleep, nervousness and jitters,

Table II. Mean CBCL attention, withdrawal, and aggression subscale scores for 5 levels of soda consumption among 5-year-old children in the Fragile Families and Child Wellbeing Study

	Soda consumption in a typical day				
	None	1 serving	2 servings	3 servings	4+ servings
Total attention score*	51.4 $\pm$ 3.4	51.4 $\pm$ 3.2	51.6 $\pm$ 3.6	51.8 $\pm$ 3.6	53.3 $\pm$ 5.9
Total withdrawal score*	54.1 $\pm$ 5.7	54.7 $\pm$ 6.2	55.5 $\pm$ 6.1	55.3 $\pm$ 6.1	56.7 $\pm$ 7.2
Total aggression score*	56.2 $\pm$ 7.5	57.2 $\pm$ 7.6	58.4 $\pm$ 8.6	58.7 $\pm$ 8.5	62.0 $\pm$ 9.0

Data are mean $\pm$ SD.

* $P < .05$, ANOVA.

Table III. Adjusted linear regression analyses of CBCL subscales and soda consumption, Fragile Families and Child Wellbeing Study

Soda consumption, servings per day	Model I*	Model II†	Model III‡,§
Withdrawal subscale estimate (95% CI)			
0	Reference	Reference	Reference
1	0.44 (−0.05 to 1.0)	0.42 (−0.1 to 0.9)	0.49 (−0.07 to 1.1)
2	1.03 (0.3 to 1.8)¶	0.73 (−0.03 to 1.5)	1.00 (0.1 to 1.8)¶
3	0.70 (−0.4 to 1.7)	0.29 (−0.8 to 1.4)	0.25 (−0.9 to 1.4)
4+	1.95 (0.8 to 3.1)¶	1.23 (0.02 to 2.4)¶	1.20 (−0.11 to 2.5)
Attention subscale estimate (95% CI)			
0	Reference	Reference	Reference
1	0.04 (−0.3 to 0.3)	0.02 (−0.3 to 0.3)	0.04 (−0.3 to 0.4)
2	0.15 (−0.3 to 0.6)	0.03 (−0.4 to 0.5)	0.17 (−0.3 to 0.7)
3	0.38 (−0.2 to 1.0)	0.21 (−0.4 to 0.9)	0.19 (−0.5 to 0.9)
4+	1.70 (1.0 to 2.4)¶	1.48 (0.8 to 2.2)¶	1.52 (0.8 to 2.3)¶
Aggression subscale estimate (95% CI)			
0	Reference	Reference	Reference
1	0.74 (0.07 to 1.4)¶	0.58 (−0.1 to 1.3)	0.69 (−0.01 to 1.4)
2	1.77 (0.8 to 2.7)¶	1.07 (0.07 to 2.07)¶	1.22 (0.2 to 2.3)¶
3	2.00 (0.6 to 3.4)¶	1.11 (−0.3 to 2.5)	0.95 (−0.5 to 2.4)
4+	4.74 (3.2 to 6.2)¶	3.28 (1.7 to 4.9)¶	3.00 (1.3 to 4.7)¶

*Model I was adjusted for sex, maternal race/ethnicity, maternal education, marital status, and receipt of public assistance.

†Model II was adjusted for the covariates in model I as well as TV watching, candy/sweets consumption, and fruit juice consumption.

‡Model III was adjusted for the covariates in models I and II, as well as probable maternal depression, maternal report of IPV, and paternal incarceration.

§Sample size for model III is 2596.

¶ $P < .05$.

impulsivity, and risk-taking in children and adolescents,²¹ and a study of 9- to 12-year-old children in Brazil found that those with depression were more likely to consume caffeine.²² Thus, caffeine may explain or contribute to our results. Although sugar often is thought to affect children's behavior, the scientific literature is not definitive.²³ In our study, high fruit juice consumption was associated with lower aggression subscale scores, and high candy/sweets consumption was associated with higher scores. Another possibility is that underlying organic conditions, such as low blood glucose, could lead children both to want soda and to be aggressive or withdrawn. High soda intake may affect blood glucose levels.²⁴ Unfortunately, we did not have a direct measure of blood glucose.

This study has some limitations. First, owing to the cross-sectional nature of our analysis, we cannot determine causality. However, a yearly time series might not be appropriate if the effect of soda on behavior is short-lived. Second, data on both soft drink consumption and behavior are based on parent reports; furthermore, the size of a soda serving was never defined. This potentially could have introduced some misclassification of exposure, although we have no reason to expect it to be related to the parental reports of child behavior. Third, we have no information on what type of soft drinks were consumed, particularly whether they were regular or diet, sugar-sweetened or artificially sweetened, cola or noncola, and caffeinated or noncaffeinated. Fourth, there are other potential confounders that we cannot adjust for that may be related to both soda consumption and child behavior, such as physical activity, watching violent video games, and other dietary factors. For example, food coloring agents have been examined as a potential negative influence on child behavior.²⁵ Finally, our sample is not

representative of all US 5-year-old children and may have limited generalizability.

These limitations notwithstanding, in this large sample of 5-year-old urban US children, we found strong and consistent relationships between soda consumption and a range of problem behaviors, consistent with the findings of previous studies in adolescents (Hemenway et al, unpublished data, 2013).⁴⁻⁷ Children with higher soda consumption had higher aggression subscale scores and were more likely to destroy other people's belongings, get into fights, and physically attack people. These children also were more likely to exhibit withdrawn behavior and attention problems. These effects were present even after accounting for an array of sociodemographic factors and psychosocial stressors. Our study focuses on the association between soda consumption and behavior among young children. Studies in other populations of children and of a longitudinal nature may provide further insight into the relationship between soda consumption and child behavior. ■

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References

1. Check D, Dodson M, Kirk C. Americans drink more soda than anyone else. Slate; 2011. Available at http://www.slate.com/articles/health_and_science/map_of_the_week/2012/07/map_of_soda_consumption_americans_drink_more_than_anyone_else.html. Accessed July 16, 2013.

2. Kranz S, Smiciklas-Wright H, Siega-Riz AM, Mitchell D. Adverse effect of high added sugar consumption on dietary intake in American preschoolers. *J Pediatr* 2005;146:105-11.
3. Babey SH, Jones M, Yu H, Goldstein H. Bubbling over: soda consumption and its link to obesity in California. Policy Brief UCLA Cent Health Policy Res 2009;PB2009-5:1-8.
4. Solnick SJ, Hemenway D. The "Twinkie defense": the relationship between carbonated non-diet soft drinks and violence perpetration among Boston high school students. *Injury Prev* 2012;18:259-63.
5. Solnick S, Hemenway D. Soft drinks, aggression and suicidal behavior in US high school students. *Int J Inj Contr Saf Promot*. 2013. In press.
6. Hemenway D, Solnick S. The relationship of non-diet soft drinks to depression, self-harm and suicidal behavior among Boston high school students. Working paper. 2012.
7. Lien L, Lien N, Heyerdahl S, Thoresen M, Bjertness E. Consumption of soft drinks and hyperactivity, mental distress, and conduct problems among adolescents in Oslo, Norway. *Am J Public Health* 2006;96:1815-20.
8. Pan X, Zhang C, Shi Z. Soft drink and sweet food consumption and suicidal behaviours among Chinese adolescents. *Acta Paediatr* 2011;100:e215-22.
9. Freeman LN, Mokros H, Poznanski EO. Violent events reported by normal urban school-aged children: characteristics and depression correlates. *J Am Acad Child Adolesc Psychiatry* 1993;32:419-23.
10. Campbell C, Schwarz DF. Prevalence and impact of exposure to interpersonal violence among suburban and urban middle school students. *Pediatrics* 1996;98:396-402.
11. Schwab-Stone M, Chen C, Greenberger E, Silver D, Lichtman J, Voyce C. No safe haven, II: the effects of violence exposure on urban youth. *J Am Acad Child Adolesc Psychiatry* 1999;38:359-67.
12. Goodman SH, Gotlib IH. Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. *Psychol Rev* 1999;106:458-90.
13. Field T, Diego M, Hernandez-Reif M. Prenatal depression effects on the fetus and newborn: a review. *Infant Behav Dev* 2006;29:445-55.
14. Reichman N, Teitler J, Garfinkel I, McLanahan S. Fragile families: sample and design. *Child Youth Serv Rev* 2001;23:303-26.
15. Achenbach TM. Manual for the Child Behavior Checklist/2-1 and 1992 Profile. Burlington (VT): University of Vermont Department of Psychiatry; 1992.
16. Achenbach TM, Rescorla L. Manual for the ASEBA Preschool Forms and Profiles. Burlington (VT): University of Vermont, Research Center for Children, Youth & Families; 2000.
17. Kessler R, Andrews G, Mroczek D, Ustun T, Wittchen H. The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF). *Int J Methods Psychiatr Res* 1998;7:171-85.
18. Kessler RC, Wittchen H-U, Abelson JM, McGonagle KA, Schwarz N, Kendler KS, et al. Methodological studies of the Composite International Diagnostic Interview (CIDI) in the US National Comorbidity Survey. *Int J Methods Psychiatr Res* 1998;7:33-55.
19. Lloyd S. The effects of domestic violence on women's employment. *Law Policy* 1997;19:139-67.
20. Sweet J, Bumpass L, Call V. The design and content of The National Survey of Families and Households. NSFH Working Paper 1. Madison (WI): Center for Demography and Ecology, University of Wisconsin-Madison; 1988.
21. National Center for Health Statistics. 2000 CDC growth charts: United States. Hyattsville (MD): National Center for Health Statistics; 2004.
22. Temple JL. Caffeine use in children: what we know, what we have left to learn, and why we should worry. *Neurosci Biobehav Rev* 2009;33:793-806.
23. Benko CR, Farias AC, Farias LG, Pereira EF, Louzada FM, Cordeiro ML. Potential link between caffeine consumption and pediatric depression: a case-control study. *BMC Pediatr* 2011;11:73.
24. Benton D. The impact of diet on anti-social, violent and criminal behaviour. *Neurosci Biobehav Rev* 2007;31:752-74.
25. Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *Am J Public Health* 2007;97:667-75.