Original Paper

Children's Growth Parameters Vary by Type of Fruit Juice Consumed

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Key words: child nutrition, obesity, body height, fruit juice, beverages, diet, nutrition policy, growth disorders

Background: Excessive fruit juice consumption in young children has been associated with nonorganic failure to thrive and short stature in some children and with obesity in others.

Objective: To evaluate, in a sample of healthy young children, whether the associations between fruit juice intakes and growth parameters differ by the type of fruit juice consumed.

Design: Cross-sectional study.

Setting: General primary care health center in upstate New York.

Participants: One hundred sixteen two-year-old children and one hundred seven five-year-old children, who were scheduled for a nonacute visit, and their primary care-takers or parents were recruited over a two-year period.

Methods: For 163 children (73% of total), 14 days of dietary records were available. The dietary records were entered and analyzed using the Nutrition Data System (NDS). Type of fruit juice was classified according to Nutrition Coordinating Center food codes. Height was measured using a Harpenden Stadiometer. Weight was measured using a standard balance beam scale.

Results: The children consumed, on average, 5.5 fluid oz/day of fruit juices, which were classified by the NDS software as 35% apple juice, 31% orange juice, 25% grape juice and 9% other types and/or mixtures of fruit juice. Children with higher fruit juice intakes had lower total fat, saturated fat and cholesterol intakes. Child height was inversely related to apple juice intake ($p=0.007$) and grape juice intake ($p=0.02$), after adjustment for child age, gender and energy intake (excluding fruit juice) and maternal height. Apple juice intake was correlated with child body mass index ($p<0.05$) and ponderal index ($p<0.005$), after adjustment for the above covariates. Total cholesterol, LDL-cholesterol, triglyceride and lipoprotein(a) levels were not related to intakes of any of the fruit juices examined. The children's ratios of total cholesterol to HDL cholesterol were correlated with grape juice intakes, while HDL-cholesterol levels were inversely related to grape juice intakes. There were no significant relationships between fruit juice intake and measures of anemia (hematocrit or mean corpuscular volume).

Conclusions: The previously reported associations between short stature and high intakes of fruit juice were observed for intakes of both apple juice and grape juice. The associations between high fruit juice intakes and obesity were observed with apple juice intakes only. Because most of the fruit juice mixtures were classified as single fruit juices, the findings, especially those with grape juice, need to be cautiously interpreted. High intakes of fruit juice, however, appear to be associated with growth extremes in young children. Thus, it would seem prudent for parents and caretakers to moderate the fruit juice intakes of their young children.

INTRODUCTION

Fruit juice consumption by infants and young children has increased over the past 30 to 40 years because of increased availability, convenience, marketing and children's preferences. Sweetened beverages are preferred over unsweetened drinks even by neonates, as well as young children [1,2]. By one year of age almost all children drink fruit juice [3].

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Abbreviations: AAP=American Academy of Pediatrics, BMI=body mass index, Lp(a)=Lipoprotein(a), NCC=Nutrition Coordinating Center, NDS=Nutrition Data System, SAS=Statistical Analysis System.

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Concerns about children's excessive consumption of fruit juice have been raised by a number of professional groups. The American Academy of Pediatrics (AAP) and the American Academy of Pedodontics have expressed concerns about tooth decay and fruit juice [4]. The AAP Committee on Nutrition has expressed concern about sorbitol, a naturally occurring, but nonabsorbable sugar alcohol present primarily in pear juice and apple juice; they cautioned that the "excessive use of fruit juice" may result in gastrointestinal symptoms, such as chronic diarrhea, abdominal pain or bloating [5]. The role of juice carbohydrate malabsorption (especially fructose) in chronic nonspecific diarrhea in children has been recognized for some time [6,7].

Among children referred for evaluation of failure to thrive, excessive fruit juice consumption was reported as a contributing factor in nonorganic failure to thrive in eight children, aged 14 to 27 months [8]. In some children, an association between excessive fruit juice consumption and short stature was reported, while in other children, a relationship between high intakes of fruit juice and obesity was found [9].

The purpose of this study was to evaluate, in a sample of healthy preschool-aged children, whether the associations between fruit juice intake and growth parameters differ by the type of fruit juice consumed.

METHODS

Study Population

A total of 223 children, two through five years of age, who were scheduled for a nonacute visit, and their parent or primary caretaker were recruited from a general primary care practice located in Schoharie County, a rural community in upstate New York. The study population is 97% white and low to middle class. Children with significant medical conditions that affect growth and/or dietary intake were excluded (one with diabetes mellitus and one with chronic renal failure). Data were collected during 1992 and 1993 as part of a larger study to evaluate different methods of assessing dietary fat intake in young children. Written informed consent was obtained from the child's parent or legal guardian. This study was approved by the Institutional Review Board of The Mary Imogene Bassett Hospital.

Dietary Intake Assessment

A 24-hour dietary recall for the child was collected from the child's parent or primary caretaker at the initial visit. The child's parent or parents or primary caretaker was given detailed instructions by a research nutritionist in how to complete a written, consecutive, seven-day dietary record for their child. Dietary recalls and records included brand names of foods, preparation techniques and a detailed description of the foods consumed. To improve estimation of portion size, parents were given measuring cups and spoons, rulers and a "Kids Food Portion Booklet." They were also given a postage-paid, pre-addressed envelope to return the written seven-day dietary record. If necessary, the primary caretakers were called twice to remind them to mail in the written dietary record. Once the written dietary record was finished, six additional 24-hour dietary recalls were obtained. Telephone calls to collect the dietary recalls were scheduled randomly over a three-week period so that all days of the week would be included.

Dietary data were reviewed by a registered dietitian and entered by an experienced research nutritionist. Nutrient calculations were performed using the Nutrition Data System (NDS) software developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN, Version 2.3; Nutrient Database, Version 20. For the 14 days of dietary records, entered and analyzed using the NDS program, the amounts of apple, grape and orange and other fruit juices consumed were determined based on the NCC food codes (Appendix I).

The amounts of all 100% fruit juices consumed (apple juice, orange juice, grape juice and other/mixed fruit juice) were also determined by manual review of the seven-day written food records.

Children's Anthropometric Measurements

The child's height, in stocking feet, was measured to the nearest 0.1 cm using a Harpenden Stadiometer (Cambridge, MD). The child, lightly clad and in stocking feet, was measured to the nearest 0.25 pounds using a standard balance beam scale.

Questionnaire Data

Demographic data and self-reported height and weight were collected from the parent or primary caretaker by an experienced interviewer. All questionnaire data were dual-entered and verified before being entered into a Statistical Analysis System (SAS Institute, Cary, NC, Version 6.12) data base.

Laboratory Data

After an eight- to twelve-hour fast, five cc of blood were collected by venipuncture from an antecubital vein.

Lipid and Lipid Profiles. The blood was allowed to clot for ten minutes; the serum was separated by centrifugation and stored on ice for a maximum of four hours. Analysis of total cholesterol, HDL-cholesterol and triglycerides was conducted at the MIBH Clinical Laboratory according to standard protocols. LDL-cholesterol was computed using the Friedewald equation. The laboratory participates in the CDC-Standardization program. The coefficient of variation for total cholesterol was 3%.

Lipoprotein (a). Lipoprotein (a) (Lp(a)) was measured by a commercially available ELISA (Enzyme Linked Immunosorbent Assay) using the Macra Lp(a) kit manufactured by Strategic Diagnostics (Newark, NJ). Monoclonal antibody to Lp(a), immobilized on microtiter wells, served as the capture antibody. Bound Lp(a) was detected using a polyclonal anti-Lp(a) antibody conjugated with horseradish peroxidase. The complex was detected and quantified by chromogen formation upon incubation of peroxide and o-phenylenediamine substrate. A 100-microliter aliquot of serum, stored at −80°C, was used for this assay. The antisera, calibrators and controls were provided by the manufacturer in their Macra Lp(a) kit. ELISA plates were read on an automated ELISA plate reader, Dynatech Model MR5000 set to monitor at 492 nm. A calibration curve, consisting of six standards ranging from 0–80 mg/dL Lp(a) were run in duplicate within each batch. Each sample was analyzed in duplicate. The precision of Lp(a) at 15 mg/dL has a long-term (day-to-day) precision of 3.9% and within run of 1.4%. Lp(a) of 36 mg/dL has a long-term precision (day-to-day) of 3.8% and within run of 1.8%. Samples with Lp(a) concentrations above the highest calibrator or absorbing at over 3.0 absorbing units are diluted 1-to-1 with saline and repeated on another run.

Red Blood Cell Counts and Indices. Complete blood counts and indices were measured in the Bassett Hospital Clinical Laboratory using standard methods. Spun hematocrits (in duplicate) were measured in the office laboratory using standard methods.

Statistical Analysis

After the dietary data were entered and analyzed using the NDS computer software program, the total daily intake of each nutrient was calculated and transferred to an ASCII file, which was used to create a SAS database. The 14-day mean intake of each nutrient and each beverage consumed were determined and used in all analyses.

Obesity is a relative index and may be defined by a number of measures. Although the body mass index (BMI) is generally accepted as the standard measure of adiposity in adults, the ponderal index, which shows a lower direct correlation with height than BMI, may be a better measure of excess weight in growing children [10]. Therefore, both BMI and the ponderal index were used as measures of adiposity. BMI was calculated as BMI=weight (kg)/[(height (m)]^2. The ponderal index was calculated as Ponderal Index=weight (kg)/[height (m)]^3. Age and gender-specific height, weight and weight for height percentiles were determined using Epi Info (Version 6.04b; URL: http://www.cdc.gov/epo/epi/downepi6.htm).

Chi-square tests or Fisher's exact tests were used to compare dichotomous variables. Nonparametric tests (Wilcoxon) were used to compare ordered data. Student's *t* tests were used to compare continuous variables. Multiple Linear Regression Models (SAS: PROC GLM) were used for multivariate analysis of child height, weight, BMI and ponderal index, which included child age, child gender, maternal height and total energy intake (excluding fruit juice intake), as covariates. Unless otherwise indicated, all statistical tests were two-sided. All statistical analyses were conducted using the SAS software package (Version 6.12) on a VAX computing system.

RESULTS

Study Participant Characteristics

The study population has been described previously [9]. For 163 children, 14 days of dietary records were available (seven days of written dietary records and seven days of 24-hour dietary recalls). Of note, the children's mean height was at the 50th age-and-gender-specific percentile, while their mean weight was at the 57th age-and-gender-specific percentile (Table 1). Ninety-six percent of the children participating in the study were accompanied by their mothers. Thus, for multivariate models, the 4% of children not accompanied by their mothers were excluded, which should not change the findings.

Fruit Juice Intake

The distribution of the children's 14-day mean total fruit juice consumption was skewed to the right. The average total fruit juice consumed was 158.7 gm (5.5 oz)/day, of which 45.8 gm (1.5 oz)/day was orange juice, 52.5 gm (1.8 oz)/day was apple juice, 37.6 gm (1.3 oz)/day was grape juice and 22.7 gm (0.8 oz)/day was other fruit juice. The distribution of the children's intakes of orange juice, apple juice and grape juice were also right skewed. Only 31 children consumed no orange juice, while 59 children drank no apple juice and 76 children did not drink any grape juice during the 14 days of dietary data

Table 1. Study Population (n=163)

Child	
Age (years)	3.7±1.5*
Gender (% male)	52
Weight (kg)	16.2±3.8
(age and gender specific percentile)	57±26
Height (cm)	98.8±12.0
(age and gender specific percentile)	50±27
Body Mass Index (kg/m^2)	16.4±1.5
Ponderal Index (kg/m^3)	16.9±2.9
Parent/Guardian	
Age (years)	31.4±5.3
Relationship (% mother)	96
Mother's Height (cm) (n=157)	163.6±6.1
Mother's Weight (kg) (n=157)	65.4±19.2
Mother's Body Mass Index (kg/m^2) (n=157)	24.4±6.9

* Mean±SD

collection. Children who had the largest daily intakes of total fruit juice drank more than one type of fruit juice.

Based on a manual review of the children's seven-day written dietary records, 39% of the fruit juice consumed was mixed fruit juice, 30% was apple juice, 23% was orange juice, 7% was grape juice and 1% was pear or pear-apple juice [9]. The NDS computer program was used to enter and analyze both the written records and the dietary recalls (a total of 14 days of dietary records). The NDS program tends to classify these fruit juice blends or mixtures "according to the most prominent fruit juice" believed to be present in the blend and based on nutrient information available from the manufacturer. The average daily total fruit juice intake was the same based on the written dietary records and the 24-hour dietary records. If one assumes that the types of fruit juices consumed reported on the written dietary records were the same as those reported on the 24-hour dietary recalls, then the NDS program classified 79% of the mixed fruit juices as single fruit juices, predominantly as either apple, orange or grape juice. This resulted in apparent increases in the children's consumption of apple juice from 30% to 35%, orange juice from 23% to 31% and grape juice from 7% to 25% of total fruit juice consumed and a decrease in consumption of other mixed fruit juice from 39% to 9% of the total (Fig. 1).

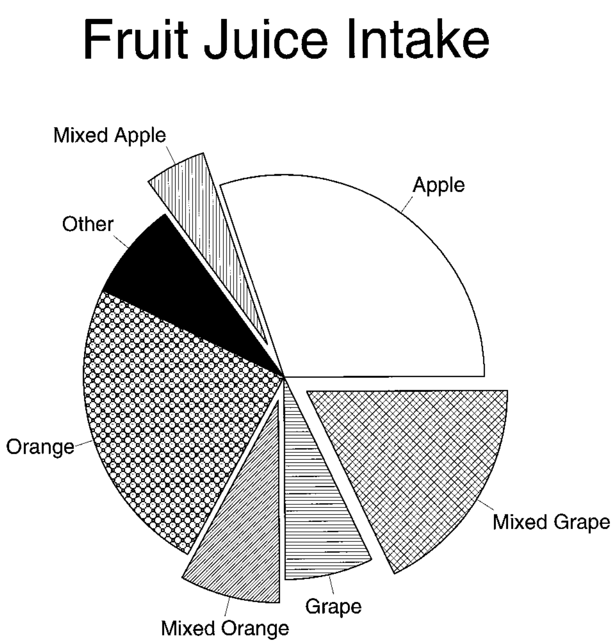

Fig. 1. The percent distribution of children's 14-day total fruit juice intake (N=163). "Mixed" fruit juices and "other" fruit juice includes mixtures or blended 100% fruit juices. The "mixed apple," "mixed orange," and "mixed grape" juices were classified as single fruit juices (apple, orange and grape juice, respectively) by the NDS software program. Thus, the NDS-classified "apple juice group" includes "apple" plus "mixed apple" juices. The NDS-classified "grape juice group" includes "grape" plus "mixed grape" juices, and the NDS-classified "orange juice group" includes "orange" plus "mixed orange" juices.

Children's Dietary Intake

Table 2 describes the children's 14-day mean dietary intakes. The relationships between selected dietary variables and total fruit juice intake are shown in Table 3. As reported previously, children with higher fruit juice intakes consumed lower percentages of calories from total fat and saturated fat and had lower energy-adjusted cholesterol intakes [9]. Children with higher intakes of fruit juice also had correspondingly higher intakes of fruit sugars (fructose and glucose), potassium, fiber and vitamin C. They also had lower intakes of sucrose. Of note, fruit juice intakes were not related to either calcium or vitamin D intakes.

Child Height and Fruit Juice Consumption

In multivariate analysis, after adjustment for child age, child gender, energy intake (excluding fruit juice) and maternal height, child height (age- and gender-specific percentile) was inversely and independently related to both apple juice intake ($p=0.007$) and to grape juice intake ($p=0.02$) (Table 4). In this model, maternal height was the strongest predictor of child height ($p=0.0001$), and neither orange juice intake nor other fruit juice intake were related to child height.

Child Adiposity and Fruit Juice Consumption

In multivariate analysis, after adjustment for child age, child gender, energy intake (excluding fruit juice) and maternal height, there was no significant relationship between child weight (age- and gender-specific percentiles) and intakes of any of the four fruit juice types (data not shown). The strongest predictor of child weight was mother's height ($p=0.0001$).

In multivariate analysis, after adjustment for child age, child gender, child age-gender interaction, energy intake (excluding fruit juice) and maternal height, apple juice intake was significantly correlated with child BMI (both $p<0.05$; Table 5). In this analysis, there was also significant relationship between

Table 2. Children's Dietary Intake (14-Day Mean)

Energy (kcal)	1387±338
Protein (gm)	49.0±14.7
(% kcal)	14.2±2.1
Total Fat (gm)	50.1±14.1
(% kcal)	32.1±4.4
Saturated Fat (gm)	20.4±6.2
(% kcal)	13.1±2.4
Cholesterol (mg)	163.5±69.5
(mg/1000 kcal)	118.6±44.6
Carbohydrate (gm)	190.2±49.4
(% kcal)	55.2±5.6
Fructose (gm)	22.6±9.9
(% kcal)	6.6±2.8
Glucose (gm)	20.6±8.7
(% kcal)	6.0±2.3
Sucrose (gm)	37.5±15.1
(% kcal)	10.9±3.5

Table 3. Relationship Between Dietary Variables and Total Fruit Juice Intake (gm/day)*

Diet Variable	Parameter Estimate	p-value
Protein (gm)	0.005	0.6
(% kcal)	−0.001	0.4
Total Fat (gm)	−0.01	0.10
(% kcal)	−0.01	0.0001
Saturated Fat (gm)	−0.006	0.08
(% kcal)	−0.006	0.0001
Cholesterol (mg)	−0.08	0.08
(mg/1000 kcal)	−0.08	0.003
Total Carbohydrate (gm)	0.01	0.0005
(% kcal)	0.02	0.0001
Fructose (gm)	0.06	0.0001
Glucose (gm)	0.04	0.0001
Sucrose (gm)	−0.02	0.01
Lactose (gm)	−0.002	0.7
Total Fiber (gm)	0.006	0.003
Calcium (mg)	0.05	0.8
Iron (mg)	−0.001	0.7
Potassium (mg)	1.7	0.0001
Sodium (mg)	−0.3	0.3
Vitamin A (mcgRE)	0.2	0.4
Beta Carotene (mcg)	0.8	0.2
Vitamin C (mg)	0.1	0.0001
Vitamin D (mcg)	0.001	0.4
Vitamin B6 (mg)	0.0007	0.02
Vitamin B12 (mcg)	0.001	0.2

* ANOVA with child age as covariate.

Table 4. Multivariate Model: Child Height (Age- and Gender-Specific Percentile)

Variable	Parameter Estimate	p-value
Intercept	−170.3	0.003
Child age (years)	−0.83	0.6
Child gender	−1.25	0.8
Energy (excluding juice) (kcal)	0.001	0.8
Maternal Height (inches)	3.54	0.0001
Orange juice (gm)	−0.0001	1.0
Apple juice (gm)	−0.069	0.007
Grape juice (gm)	−0.064	0.02
Other fruit juice (gm)	−0.02	0.7

child BMI and child gender, child age-gender interaction and maternal height. In this multivariate model, intakes of orange juice, grape juice and other fruit juice were *not* significantly related to child BMI.

In multivariate analysis, child ponderal index was negatively associated with child age (B=−1.39; p=0.0001; data not shown). After statistical adjustment for child age, child gender, child age-gender interaction, energy intake (excluding fruit juice) and maternal height, apple juice intake was significantly correlated with child ponderal index (B=0.0054; p=0.002). In this multivariate model, orange juice, grape juice and other fruit juice intakes were *not* related to child ponderal index.

Multivariate models were also developed using fruit juice intakes expressed in calories rather than in grams; the findings were the same (data not shown).

Table 5. Multivariate Model: Child Body Mass Index

Variable	Parameter Estimate	p-value
Intercept	8.8	0.003
Child age (years)	−0.15	0.2
Child gender	1.4	0.02
Child age * gender interaction	−0.34	0.03
Energy (excluding juice) (kcal)	0.0005	0.20
Maternal Height (inches)	0.11	0.02
Orange juice (gm)	0.0002	0.9
Apple juice (gm)	0.0029	0.04
Grape juice (gm)	0.0014	0.3
Other fruit juice (gm)	0.0011	0.7

Lipid and Lipoprotein Levels and Fruit Juice Consumption

In multivariate analysis, after adjustments for child age, child gender and energy intake (excluding fruit juice), children's total cholesterol levels were not significantly related to intakes of orange juice, apple juice, grape juice or other fruit juice. In multivariate analysis, LDL-cholesterol levels were not related to intakes of orange juice, apple juice, grape juice or other fruit juice. In multivariate models, triglyceride levels were also not related to intakes of orange juice, apple juice, grape juice or other fruit juice.

Child HDL-cholesterol levels increased with child age (B=1.73; p=0.01). After statistical adjustment for child age, child gender and energy intake (excluding fruit juice), children's HDL-cholesterol levels were inversely related to grape juice intake (B=0.03; p=0.01; data not shown).

The total-cholesterol to HDL-cholesterol ratios differed by child gender (B=−0.31; p=0.03; data not shown). After statistical adjustment for child age, child gender and energy intake (excluding fruit juice), the children's total cholesterol/HDL cholesterol ratios were significantly correlated with grape juice intakes (B=0.003; p=0.0006).

In multivariate analysis after adjustment for child age, child gender and energy intake (excluding fruit juice), child Lp(a) levels were not significantly related to intakes of orange juice, grape juice, apple juice or other fruit juice.

Measures of Anemia and Fruit Juice Consumption

In multivariate models, children's hematocrit was not related to intakes of orange juice, apple juice, grape juice or other fruit juice. In similar multivariate analyses, Mean Corpuscular Volume (MCV) was also not related to intakes of orange juice, apple juice, grape juice or other fruit juice.

DISCUSSION

The children's mean fruit juice intake (5.5 oz/day) based on 14 days of dietary records was very similar to that reported previously based on seven days of dietary records [9]. The study children's mean dietary intakes were comparable to those reported in the National Health and Nutrition Examination Survey III, despite differences in the years the data were collected [11].

Decreased child height or length has been reported previously with high intakes of fruit juice. Consumption of excessive fruit juice (more than 12 oz/day of "primarily apple juice") was a contributing factor in eight children with non-organic failure to thrive [8]. Five of the children (63%) had a length $<$5th percentile for age and gender, and two (25%) had a length equal to the 5th percentile. In a previous study by Dennison, *et al.*, children who consumed $\geq$12 oz/day of fruit juice, were significantly shorter after adjustment for maternal height, child age, child gender and child age-gender interaction [9].

Based on fourteen days of dietary data and analysis by type of fruit juice consumed, the relationships between fruit juice intake and adiposity (BMI and ponderal index) persisted for apple juice only. Apple juice was also the most commonly consumed fruit juice by this study population. It should be noted, however, that the children who consumed the largest amounts of fruit juices consumed more than just one type of fruit juice. In fact, few children consumed only one type of fruit juice, making interpretation of study findings difficult.

In this study, child height was inversely correlated with both apple juice intake and with grape juice intake. One might hypothesize that the finding of short stature with high intakes of apple juice, with its high fructose to glucose content, might be related, in part, to fructose malabsorption. Fructose malabsorption is relatively common [12] and increases at higher concentrations and at higher doses of fructose [13]. In the presence of sorbitol, fructose malabsorption is further increased [14]. When combined with glucose, fructose malabsorption decreases, and, at equal concentrations of fructose and glucose, fructose is rarely malabsorbed [13]. This, however, does not explain the findings observed with grape juice.

While signs of malabsorption commonly appear after ingestion of apple juice, they are less frequently present after ingestion of white grape juice (54% *vs.* 19%) [6]. Almost none of the grape juice consumed in this study was white grape juice, and only a quarter of the NDS-classified grape juice was actually plain grape juice. Almost half (46%) of the mixed fruit juices (39% of total fruit juices) were classified by the NDS system as grape juice. As a result, 72% of the NDS-classified "grape juice" was really a grape juice mixture. Thus, one needs to be very cautious in interpreting the findings associated with grape juice intake.

This classification problem occurs the least with apple juice, where only 14% of the NDS-classified apple juice was really an apple juice mixture. With orange juice, there are two potential NDS-classification problems. First, juices entered into the NDS program as "100% fruit juice, type unknown," default to "orange juice." Thus, the apparent increase in orange juice, from 23% to 31% of total fruit juice, is due to the classification of orange juice blends as well as 100% fruit juices with unknown or unspecified types as "orange juice." Overall, 26% of the NDS-classified orange juice was either orange juice blends or juices of unknown type.

One can only speculate as to why intakes of different types of fruit juice were or were not associated with short stature and/or obesity. This study was cross-sectional; therefore, causality cannot be established. The selection and consumption of different types of fruit juices were not random. Parents and caregivers serve children different types of fruit juice, and the children choose to drink different amounts and types of fruit juice for a variety of reasons.

CONCLUSION

The relationship of children's fruit juice intakes with short stature and obesity observed with seven days of dietary data persisted after analyzing 14 days of dietary data [9]. These relationships, however, varied with the type of fruit juice consumed. Intakes of orange juice or "other" fruit juice were *not* related to either child height or obesity. Apple juice intakes were significantly correlated with both child adiposity indices (BMI and ponderal index) and were negatively correlated with child height. Grape juice intakes were also negatively correlated with child height.

Because of the classification of mixed or blended fruit juices as single types of fruit juice, one needs to be cautious in interpreting these findings. Because the percent of mixed fruit juices included with each of the three major fruit juice types examined varies, with apple juice being the least affected and grape juice the most affected, the findings are also similarly affected. Because the majority (72%) of the NDS-classified grape juice was from grape juice mixtures, one must be extremely cautious when evaluating the significance of these findings. Only a very small portion of the NDS-classified grape juice was actually pure grape juice.

Additional studies, including randomized trials, are needed to further explore the relationships between children's fruit juice consumption (amount and type) and their growth parameters. In the meantime, we conclude as previously, that parents and child caretakers would be prudent to moderate young children's consumption of fruit juice.

APPENDIX:

Classification of Fruit Juices

Fruit Juice	NCC Food Code*	Description of Food
Apple	82016	Unsweetened apple juice
Grape	82024	Unsweetened grape juice
Orange	80549	Unspecified type orange juice
	80523	Unsweetened orange juice
Other	80515	Unsweetened lemon juice
	80606	Unsweetened grapefruit juice
	80614	Canned papaya juice
	82032	Frozen/canned pineapple juice
	82040	Bottle prune juice
	82107	Unsweetened black currant juice
	84509	Sweetened cranberry juice
	84525	Sweetened grapefruit juice
	84566	Sweetened cranapple juice
	85035	Juice or drink—unknown kind

* Nutrition Coordinating Center (NCC) Food Codes, Minnesota Nutrition Data System (NDS) computer software, Program Version 2.3, Food Data Base Version 5A, Nutritional Data Base Version 20, University of Minnesota, Minneapolis, MN.

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