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Original Article

Beverage consumption and anthropometric outcomes among schoolchildren in Guatemala

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Abstract

This analysis explores the clustering of beverage patterns in a single day in private vs. public school children in urban Guatemala. This study is based on measurements taken from 356 third- and fourth-grade pupils from the highland city of Quetzaltenango. Height, weight and body mass index were assessed, and one day's intake of all foods and beverages using a pictorial workbook and dietician assisted recall. Mean differences in beverage consumption were compared for private vs. public school children and by anthropometric outcomes (stunting, overweight and obesity). Plain water was consumed by 30.9% of the children on the day intakes were measured, with higher proportions of water drinkers among private school children. Children having reported water intake on that day consumed 154 fewer kcal (–7.7%) compared with the energy intake of children not having reported water intake ($P = 0.02$). Significantly more children of high socio-economic status (SES) consumed dairy, fruit juice, commercial fruit juice, fruit drink and soda whereas low SES children consumed thin gruels and infusions. A key result from this study is the finding of a lower energy intake shown by children reporting water intake.

Keywords: water, childhood obesity, nutrition, overweight, stunting, low income countries.

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Introduction

In the last decade, Latin America has experienced important transformations in its health conditions, due to demographic changes and a rapid urbanization process (Albala *et al*. 1997). The prevalence of overweight and obesity is increasing not only among adults but also in children (Martorell *et al*. 2000; de Onis & Blossner 2000) while the health burden of related complications is growing and of high concern (Uauy & Solomons 2005). The optimal diet to prevent future overweight and obesity includes restricting intake of energy-containing drinks (Astrup *et al*. 2008). According to a review by Harrington (Harrington 2008), the odds ratio of becoming obese among children increases 1.6 times for each additional can or glass of sugar-sweetened drink consumed beyond their usual daily intake of the beverage. Recently, 100% fruit juice and sweetened fruit drinks have received considerable attention as potential sources of high-energy beverages that could be related to the prevalence of obesity among young children (O'Connor *et al*. 2006). Figuring into appropriate eating guidelines are both the selection of beverages, in terms of their micronutrient density and their caloric content and of solid foods, in terms of caloric-density, nutrient density and content of noxious or beneficial constituents (Rivera *et al*. 2008).

According to Wolf *et al*. (2008) carbohydrate and alcohol-containing beverages may produce incomplete satiation relative to their energy content, preventing us from becoming appropriately satiated on beverages. As a non-caloric beverage, drinking water in place of energy containing drinks may reduce overweight and obesity risk. Gastric distension is known to contribute to satiety signals (Wang *et al*. 2008). By adding to volume, without contributing energy, water lowers energy intake and hence the chance of being overweight or obese. Contaminated water, on the other hand, is a risk factor for infectious disease, contributing to childhood diarrhoea (Bourne *et al*. 2007) and under-nutrition (Patwari 1999).

Opportunities to study plain water, an important contributor for non-caloric beverages, in survey data are relatively rare, due to a lack of specificity for its qualification of water intake in available surveys (O'Connor *et al*. 2006). Studies on beverage patterns, healthy diet and health have been derived from the National Health and Nutrition Examinations Survey (NHANES) (Popkin *et al*. 2005; Duffey & Popkin 2006; Popkin *et al*. 2006; LaRowe *et al*. 2007). One of these studies, based on the NHANES data in the United States, focuses on pre-school and school age children (LaRowe *et al*. 2007). The researchers assessed beverage pattern clusters and identified water as a key beverage pattern in the 6–11-year-old age group. The water consumption patterns of Guatemalan school children of the same age group are not known. However, LaRowe *et al*. (2007) found Mexican-American children made up the smallest proportion of water drinkers. Given the cultural similarities between children of Mexican and Guatemalan origin, Guatemalan school children may follow a similar pattern of low water intakes.

Given the importance of beverages, particularly water, to children's health it is important to characterize the consumption pattern. Namely, it is relevant to know whether children are drinking water instead of, or in addition to, other beverages. Is water intake consumed together with other beverages in the same day? If so, which other beverages are most strongly associated with water consumption? Few datasets exist to study detailed beverage intakes and the relationships between different beverages consumed in the same day. However, existing data was available from a small survey among 3rd and 4th grade students in a major city in the western highlands of Guatemala. This data included detailed self-reported dietary intakes (Vossenaar *et al*. 2009) as well as beverages (Montenegro-Bethancourt *et al*. 2009) provided data for analysis of beverages consumed together in a single 24-h period. Additional availability of anthropometric measures (Groeneveld *et al*. 2007a,b) allows for further analysis of beverage patterns in relation to anthropometric outcomes. However, while earlier research was focused on characterizing beverage pattern clustering, we are specifically interested in water. We therefore focus on the reporting of data for children reporting and not reporting water intake in a given 24-h period. In this study we aim to identify the clustering of water intake with other beverages. Furthermore, this analysis also explores whether beverage drinking, either water or other beverages, is most strongly related to anthropometric outcomes.

Key messages

- Almost a third of the schoolchildren from Quetzaltenango, Guatemala, reported water intake on the day intakes were measured.
- Schoolchildren having reported water intake consumed 154 fewer kcal compared with the energy intake of children not having reported water intake.
- There were significant differences in beverage consumption between schoolchildren from high and low socio-economic status.
- No significant differences in beverage consumption between children having reported water intake and children not having reported water intake were found.

Materials and methods

Population and subjects

The geographical setting was the city of Quetzaltenango, a provincial capital in the Western Highlands of Guatemala. The study is a secondary analysis from a cross-sectional survey conducted in the summer of 2005 to determine nutritional status from urban schoolchildren 8–10 years of age. The human studies committee of the Center for Studies of Sensory Impairment, Aging and Metabolism approved the study protocol, and regional authorities of the Ministry of Education and the institutional authorities of the participating schools obtained local permission. Participants were third and fourth grade children from public and private elementary schools from whom parental informed consent and child assent were obtained. The anthropometric data was obtained from 583 boys and girls from 17 institutions (Groeneveld *et al*. 2007b). The dietary intake was from 449 children from 12 institutions (Montenegro-Bethancourt *et al*. 2008). Combined data was available for 356 children (boys and girls), with complete anthropometric and dietary data. Quetzaltenango is an urban setting. The population consists of people with mixed ethnicities (mestizos), Mayan descendents and people of European ancestry. Ethnicity is considered a sensitive issue in Guatemala. Because of this, the specific ethnicity of the participants was not asked. Children from the public schools were categorized as lower socio-economic status (LSES) and children from private schools as higher socio-economic status (HSES).

Anthropometric data

Children were weighed on a calibrated bathroom scale (Trends mechanical scale, Guatemala) in their school uniforms, but without shoes and sweater, and after removal of heavy objects from their pockets. Weight was recorded to the nearest pound (0.45 kg). Standing height was obtained by measuring the child without shoes, using a centimetre tape measure attached vertically to the wall. Subjects stood on a flat surface, with their heels, buttocks, scapulae and head against the wall and their arms hanging freely by the sides of the trunk. A wooden, right angle headpiece was lowered until it touched the head of the child. Height was recorded tot the nearest 0.5 cm.

Dietary data

A 5-page booklet designed to assess dietary intake within a 24-h time frame was used as a data collection instrument. During school hours, the children were asked to record prospectively all drinks and food items consumed from the time the booklet was given until the next day. Instructions were given verbally and written, emphasising the importance to depict all foods and beverages and to specify brands and amounts. On the following day, the children were interviewed, face-to-face, by the researcher, assisted by two 2nd-year dietetics from a local University who were trained in the interview method. The quantities were reported in common household measures and the millilitres were converted into grams. Nutritional content for beverages (home made) was calculated using information collected by nutrition students from a local university. Specific brand product values were obtained from manufacturer information on labels. Total estimated energy intake was calculated for breakfast, lunch, dinner and snacks and also apart for beverages. Total energy intake was calculated by the sum of energy intake from all meals, and percentage energy contribution to the day's intake was calculated separately for breakfast, lunch, dinner and snacks.

Classification of beverages

Beverages were conveniently grouped in 10 categories that best reflect the unique classifications of beverages consumed in Guatemala using the classification system developed by Montenegro-Bethancourt *et al.* (Montenegro-Bethancourt *et al.* 2009). The 10 categories are as follows: (1) plain water, (2) infusions, (3) dairy, (4) thin gruel, (5) natural fruit juice, (6) commercial fruit juice, (7) fruit drinks, (8) commercial fruit drinks, (9) soda and (10) sport drinks. Infusions are beverages that consist of plain water with flavour and/or sugar added.

Examples are water with sugar, tea, lemonade and coffee. The dairy group consists of dairy beverages, like whole fat milk and chocolate milk. A thin gruel is defined as cereal based drinks, culturally consumed as beverages. Fruit juices are pure fruit juices. Commercial fruit juices are commercially canned fruit nectars. Fruit drinks are home made drinks using a fruit juice base, but sugar added. Commercial fruit drinks are artificial packaged flavoured fruit drinks. The difference between (commercial) fruit juice and (commercial) fruit drink is that juice contains an actual fruit component, whereas drink is purely artificial although it includes artificial fruit flavouring. Soda is carbonated soda, like cola. In this study, the only reported sport drink was Gatorade. Children are classified as having consumed the beverage if they reported, in the 24-h recall, drinking any quantity of a beverage fitting the above classifications. The water group consists only of plain water.

Statistical analyses

All data were analysed with SPSS for Windows, Version 13.0.1, 2004, and Epi Info tm version 3.3.2, 2005 (United States Centers of Disease Control and Prevention, Atlanta, Georgia, USA). Height for age *z*-scores (HAZ), weight for age *z*-scores (WAZ), BMI *z*-scores (BMIZ) and BMI centiles (BMIC) were obtained, using Epi Info.

Children were classified as stunted, underweight, overweight or obese based on World Health Organization criteria using references in comparison to the United States NCHS reference population. Stunting was defined as 2 *z*-scores or more below the reference median height for age. Underweight was defined as 2 *z*-scores or more below the reference median weight for age. Overweight was classified as a BMI-for-age between the 85th and 95th percentile and obesity was classified as a BMI-for-age above the 95th percentile as compared with the reference population. In addition to mean BMI *z*-scores, BMI percentiles are also given for easy interpretation of the population values in relation to the reference used for classifying overweight and obesity.

Chi-square tests were used to compare group differences in the proportion of children consuming each type of beverage after stratifying by high vs. low SES. Children reporting water intake and those reporting no water intake were also compared using chi-square tests, with significant findings reported at $P < 0.05$. Differences in means were shown using the Students' *t*-test, with significant differences reported at $P < 0.05$. Mean differences were compared for *z*-scores and BMI percentiles according to SES, sex, children reporting water intake vs. those who did not. Students' *t*-tests were also used to compare the differences in mean intake between high and low SES and children who reported water intake vs. those who did not. One day of recall is not ideal for assessing individual level quantities but can be used to reflect the usual intake of the group. Therefore analysis, where possible, was kept at the group level (group means). In the logistic regression, definitions for water intake were based on categories that distinguish groups by water consumption. Due to water safety concerns in Guatemala, we expected children who reported absolutely no water intake on the day of assessment were also likely to consume less water than other children on other days.

In order to further explore the relationships found when comparing group means, crude odds ratio (OR) results and 95% confidence intervals (95% CI) are also shown. This additional analysis was carried out to show the strength of associations between reported beverages and stunting, underweight, overweight and obesity. Crude and adjusted ORs were obtained using binary logistic regression and checked for sample size using two by two tables, stratified for confounders. ORs that were based on a result driven by less than five individuals in a single cell from two by two stratified tables were excluded from the analysis and were reported as 'unstable estimates' in the text. Crude ORs and 95% CI are only reported where sample size was sufficient to provide stable estimates. Where possible, adjusted ORs and 95% CI were calculated. SES and sex were tested as possible confounders because both are related to beverage intake as well as anthropometric outcomes. Confounders were identified as a 10% change in the odds ratio. We did not hypothesize effect modification, nor was it possible to explore. Furthermore, given the small sample size, odds ratio results should be seen as exploratory.

Results

Water consumption

Of the 356 Guatemalan children, 110 (30.9%) consumed plain drinking water as a beverage on their day of registry. Sixty-six of them were girls (60%) and 44 were boys (40%). The majority of the water-consumers were from the high SES group (68%), attending private school. Among water-consumers, mean intake of water was 491 mL.

Water and other beverage consumption

Table 1 shows that drinking patterns between children reporting water vs. those not reporting water did not differ greatly, except for commercial fruit drink. A significantly higher percentage of children reporting no water reported commercial fruit drink (45.1% vs. 22.7%), and a greater volume (406 mL vs. 300 mL) vs. children reporting water.

Significant differences were found among SES groups. Significantly more children of high SES reported dairy, fruit juice, commercial fruit juice, fruit drink and soda, whereas thin gruels and infusions were consumed by more children of low SES ($P < 0.05$). In contrast, no significant differences in volume reported were observed based on probability values (Table 2). In Table 3, when data were stratified for water consumption and SES, only a significant difference remained for commercial fruit drink. Water non-reporters from high SES had significantly greater consumption of commercial fruit drink compared with the same SES group children who reported water intake. The same relationship was observed in lower SES children.

Water consumption status and energy intake

As shown in Table 4, there was a statistical difference at the $P < 0.05$ level for total reported energy intake: 1839 kcal for water reporters vs. 1993 kcal for children not reporting water. This is a difference across the means of 154 kcal. On a meal-by-meal basis, this significant inter-group difference existed for lunch and dinner meal times, but not for breakfast or snacking. Related to the total energy intake of each group, the percentage of total daily energy derived from lunch and from snacks differed significantly with water-drinking status. Interestingly, the energy from all beverages contributed 22.6 ± 10.6% of total energy in water drinkers and 28.1 ± 10.5% in those who did not, a significant difference ($P < 0.01$).

Associations between beverage patterns and anthropometric outcomes

It should be noted that this is a subset of children previously described along similar variables by Groeneveld *et al.* (2007a). In general, stunting and underweight were more prevalent among low SES

Table 1. Comparisons of beverage patterns in Quetzaltenango children who do and don't consume water

Other beverages reported (not water)	Children reporting water consumption ($n = 110$)		Children reporting no water consumption ($n = 246$)	
	Children reporting consumption n (%)	Average reported intake† (mL) [SD]	Children reporting consumption n (%)	Average reported intake† (mL) [SD]
Soda	21 (19.1)	431 [256]	68 (27.6)	364 [159]
Infusions	78 (70.9)	454 [357]	188 (76.4)	487 [339]
Dairy	65 (59.1)	315 [144]	151 (61.4)	334 [162]
Fruit juice	11 (10.0)	295 [101]	25 (10.2)	280 [83]
Commercial fruit juice	11 (10.0)	329 [104]	26 (10.6)	333 [97]
Fruit drink	25 (22.7)	330 [139]	50 (20.3)	385 [203]
Commercial fruit drink	25 (22.7*)	300** [129]	111 (45.1*)	406** [258]
Gruels	33 (30.0)	287 [111]	84 (34.1)	335 [165]
Sport drink	1 (0.9)	200 [-]	3 (1.2)	200 [0]

*$P < 0.05$; **$P = 0.05$. †Excluding non-consumers.

Table 2. Descriptive characteristics of children from Quetzaltenango, Guatemala, aged 8–10 years, stratified for high and low socio economic status (SES)

Beverage categories reported on 24 h recall	High SES (n = 202)		Low SES (n = 154)	
	Children reporting consumption n (%)	Average reported intake† (mL) [SD]	Children reporting consumption n (%)	Average reported intake† (mL) [SD]
Water	68 (33.7)	500 [283]	42 (27.3)	476 [405]
Soda	60 (29.7*)	391 [205]	29 (18.8*)	357 [143]
Infusions	130 (64.4*)	438 [337]	136 (88.3*)	515 [347]
Dairy	161 (79.7*)	338 [166]	55 (35.7*)	302 [123]
Fruit juice	31 (15.3*)	290 [93]	5 (3.2*)	250 [0]
Commercial fruit juice	30 (14.9*)	334 [106]	7 (4.5*)	320 [53]
Fruit drink	55 (27.2*)	391 [203]	20 (13.0*)	300 [103]
Commercial fruit drink	76 (37.6)	397 [280]	60 (39.0)	372 [187]
Gruels	37 (18.3*)	275* [113]	80 (51.9*)	343* [164]
Sport drink	1 (0.5)	200 [-]	3 (1.9)	200 [0]

*$P < 0.05$. †Excluding non-consumers.

children, whereas overweight and obesity were more prevalent among high SES children (Fig. 1). For this particular analysis, prevalence of overweight and obesity were higher in HSES boys (23.0% and 17.0%) than in LSES boys (10.9% and 4.7%). Overweight affects 13.3% in girls of low SES, and 22.8% in girls of high SES. Some 12.0% of higher SES girls were obese, and just 1.1% of lower SES girls exceeded the 95th percentile of the reference curve.

Children reporting infusions and commercial fruit drinks had a statistically lower BMI, by both z-score and centile, compared with children not reporting infusions and commercial fruit drink. Conversely children reporting dairy drinks, home-prepared fruit drinks and commercial fruit juices had statistically higher BMI on one or both indicators than other children (data not shown). Stratified for SES, commercial fruit juice consumers from the high SES subgroup weighed more on both indices, with no effect in the low SES sample (Table 5). For the high SES group only, children reporting carbonated soda were lighter in weight on both indices compared with those not drinking soda (Table 5).

Table 6 shows the associations between beverage drinking patterns in relation to stunting, overweight and obesity. Children reporting dairy beverages in a single 24 h period were less than half as likely (OR = 0.44) to be stunted and this finding was statistically significant (95% CI = 0.24, 0.80). These results were most likely driven by SES. After controlling for SES the association between stunting and dairy consumption is attenuated and no longer statistically significant (OR = 0.82; 95% CI = 0.42, 1.60). The adjusted estimate was unstable as there were only two cases of stunted children who reported no dairy beverages on the interview day. Children who drank commercial fruit juice were 2.6 times more likely to be overweight than children who did not drink commercial fruit juice. This association was statistically significant (95% CI = 1.23, 5.61) and was not confounded by gender. This result also appeared to be strongly driven by SES. Adjusted estimates of the association are attenuated by more than 10% (OR = 2.23). Although the association remained statistically significant (95% CI = 1.43, 2.87) the adjusted estimate by SES was driven by the results of only one lower SES child who was overweight and consuming commercial fruit juice. Children who drank fruit juice were more likely (OR = 2.72; 95% CI = 1.09, 6.81) to be obese, a result that attenuated to 2.50 (95% CI = 0.99, 6.32) adjusting for confounding by gender. These results were likely to have been driven by differences in SES, but adjusted ORs cannot be presented due to insufficient sample size. In contrast to the results for fruit juice, children who reported commercial fruit drink were less likely to be obese (OR = 0.38; 95% CI = 0.16, 0.91). The association between obesity and commercial fruit drink remained protective and significant

Table 3. Descriptive characteristics of children from Quetzaltenango, Guatemala, aged 8–10 years, stratified for water consumers and water non-consumers and high and low socio economic status SES

Other beverages reported (not water)	Children reporting water consumption ($n = 110$)				Children reporting no water consumption ($n = 246$)			
	High SES ($n = 68$)		Low SES ($n = 42$)		High SES ($n = 134$)		Low SES ($n = 112$)	
	Children reporting consumption *n* (%)	Average reported intake† (mL) [SD]	Children reporting consumption*n* (%)	Average reported intake† (mL) [SD]	Children reporting consumption *n* (%)	Average reported intake† (mL) [SD]	Children reporting consumption *n* (%)	Average reported intake† (mL) [SD]
Infusions	43 (63.2)	367 [183]	35 (83.3)	561 [475]	87 (64.9)	473 [387]	101 (90.2)	499 [292]
Dairy	51 (75.0)	321 [145]	14 (33.3)	294 [144]	110 (82.1)	346 [176]	41 (36.6)	305 [117]
Gruels	13 (19.1)	272 [72]	20 (47.6)	297 [131]	24 (17.9)	276 [132]	60 (53.6)	358 [172]
Fruit juice	9 (13.2)	306 [110]	2 (4.8)	250 [0]	22 (16.4)	284 [88]	3 (2.7)	250 [0]
Commercial fruit juice	10 (14.7)	342 [100]	1 (2.4)	200 [-]	20 (14.9)	331 [111]	6 (5.4)	340 [0]
Fruit drink	21 (30.9)	333 [144]	4 (9.5)	313 [125]	34 (25.4)	426 [226]	16 (14.3)	297 [101]
Commercial fruit drink	16 (23.5**)	314 [149]	9 (21.4***)	276 [84]	60 (44.8**)	419 [303]	61 (45.5***)	389 [196]
Soda	16 (23.5)	465 [281]	5 (11.9)	324 [111]	44 (32.8)	365 [165]	24 (21.4)	363 [150]
Sport drink	1 (1.5)	200 [-]	0 (0)	–	0 (0)	–	3 (2.7)	200 [0]

**Indicates a significant difference by $P < 0.01$; ***Indicates a significant difference by $P < 0.01$. †Excluding non-consumers.

after controlling for SES (OR = 0.41; 95% CI = 0.17, 0.99). The odds ratios adjusted for sex cannot be presented due to insufficient sample size.

Discussion

We acknowledge a series of limitations in the research design and methods of our study. The pictorial workbook method represents a prospective and recorded variant of self-reported intake over 24 h. This method is used as a means of limiting errors of omission or substitution that might occur from recall alone. As with most 24-h recall approaches in children (Livingstone & Robson 2000; Baxter *et al.* 2004) however, it has not been validated against other dietary intake methods. Our analysis, and that of others cited (Popkin *et al.* 2005; Duffey & Popkin 2006) is based on a single 24-h period; this is too short a period to assess the stable consumption pattern of an individual. However, our aim is not to categorize children's usual consumption patterns but to test the associations between beverages consumed in a single day. The associations with anthropometric outcomes are exploratory and provide promising potential avenues of future research. Furthermore, it is also important to note that our measure of SES does not distinguish between several different aspects of socio-economic status, including household income, ethnicity, neighbourhood and school environment. Additionally, misclassification is possible. A child who has an overall low social status may attend an expensive private school. Likewise, a child with an overall high social status might attend a public school in a low-income neighbourhood. While the explanatory mechanisms are yet to be determined, these results do indicate clear differences in the beverage patterns between private and public school children.

The finding that plain water on the recorded day was associated with consuming less dietary energy corresponds to the observation of Stookey (Stookey 2001), from a survey of 3-day measured dietary intake in over 5700 Chinese adults. However, unlike Stookey (Stookey 2001) we did not find an association between water drinking in Guatemalan school children and overweight/obesity risk. However, our findings are limited by the finding of a greater net

Table 4. Mean (SD) energy intake and mean (SD) percent contribution to daily energy for each total registered diet and individual meal times as contrasted by water consumption status

Meal time	Water consumers ($n = 110$)		Water non-consumers ($n = 246$)	
	Kcal	% total energy	Kcal	% total energy
Total	1839 ± 564*	–	1993 ± 612*	–
Breakfast	440 ± 234	24.2 ± 11.1	455 ± 243	23.2 ± 10.7
Lunch	513 ± 235*	28.2 ± 9.9*	608 ± 269*	31.0 ± 10.5*
Dinner	416 ± 245*	22.3 ± 9.9	488 ± 291*	23.9 ± 10.8
Snacks	470 ± 292	25.3 ± 13.2*	442 ± 274	21.9 ± 10.7*

*Indicates a significant difference by $P < 0.05$.

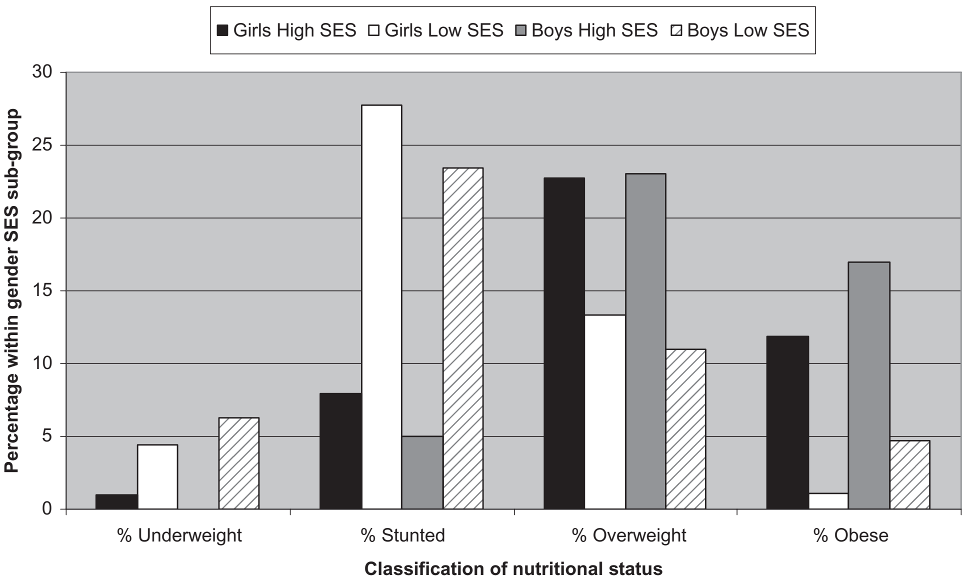

Fig. 1. Low SES children (girls and boys) have the highest prevalences of underweight and stunting. High SES children (girls and boys) have the highest prevalences of overweight and obesity.

consumption and participation in the consumption of plain drinking water found among the high SES children in Guatemala. Previous studies, on the same study population, have shown that the high SES children are also more likely to be overweight and obese (Groeneveld *et al*. 2007a). Likewise, the increased water drinking in high SES children may reflect their greater access to clean water. Furthermore, associations between water intake and overweight status are likely to be confounded by the fact that high SES children are more likely to drink clean, purified or bottled, water. In contrast, lower income children who drink water may be at greater risk of water-borne infection. Unfortunately, due to the small sample size, it was not possible to control for SES in this analysis.

These results show important differences in the beverage patterns of high vs. low SES children, as measured by private vs. public school attendance. Results showing significantly more of the high SES children reported dairy, fruit juice, commercial fruit juice, fruit drink and soda whereas more of the low SES children consumed gruel and infusions. Results showed few significant differences between water-consumers and non-water consumers. Children reporting no water intake were more likely to report commercial fruit drink, even after stratifying by SES.

Table 5. Mean body mass index z-score (BMIZ) and body mass index-for-age centile (BMIC) by beverage classification stratified by socioeconomic status (SES)

	BMIZ†		BMIC†	
	High SES	Low SES	High SES	Low SES
Water consumers (68)/[42]‡	0.56552	–0.18452	65.42269	44.78500
Water non-consumers (134)/[112]	0.51560	0.06116	64.36284	51.85196
Infusion consumers (130)/[136]	0.47279	0.00978	62.91667	50.16412
Infusion non-consumers (72)/[18]	0.63875	–0.12389	67.94014	48.11500
Dairy consumers (161)/[55]	0.50410	0.15745	64.30565	54.61491
Dairy non-consumers (41)/[99]	0.64550	–0.09657	66.36825	47.31889
Gruel consumers (37)/[80]	0.46150	0.12556	63.34675	53.78500
Gruel non-consumers (165)/[74]	0.54981	–0.12122	65.05634	46.53500
Fruit juice consumers (31)/[5]	0.62323	0.15200	66.64548	56.14800
Fruit juice non-consumers (171)/[149]	0.51565	–0.01114	64.36429	49.71577
Commercial fruit juice consumers (30)/[7]	0.90207*	–0.31000	75.25690*	39.34833
Commercial fruit juice non-consumers (172)/[147]	0.46988*	0.00649	62.93890*	50.35338
Fruit drink consumers (55)/[20]	0.60750	0.11818	68.26821	57.50955
Fruit drink non-consumers (147)/[134]	0.50317	–0.02652	63.34428	48.66045
Commercial fruit drink consumers (76)/[60]	0.38644	–0.11388	60.67987	45.78582
Commercial fruit drink non-consumers (126)/[94]	0.61539	0.07736	67.01805	53.11195
Soda consumers (60)/[29]	0.30169*	0.02379	57.40424*	50.92931
Soda non-consumers (142)/[125]	0.62803*	–0.01272	67.75416*	49.69152
Sport drink consumers (1)/[3]	–0.43000	0.28000	33.24000	60.95000
Sport drink non-consumers (201)/[151]	0.53705	–0.00771	64.87350	49.85255

*Indicates significant difference by $P < 0.05$. †Within each gender and SES-specific couplet within a column, a statistical comparison has been generated. ‡the number in parenthesis () represents the number of individuals of the HSES population either consuming (superior value in the couplet), or not-consuming (inferior value in the couplet) the beverage of interest, whereas the number in brackets [ ] represents the corresponding subsamples of consumers and non-consumers for the LSES population.

Table 6. Associations between of stunting, overweight and obesity and beverage consumption

	Stunting crude OR (CI)	Overweight OR (CI)	Obesity OR (CI)
Water	0.87 (0.46, 1.67)	0.84 (0.46, 1.52)	1.33 (0.63, 2.80)
Infusions	1.19 (0.60, 2.38)	0.95 (0.51, 1.75)	0.65 (0.30, 1.40)
Dairy	0.43 (0.24, 0.78)*	1.12 (0.64, 1.96)	1.54 (0.71, 3.34)
Gruels	1.14 (0.61, 2.11)	0.96 (0.54, 1.71)	0.45 (0.18, 1.13)
Fruit juice	Insufficient sample size	0.88 (0.35, 2.21)	2.72 (1.09, 6.81)***
Commercial fruit juice	Insufficient sample size	2.63 (1.23, 5.61)**	1.74 (0.63, 4.84)
Fruit drink	1.05 (0.52, 2.11)	1.47 (0.80, 2.71)	0.95 (0.40, 2.28)
Commercial fruit drink	1.59 (0.88, 2.86)	1.03 (0.55, 1.78)	0.38 (0.16, 0.91)****
Soda	0.87 (0.44, 1.74)	0.64 (0.32, 1.26)	0.97 (0.42, 2.23)
Sport drink	Insufficient sample size for a stable estimate of the odds ratio		

*$P = 0.006$; **$P = 0.012$; ***$P = 0.033$; ****$P = 0.029$.

These results are consistent with a study of adults in the United States (Popkin *et al.* 2005) showing those reporting no water were less likely to consume carbonated beverages and fruit juices. In our study, Guatemalan school children reporting water less frequently report commercial fruit drink intake ($P < 0.05$). Although the two studies differ in the specific beverages chosen, both studies confirm findings of water associated with caloric beverage intake. Furthermore, Popkin *et al.* (2005) also showed water consumers reported 8.9% less energy on that day, a difference of 194 kcal. Likewise, our results showed children reporting water reported 7.7% less energy, a difference of 154 kcal.

In spite of an association with water intake, commercial fruit drinks were found to be protective of obesity. This could be explained by the limitations of our data collection and sample size. In a study of children in the UK 7–18 years of age, Gibson & Neate (2007) found the risk associated with caloric soft drinks only among the very high consumers, in spite of significant differences in energy intake. The current study is limited to comparisons of children who do or do not report any intake, not based on volume of consumption. Associations with anthropometric outcomes may only be apparent at the highest levels of intake, as in the Gibson and Neate study (Gibson & Neate 2007). Alternatively, fruit drinks could be replacing water at meals. Understanding these results requires additional research into the role of commercial fruit drink in the beverage patterns of Guatemalan school children. Given the limitations of variables and sample size, these results should be interpreted as exploratory. Further exploration is needed, using a larger study population and ideally additional days of beverage intake, to help clarify the relationships of beverage intake and child nutrition.

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Conflicts of interest

No conflicts of interest have been declared.

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