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Short Communication

Correlates of sugar-sweetened beverage intake among low-income women during the first 1000 days

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Abstract

Objective: To describe prenatal and postpartum consumption of water, cows' milk, 100 % juice and sugar-sweetened beverages (SSB) among women enrolled in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) programme in New York City (NYC) and to identify correlates of SSB intake in this population.

Design: Cross-sectional data were collected from structured questionnaires that included validated beverage frequency questionnaires with the assistance of container samples. The association of maternal and household factors and non-SSB consumption with habitual daily energetic (kJ (kcal)) intake from SSB was assessed by using multivariable median regression.

Setting: WIC programme in NYC, NY. Data were collected in 2017.

Participants: 388 pregnant or postpartum women (infant aged <2 years) from the NYC First 1000 Days Study.

Results: Median age was 28 years (interquartile range (IQR) 24–34); 94·1 % were Hispanic/Latina, and 31·4 % were pregnant. Overall, 87·7 % of pregnant and 89·1% of postpartum women consumed SSB ≥ once weekly, contributing to a median daily energetic intake of 410 kJ (98 kcal) (IQR (113–904 kJ) 27–216) and 464 kJ (111 kcal) (IQR (163–1013 kJ) 39–242), respectively. In adjusted analyses, only consumption of 100 % juice was associated with greater median energetic intake from SSB (adjusted β for each additional ounce = 13; 95% CI 8, 31 (3·2; 95 % CI 2·0, 7·3).

Conclusions: Among pregnant and postpartum women in WIC-enrolled families, interventions to reduce SSB consumption should include reduction of 100 % juice consumption as a co-target of the intervention.

Keywords
Obesity
Nutrition
Low income
Sugar-sweetened beverages
Beverage
WIC

The first 1000 d (e.g., the period from gestation through age 2 years) is a critical period for the development of childhood obesity[1]. The importance of nutrition during the first 1000 d is increasingly recognised, and the impending Dietary Guidelines for Americans 2020–2025 will include comprehensive dietary guidelines on this life course period for the first time ever[2]. Sugar-sweetened beverages (SSB), including soda, sports/energy drinks, lemonade and sweetened fruit drinks, are known contributors to the obesity epidemic[3] and prime targets for prevention strategies. In particular, targeting women's SSB consumption during pregnancy and postpartum could have downstream benefits for preventing obesity in children. This idea is supported by prospective research showing higher adiposity among school-aged children whose mothers consumed more SSB during pregnancy[4] and by cross-sectional data

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Table 1 Characteristics of study sample overall and by pregnancy status, among women in WIC households

	Overall (*n* 388)		Pregnancy status			
			Pregnant (*n* 122)		Postpartum (*n* 266)	
	n	%	*n*	%	*n*	%
Maternal characteristics						
Maternal age, years						
18–24	107	27·6	40	32·8	67	25·2
25–29	107	27·6	31	25·4	76	28·6
30–34	98	25·3	34	27·9	64	24·1
≥35	76	19·6	17	13·9	59	22·2
Maternal race/ethnicity						
White/other, non-Hispanic	11	2·8	4	3·3	7	2·6
Black, non-Hispanic	12	3·1	5	4·1	7	2·6
Hispanic/Latina	365	94·1	113	92·6	252	94·7
Pre-pregnancy BMI						
<25 kg/m^2	164	42·3	46	37·7	118	44·4
25–<30 kg/m^2	109	28·1	39	32·0	70	26·3
≥30 kg/m^2	111	28·6	34	27·9	77	29·0
Unknown	4	1·0	3	2·5	1	0·4
Household characteristics						
Highest parental education						
High school degree or less	190	49·0	60	49·2	130	48·9
Some college	125	32·2	37	30·3	88	33·1
Bachelor's degree	63	16·2	20	16·4	43	16·2
Graduate or professional degree	10	2·6	5	4·1	5	1·9
Annual household income						
<$15 000	153	39·4	45	36·9	108	40·6
$15 000 to <$35 000	134	34·5	41	33·6	93	35·0
≥$35 000	38	9·8	14	11·5	24	9·0
Unknown	63	16·2	22	18·0	41	15·4
Maternal habitual beverage consumption (≥ once weekly)						
Water	386	99·5	122	100·0	264	99·3
Milk	328	84·5	112	91·8	216	81·2
100 % juice	328	84·5	104	85·3	224	84·2
SSB*	344	88·7	107	87·7	237	89·1

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; SSB, sugar-sweetened beverages.
*Includes regular soda, sports drink, energy drink and sweetened coffee/tea drink.

noting positive associations of parent SSB consumption with SSB consumption in their children[5]. A better understanding of factors associated with women's SSB consumption during this time would further inform obesity prevention strategies, especially given that pregnant women are motivated for behaviour change to promote offspring health[6].

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutrition counselling, education and a food package to qualifying women and children under age 5 years. Given its focus on early life, WIC is a platform for early childhood obesity prevention[7], which is particularly important for racial/ethnic minority and low-income populations because they experience higher rates of childhood obesity[8–12]. Reports of dietary patterns of WIC participants exist, but they focus almost exclusively on infants and children, while evidence on diet quality of pregnant and parenting women in WIC, particularly with regard to beverage intake, is more limited. We recently found a high prevalence of SSB consumption among parents in a multi-site WIC programme located in northern Manhattan, New York City (NYC), NY[13]. In order to inform future interventions to promote healthy beverage consumption in this population, the current study describes prenatal and postpartum consumption of water, cows' milk, 100 % juice and SSB and analyses demographic and beverage correlates of SSB intake in this high-risk population.

Methods

Cross-sectional data were from 388 pregnant and postpartum, WIC-enrolled women (infant aged <2 years) participating in the NYC First 1000 Days Study, an observational research study that took place at the NewYork-Presbyterian Hospital WIC locations[13]. Study staff administered questionnaires to collect data on beverage consumption and maternal and household characteristics, including age, race/ethnicity, pre-pregnancy weight, education and income. We obtained written informed consent; all materials were available in English and Spanish. The authors' institutional review board approved the study.

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Table 2 Maternal patterns of beverage consumption in the First 1000 d according to pregnancy status among women in WIC households*

	Pregnant (n 122)								Postpartum (n 266)							
	Habitual consumers		Daily consumption in fluid ounce		Daily kJ (kcal) intake				Habitual consumers		Daily consumption in fluid ounce		Daily kJ (kcal) intake			
					n		IQR						*n*		IQR	
	n	%	*n*	IQR	kJ	kcal	kJ	kcal	*n*	%	*n*	IQR	kJ	kcal	kJ	kcal
Beverage type																
Water	122	100·0	36	24–51	0		0–0		264	99·3	24	24–36	0		0–0	
Milk	112	91·8	8	5–16	626	150	328–1150	78–275	216	81·2	8	1–16	383	92	81–767	19–183
100 % juice	104	85·3	8	1–16	591	141	84–1183	20–283	224	84·2	6	1–12	422	101	84–887	20–212
SSB†	107	87·7	8	2–18	411	98	114–902	27–216	237	89·1	10	4–20	464	111	163–1012	39–242

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; IQR, interquartile range; SSB, sugar-sweetened beverages.
*Consumption measured in fluid ounces.
†Included regular soda, sports drink, energy drink and sweetened coffee/tea drink.

Beverage consumption was measured by the BEVQ-15[14], a validated questionnaire that assesses beverage consumption across fifteen individual categories. We used container samples as visual aids to facilitate participants' responses to serving size information. We estimated median daily intake of SSB in kilocalories (kcal) and ounces using validated methods[14]; daily intake was assessed by converting frequency of consumption over the past month to average daily consumption and then multiplying by the reported volume per serving. We defined SSB as liquids containing added energetic sweeteners (e.g., fructose, glucose or high-fructose maize syrup) and habitual beverage consumers as those who reported consuming beverages at least once weekly.

Analyses were conducted using SAS 9.4. We summarised the sample characteristics overall and by women's pregnancy status (i.e., pregnant, postpartum). We then used multivariable quantile regression to assess associations of maternal and household factors and other beverage consumption on median daily SSB consumption. Maternal and household factors were selected *a priori* based on their association with SSB consumption in other populations[15]. The model included self-reported maternal and household factors, as well as median daily intake of water, milk and 100 % juice. Throughout, we present 95 % CI, corresponding to a two-sided α level of 0·05.

Results

The sample consisted of 388 low-income (<185 % federal poverty level) predominately Hispanic/Latina women enrolled in WIC; 31 % (n 122) were pregnant (Table 1) and 89 % reported habitual consumption of SSB.

Nearly all women reported drinking water, milk and 100 % fruit juice (Table 2). Pregnant and postpartum women consumed a median of 8 (interquartile range (IQR) 2–18) and 10 (IQR 4–20) fluid ounces of SSB, respectively, contributing to a median daily energetic intake of 410 kJ (IQR 113–904) 98 kcal (IQR 27–216) and 464 kJ (IQR 163–1013) (111 kcal (IQR 39–242)). Milk was the most frequently consumed energy-containing beverage among pregnant women, accounting for 628 median daily beverage kJ (IQR 326–1151) (150 kcal (IQR 78–275)), followed by 100 % juice, which was consumed by 85 % of pregnant women and accounted for median 590 daily kJ (IQR 84–598) (141 daily kcal (IQR 20–143)). SSB were the most frequently consumed energy-containing beverage (89 %) among postpartum women, and accounted for the most kJ intake (median 464 kJ; IQR 163–1013) kcal intake (median 111 kcal; IQR 39–242). Eighty-four percent of postpartum women consumed 100 % juice, a daily average of 6 fluid ounces and 423 kJ (101 kcal).

During pregnancy, any 100 % juice and milk consumption were positively correlated (Spearman r 0·2; P 0·03), while 100 % juice and SSB consumption were positively correlated during the postpartum period (Spearman r 0·2;

Table 3 Associations of maternal and household characteristics with maternal daily sugar-sweetened (SSB) consumption. Parameter estimates from quantile regression models. Data from 388 women in the first 1000 d*

	Median maternal SSB kilojoules (kilocalories†)			
	Estimate		95 % CI	
	kJ	kcal	kJ	kcal
Maternal characteristics				
Maternal age, years				
18–24	0·0	0·0	Ref	
25–29	−192·3	−46·0	−409·1, 21·0	−97·8, 5·0
30–34	−225·8	−54·0	−379·0, 2·0	−90·6, 0·5
≥35	−216·6	−51·8	−447·2, 125·5	−106·9, 30·0
Pre-pregnancy BMI[b]				
<25 kg/m^2	0·0	0·0	Ref	
25 to <30 kg/m^2	5·7	1·4	−118·3, 125·9	−28·3, 30·1
≥30 kg/m^2	151·2	36·1	−43·3, 293·8	−10·3, 70·2
Pregnancy status				
Pregnant	0·0	0·0	Ref	
Postpartum	54·9	13·1	−60·9, 218·4	−14·6, 52·2
Household characteristics				
Household income				
<$15 000	0·0	0·0	Ref	
$15 000 to <$35 000	116·8	27·9	−71·1, 294·2	−17·0, 70·3
≥$35 000	102·2	24·4	−183·3, 150·6	−43·8, 36·0
Unknown	−5·2	−1·2	−209·4, 156·8	−50·0, 37·5
Highest parental education				
High school degree or less	0·0	0·0	Ref	
Some college	−152·4	−36·4	−311·2, 27·3	−74·4, 6·5
Bachelor's degree	−191·9	−45·9	−350·4, 55·0	−83·7, 13·1
Graduate or professional degree	−172·3	−41·2	−474·1, 211·6	−113·3, 50·6
Maternal beverage consumption (for each additional ounce)				
Water	−1·9	−0·4	−6·1, 3·9	−1·5, 0·9
Milk	0·11	0·03	−5·6, 2·8	−1·3, 0·7
100 % juice	13·3	3·2	8·3, 30·6	2·0, 7·3

*We estimated medians and used quantile regression due to the non-normal distribution of SSB consumption; β estimates represent the median difference in kJ (kcal) consumption compared with the reference group.
†Adjusted for maternal age, pre-pregnancy BMI and pregnancy status; household income and highest educational level; and maternal beverage consumption.
‡Effect estimates and CI for eight participants with unknown pre-pregnancy BMI are not estimable.

P 0·005). In both pregnancy and postpartum periods, greater 100 % juice consumption was correlated with lower water consumption (*P* 0·07 and 0·04, respectively; data not shown).

In our multivariable analysis (Table 3), only consumption of 100 % juice was associated with greater median SSB energetic intake (adjusted β for each additional 100 % juice ounce (approximately 74 kJ (17·7 kcal)) = 13 SSB kJ; 95% CI 8, 31 (3·2 SSB kcal; 95 % CI 2·0, 7·3).

Discussion

Nearly all of the pregnant and postpartum women in our sample – almost 90 % – drank SSB during the past month, contributing approximately 418 kJ (100 kcal) to overall daily energy intake. The median consumption of SSB kJ (kcal) in our sample was lower than mean estimates found in previous research among women aged 20–39 years from nationally representative National Health and Nutrition Examination Survey data[16]. This discrepancy may be due to population differences, as our sample of low-income WIC participants was not population based or nationally representative like the National Health and Nutrition Examination Survey sample. Measurement differences may also play a role, as the National Health and Nutrition Examination Survey study reports mean daily consumption of 622 and 646 kJ (158·3 and 154·4 kcal) for pregnant and non-pregnant women, respectively[16], while we examined habitual consumption as median (not mean) daily kcal and ounces.

The types of beverages consumed by women varied across pregnancy status. Among pregnant women, the main sources of SSB kJ (kcal) were sweetened fruit drinks and soda, *v.* sweetened coffee/tea drinks and soda among women postpartum. Pregnant women did not consume sweetened coffee/tea drinks, aligned with recommendations to limit caffeine intake during pregnancy[17,18].

In our sample, 100 % juice was the second largest contributor to kJ (kcal) intake from beverages among pregnant women, after cows' milk, and a major source of kJ (kcal) intake for women postpartum. Juice was also the only correlate of SSB consumption in adjusted analyses. Several mechanisms may explain this association. First, women may not know the difference between 100 % fruit juice and fruit drinks that contain added sugars. In prior qualitative research in the same population[6], we found that

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women were unaware of the sugar content in 100 % juice and were confused about the difference between 100 % juice, which does not contain added sugars, and sweetened fruit drinks, which do. Cravings and taste preferences could also play a role. Sonneville proposed that drinking 100 % juice may impact the early development of taste preferences and lead to a partiality for other sweetened beverages. Their study[19] found that higher 100 % juice intake at 1 year of age was associated with higher 100 % juice intake, SSB intake and BMI *z*-score during early and mid-childhood.

WIC provides a monthly allotment of 100 % fruit juice that equates to an average of 3–5 ounces/d to pregnant and postpartum women, presenting an opportunity for intervention[20]. A study in South Carolina revealed that more than 80 % of WIC participants would prefer fresh fruit over juice[21], suggesting that reducing juice consumption in this population is a realistic goal. In 2017, an expert review of WIC food packages published by the National Academy of Sciences recommended specific changes to packages formulated for women and children, including WIC, in order to increase the value of the cash value benefit for fruits and vegetables, reduce the allocation of 100 % fruit juice and cows' milk and provide the option for WIC participants to replace 100 % fruit juice with a greater cash value benefit amount[22]. Our results suggest that implementation of these recommendations may possibly have secondary benefits of reducing SSB consumption among pregnant and postpartum women.

We acknowledge several limitations. Our sample is taken from a large urban setting and findings might not be generalisable to WIC families in other areas. Our sample was also predominately Hispanic/Latina. The sample size was not sufficient to conduct subgroup analyses of race/ethnicity, income or other factors associated with beverage consumption. Moreover, data are cross-sectional so we cannot establish temporality.

Evidence on dietary patterns of pregnant and parenting women in WIC is limited, although a recent study of pregnant WIC enrollees found low consumption of dark green vegetables, beans/plant proteins and whole grains[23]. Our results add to the literature by characterising energetic and non-energetic beverage consumption in this population. Our data reveal that SSB consumption is prevalent among low-income predominantly Hispanic/Latina women enrolled in WIC who are either pregnant or within 2 years of giving birth, along with 100 % juice, accounts for a large portion of beverage kcal they consume. Targeting healthy beverage consumption for women in WIC-enrolled families may be important to fight the child obesity epidemic. Interventions targeting SSB reduction in this population should also target reduction of 100 % juice consumption. Further understanding why 100 % juice consumption is associated with SSB consumption could help with the design of such interventions.

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