Added sugar and dietary sodium intake from purchased fast food, confectionery, sweetened beverages and snacks among Sowetan adolescents

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Background. Greater availability and accessibility of fast foods, sugar-sweetened beverages and snacks in urban South Africa may be contributing to the burgeoning obesity epidemic in adolescents.

Objectives. To determine the consumption of purchased foods and drinks among a cohort of urban adolescents, and to estimate the added sugar and dietary sodium intake from these foods and beverages.

Methods. Participants (N=1 451, 49.6% male, mean 17.7 years of age) completed interviewer-assisted questionnaires on dietary intake practices pertaining to food choices in the home, school and community. The consumption of fast foods, sugar-sweetened beverages and snacks was determined and the average added sugar and sodium intakes were estimated.

Results. The median (interquartile range) intake of fast foods was 11 (7 - 16) items/week in both sexes. Sweetened beverages were consumed 8 (5 - 11) and 10 (6 - 11) times/week by males and females, respectively (p<0.02). Females consumed confectionery more often than males (13 (9 - 17) and 11 (8 - 15) items/week, respectively; p<0.01). Seven (5 - 10) salty snack items/week were consumed by both sexes. Overall, mean added sugar intake from these purchased food items was estimated at 561.6 g/week for males and 485.3 g/week for females, respectively (p=0.02), and dietary salt at 4 803 mg/week for males and 4 761 mg/week for females, respectively (p>0.05).

Conclusion. In this study, males and females consumed on average three times the recommended daily intake of added sugar, and more than half of the recommended daily salt intake from these purchased foods alone. These dietary patterns during adolescence may exacerbate the risk of obesity and hypertension in later adult life.

In 2004, the World Health Organization (WHO) suggested that non-communicable diseases (NCDs) caused 28% of the total burden of disease measured by disability-adjusted life-years in South Africa (SA).[1] Of concern is the high prevalence of hypertension among SA adults, which is estimated to be between 14% and 33% nationally, and in some regions, such as Soweto, to be very high (42% in middle-aged Soweto women).[1,2] Average dietary sodium (salt) intake in SA adults was estimated at 8.1 g/day,[3] which is higher than the WHO recommendation of 4 - 6 g/day. Much of the salt consumption comes from non-discretionary intake (highest proportion from bread, followed by margarine, soup mixes and gravies) which may contribute to hypertension and cardiovascular disease risk.[4] SA is also burdened with a high prevalence of overweight and obesity among adult women (55%) and men (30%).[5] Overweight and obesity also affects younger age groups, for example, among the Birth to Twenty cohort in the Soweto-Johannesburg municipality, 27% and 8% of 17-year-old females and males, respectively, have been found to be either overweight or obese.[6]

'Added sugar' refers to all monosaccharides and disaccharides that are added to foods and drinks during preparation and cooking.[7] However, both internationally and nationally there is no consensus regarding this definition. There is evidence to support the role increased sugar intakes play in the development of obesity.[8-10] Although the WHO recommends a sugar intake of <10% of total energy in order to prevent NCDs including obesity,[11] other researchers recommend a lower proportion of <6%.[12]

With greater urbanisation in SA, fast foods, sugar-sweetened beverages, and sweet and salty snacks are more available and accessible and may be contributors to obesity and hypertension risk.[9,10,13] More nutrition epidemiological data of the consumption patterns of these purchased items, particularly in children and adolescents, are essential for clinical and public health professionals and policy leaders to better understand the impact these dietary consumption practices may have on health outcomes.

Objective

The objective of this study was, firstly, to determine the consumption of purchased foods and drinks (fast foods, sweetened beverages, confectionery and snacks), and secondly, from these consumption practices, estimate the sugar and sodium intakes from these foods among a cohort of adolescents living in urban Soweto, SA.

Methods

Study population, design and sample size

Data for this study were obtained from a longitudinal birth cohort study, the Birth to Twenty (Bt20) Plus cohort, which started in 1989.[14] Singleton children (*n*=3 273, 78% black participants) born between April and June 1990 and resident for at least 6 months in the Soweto-Johannesburg municipality were enrolled into the birth cohort and have been followed up almost annually between birth and 23 years of age. Data for this current study were collected when participants were 17 - 18 years old (mean age 17.7 years). Only participants living in Soweto were included in the analytic sample (*n*=1 451; 49.6% male).

Dietary behaviour assessment

Participants completed interviewer-assisted questionnaires on dietary practices (including frequency) occurring in the home, school and community as utilised in previous studies.[15-22] The questions determined if participants engaged in a particular eating behaviour, and if they did, we enquired about which foods they ate (from a predetermined list) and how often they ate them in the previous week. Further information on the tool's development and piloting can be found in Feeley *et al*.[23] Utilising the consumption data of food purchased from school and in the community, the standardised portion estimates in the Medical Research Council's (MRC's) Dietary Assessment Education Kit (DAEK)[24] and SA Food Composition Tables, we calculated average consumption of added sugar and salt from these purchased foods. Information from food labels was used if the product information could not be determined through the SA Food Composition Tables. Data were imported into STATA version 10 for analysis. Food item variables were summed and categorised into appropriate groups. The Wilcoxon-Mann-Whitney test was used to assess gender differences for the food categories. Ethics clearance was obtained from the University of the Witwatersrand Human Research Ethics Committee (M080320) and each adolescent provided written assent and guardian consent.

Results

The dietary data were grouped into four categories: (*i*) fast foods; (*ii*) sweetened beverages; (*iii*) confectionery; and (*iv*) salty snacks (Tables 1 - 4). Overall, the median (IQR) intake for fast foods was 11 (7 - 16) items/week and there were no sex differences ($p > 0.05$). The three most popular fast foods included fried chips, vetkoek and pies (Table 1).

Among the cohort, sweetened beverages were consumed 8 (5 - 11) and 10 (6 - 11) times/week by males and females, respectively ($p < 0.02$), with carbonated soft drinks being the most popular drink consumed (Table 2). The consumption of confectionery (Table 3) was higher among the females in the cohort than males (13 (9 - 17) and 11 (8 - 15) items/week, respectively; $p < 0.01$). Sweets, followed by cakes and doughnuts, were the most popular items (Table 3). Salty snacks were also consumed regularly, with a median value of 7 (5 - 10) items/week for both sexes; with crisps (potato or maize) the

most consumed snack item (Table 4). Confectionery was consumed on average more than sweetened beverages and salty snacks among females ($p < 0.03$), with less of a difference among males.

From the average intakes and estimated portion sizes, the mean added sugar content from these purchased food items was 561.6 g/week for males and 485.3 g/week for females, respectively ($p = 0.02$). Mean sodium content from these foods was 4 803 mg for males and 4 761 mg for the week ($p > 0.05$). Beverages (55.7%) followed by confectionery (44.2%) contributed the greatest amount to added sugar. Fast foods contributed the greatest amount to sodium (52.5%), followed by salty snacks (31.2%), confectionery (12.7%) and sweetened beverages (3.6%).

Discussion

There is a paucity of data on SA adolescent consumption of fast (street) foods. From adult studies, in 2010 van Zyl *et al*.[25] reported that 21% of Soweto adults consumed fast food at least once per week while 28% consumed it two to three times per week. In a national survey, Steyn *et al*.[26] found that frequent adult fast food consumption (>2 fast food items per week) ranged between 1.5% and 15% depending on geographic location and socio-economic group. Previously among Soweto adolescents, we reported that 30% consumed fast foods five to seven times a week with another 20% consuming it two to four times a week.[27] This study found that the median (50%) of Soweto adolescents consumed more than 11 fast food items per week, which is not only greater than previous reported SA studies, but also greater than reported fast food consumption among US adolescents.[28]

Sweetened beverage consumption among this cohort was also relatively high, at 1.1 - 1.4 servings per day, which is similar to consumption by 11 - 12-year-old males and females in the US.[8] Research has shown that just one serving (250 ml) of a sweetened beverage per day over a 6-month period is associated with an increase in BMI.[9,10] Since 1989, snack consumption by children in the US has increased to three per day.[29] In our study, snacking behaviour (confectionery and salty snacks) was slightly lower, with an average of 2.5 snacks consumed per day.

The estimated total energy requirement for a 17-year-old adolescent is 10 500 kJ per day.[30] For added sugar, the American

Table 1. Fast food consumption in the previous week

Fast food	Males (*n*=720)				Females (*n*=731)			
	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)
Fried chips	37.1	5 (3 - 7)	0	1 003.0	35.6	5 (3 - 7)	0	914.0
Vetkoek	18.6	4 (2 - 6)	0	19.7	17.0	4 (2 - 6)	0	16.0
Pie	12.4	4 (2 - 6)	0	452.0	16.4	4 (2 - 5)	0	254.7
Boerewors*	8.1	2 (1 - 3)	0	351.4	6.6	2 (2 - 3)	0	269.9
Fried fish	5.8	2 (1 - 2)	0	23.9	5.5	2 (1 - 2)	0	21.3
Hotdog*	4.9	2 (1 - 3)	0	212.6	4.7	1 (1 - 3)	0	77.6
Pizza	4.0	1.5 (1 - 2)	0.1	69.0	4.7	2 (1 - 3)	0.1	192.3
Hamburger	4.0	2 (1 - 3)	0.6	115.4	4.1	1 (1 - 2)	0.6	113.1
Chicken burger	2.0	2(1 - 3)	0	69.2	2.4	1 (1 - 2)	0	76.1
Samoosa	1.9	1 (1 - 3)	0	2.2	1.9	2 (1 - 3)	0	1.1
Pita*	1.0	2 (1 - 3)	0	18.1	1.2	2 (1 - 3)	0	19.3
Total	100	11 (7 - 16)	0.7	2 336.5	100	11 (7 - 15)	0.7	1 995.4

IQR = interquartile range.

*Excluding condiments.

Heart Association (AHA) recommends a prudent upper limit of no more than 420 kJ (25 g) per day for women and no more than 630 kJ (38 g) per day for men.[31] Among the Soweto adolescent population, males on average consumed three times more (80 g; 1 244 kJ/day) and females a bit less (69 g; 1 164 kJ/day) respectively. These estimates are well above the prudent recommendation.[31]

The AHA recommends limiting sodium intake to <1 500 mg/day.[32] Calculated per day, this cohort consumed more than half of the recommendation (686 mg/day and 680 mg/day for males and females, respectively) from these purchased foods alone. This is a concern, especially when considering sodium intake in the pathogenesis of hypertension in black South Africans. There is strong evidence to show that a reduction in sodium is associated with a reduction in blood pressure. A meta-analysis of 50 randomised trials documented that a median reduction in urinary sodium to 1 800 mg/day reduced systolic/diastolic blood pressure by 2.0/1.0 mmHg in non-hypertensive subjects and by 5.0/2.7 mmHg in hypertensive individuals.[33] It is encouraging that SA has begun to address the high sodium content in bread[4] but more may need to be addressed in relation to sugar

consumption, especially when some reports have shown that dietary protein is displaced by sugar.[12]

Dietary practices formed in childhood have been shown to track into adulthood,[34-36] and poor dietary practices predispose individuals to obesity and related metabolic diseases later in life.[37] The cohort in this study showed a high propensity for the consumption of purchased food items with high energy density and sodium, and little fibre, which may result in greater obesity and NCD risk in later years.

Study limitations
This study only examined dietary practices relating to purchased food items and not total dietary intake. We are currently investigating total food intake and the relative contribution of purchased convenience foods to macro-nutrient intake among the Birth to Twenty cohort. We recognise that using standardised portion estimates from the MRC DAEK and that variation in information from the SA Food Composition Tables and food labels due to different definitions being applied may impede the accuracy of the added sugar and salt estimates. However, the consumption patterns of

Table 2. Sweetened beverage consumption in the previous week

Beverage	Males (*n*=720)				Females (*n*=731)			
	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)
Soft drinks	79.9	7 (5 - 10)	180.2	121.8	75.0	7 (5 - 10)	185.5	125.5
Squash	10.9	4 (2 - 5)	10.9	8.2	12.8	3 (2 - 5)	0	59.9
Fruit juice	9.3	3 (2 - 5)	121.9	38.6	12.2	4 (2 - 5)	13.1	9.8
Total count	100	8 (5 - 11)	313.0	168.6	100	10 (6 - 11)	198.6	195.2

IQR = interquartile range.

Table 3. Confectionery consumption in the previous week

Confectionery	Males (*n*=720)				Females (*n*=731)			
	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)
Sweets	60.5	8 (5 - 10)	131.0	34.1	58.0	8 (5 - 10)	149.0	38.8
Cake	15.2	4 (2 - 5)	75.8	891.0	16.5	3 (2 - 5)	78.7	925.9
Doughnuts	2.1	2 (1 - 3)	0.64	18.1	13.5	4 (2 - 5)	0.8	23.5
Chocolate	13.1	2 (2 - 4)	32.2	29.1	9.7	3 (2 - 5)	47.1	42.7
Ice cream	9.2	2 (2 - 4)	8.3	36.7	2.3	2 (2 - 3)	10.3	45.3
Total	100	11 (8 - 15)	247.9	1 009	100	13 (9 - 17)	285.9	1 076.2

IQR = interquartile range.

Table 4. Salty snacks consumption in the previous week

	Males (*n*=720)				Females (*n*=731)			
	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)	Per cent (%)	Median (IQR)	Added sugar (g)	Sodium (mg)
Crisps (potato or maize)	84.3	6 (5 - 9)	0	1 003.0	89.0	6 (5 - 9)	0	914.5
Peanuts	9.2	3 (2 - 5)	0	94.1	8.2	3 (2 - 4)	0	29.6
Popcorn	6.4	3 (2 - 4)	0	192.0	2.8	2 (2 - 5)	0	254.1
Total	100	7 (5 - 10)	0	1 289.1	100	7 (5 - 10)	0	1 198.2

IQR = interquartile range.

purchased food are indicative enough that, in an urban environment such as Soweto, adolescents are consuming a large number of fast foods, sugar-sweetened beverages, confectionery and salty snacks. This study highlights the need for further research to better estimate added sugar and salt intake among adolescents through quantified dietary- and salt-intake instruments, 24-hour urinary sodium excretion, table salt use, and so on.

Conclusion

This study sounds the alarm that urban adolescents are consuming large intakes of fast food, sugar-sweetened beverages and snacks, which increase the intake of sugar and salt in the diet. These patterns may exacerbate the risk of obesity and hypertension in later adult life. Given the Department of Health's Strategic Plan for the Prevention and Control of Non-communicable Diseases 2013 - 2017, which aims to tackle obesity, salt intake and hypertension, it is vital that multidisciplinary teams unite with policy makers to create greater awareness and changes in dietary practices pertaining to sugar and salt consumption, in particular those relating to the consumption of fast foods, sweetened beverages and snacks. The following could be considered: restricting sweetened beverage advertising and sales in schools and, although controversial in a developing country setting, possibly introducing a 'sin tax' on sugar-sweetened beverages.[38]

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