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Consumption of Sugar-Sweetened Beverages in People with Severe Mental Illness: A Community-Based Cohort Study

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Objective: Excess mortality in mentally ill is largely due to high rates of physical illnesses that lead to worse health outcomes. This study examines the intake of added sugar from sugar-sweetened beverages (SSBs) and factors associated with poor mental and physical health in people with severe mental illness.

Methods: Data were collected as part of the standard care of consumers attending the Collaborative Centre for Cardiometabolic Health in Psychosis clinics where a diet history is taken by a dietitian. SSBs and tea/coffee with added sugars consumed in the past seven days were collected.

Results: Overall, 1648 occasions of service comprising 1142 consumers (mean age 45.0 ± 12.5 years, 63.5% males) were seen. Of these, 1234 (74.9%) occasions of service were provided by a dietitian. Two-thirds (n = 840) self-reported to have consumed one or more SSBs or tea/coffee with sugar. Over half 697 (56.5%) consumed one or more SSBs and 437 (35.4%) tea/coffee with sugar. The mean daily consumption of added sugar from SSBs and tea/coffee was 86.2 g/day. On multivariable analysis, males, those diagnosed with schizophrenia, being on Olanzapine ± other antipsychotics and lower socio-economic status were statistically associated with consumption of added sugar.

Conclusion: Consumption of added sugars from SSBs in consumers of community mental health services is four times higher than the general population. This is an underestimation of the total intake of added sugars without other contributors from discretionary foods. Measuring consumption of SSBs may be an easy-to-use proxy for assessing dietary risk when dietitians are not available.

Keywords: sugar-sweetened beverages, severe mental illness, soft drinks, tea, coffee

Introduction

The reduction in life expectancy of people living with severe mental illness (SMI) relative to the general population has been well documented.[1–3] A reduction of 15.9 years for men and 12 years for women has been reported for consumers with mental illness in Western Australia.[1] These findings have been replicated in other countries,[2–4] and evidence suggests that the gap has been widening with time.[5]

Physical comorbidities, particularly cardiovascular disease, contribute to the majority of early death of people living with SMI.[6] A number of cardiovascular risk factors such as central adiposity, smoking, dyslipidaemia, impaired fasting glucose, and obesity are experienced at higher rates by those living with SMI than the Australian population.

The increased prevalence of cardiometabolic risk factors amongst people living with SMI is partly attributed to dietary choices and sedentary lifestyle. However, literature is scarce regarding the dietary habits of this group of people. A recent systematic review of 58 studies concluded that consumers with SMI have a dietary pattern which is high in sugar and saturated fat and low in fibre.[7] Of the three studies in this review that quantified sugar intake in people with

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SMI, Ratliff et al reported significantly higher total sugar consumption in people living with schizophrenia than the general population.[8] Moreover, higher intakes of sugar from sweetened beverages[9] and soft drinks[10] compared to comparison groups were reported. In addition, it has been suggested that the use of antipsychotic medication is a key driver for dietary intake and eating behaviours attributing to increased cravings for sweet foods and beverages.[11,12] Furthermore, the orexigenic potential of many antipsychotics via central anti-satiety pharmacology effects is well described.[13,14] Finally, some antipsychotics appear to be dyslipogenic independent of adiposity.[15]

In a large Japanese study, 80% of people with schizophrenia reported drinking soft drinks (eg, cola) more than once a month.[10] Another cross-sectional study found increased consumption of sugar-sweetened beverages (SSBs) among New Zealanders with bipolar illness compared to the general population.[9] Similar results were reported in young Icelandic adults (18–30 years) with a psychotic disorder.[16] Furthermore, a survey on US adults showed consuming SSBs one or more times a day was significantly associated with poor mental health[17] and with increased odds of depression.[18]

Furthermore, gender, age and socio-economic status are thought to be associated with dietary patterns. The most recent nutrition survey conducted by the Australian Bureau of Statistics (ABS) showed that sugar consumption was highest in men and in younger age groups.[19] Socio-economic status is inversely correlated with fast food consumption in people living with SMI.[20,21]

Clinical observations suggest that most people who live with SMI are, to varying degrees, aware of the adverse effects of smoking, sedentary lifestyle, and excessive alcohol consumption on their general health, but health literacy regarding diet is generally poor. An inverse correlation between health literacy and SSB consumption has been documented.[8]

Although poor diet, encompassing macronutrient distribution, fat type, fibre content and low nutritive foods play an important role in cardiometabolic risk development,[22] many mental health practitioners are constrained in taking a complete dietary history because of the effort and expertise required of them. Principally, our study cohort is comprised of people with schizophrenia (67%), schizoaffective (8.4%), bipolar (11.4%), depression (2.8%) and other related psychosis (10%). Dietary data are notoriously difficult to gather without bias in any population. For those living with SMI, memory and abstract thinking can be impaired which adds to the burden of providing reliable self-reports. However, the discrete and uniform nature of soft drink bottle/can sizes creates a reporting format that is simple and clear making this part of a consumer's diet history often times the most reliable. This furnishes the quantification of SSBs with an advantage over other discrete food groups/macronutrients or foods which also contribute to a deleterious dietary profile. For example, defining and quantifying general snacks has not been shown to be feasible within the time constraints our clinicians operate under.

Determining the amount of sugar consumed through SSBs may allow such a measure to act as a proxy variable for more general high metabolic risk dietary behaviours.

Therefore, in this study, we aimed to quantify the amount of sugar consumed by people living with SMI via SSBs and compare it with the American Heart Association (AHA) recommendations[23] and with consumption of SSBs in the general population. As a secondary aim, we investigated some of the contributing factors associated with the consumption of SSBs in people with SMI.

Methods

The Collaborative Centre for Cardiometabolic Health in Psychosis (ccCHiP) clinical service is a multidisciplinary team based in Sydney, Australia, that provides an integrated service to adults (18–65 years old) living with an SMI including schizophrenia, schizoaffective disorder, bipolar affective disorder, severe forms of depression such as melancholic and psychotic depression, and other types of psychosis.[15] An individualised, holistic management plan is formulated by the multidisciplinary team in collaboration with the consumer.[24] All consumers attending the ccCHiP clinical service between July 2016 and December 2019 aged 18 years and older were included in this study.

Collection and analysis of data were approved through the Sydney Local Health District ethics committee.

As part of standard care, a diet history is conducted by a dietitian for all consumers who are capable of the required recall. The dietitian moves to a 24hr recall or a food frequency style assessment should full diet history not be possible. Beyond this broad assessment of diet, there are specific questions in the online forms regarding the consumption of SSB and caffeine in the past week (Supplementary Figure 1). For this study, SSBs comprised carbonated soft drinks (including

cola), flavoured milk, cordial, juice, and energy drinks. This term does not include tea/coffee with sugar, and we report it separately. Sugar-free drinks included "zero" drinks, milk, tea/coffee without sugar and water. Those with missing SSB data were analysed as "unknown".

To calculate the total amount of added sugar consumed through SSBs, the dietitian utilised information gathered via diet history as well as food frequency style questions including serve size to be able to calculate mean daily intake for each type of SSB. Sugar content of each SSB (Supplementary Figure 2) was calculated using Australian Nutrition Guidelines and in consultation with a research dietitian.[25,26] For sugar added to tea/coffee, the total number of teaspoons of sugar added to tea/coffee was converted to grams and kcal for analysis.

Data were analysed using SAS version 9.4.[27] Using all consumers with valid dietary data, the Mean Daily Sugar Consumption (MDSC) and frequency of SSB consumption were compared to the same measures in the general Australian population as reported by the ABS.[19,28] A similar comparison across different age groups and for each SSB type was also performed.

The MDSC from SSB amongst our consumers was compared to AHA recommendations for total daily added sugar limit from all dietary sources (25 g/day for women and 37.5 g/day for men).[23] The dependent variable, total grams of sugar consumed from SSBs and tea/coffee with sugar, was log transformed to provide a normal distribution because of a right skewed distribution and analysed as a continuous variable. "Proc Mixed" procedure in SAS was used to conduct linear mixed model analysis using subject as random effect with an autoregressive correlation structure.

There were six outliers that consumed more than 504 g/day of sugar from SSBs. We chose this cutoff for outliers where measurements fell beyond three standard deviations of the mean.

Further, we conducted an additional analysis including the outliers and results from this sensitivity analysis showed almost the same associations as the original analysis. There was no significant change in the outcomes of the logistic regression model compared to the original model. Therefore, these findings suggest that the original findings are generalisable of our population, and we present the results excluding the six outliers.

Results

A total of 1142 consumers attended 1648 occasions of service at the ccCHiP clinical service. Of these, 1234 (74.9%) occasions of service were seen by a dietitian. Mean age of consumers was 45.0 (SD = 12.5) years and comprised of 63.5% males. The majority (89%) had a high waist-to-height ratio (WHtR). Two-thirds of consumers (67.3%) were receiving a pension, and almost all of them on a disability support pension. A third were living alone. Type 2 Diabetes was diagnosed in 23.4% (Table 1).

Table 1 SSBs and/or Tea Coffee with Sugar Consumed by Consumers with SMI

Response variable	**Total occasions of service**		**SSB category**				
	n	%	SSB only (n=218) %	Tea/coffee with sugars only (n=102) %	SSB and Tea/coffee with sugars (n=294) %	Sugar free drinks only (n=180) %	Unknown (n=214) %
Total	1234	100	17.7	8.3	23.8	14.6	17.3
Age groups (years)							
18-24	89	7.2	34.8*	3.4*	20.2	12.4	13.5
25-34	163	13.2	19.0	4.3	21.5	15.3	18.4
35-44	307	24.9	18.9	9.1	25.1	14.0	15.6
45-54	351	28.4	14.8	11.1	26.5	15.1	16.0
55-64	262	21.2	15.3	8.4	22.9	13.7	18.7
>64	62	5.0	9.7	4.8	17.7	19.4	30.7

(*Continued*)

Table 1 (Continued).

Response variable	Total occasions of service		SSB category				
Male	783	63.5	18.9	8.4	27.0*	13.0*	16.2
Female	451	36.5	15.5	8.0	18.4	17.3	19.3
Waist-to-height ratio†							
Normal	126	11.0	16.7	11.9	23.0	15.1	21.4
Abnormal	1018	89.0	17.8	8.2	23.2	14.7	16.8
BMI†							
Normal (20-24.99 kg/m^2)	234	19.4	15.8	10.3	24.8	14.5	24.4
Obese (≥30 kg/m^2)	621	51.5	19.8	7.7	23.2	15.9	14.3
Overweight (25-29.99 kg/m^2)	352	29.1	15.3	8.0	22.7	12.8	17.9
Vocational level†							
Pension	800	67.3	16.3*	10.0*	25.0	14.4	17.3
Unemployed	153	12.9	18.3	6.5	22.9	10.5	22.2
Employed	185	15.6	17.3	3.2	21.6	17.8	16.8
Studying	50	4.2	34.0	6.0	16.0	14.0	18.0
Living arrangements†							
Alone	403	33.3	16.4	9.7	20.6*	18.6*	16.6
Spouse/de facto	109	9.0	15.6	9.2	14.7	14.7	24.8
Parents or siblings	335	27.7	21.8	5.7	24.2	12.2	17.3
Other family member	52	4.3	13.5	5.8	30.8	25.0	11.5
One other (not family)	44	3.6	22.7	4.6	27.3	11.4	11.4
Group of others	45	3.7	15.6	11.1	33.3	13.3	17.8
Long term hospital	7	0.5	14.3	14.3	42.9	0	0
Supported accommodation	64	5.3	20.3	10.9	17.2	12.5	20.3
Boarding house	152	12.5	13.8	9.2	34.9	7.9	19.1
Socio-economic status†							
Upper	270	22.0	21.9*	3.7*	18.9*	16.7	17.0
Middle	265	21.5	11.3	8.7	28.3	14.3	18.9
Lower	695	56.5	18.6	9.9	24.0	13.8	17.0
Psychiatric diagnosis†							
Schizophrenia	831	67.4	18.3	9.2	25.0	13.6	17.0
Schizoaffective	103	8.4	12.6	8.7	14.6	15.5	23.3
Bipolar	140	11.4	14.3	7.9	22.1	20.7	12.9
Depression	34	2.8	14.7	0	17.7	2.9	29.4
Other psychosis/All others	124	10.0	22.6	4.0	27.4	16.1	17.0
Family history (diabetes)†							
No	595	50.0	56.5	9.2	24.0	13.5	17.5
Yes	596	50.0	56.5	7.4	23.0	16.1	17.1
Diabetes							
No	945	76.6	18.0	8.9	24.7	14.4	16.3
Yes	289	23.4	16.6	6.2	21.1	15.2	20.8
Dyslipidaemia†							
No	433	26.3	19.1	9.1	23.0	15.9	18.5
Yes	1215	73.7	17.2	8.0	24.1	14.2	17.0
Hypertension							
No	860	69.7	19.2*	7.9	22.9	15.0	17.3
Yes	374	30.3	14.2	9.1	25.9	13.6	17.4

(*Continued*)

Table 1 (Continued).

Response variable	Total occasions of service		SSB category				
Antipsychotic medication use							
Clozapine and other	419	34.0	54.2	7.9	22.4	13.6	20.3
Olanzapine and other	183	14.8	56.6	8.2	29.7	16.5	15.9
Other only	554	44.9	58.2	9.0	23.2	14.2	15.5
None	78	6.3	56.4	5.1	21.8	18.0	18.0

Notes: †: Number not equal to 1234. *:Pearson Chi squared test ($p<0.05$) shows whether the distribution of SSB categories by each response variable differed in (SSB only/Not SSB only), (Tea/coffee with sugars only/Not Tea/coffee with sugars only), (SSB and Tea/coffee with sugars/Not SSB and Tea/coffee with sugars), (Sugar free drinks only/Not Sugar free drinks only), (Unknown/Not Unknown) groups.
Abbreviations: SSB, sugar sweetened beverages; SMI, severe mental illness.

Consumers at 840 (68.1%) occasions of service reported to have consumed SSBs or tea/coffee with sugar. Over half of consumers, 56.5% (n = 697) reported drinking one or more type of SSBs with a MDSC of 101.9g/day (SD=95.9g/day; median 76.0g/day). Two-thirds (69.7%) of those aged 18–24 years reported to have consumed one or more SSBs and 59.1% of males were consuming regular SSBs, statistically significantly more than females ($p < 0.05$). Over half (55.3%) of those receiving a disability support pension consumed one or more type of SSBs. One in five reported to have consumed only premade SSBs (18%), 8% only tea/coffee with added sugar and 24% consumed both (Figure 1). Table 1 shows that over a third who consumed only SSB were between 18 and 24 years of age (34.8%).

Over a third of consumers (n = 437, 35.5%) reported consumption of added sugars from tea/coffee. MDSC from tea/coffee was 33.8 (SD = 79.6) (median 16.8) g/day.

During 15% (n = 180) of occasions of service, consumers reported drinking only sugar-free drinks. Of these, 73 (40.6%) consumed zero sugar carbonated beverages, 129 (71.7%) tea/coffee without added sugar, 15 (8.3%) milk and 2 (1.1%) water. Of those who consumed any sugar-free drinks, 237 (19.2%) also consumed one or more SSB's and 93 (7.5%) consumed tea/coffee with added sugar. Seventeen percent (n = 214) were unknown regarding their beverage consumption (Figure 1).

Regular SSB consumption was reported at more than half 56.5% (n = 697) of the dietitian appointments compared to 42% of people in the general population.[19] MDSC from SSBs was 86.7 g/day (SD = 84.2 g/day; median 76.0 g/day) which was almost four times higher than the average daily sugar consumed through SSBs in the general population (22.5 g/day).[19] After removing extreme outliers based on the box-and-whisker plot analysis (n = 6), the difference remained elevated (mean = 83.7 g/day).

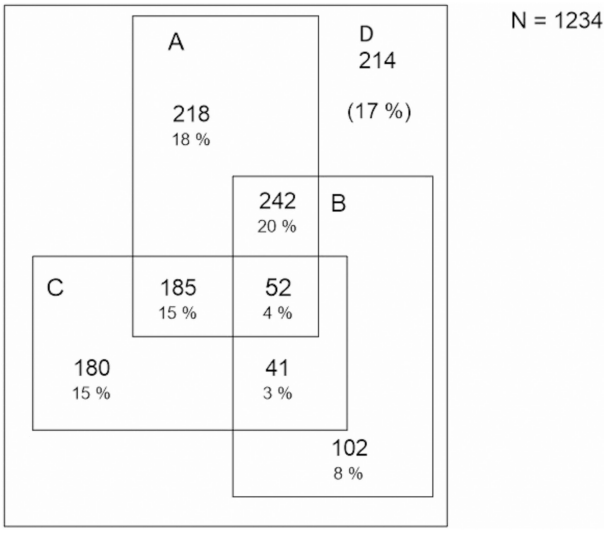

Figure 1 Proportion of consumers with SMI consuming SSBs. (**A**): Sugar sweetened beverages. (**B**): Tea or coffee with sugars. (**C**): Sugar free drinks. (**D**): Unknown.

Notably, MDSC from SSBs excluding tea/coffee with sugar was not lower in older age groups within the ccCHiP sample, unlike that seen in the general population (Figure 2).

The MDSC from SSBs and/or tea/coffee with sugar was 91.7 g/day (86.2 g/day without extreme outliers) with 72.3% of those consumers exceeding the AHA total daily sugar allowance from all dietary sources (25 g/day for women and 37.5 g/day for men). Those whose sugar consumption exceeded AHA recommendations were more likely to be men (65.1%) and on a pension (70.4%).

The MDSC from SSBs and/or tea/coffee with sugar is shown in Table 2 (without extreme outliers). There were statistically significant differences in the quantity of sugar consumed from SSB or tea/coffee among gender, ethnic origin of consumers, vocation level, consumers with dyslipidaemia and in those from mid to low socio-economic status. There was no significant difference in SSB consumption across different age groups ($p = 0.3$), however people 25–34 years of age had the highest sugar consumption (97.8g/d) (Table 2). MDSC was 92.1g/d in males and 74.9g/d in females ($p < 0.001$). Those receiving a disability support pension consumed 93.3g/d from SSBs or tea/coffee statistically significantly more than by those who are employed (73.6g/d) ($p < 0.001$) and they consumed consistently higher than all other types of vocation.

Consumers with dyslipidaemia consumed a statistically significantly higher quantity of added sugar from SSBs compared to those without it.

Carbonated soft drinks (58.9%) and juice/cordial (51.2%) were the most frequently consumed SSBs in our consumers. Flavoured milk was reported at 14.5% and energy drinks at 7.1% of occasions of service. Among those who consume carbonated soft drinks, the average daily consumption was 584.7mL (median 375mL, range 30–4000mL) which contains 69.4g of sugar. Average juice/cordial daily consumption was 403.9mL containing approximately 44.1g of sugar.

The MDSC from SSB and tea/coffee with sugars was considerably more (117.3g/day) than from other categories of added sugar intake (Table 2). Consumers of SSB and tea/coffee with sugars were significantly more likely to be on disability support pension, living in supported accommodation and lower SES compared to the rest of the study population ($p < 0.05$).

Among people who consume SSBs and tea/coffee with sugars, the average calorie intake from added sugar from these beverages was 355.4kcal. The World Health Organisation (WHO) recommends the total sugar intake from all sources not to exceed 10% of the daily energy intake (50g for a calorie intake of 2000 kcal).[29] When sugar from all sources is accounted for, 52% of the Australian general population exceed the above recommendations.[28]

On multivariable analysis, males showed 34.2% higher consumption of sugar from SSBs and tea/coffee with sugars compared to females (Table 3). Consumers with schizoaffective disorder were consuming 31.1% less added sugar compared to those diagnosed with schizophrenia. Consumers who were on "olanzapine and other", and "other only" antipsychotic medications compared to "clozapine and other" reported increased consumption of added sugar of 35.9% and 21.9%, respectively. Those in both the "middle" and "lower" categories of socio-economic status reported to have an increased consumption of sugar, 35.9% and 26.6% higher compared to people who were in the "higher" SES.

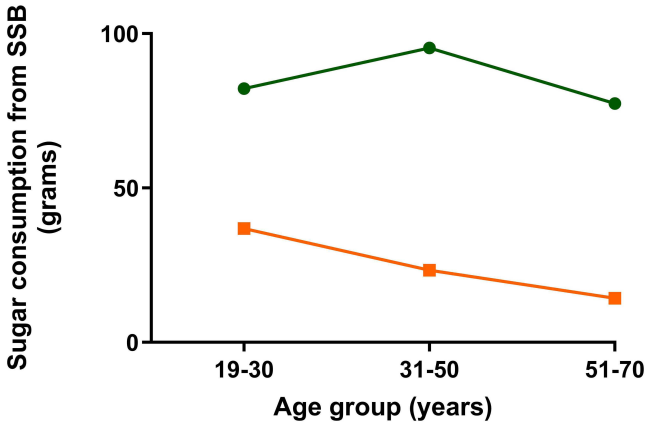

Figure 2 Mean amount of total sugar consumption from sugar-sweetened beverages (SSBs) across lifespan of ccCHiP and general population. Green represents ccCHiP. Orange represents Australian population.

Table 2 MDSC from Sugar-Sweetened Beverages and/or Tea Coffee with Sugar

Response Variable	SSB only (n=217) g/day	Tea/coffee with Sugars Only (n=101) g/day	SSB or tea/coffee with Sugars (n=834) g/day	SSB and Tea/ coffee with Sugars (n=290) g/day
Total	97.9	34.3	86.2	117.3
Age groups (years)				
18-24	93.6	9.8	82.4	88.5
25-34	116.3	40.5	97.8	131.6
35-44	103.1	27.1	87.6	117.2
45-54	87.9	33.0	87.7	127.3
55-64	92.3	47.0	80.0	108.9
>64	98.7	33.6	69.1	82.8
Male	104.1	37.0	92.1*	117.5
Female	84.9	29.6	74.9	116.7
Waist-to-height ratio				
Normal	68.3*	21.7*	76.1	116.0
Abnormal	104.0	36.3	88.4	119.3
BMI				
Normal (20-24.99 kg/m^2)	79.1	43.7	85.1	116.1
Overweight (25-29.99 kg/m^2)	90.6	32.0	80.7	112.5
Obese (≥30 kg/m^2)	107.8	31.8	90.0	121.9
Vocational level				
Pension	106.7	37.4	93.3*	128.6*
Unemployed	78.4	26.5	64.3	90.0
Employed	90.6	18.2	73.6	89.2
Studying	78.1	33.6	76.7	102.9
Living arrangements				
Alone	90.8	36.8	83.7	122.8*
Spouse/de facto	76.8	33.0	66.5	107.7
Parents or siblings	100.2	22.1	89.4	115.9
Other family member	129.0	19.6	101.9	122.3
One other (not family)	76.1	37.8	80.0	106.6
Group of others	71.6	35.3	90.1	119.7
Long term hospital	176.0	8.4	64.6	76.7
Supported accommodation	137.0	23.4	113.4	198.9
Boarding house	106.9	52.8	85.2	101.3
Socio-economic status				
Upper	90.4	16.4	74.1	90.6*
Middle	90.9	42.7	89.4	120.9
Lower	100.5	34.2	90.0	124.4
Psychiatric diagnosis				
Schizophrenia	99.9	35.0	89.7	121.6
Schizoaffective	119.1	14.9	74.4	91.9
Bipolar	82.0	25.8	73.2	110.5
Depression	47.0	0	75.0	160.2
Other psychosis/All others	98.4	84.0	89.8	100.9
Family history (diabetes)				
No	90.6	35.7	83.1	113.3
Yes	101.8	33.0	87.7	119.1
Diabetes				
No	94.8	31.1	84.6	114.2
Yes	109.1	50.2	92.2	129.3

(*Continued*)

Table 2 (Continued).

Response Variable	SSB only (n=217) g/day	Tea/coffee with Sugars Only (n=101) g/day	SSB or tea/coffee with Sugars (n=834) g/day	SSB and Tea/ coffee with Sugars (n=290) g/day
Dyslipidaemia				
No	68.4*	30.5	76.0*	116.2
Yes	108.9	35.8	89.5	117.6
Hypertension				
No	95.6	34.6	86.0	117.4
Yes	105.2	33.8	86.8	117.0
Antipsychotic utilization				
Clozapine ± other antipsychotic	84.9	26.0	78.4	108.0
Olanzapine ± other antipsychotic	106.1	47.1	96.7	121.6
Other antipsychotic only	106.6	36.4	90.1	125.1
No antipsychotic medication	86.9	32.6	73.9	95.6

Notes: *p values < 0.05 derived from *t*-tests or anova tests as appropriate, for testing the differences in MDSC for each type of SSB consumption across levels of response variables.
Abbreviations: MDSC, mean daily sugar consumption; SSB, sugar sweetened beverages.

Table 3 Factors Associated with Consumption of Added Sugar from SSBs and Tea/ Coffee with Sugar

Variable	Univariate	Multivariate
	% change (95% CI)	% change (95% CI)
Age in years		
19 to 30	4.3 (-16.4 to 30.1)	20.3 (-6.1 to 54.1)
31 to 50	8.6 (-7.2 to 27.3)	17.5 (-0.5 to 38.6)
51 to 70	Reference	Reference
Gender		
Males	35.5 (16.6 to 57.3)*	34.2 (14.8 to 56.9)*
Females	Reference	Reference
BMI		
Normal (<25 kg/m^2)	Reference	
Overweight (≥25 and <30 kg/m^2)	-8.6 (-26.9 to 14.3)	-
Obese (≥30 kg/m^2)	7.9 (-12.2 to 32.6)	
Waist to Height ratio		
Abnormal	17.0 (-8.9 to 50.4)	-
Psychiatric diagnosis		
Schizophrenia	Reference	Reference
Schizoaffective	-31.6 (-48.4 to -9.2)*	-31.1 (-48.0 to -8.8)*
Bipolar	-23.2 (-39.4 to -2.7)*	-24.2 (-40.8 to -3.0)*
Depression	-28.4 (-54.3 to 12.2)	-23.3 (-53.2 to 25.6)
Other psychosis	5.0 (-17.9 to 34.2)	0.8 (-23.0 to 31.0)
Living arrangements		
Alone	Reference	-
Spouse/de facto	-29.1 (-46.9 to -5.3)	
Parents or siblings	10.6 (-8.7 to 34.1)	
Other family member	36.7 (-7.1 to 101.3)	
One other (not family)	18.1 (-19.4 to 72.9)	
Group of others	4.7 (-30.8 to -30.8)*	
Long term hospital	-31.6 (-68.6 to 48.9)	

(*Continued*)

Table 3 (Continued).

Variable	Univariate	Multivariate
	% change (95% CI)	% change (95% CI)
Supported accommodation	34.1 (-5.6 to 90.6)	
Boarding house	12.2 (-12.5 to 43.9)	
Family history of diabetes		
Yes	11.2 (-4.4 to 29.4)	-
Diabetes		
Yes	18.7 (-0.8 to 42.1)	-
Dyslipidaemia		
Yes	13.2 (-4.7 to 34.4)	-
Hypertension		
Yes	-1.4 (-15.9 to 15.6)	-
Antipsychotic utilization		
Clozapine ± other antipsychotic	Reference	Reference
Olanzapine ± other antipsychotic	28.3 (1.4 to 62.4)*	35.9 (7.2 to 72.4)*
Other antipsychotic only	14.0 (-3.9 to 35.3)	21.9 (2.4 to 45.2)*
No antipsychotic medication	-15.8 (-38.9 to 16.0)	6.1 (-26.2 to 52.5)
Physical activity		
Sedentary	Reference	-
Lightly active	-8.9 (-22.9 to 7.6)	
Moderately active	-22.9 (-40.6 to -0.1)*	
Very active	-54.9 (-78.1 to -6.9)*	
Vocation level		
Employed	Reference	-
Pension	34.2 (8.2 to 66.5)*	
Studying	19.9 (-20.4 to 80.8)	
Unemployed	-6.2 (-29.2 to 24.3)	
Socioeconomic status		
Higher	Reference	Reference
Middle	24.5 (-0.9 to 56.3)	35.9 (7.8 to 71.4)*
Lower	29.0 (6.8 to 55.9)*	26.6 (4.4 to 53.3)*

Note: *statistically significant at p<0.05.
Abbreviation: SSB, sugar-sweetened beverages.

Discussion

In this large community-based study of people with SMI, we found the mean consumption of sugar from SSBs and tea/coffee with sugar was 86.2 g/day. This is almost four times higher than the average daily sugar consumed through SSBs in the Australian General population (22.6 grams).

The majority of our cohort consumed added sugar from SSBs and/or tea/coffee with sugar (68.1%). Eighteen percent of the cohort consumed SSB only, 8% tea and coffee without added sugars only and 23.8% consumed both of these possibly indicating stage of change with reducing added sugar intake. Overall, 56.5% consumed SSBs and 35.4% consumed tea/coffee.

Consistent with the Australian general population, with males (39%) more likely to consume SSBs than females (29%),[19] in this study of people with SMI, 59% of the males and 52% of the females consumed SSBs. Additionally, males showed 34.2% higher consumption of sugar from SSBs and/or tea/coffee compared to females.

Consumers with schizoaffective disorder were consuming 31% less added sugar compared to those diagnosed with schizophrenia. Interestingly, while Clozapine is often regarded as the most orexigenic of antipsychotic medications, in this case it was Olanzapine ± other medications that were associated with increased consumption of SSB. Consumers

who were on "olanzapine and other", and "other only" antipsychotic medications compared to "clozapine and other" reported increased consumption of sugar of 40% and 22%, respectively.

As is consistent with most nutrition and SES data the "lower" and "middle" categories of SES were higher consumers of sugar from SSBs and/or tea/coffee compared to consumers in the "higher" category.

There are two important findings that emerge from this study. Firstly, the total added sugar consumption from SSBs and tea/coffee alone in the ccCHiP clinic population (MDSC = 91.7 g/day) exceeds the maximum daily added sugar limit from all food sources as recommended by the AHA guidelines.[23] The MDSC from SSBs among ccCHiP consumers was 86.7 g/day. This is almost four times higher than the average daily sugar consumed through SSBs in the general Australian population, which was 22.6 g/day as reported by the ABS Australian Health Survey report.[19,28]

Of concern, the mean daily sugar consumption reported in the ccCHiP population does not include the added sugar content of food, and in particular sweet snacks, which may also be substantial in this population.

Second, the findings show that those with SMI consume excessive amounts of sugar across all life stages. This contrasts with the trend in the general population where sugar consumption is lower in older age groups. The excessive sugar consumption across the age groups of people with SMI may be partly due to widespread and lifelong socio-economic disadvantage. However, there may be a biological explanation for this observation; sugar increases opioid and dopamine release in the limbic system and activates the hedonic pathways similar to drugs of addiction.[30,31] People with SMI often experience apathy caused by their illness or as a result of dopamine blockade with neuroleptic medication.[32] They might be "self-medicating" with sugar to activate their reward pathways, and it has been shown elsewhere that people with enduring mental illness tend to choose food that is high in sugar and fat.[33] Another possible explanation is that many SSBs contain caffeine, which also activates brain regions associated with vigilance,[34] and may counter sedative effects of antipsychotics. Of course, the fact that antipsychotic treatment is generally lifelong (at least for schizophrenia) means that the orexigenic drive from antipsychotics is still a major issue in the older patient.

Furthermore, in this study consumers with dyslipidaemia consumed a statistically significantly higher quantity of added sugar from SSBs compared to those without, supporting the role of fructose in generating dysmetabolic effects.[35] This finding is novel as data is scarce regarding dyslipidaemia in people with SMI.

A study in South Australia reported a positive association between consumption of soft drinks and mental health problems, finding that individuals who consumed more than 500ml of soft drinks per day showed a 60% greater risk of having depression, stress, suicidal thoughts and psychological distress than those who did not consume soft drinks.[36] A recent study from Japan reported that high SSB consumption may be related to depression.[37] However, Sanchez-Villegas et al reported no association between SSBs and risk of depression.[38] Our multivariate analysis shows that people with depression were consuming 23% less sugar compared to those with schizophrenia.

To our knowledge, this is the first large community-based cohort study in Australia where the consumption of SSBs in people with SMI was elicited by a mental health dietitian. Most of the previous studies were limited to data collection via questionnaire surveys and looked at association with depression, little is known about the relationship with other types of mental illness. The strength of the study is its prospective nature and access to people with SMI attending a clinical service that effectively ascertains consumers from community mental health services across a large geographic area accessing both public and private services.[24] Moreover, we have measured the type of SSB including their tea/coffee consumption pattern, quantity of sugar and volume of SSB consumed by people with SMI.

The main limitation of the study is the self-reported nature of our data collection inherent in dietary data reporting whereby all people often underestimate their consumption or tailor it to their assumptions of health. However, we would like to highlight the fact that the validity of these results is potentially higher than previous questionnaire-based studies, as our data was elicited by a mental health dietitian interacting with each patient, based on their individual presentation styles.

Future studies looking to validate SSB as a proxy for poor dietary intake in this population or otherwise as a marker for cardiometabolic health risk should include more objective measures in addition to self-report such as a daily food log perhaps administered by a trained clinician in an effort to fully control for this limitation.

There is no doubt that an integrated health care approach is paramount to ensure physical health comorbidities of people living with SMI are adequately monitored and treated.

Our SSB module is very easy to administer and being software-based generates all totals and associated graphs automatically. It enables non-dietitian health workers to collect data that may be a valid proxy for other dietary choices and behaviours. This would allow for basic dietary interventions to be carried out in many clinical settings where a dietitian is not available.

Conclusion

People with SMI are at increased risk of obesity and cardiovascular disease which in turn attributes to their premature mortality. The findings of this study demonstrate a four-fold consumption of sugar from SSBs alone compared to the Australian General population.

Interventions targeting consumption of this high-risk beverage type and/or at high-risk groups to reduce the consumption of SSBs may help to decrease the prevalence of various adverse health outcomes including cardiometabolic disorders which may go some way to reduce the life expectancy gap for people living with SMI. This could look like a harm minimisation type advice structure similar to that of brief interventions of smoking cessation, though optimally action on improving the dietary intake of people living with SMI would be supported by expert dietitians employed within the community mental health settings where these consumers are provided care.

Ethics Approval

Collection and analysis of ccCHiP data were approved under REGIS 2019/ETH07689 (Previously HREC/16/CRGH/101) through the Sydney Local Health District ethics committee. The Ethics Committee granted a waiver of consent process for the use of consumer data in this research project. For the preparation of this paper, the data accessed complied with relevant data protection and privacy regulations.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors declare no conflicts of interest in this work.

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