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Original Research Article

A cross-sectional study on awareness and perceptions regarding taxation and health warnings and factors influencing decreased consumption of sugar sweetened beverages among medical students of Bhopal, India with respect to future implementation of such policies

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ABSTRACT

Background: Consumption of excessive sugar sweetened beverages (SSBs) has been linked to non-communicable diseases. It is imperative to understand the perceptions regarding taxation and health warnings amongst the medical students, since they are important stakeholders and as there is some evidence that the government may introduce these soon. Objective was to document the awareness and perceptions about taxation and health warnings on SSBs and the predictors of decreasing consumption of SSBs with regards to their future implementation.
Methods: This cross-sectional study was conducted among all the undergraduate medical students of a premier teaching hospital of central India during October and November 2019. A web-based self-administered semi-structured questionnaire was used for data collection using Kobo toolbox. Data were analysed using the SPSS software version 24 (IBM SPSS).
Results: About three fourths of the study participants were not aware of any taxes on SSBs and had never seen any health warning on SSB packaging. Multivariable logistic regression analysis showed that those aged ≥ 20 were not in favour of decreasing SSB consumption if health warning is present. Participants who were females, whose fathers were professionals, had consumed SSB in the previous seven days, were aware of taxes and those with inadequate sleep were not in favour of decreasing SSB consumption if taxes are increased.
Conclusions: There is a need to include health education regarding the harmful effects of consumption of SSBs and to make aware of the benefits of the taxes and warning labels beginning from school days and continued during medical schools.

Keywords: Awareness, Pictorial, Perception, Sugar sweetened beverages, Students, Warning labels

INTRODUCTION

Sugar-Sweetened Beverages (SSBs) are any liquids that are sweetened with various forms of added sugars.[1] Excessive consumption of SSBs is associated with an increased risk of non-communicable diseases (NCDs), primarily through its association with weight gain.[2-4] One serving of SSBs per day is associated with 8%, 17% and 18% greater incidence of type 2 diabetes, coronary heart disease and hypertension respectively.[5,6] The SSBs are usually advertised as energy boosters, neglecting their harmful effects, with aggressive marketing, making

excessive intake a social norm, particularly targeting emerging economies that can now afford SSBs and other low-cost, high-sugar foods.[7,8] SSBs sales in India have been growing by 13%, year-on-year since 1998, exceeding 11 litres per capita per year.[9] Current consumption trends, if not intervened, will lead to high rates of obesity-related noncommunicable diseases (NCDs), premature deaths and increased healthcare costs. The World Health Organization (WHO) has already proposed guidelines on sugar consumption in an effort to reduce the burden of premature deaths due to NCDs by 25% by 2025.[10] As seen from the previous experiences of increased taxation on tobacco and alcohol; the same effect of increased taxation and warning labels, was seen on SSBs consumption by modifying consumption and potentially leading to positive diet and weight outcomes.[9,11-14]

Although so far the government of India has not implemented a separate "sugar tax" or "soda tax", there have been signs towards increasing taxes on aerated drinks and introduction of warning labels on packaging of food and beverages high in fat, sugar or salt content.[15,16] But unless proper knowledge is instilled in people's minds and behaviours modified in a favourable direction, there is risk that these policies might fail.

Medical students are the future healthcare providers (HCPs). They will be the key providers of education regarding healthy dietary choices leading to behaviour change in their patients. If they have a favourable outlook towards taxes and warning labels on SSBs, then the same might be inculcated and accepted by the general population with minimal effort. Hence, before such policies are implemented, the awareness and perceptions of this important group of stakeholders should be understood.

The objectives of the present study were thus to document the awareness and perceptions about taxation and health warnings on SSBs and to find out the predictors of favourable response to decreasing consumption of SSBs with future increase in taxes or presence of health warnings on SSB packaging.

METHODS

This cross-sectional study was conducted among all the undergraduate medical students and interns of a premier tertiary care teaching hospital of central India during October and November 2019. A web-based self-administered questionnaire (having both closed and open-ended questions) was developed in English using the Kobo Toolbox (Harvard Humanitarian Initiative), which is free for non-commercial use.[17] Information regarding socio-demographic and behavioural characteristics, presence of chronic illness, along with the amount, patterns and expenditure related to SSB consumption were collected.

Every student was briefed about the study by the investigators in the classroom setting and a link to the questionnaire, along with the electronic copies of participant information sheet and consent form were shared with them on WhatsApp (Facebook Corp) mobile messaging application. The participants were then asked to fill their responses in the next 20 minutes. At least two reminders were sent to the participants (absentees and non-responders) through phone call, WhatsApp, or personal contact, before marking him/her as non-responder. Permission from the institutional human ethics committee of AIIMS Bhopal was obtained (IHEC-LOP/2018/STS0146). Informed consent was obtained. The following operational definitions were used in the present study.

SSB was defined as liquids sweetened with various forms of added sugars like brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose. SSBs include but are not limited to regular soda (not sugar-free), fruit drinks, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugar.[1] For the purpose of our study, we limited this definition to beverages which were sold in the market and purchased by people, and not homemade beverages, like coffee, tea, etc.

Education and occupation of parents were categorized according to Modified Kuppuswamy scale.[18] During analysis, some of these categories were clubbed together to re-categorise to draw meaningful conclusions. Total family income was divided by the number of family members to generate per capita income. This was further categorized as 0-4999 INR, 5000-24999 INR, and >25000 INR and again into <5000 and ≥5000 INR for further analysis.

Current tobacco and alcohol use were defined as tobacco used in any form, either smoked or smokeless, and any amount of alcohol consumed in the last one month respectively. Sufficient physical activity (Yes/No) and enough sleep (Yes/No) were defined as perceived self-reported amounts of physical activity and sleep respectively.

Data were exported from Kobo toolbox software to Microsoft Excel 2010 and analysis was performed using Statistical Package for Social Sciences version 24 (IBM SPSS). Proportions and means were calculated and 95% confidence interval (CI) and standard deviation (SD) reported. Chi-square test was used to test associations by comparing proportions among groups. Univariable logistic regression analysis was conducted to find out the predictors of decreased consumption of SSBs with increase of taxes and if health warnings are introduced on SSB packaging. The variables having a p value<0.25 in univariable analysis were entered in the multivariable model. $p<0.05$ was taken as statistically significant and adjusted odds ratios were calculated.

RESULTS

Out of total 499 students who were invited through the Kobo Collect questionnaire link, 358 responses were received, and 357 were finally analysed (one participant had missing data/inappropriate responses in most fields). Out of 357, 260 (72.8%) were residing in urban areas, 256 (71.7%) were males, 214 (59.9%) were below 20 years of age and 306 (85.7%) belonged to a nuclear family. Fathers of most participants were graduates and semi-professionals by occupation i.e. 147 (41.2%) and 113 (31.6%) respectively. Mothers were mostly graduate and homemakers i.e. 93 (26.1%) and 263 (73.7%) respectively. Out of 357, 268 (75.1%) participants were not aware (never heard) of any taxes on SSBs. Among the rest 89 participants who were aware, most, i.e. 27 (7.6%) responded current taxes on SSBs to be 10%–20% tax, 34 (9.5%) to be 5%–10% tax, 14 (3.9%) to be <5% tax, 10 (2.8%) to be 20%–30% tax, three (0.8%) to be >30%, and one (0.3%) responded that there was no existing tax at present. Majority of the participants i.e. 269 (75.4%) had never seen any health warning on SSB packaging.

The perception and attitude of participants regarding health effects, taxes, and health warnings with respect to SSBs is shown in Figure 1.

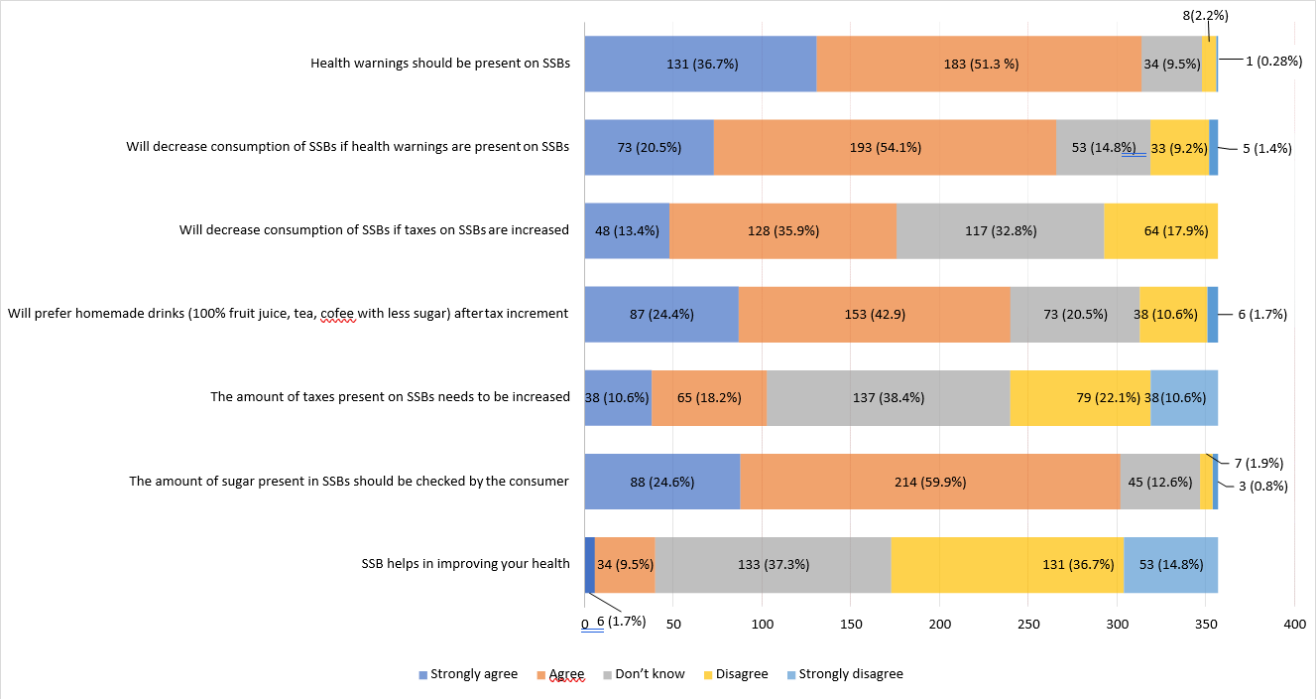

Figure 1: Participants' perception and attitude regarding health effects, taxes and health warnings in relation to SSBs (n=357).

Most participants wanted health warnings to be introduced on SSB packaging and told that they would decrease consumption of SSBs if warnings were present on packaging. However, with respect to increase of taxes, majority either disagreed or didn't know whether this was a good idea. Similarly, close to half of all participants either disagreed to decrease consumption or didn't know what they would do, if taxes are increased. Majority however agreed that they would prefer homemade drinks in case of increase of taxes.

Majority of the participants, i.e. 161 out of 311 (45.1%) wanted both textual and pictorial warnings to be present on the packaging. Rest 63 (17.6%) participants wanted solely textual warning, 34 (9.5%) wanted only pictorial warning, and 53 (14.8%) wanted only nutritional information (without any warning). Out of 357 participants, 174 (48.7%) wanted the textual warning to be in English, 145 (40.6%) in a local language and 109 (30.5%) in Hindi, the national language (multiple answers were possible for this question). Regarding ideal coverage of surface area on the SSB packaging, 102 (62.6%) out of 163 participants suggested that the coverage should be 25-50%, 61 (37.4%) suggested <25%, 15 (9.2%) suggested 50-75%, and 8 (4.9%) wanted it >75%. Figure 2 and 3 depict content of textual and pictorial warnings on packaging. When asked about any other suggestions regarding taxes and health warning (open ended questions), 256 (71.7%) participants responded, out of which 60 (16.8%) suggested highlighting the health warning with different colours and use bold letters, and 40 (11.2%) suggested strategies such as spreading public awareness by using statistical data and advertisements.

Some of the other suggestions were making SSBs restricted for children through display of warning etc. Tables 1 and 2 describe the results of univariable and multivariable logistic regression analyses to determine

factors independently predicting the favourable response of decrease in SSB consumption if health warnings are introduced or taxes are increased.

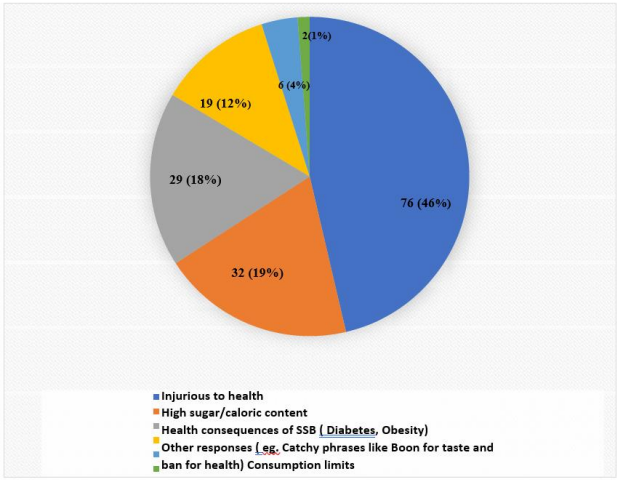

Figure 2: Participants' responses regarding what should be the content of textual warning (n=164).

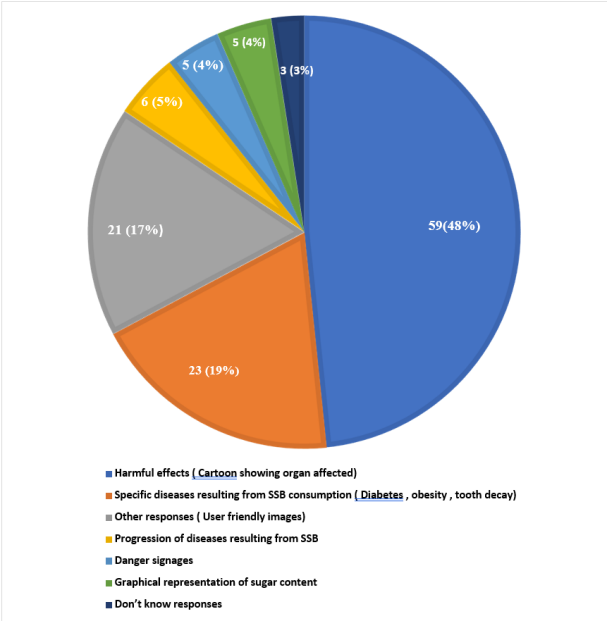

Figure 3: Participants' responses regarding what should be the content of pictorial warning (n=122).

Table 1: Results of univariable and multivariable logistic regression analysis to determine factors predicting participant's favourable response to decreasing consumption of SSBS if health warnings are present on SSB packaging (n=357).

Variable and category	Decrease consumption of SSB if health warning is present		Total	Unadjusted Odd's ratio	P value	Adjusted Odd's ratio*	P value
	In favour N (%)	Not in favour N (%)		(95% CI)		(95% CI)	
Age (in years)							
<20	169 (79)	45(21)	214	(Ref)	-	-	-
≥20	98 (68.5)	45 (31.5)	143	1.72 (1.07-2.79)	0.027	1.78 (1.05-3.02)	0.032
Gender							
Male	188(73.4)	68 (26.6)	256	(Ref)	-	-	-
Female	79(78.2)	22 (21.8)	101	0.77 (0.45-1.33)	0.351	-	-
Residence							
Urban	191 (73.5)	69 (26.5)	260	1.31 (0.75-2.28)	0.345	-	-
Rural	76 (78.4)	21 (21.6)	97	(Ref)	-	-	-
Family type							
Nuclear	226 (73.9)	80 (26.1)	306	1.45 (0.69-3.03)	0.321	-	-
Extended	41 (80.4)	10 (9.6)	51	(Ref)	-	-	-
Father's occupation							
Not Professionals	189 (75.3)	62 (24.7)	251	(Ref)	-	-	-
Professionals	72 (75)	24 (25)	96	1.02 (0.59-1.75)	0.954	-	-
Mother's occupation							
Homemaker/Unemployed	197 (74.9)	66 (25.1)	263	(Ref)	-	-	-
Employed	69 (74.2)	24 (25.8)	93	1.04 (0.60-1.79)	0.892	-	-
Father's education							
Not graduates	64 (80)	16 (20)	80	(Ref)	-	-	-
Graduates	198 (72.8)	74 (27.2)	272	1.50 (0.81-2.75)	0.196	-	-
Mother's education							
Not graduates	102 (73.9)	36 (26.1)	138	(Ref)	-	-	-

Continued.

Variable and category	Decrease consumption of SSB if health warning is present		Total	Unadjusted Odd's ratio	P value	Adjusted Odd's ratio*	P value
Graduates	159 (75)	53 (25)	212	0.94 (0.58-1.54)	0.819	-	-
Per capita income (in INR)				1.719			
<5000	49 (76.6)	15 (23.4)	64	(Ref)	-	-	-
≥5000	218 (74.4)	75 (25.6)	293	1.12 (0.6-2.12)	1.719	-	-
Current tobacco use (last month)							
No	255 (74.6)	87 (25.4)	342	(Ref)	-	-	-
Yes	12 (80)	3 (20)	15	0.73 (0.2-2.66)	0.636	-	-
Current alcohol use (last month)							
No	256 (75.3)	84 (24.7)	340	(Ref)	-	-	-
Yes	11 (64.7)	6 (35.3)	17	1.66 (0.60-4.63)	0.331	-	-
Perceived self-reported amount of physical activity							
Inadequate	59 (78.7)	43 (21.3)	202	1.61 (0.10-2.61)	0.052	-	-
Adequate	108 (69.7)	47 (30.3)	155	(Ref)	-	-	-
Perceived self-reported amount of sleep							
Inadequate	85 (73.3)	31 (26.7)	116	1.13 (0.68-1.87)	0.648	-	-
Adequate	182 (75.5)	59 (24.5)	241	(Ref)	-	-	-
History of chronic disease							
No	264 (74.6)	90 (25.4)	354	(Ref)	-	-	-
Yes	3 (100)	0	3	-	0.999	-	-
Ever heard of SSB							
No	82 (73.9)	29 (26.1)	112	1.07 (0.64-1.79)	0.789	-	-
Yes	185 (75.2)	61 (24.8)	246	(Ref)	-	-	-
Last consumption of SSB							
Consumed in last 7 days	190 (75.1)	63 (24.9)	253	1.29 (0.69-2.39)	0.427	-	-
Not consumed in last 7 days	62 (79.5)	16 (20.5)	781	(Ref)	-	-	-
Quantity of SSB consumed							
< 1 litre	155 (77.9)	44 (22.1)	199	(Ref)	-	-	-
≥ 1 litre	93 (72.7)	35 (37.3)	128	1.33(0.79-2.21)	0.281	-	-
Types of SSB consumed							
Soft drinks	122 (68.5)	56 (31.5)	178	2.87(0.95- 8.64)	0.061	3.02 (0.99-9.21)	0.051
Energy drinks/Sports drinks	17 (85)	3 (15)	20	1.1 (0.22-5.57)	0.906	1.06 (0.21-5.42)	0.947
Sweetened packaged fruit drinks	88 (84.6)	16 (15.4)	104	1.14 (0.35-3.7)	0.832	1.18 (0.26-3.91)	0.782
Others (including milk-based packaged drinks	25 (86.2)	4 (13.8)	29	(Ref)	-	-	-
Look for Amount of calorie in SSB							
No	63 (75.9)	20 (24.1)	83	1.08 (0.61-1.91)	0.79	-	-
Yes	204 (74.5)	70 (25.5)	274	(Ref)	-	-	-
Money spent on SSB in the last month							
0-50	93 (77.5)	27 (22.5)	120	(Ref)	-	-	-
51-200	74 (78.7)	20 (21.3)	94	0.93 (0.48-1.79)	0.83	-	-
>200	85 (72.6)	32 (27.4)	117	1.30 (0.72-2.34)	0.389	-	-
Awareness of taxes on SSB							
Aware	67 (75.3)	22 (24.7)	89	0.97 (0.55-1.68)	0.902	-	-

Continued.

Variable and category	Decrease consumption of SSB if health warning is present		Total	Unadjusted Odd's ratio	P value	Adjusted Odd's ratio*	P value
Not aware	200 (74.6)	68 (25.4)	268	(Ref)	-	-	-
Noticed health warning							
Noticed	63 (71.6)	25 (28.4)	88	1.28(0.73- 2.74)	0.426	-	-
Not noticed	204 (75.3)	65 (23.7)	269	(Ref)	-	-	-

*Variables with p value <0.25 in univariable analysis were entered in the multivariable model included age, gender, father's education, mother's education, father's occupation, mother's occupation, alcohol, sleep, ever heard of SSBs, last consumption of SSB, amount of SSB consumed, expenditure on SSB and awareness of taxes.

Table 2: Results of univariable and multivariable logistic regression analysis to determine factors predicting participants favourable response to decrease SSB consumption if taxes on SSBs are increased (n=357).

Variable and category	Decrease consumption of SSB if taxes are increased		Total	Unadjusted Odd's ratio	P value	Adjusted odds ratio (95%CI)	P value
	In favour N (%)	Not in favour N (%)		(95% CI)		(95% CI)	
Age (in years)							
<20	105(49.1)	109(50.9)	214	(Ref)	-	-	-
≥20	70(49)	73(51)	143	1.01 (0.66-1.53)	0.983	-	-
Gender							
Male	137(53.5)	190(46.5)	256	(Ref)	-	-	-
Female	38(37.6)	63(62.4)	101	1.91 (1.19-3.06)	0.007	1.84 (1.08-3.12)	0.043
Residence							
Urban	123(47.3)	137(52.7)	260	1.29 (0.81-2.05)	0.29	-	-
Rural	52(63.6)	45(46.4)	97	(Ref)	-	-	-
Family type							
Nuclear	149 (48.7)	57(51.3)	306	1.10 (0.61-1.98)	0.762	-	-
Extended	26(51)	25 (49)	51	(Ref)	-	-	-
Father's occupation							
Not professionals	133(53)	118 (47)	251	(Ref)	-	-	-
Professionals	39 (40.6)	57 (59.4)	96	1.65 (1.02-2.65)	0.04	1.83 (1.02-3.30)	0.043
Mother's occupation							
Homemaker/Unemployed	138(52.5)	125(47.5)	263	(Ref)	-	-	-
Employed	36(38.7)	57(61.3)	93	1.75(1.08 -2.83)	0.023	-	-
Father's education							
Not graduates	44(55)	36(45)	80	(Ref)	-	-	-
Graduates	126 (46.3)	146 (53.7)	272	1.42 (0.86-2.33)	0.173	-	-
Mother's education							
Not graduates	65 (47.1)	73 (52.9)	138	(Ref)	-	-	-
Graduates	108 (50.9)	104 (49.1)	212	0.86 (0.56-1.31)	0.482	-	-
Per capita income (in INR)							
<5000	37 (57.8)	27 (42.2)	64	(Ref)	-	-	-
≥5000	138 (47.1)	155 (52.9)	293	1.54 (0.89-2.66)	0.122	-	-
Current tobacco use (last month)							
No	169 (49.4)	173 (50.6)	342	(Ref)	-	-	-
Yes	6 (40)	9(60)	15	1.47 (0.51-4.21)	0.478	-	-
Current alcohol use (last month)							
No	170 (50)	170 (50)	340	(Ref)	-	-	-
Yes	5(29.4)	12 (70.6)	17	2.4 (0.83-6.96)	0.107	-	-
Perceived self-reported amount of physical activity							

Continued.

Variable and category	Decrease consumption of SSB if taxes are increased		Total	Unadjusted Odd's ratio	P value	Adjusted odds ratio (95%CI)	P value
Inadequate	100(49.5)	102 (50.5)	202	1.05 (0.69-1.59)	0.834	-	-
Adequate	75 (48.4)	80 (51.6)	155	(Ref)	-	-	-
Perceived self-reported amount of sleep							
Inadequate	49 (42.2)	67 (57.8)	116	1.50 (0.96-2.34)	0.076	1.74 (1.03-2.91)	0.037
Adequate	126 (52.3)	115 (47.7)	241	(Ref)	-	-	-
History of chronic disease							
No	174 (49.2)	180 (50.8)	354	(Ref)	-	-	-
Yes	1 (33.3)	2 (66.7)	3	1.93(0.17-21.52)	0.592	-	-
Heard of SSB							
No	48(43.2)	63 (56.8)	111	1.40 (0.89-2.20)	0.143	-	-
Yes	127 (51.6)	119 (48.4)	246	(Ref)	-	-	-
Last consumption of SSB*							
In last 7 days	15 (45.5)	138 (54.5)	253	2.40 (1.41-4.08)	0.001	2.42 (1.26-4.62)	0.008
Not in last 7 days	52(66.7)	26 (33.3)	78	(Ref)	-	-	-
Quantity of SSB consumed							
< 1 litre	109(54.8)	90 (45.2)	199	(Ref)	-	-	-
≥ 1 litre	54(42.2)	74 (57.8)	128	1.66 (1.06-2.60)	0.027	-	-
Types of SSB preffered							
Soft drinks	87 (48.9)	91 (51.1)	178	0.85 (1.06-2.60)	0.686	-	-
Energy drinks/Sports drinks	10 (50)	10 (50)	20	0.81 (0.26-0.54)	0.722	-	-
Sweetened packaged fruit drinks	57 (54.8)	47 (45.2)	104	0.67 (0.29-1.53)	0.343	-	-
Others (including milk-based packaged drinks)	13 (44.8)	16 (55.2)	29	(Ref)	-	-	-
Look for Amount of calorie in SSB							
No	43 (51.8)	40 (48.2)	83	1.16 (0.70-1.89)	0.562	-	-
Yes	132 (48.2)	142 (51.8)	274	(Ref)	-	-	-
Money spent on SSB in the last month							
0-50	65(54.2)	55(45.8)	120	(Ref)	-	-	-
51-200	54(57.4)	40(42.6)	94	0.87 (0.51-1.50)	0.632	-	-
>200	48(41)	69(59)	117	1.70 (1.01-2.84)	0.043	-	-
Awareness of taxes on SSB							
Aware	37(41.6)	52(58.4)	89	1.49 (0.92-2.42)	0.106	1.98 (1.10-3.57)	0.02
Not aware	138(51.5)	130(48.5)	268	(Ref)	-	-	-
Ever noticed health warning							
Noticed	35(39.8)	53(60.2)	88	1.64 (1.01-2.68)	0.047	-	-
Not noticed	140 (52)	129(48)	269	(Ref)	-	-	-

DISCUSSION

In our study, 75.1% of the participants were not aware of any taxes on SSBs. In India, the GST (Goods and Service tax) for SSBs ranges from 5%-28%.[19] Around half (49%) of our study participants agreed that they would decrease consumption if taxes were increased. Teng et al reported that for an average 10% tax on SSBs, there was a decrease of 10% of consumption of SSBs.[20] Silver et al reported that upon increase in tax, there was increase in consumption of fruit juice and milk. These might happen as there were lower taxes on these drinks and also these are the drinks which can be easily prepared at home.[21]

We couldn't find any plausible explanation why females gave unfavourable response to decreasing SSB consumption if taxes are increased. This can be an area of future exploration.

We found that participants whose fathers were professionals had an unfavourable response to future decrease in consumption with increase of tax. It is possible that fathers who are professionals may have been

busier and could not have tracked SSB consumption patterns of their children and failed to communicate its harmful effects. Also, these students usually belong to financially well to do families, thus, increase of taxes is less likely to have an impact on their SSB buying potential and consumption behaviour. In a qualitative study by Krukowski et al, participants (students) responded that SSBs were bought by their parents.[22] One of the most effective ways of lowering consumption was found to be certain practices being adopted by parents, such as telling their children about the harmful effects of SSBs, amount to drink etc.[23,24]

In our study, close to one third (Figure 1) participants either weren't sure about the necessity of increasing taxes on SSBs, and whether they would decrease consumption of SSBs with increase of taxes. Various studies have reported decrease in consumption of SSBs upon increase in taxes.[25,26] But contrasting findings have also been reported, where increase in taxation did not have any impact on consumption.[21] Some important factors influencing SSB consumption were home environment, policies by government, motivation etc.[22,27]

Often SSBs are consumed as a "treat", usually on weekends, accompanied by high carb diet. Over time, frequency of SSB consumption has increased.[28] There is usually a rise in craving and withdrawal symptoms on cessation of intake.[29,30] These might be the reasons why participants in our study, who had consumed SSBs in last seven days, didn't want to decrease consumption even if the taxes were increased.

In our study, 88.2% participants wanted some health warning to be present on packaging. Also, majority of the participants (74.8%) responded that they would decrease the consumption if warning was present. Recent studies did mention decrease in SSB consumption when it was accompanied with health warning.[14,31] But this finding wasn't replicated in many other studies.[32,33] This could be because of different study designs used in the said studies.

In our study, those above 20 years of age were less willing to decrease consumption if pictorial warnings are present. Higher stress of studies/work in higher semesters/internship may be a possible factor in this. Also, 45.1% participants suggested both textual and pictorial warnings to be present on packaging. Our finding was corroborated by many studies.[14,31] Pictorial warnings, as per many studies, had negative impact on people buying SSBs.[31,34,35]

To the best of our knowledge, this is the first global study reporting perceptions of undergraduate medical students about taxes and health warning. Since data on this was not available, we did not calculate sample size apriori. However, our study participants were far greater in number than taking maximum prevalence as 50%, with 5% allowable error and 20% relative precision. Our study has some limitations. As this study was conducted in a government institutional set up, it might not be possible to extrapolate the results to a private institution, where the socio-economic background of students may be different. Direct indices of obesity were not measured.

Health education regarding adverse effects of SSBs should be provided to students. Students should be made aware of taxation through lectures on how it can help decrease in SSB sales and thus consumption.

CONCLUSION

To conclude, almost three-fourths of medical students were not aware of the taxes on SSBs. Students of female gender, having fathers' who are professionals, having consumed SSB in the last seven days, those aware of taxation on SSBs, and those with inadequate sleep, had unfavourable response to future decrease of SSB consumption if taxes are increased. While 88% of students were of view that health warnings should be present on SSB packaging and most (74.6%) agreed to cut down the consumption if health warnings are introduced, those aged ≥ 20 years were less likely to do so. Providing health education to students and increasing awareness on role of taxation in SSB consumption are important. Policy makers should consider these findings before implementing such policies.

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REFERENCES

1. CDC. Sugar Sweetened Beverage Intake," Centers for Disease Control and Prevention, Oct. 23, 2018. Available at https://www.cdc.gov/nutrition/data-statistics/sugar-sweetened-beverages-intake.html. Accessed on 17 March 2019.
2. Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. Am J Public Health. 2007;97(4):667-75.
3. Morenga LT, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. BMJ. 2013;346:11-6.
4. Guideline: sugars intake for adults and children. Available at https:// www. who. int/publications/i/item/9789241549028. Accessed on 3 September 2020.

5. Imamura F. Consumption of sugar sweetened beverages, artificially sweetened beverages, and fruit juice and incidence of type 2 diabetes: systematic review, meta-analysis, and estimation of population attributable fraction. BMJ. 2015;351:3576-9.
6. Xi B. Sugar-sweetened beverages and risk of hypertension and CVD: a dose-response meta-analysis. Br J Nutr. 2015;113(5):709-17.
7. Uwaifo GI. Beware energy drinks: a case of a toxic triad syndrome in a diabetic patient with nonalcoholic fatty liver disease. Am J Med Sci. 2019;358(4):304-11.
8. Ja W, Ea L, Ad S. The sugar-sweetened beverage wars: public health and the role of the beverage industry. Curr Opin Endocrinol Diabetes Obes. 2013;5:401-6.
9. Basu S, Vellakkal S, Agrawal S, Stuckler D, Popkin B, Ebrahim S. Averthing obesity and type 2 diabetes in India through sugar-sweetened beverage taxation: an economic-epidemiologic modeling study. PLoS Med. 2014;11(1):e1001582.
10. WHO. WHO calls on countries to reduce sugars intake among adults and children. Available at https://www.who.int/mediacentre/news/releases/2015/sugar-guideline/en/. Accessed on 3 September 2020.
11. Andreyeva T, Chaloupka FJ, Brownell KD. Estimating the potential of taxes on sugar-sweetened beverages to reduce consumption and generate revenue. Prev Med. 2011;52(6):413-6.
12. Escobar MA, Veerman JL, Tollman SM, Bertram MY, Hofman KJ. Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. BMC Public Health. 2013;13(1):1072.
13. Jou J, Techakehakij W. International application of sugar-sweetened beverage (SSB) taxation in obesity reduction: factors that may influence policy effectiveness in country-specific contexts. Health Policy. 2012;107(1):83-90.
14. Roberto CA, Wong D, Musicus A, Hammond D. The influence of sugar-sweetened beverage health warning labels on parents' choices. Pediatrics. 2015;137(2):2015-3185.
15. GST: Prices of soft drinks to increase 5-10% - The Economic Times. Available at https://economictimes.indiatimes.com/industry/cons-products/fmcg/prices-of-soft-drinks-to-increase-5-10/articleshow/58753124.cms?from=md. Accessed 21 September 2020.
16. FSSAI: FSSAI calls for colour-coded labels on products with high fat, sugar content. Available at https://economictimes.indiatimes.com/industry/cons-products/food/fssai-calls-for-colour-coded-labels-on-products-with-high-fat-sugar-content/articleshow/69967254.cms?from=mdr. Accessed on 21 September 2020.
17. KoBoToolbox. Data Collection Tools for Challenging Environments. KoBoToolbox. Available at https://kobotoolbox.org/. Accessed on 17 July 2020.
18. Wani RT. Socioeconomic status scales-modified Kuppuswamy and Udai Pareekh's scale updated for 2019. J Family Med Primary Care. 2019;8(6):1846.
19. Goods-rates-booklet-03July2017.pdf. Available at http://gstcouncil.gov.in/sites/default/files/NOTIFICATION%20PDF/goods-rates-booklet-. Accessed on 14 June 2020.
20. Teng AM, Jones AC, Mizdrak A, Signal L, Genç M, Wilson N. Impact of sugar-sweetened beverage taxes on purchases and dietary intake: Systematic review and meta-analysis. Obesity Rev. 2019;20(9):1187-204.
21. Silver LD. Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: a before-and-after study. PLoS Med. 2017;14(4):1022-9.
22. Krukowski C, Conley K, Sterling M, Rainville A. A qualitative study of adolescent views of sugar-sweetened beverage taxes, Michigan, 2014. Preventing Chronic Dis. 2016;13:150-63.
23. Horst B, Kremers S, Ferreira I, Singh A, Oenema A, Brug J. Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. Health Educ Res. 2007;22(2):295-304.
24. Bruijn GJ, Putte G. Adolescent soft drink consumption, television viewing and habit strength. Investigating clustering effects in the Theory of Planned Behaviour. Appetite. 2009;53(1):66-75.
25. Stacey N, Summan A, Tugendhaft A, Laxminarayan R, Hofman K. Simulating the impact of excise taxation for disease prevention in low-income and middle-income countries: an application to South Africa. BMJ Glob Health. 2018;3(1):568-75.
26. Veerman VL, Sacks G, Antonopoulos N, Martin J. The impact of a tax on sugar-sweetened beverages on health and health care costs: a modelling study. PLOS ONE. 2016;11(4):e0151460.
27. Meyer MT, Mytton O, Adams J. Public responses to proposals for a tax on sugar-sweetened beverages: a thematic analysis of online reader comments posted on major UK news websites. PLoS ONE. 2017;12:e0186750,
28. Miller C. When we were young, it really was a treat; now sugar is just the norm every day a qualitative study of parents' and young adults' perceptions and consumption of sugary drinks. Health Promotion J Australia. 2020;31(1):47-57.
29. Falbe J, Thompson HR, Patel A, Madsen KA. Potentially addictive properties of sugar-sweetened beverages among adolescents. Appetite. 2019;133:130-7.
30. Bray GA, Popkin PM. Dietary sugar and body weight: have we reached a crisis in the epidemic of obesity and diabetes?: health be damned! Pour on the sugar. Diabetes Care. 2014;37(4):950-6.
31. The effect of graphic warnings on sugary-drink purchasing. Available at https:/ /journals.

sagepub.com/doi/10.1177/0956797618766361 Accessed on 15 June 2020.
32. Bollard T, Maubach N, Walker N, Mhurchu CN. Effects of plain packaging, warning labels, and taxes on young people's predicted sugar-sweetened beverage preferences: an experimental study. Int J Behavioral Nutrition Physical Activity. 2016;13(1):95.
33. Gray JP, Karnon J, Blackwell L. Sugar consumption from beverages and the potential effects of a text-based information label. Australian New Zealand J Public Health. 2011;35(1):88-9.
34. Popova L, Nonnemaker J, Taylor N, Bradfield B, Kim A. Warning labels on sugar-sweetened beverages: an eye tracking approach. Am J Health Behav. 2019;43(2):406-19.
35. Mantzari E, Vasiljevic M, Turney I, Pilling M, Marteau T. Impact of warning labels on sugar-sweetened beverages on parental selection: An online experimental study. Prev Med Rep. 2018;12:259-67.

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