

Research

# Association between sugar-sweetened beverage consumption and constructs of the Health Belief Model in young adult students at the University of Chester

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## Background

Young adults are reported as one of the major consumers of sugar-sweetened beverages (SSBs) globally and the consumption of SSBs is associated with long-term medical conditions. The Health Belief Model (HBM) has been applied to understand SSB consumption by children and adolescents through the use of its constructs. There is a gap in knowledge of HBM application to SSB consumption of young adults. Therefore, the present study was undertaken to fill this gap.

## Objective

The primary objective of the study was to determine if an association existed between SSB consumption status and the constructs of the HBM: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues in young adult students.

## Methods

**Design:** Cross-sectional data were obtained using an online self-administered structured questionnaire. Descriptive statistics and Chi-squared ( $X^2$ ) test for association were used to analyse the data.

**Setting:** Participants were recruited via email and WhatsApp.

**Participants:** Seventy young adult students aged 18 to 30 years studying at the University of Chester, England.

## Results

The mean age of the participants was 25.5 years (SD: 3.0). 53% consumed SSBs on a given day. Postgraduates (58%), Blacks (52%), and Asian students (70%) had the greater percentages of SSB consumers. There was a very strong significant association between SSB consumption status and level of perceived severity of diseases from a high intake of SSBs,  $X^2$  (1, N = 70) = 6.94, P = 0.01, Cramer's V = 0.32. Also, a very strong association existed between SSB consumption status and self-efficacy level to control SSB intake,  $X^2$  (1, N = 70) = 8.83, P = 0.00, Cramer's V = 0.36.

## Conclusions

A high percentage of young adult students especially those from minority ethnic groups in the UK consumed SSBs which indicates that targeted initiatives at these groups are required to control their intake. Interventions to control SSB intake in young adult students should consider increasing their level of perceived severity of diseases from a high intake of SSBs and self-efficacy to control SSB intake. We recommend actions that can further increase their awareness of how serious diseases from a high intake of SSBs are. We also recommend measures intended to increase the confidence of young adult

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students in their ability to avoid SSBs when they are stressed, after writing exam, when they are eating, and when they engage in sedentary activities. In particular, modifying their environment to prevent the availability of SSBs at home and regulating the promotion and cost (via taxation) of SSBs in stores would help to increase their self-efficacy level. Further studies to determine why a greater percentage of postgraduate students are consuming SSBs despite their level of education is required. More comprehensive research on SSB consumption in young adults using the HBM is necessary.

## INTRODUCTION

Sugar-sweetened beverages (SSBs) contribute more than 5% of free sugars to daily dietary energy intake (Public Health England, 2015). According to the WHO (2017), the free sugars in a standard can (330 ml) of SSB account for almost 8% of the daily energy requirement.

Studies have identified an association between the consumption of SSBs and poor health outcomes (Mazarello et al, 2015; WHO, 2015). An increased risk of developing type 2 diabetes in young adults was identified with an intake of one to two cans of SSBs in a day (Malik et al, 2010). A systematic review and meta-analysis reported that SSBs accounted for 2.6 million events of type 2 diabetes in the UK in 2015 (Imamura et al, 2015). A high hazard ratio for all-cause mortality was reported for an intake of greater than two cans, bottles or cups of SSBs per day in a UK Biobank Prospective Study (Anderson et al, 2020).

The Framingham Heart Study reported that a regular intake of at least one SSB was associated with the development of metabolic syndrome and elevated blood sugar (Dhingra et al, 2007). Malik et al (2019) found that consumption of SSBs was positively associated with CVD mortality and showed a graded association with dose.

For the purpose of this study, an SSB is defined as any non-alcoholic drink or fluid with added sugar whether packaged or prepared by the consumer (Keller & Torre, 2015). Examples include carbonated drinks, energy drinks, and squash.

Young adults are reported to be one of the major consumers of SSBs (Doherty et al, 2021; Singh et al, 2015). In the United States, 85.3% of young adults (18 to 39 years old) consumed SSBs on a given day (Kim et al, 2017). Barrett et al (2017) reported that 20.4% of adults living in Cambridgeshire aged between 30 and 64 years consumed SSBs daily. Qutieshat (2020) identified that less than 10% of University of Dundee students aged between 18 and 28 years consumed carbonated beverages daily; however, this could be explained by its focus on carbonated beverages alone (Malik et al., 2006). In Warner and Ha (2017), 73% of the students aged 18 years and above in the Cambridge campus of the Anglia Ruskin University were consumers of SSBs.

Due to the poor health outcomes associated with the consumption of SSBs, actions are required to reduce the prevalence of SSB consumption among young adults. To do so, one must understand why young people consume these drinks. In a qualitative study, young adults reported that their reasons for consuming SSBs were the taste of SSBs and their craving for SSBs (Lee et al, 2023). Some studies to understand the factors influencing the consumption of SSBs in different age groups of the population have utilized constructs of the models and theories of behaviour change (Deshpande et al, 2009; Wang & Chen, 2022). The Theory of Planned Behaviour (TPB) is widely used to understand and

control SSB consumption in different age groups. Behavioural intentions, attitudes, perceived behavioural control, and subjective norms are the constructs of the TPB reported to have strong relationship with SSB consumption (Zoellner et al, 2011). Self-efficacy, a construct of the Social Cognitive Theory (SCT) and the Health Belief Model (HBM) are also cited as the strongest predictors of SSB consumption (Sharafkhani et al, 2021; Xu et al, 2017).

The HBM has six main constructs (perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues) that are individually and holistically used to understand and predict behaviours (Asefa et al, 2022; Beyera et al, 2022; Begum et al, 2022; Hu et al, 2022; Johnson et al, 2021; Khosravizadeh et al, 2021). Perceived susceptibility refers to a feeling of being at risk of a disease; perceived severity refers to one's opinion about the seriousness of a disease. Perceived barriers explain an individual's limitations to adopt a habit while benefits refer to the gains one attaches to a change in behaviour. Self-efficacy describes one's confidence to undertake an action and cues are reminders to continue an action (Afrasiabi et al, 2022; Asefa et al, 2022).

There is insufficient data for the use of the HBM in studies to understand SSB consumption. The few studies globally that have reported on the use of the HBM in understanding SSB consumption were focused on children, adolescents, and high school students (Salem & Said, 2018; Wang & Chen, 2022). A gap exists in the application of this model to SSB consumption in young adults. In the UK, there is no report of its use in controlling or understanding SSB consumption in any age group of the population. Therefore, the primary objective of this research was to determine the association between SSB consumption status and the levels of the HBM constructs in young adults (18-30) studying at the University of Chester.

## METHODS

### STUDY DESIGN

This was a cross-sectional study with seventy young adults (18 to 30 years) studying at the University of Chester, England conveniently recruited online. An invitation letter containing participant's eligibility criteria and a link to the online self-administered structured questionnaire hosted by the JISC Online Survey (<https://www.onlinesurveys.ac.uk/>) was sent to students via their student emails and class WhatsApp groups. The link to the online questionnaire was active from 26<sup>th</sup> May to 31<sup>st</sup> July after which it was deactivated. The online questionnaire was composed of the participant information sheet (PIS), consent form, screening question, and questions to assess demographic characteristics, SSB consumption status, and the levels of the HBM constructs. The questionnaire is available from the

corresponding author. A sample size of seventy was adopted from the Cohen's sample size table as it was sufficient to detect a medium effect size  $w = 0.34$  using an error mean of 0.5, power of 0.80, and one degree of freedom (Cohen, 1988). Studying at the University of Chester, England and aged between 18 and 30 years were the inclusion criteria for the study. The respondents answered a total of thirty questions that were marked required, as each contributed to meeting the objectives of the study. The on-line questionnaire took approximately ten minutes to complete and each eligible respondent submitted one response. The participants were informed by the PIS on how to withdraw at any point during completing the online questionnaire by closing their web browser. This automatically deleted any partially filled responses; only seventy completed questionnaires were received. Responses could not be withdrawn as they were anonymously completed to maintain confidentiality of data. Participants were informed of this on the PIS sheet. The risk assessment undertaken prior to the study commencement showed that the online questionnaire could arouse feelings of guilt. Therefore, a link to the Student Wellbeing Adviser was provided for the respondents on the PIS and final page of the on-line questionnaire to manage risks.

#### ASSESSMENT OF DEMOGRAPHIC CHARACTERISTICS

Participants were asked their age, sex assigned at birth, level of study (undergraduate or postgraduate), and ethnicity. Participants were divided into five ethnic origins: white; Asian or Asian Black; Black, Black British, Caribbean or African; Mixed or Multiple Ethnic Groups; and Others) (Office for National Statistics, 2021).

#### ASSESSMENT OF SSB CONSUMPTION STATUS

SSB consumption status (non-consumer or consumer) in this research was not determined by the quantity of free sugar or added sugar consumed but dependent on if one had or did not have an SSB drink the day before the survey. SSB consumption was elicited by asking how many cups/cans/bottles of SSBs that were consumed in the previous day (Anderson et al, 2020). Responses were categorised into none, less than or equal to one, greater than one or equal to two, and greater than two (Anderson et al, 2020). Respondents that selected none were classified as non SSB consumers while the participants that selected the other responses were classed as consumers.

#### ASSESSMENT OF THE LEVELS OF THE HBM CONSTRUCTS

Structured and validated questionnaires (Salem & Said, 2018; Wang & Chen, 2022) used to assess the levels of the HBM constructs for healthy eating and SSB intake in adolescents were adopted and modified for this study. For validation of the questionnaire used in this study, it was reviewed by some Lecturers in the Department of Clinical Sciences and Nutrition and pretested amongst young adult students within and outside the study location. The reliability test of the questionnaire showed that the Cronbach's Alpha for perceived susceptibility (0.71) and perceived severity (0.79) were within the acceptable levels. For self-efficacy, the Cronbach's Alpha (0.91) was within the excellent level while perceived barriers (0.80) fell within the good reliability level. The Cronbach's Alpha for cues (0.45) and perceived benefits (0.65) were below the acceptable

reliability levels (Cronbach, 1951).

In setting the levels of the HBM constructs, perceived susceptibility to diseases from daily SSB intake had two items with four responses in each (Salem & Said, 2018). The responses received a score of one to four with four being the strongest accepted response (Salem & Said, 2018). This summed up to a minimum and maximum score of two and eight respectively (Salem & Said, 2018). The scores were categorised into low or high scores. Scores of two to five indicated low perceived susceptibility to diseases from a daily SSB intake, while scores of six to eight indicated high perceived susceptibility to diseases from daily SSB intake (Salem & Said, 2018). The same scoring and categories applied to perceived severity of diseases from a high SSB intake and cues to limit SSB intake (Salem & Said, 2018). Perceived benefits of consuming SSBs had three items and five responses to each item, with a minimum and maximum score of zero and sixteen respectively (Wang & Chen, 2022). Scores of zero to ten indicated low perceived benefits of consuming SSBs, while eleven to sixteen indicated high perceived benefits (Wang & Chen, 2022). Similar scoring and categories applied to perceived barriers that reduce the quantity of SSBs consumed (Wang & Chen, 2022).

Furthermore, self-efficacy to control SSB intake was grouped into three contexts, mental exhaustion; need for company, and increased accessibility to SSBs (Wang & Chen, 2022). Each context had three items with four responses having a minimum and maximum score of zero and three respectively for each item (Wang & Chen, 2022). This summed up to a minimum and maximum total score of zero and twenty-seven respectively (Wang & Chen, 2022). Scores of zero to fourteen indicated low self-efficacy to control SSB intake, while fifteen to twenty-seven indicated high self-efficacy to control SSB intake (Wang & Chen, 2022).

#### STATISTICAL ANALYSIS

Descriptive statistics were used to analyse the demographic characteristics, prevalence of SSB consumption, and SSB consumption status (non-consumer or consumer). Chi-squared test was used to determine the association between SSB consumption status and the levels of the HBM constructs. All analyses were undertaken using the IBM SPSS version 26.

#### ETHICAL STANDARDS DISCLOSURE

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and approved by the Faculty of Medicine and Life Sciences Research Ethics Committee at the University of Chester. Written informed consent was obtained from all participants.

## RESULTS

Participants' scores of the constructs are shown in Table 1.

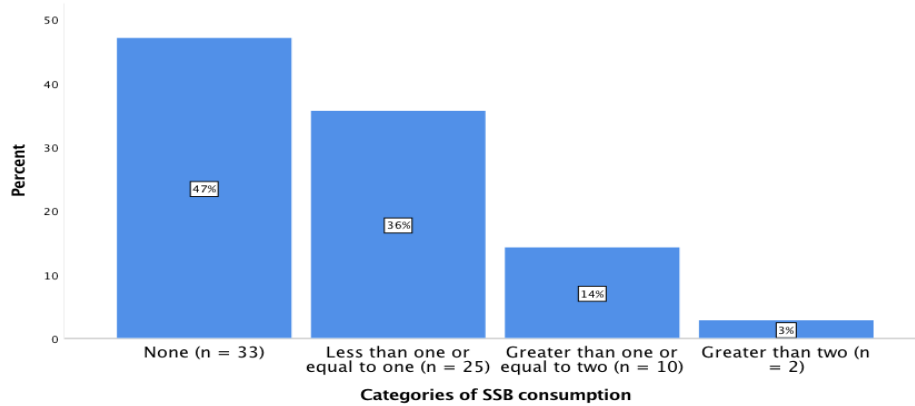
**Table 1. Scores on the HBM constructs among a sample of young adult students**

HBM Constructs	Mean	Standard Deviation
Perceived susceptibility	5.3	1.7
Cues	6.0	1.4
Perceived severity	6.5	1.3
Perceived benefits	9.3	3.0
Perceived barriers	9.9	3.3
Self-efficacy	15.1	6.9

53% of our sample consumed SSBs the day before the survey. Of this percentage, 17% drank more than one cup/can/bottle of SSBs (Figure 1).

Mean age of the participants was 25.5 years (SD: 3.0). Table 2 shows the other demographic characteristics of the sample linked to their SSB consumption status. The greatest percentages of SSB consumers were found among postgraduate students (58%) and the Asian or Asian British ethnic group (70.0%).

Table 3 shows whether the HBM constructs were associated with SSB consumption status. There was a significant association with only two of the six constructs: level of perceived severity of diseases from a high intake of SSBs,  $X^2(1, N = 70) = 6.94, P = 0.01$ , Cramer's  $V = 0.32$ ; and level of self-efficacy to control SSB intake,  $X^2(1, N = 70) = 8.83, P = 0.00$ , Cramer's  $V = 0.36$ .



**Figure 1. Sugar-sweetened beverage consumption in a sample of young adult students the day before the survey (N=70)**

**Table 2. Demographic characteristics of a sample of young adult students, stratified by their sugar-sweetened beverage non-consumer and consumer status**

Variables	Full sample (N = 70)		SSB Consumption Status			
	n	%	Non-consumer (n = 33)		Consumer (n = 37)	
			n	%	n	%
<b>Sex at birth</b>						
Female	48	69	23	48	25	52
Male	22	31	10	45	12	55
<b>Level of study</b>						
Undergraduates	18	26	11	61	7	39
Postgraduates	52	74	22	42	30	58
<b>Ethnicity</b>						
White	26	37	15	58	11	42
Asian or Asian British	20	29	6	30	14	70
Black, Black British, Caribbean or African	21	30	10	48	11	52
Mixed or Multiple	1	1	1	100	-	-
Other	2	3	1	50	1	50

N = Sample Size, n = Frequency.

**Table 3. Association between sugar-sweetened beverage (SSB) consumption status and Health Belief Model (HBM) constructs in a sample of young adult students (N=70)**

SSB Consumption Status		Levels of the HBM Constructs	Chi-Square Value	P Value
Non consumer Expected Count (Observed Count)	Consumer Expected Count (Observed Count)			
17.4 (16)	19.6 (21)	<b>Perceived susceptibility to diseases from daily SSB intake:</b>	0.479	0.489
15.6 (17)	17.4 (16)	Low perceived susceptibility		
		High perceived susceptibility		0.012*
3.3 (0)	3.7 (7)	<b>Perceived Severity of diseases from a high intake of SSBs:</b>	6.937	(Cramer's V = 0.52).
29.7 (33)	33.3 (30)	Low perceived severity		
		High perceived severity		

Table 3 continued

SSB Consumption Status		Levels of the HBM Constructs	Chi-Square Value	P Value
Non consumer Expected Count (Observed Count)	Consumer Expected Count (Observed Count)			
<b>Perceived barriers that reduce SSB consumed:</b>				
17.0 (16)	19.0 (20)	Low perceived barriers	0.217	0.642
16.0 (17)	18.0 (17)	High perceived barriers		
<b>Perceived benefits of consuming SSBs:</b>				
20.7 (21)	23.3 (23)	Low perceived benefits	0.016	0.899
12.3 (12)	13.7 (14)	High perceived benefits		
<b>Self-efficacy to control SSB intake:</b>				
14.1 (8)	15.9 (22)	Low self-efficacy	8.834	0.003* (Cramer's V = 0.36)
18.9 (25)	21.1 (15)	High self-efficacy		
<b>Cues to limit SSB intake:</b>				
9.0 (7)	10.0 (12)	Low cues	1.110	0.420
24.0 (26)	27.0 (25)	High cues		

\*Degree of Freedom (df) = 1. All P values were computed by Pearson Chi-Square Test except the P values of cues to limit SSB intake and perceived severity of diseases from a high intake of SSBs that were computed using Fisher's Exact Test as some of their expected counts were less than 10. P values were significant at  $\leq 0.05$ .

## DISCUSSION

The current study included seventy young adult students (18 to 30 years) studying at the University of Chester, England. Two in five young adult students drank at least one cup/can/bottle of SSB. Amongst the six constructs of the HBM, perceived severity of diseases from a high intake of SSBs and self-efficacy to control SSB intake were the only constructs that showed significant association with SSB consumption status.

Previous studies have also reported a high proportion of young adults consuming SSBs (Herrick & Gahche, 2017; Warner & Ha, 2017). Warner and Ha (2017) reported that 73% of the students in the Cambridge campus of the Anglia Ruskin University, UK consumed SSBs.

Several studies have found that males consume more SSBs (Barrett et al, 2017; Herrick & Gahche, 2017; Hu, 2013; Kuo et al, 2023; Rosinger et al, 2017; Satana-Jimenez et al, 2023; Singh et al, 2015). In Kuo et al (2023), the proportion of men that drank SSBs was greater than women by 6.1%. The percentage of US men that consumed SSBs on a given day was greater than women by 8.5% (Herrick & Gahche, 2017). In the present study, the difference was not this large. Although studies have found an association between a healthy diet and higher level of education (Elfassy et al, 2019; Galobardes et al, 2001; Santana-Jimenez et al, 2023; Thiele et al, 2004; Turrel & Kavanagh, 2006), the present study found more postgraduates consuming SSBs than undergraduates.

The present study supports that self-efficacy is strongly associated with SSB consumption (Fajarini et al, 2021; Garza et al, 2013; Githinji & Murimi, 2022; Sharafkhani et al, 2021; Wang & Chen, 2022). This study also found that perceived severity was associated with SSB consumption, which has not been previously reported. This suggests that among young adult students with a low perceived severity of diseases from a high intake of SSBs, a higher percentage will consume SSBs.

Interventions targeted at reducing SSB intake in a population similar to ours should consider aiming to improve the self-efficacy and perceived severity. Strategies related to improving self-efficacy that have been applied to

control SSB consumption in existing studies include improving access to drinking water, reducing the cost of healthful SSB alternatives, and restricting the sales and marketing of SSBs (Centers for Disease Control and Prevention, 2010). For young adult students, this study recommends that strategies should target at increasing their confidence to avoid SSBs when they are stressed, after writing exam, when they are eating, and when they engage in sedentary activities. To increase young adult students' perceived severity, this study recommends increasing awareness of how serious diseases are that are linked to a high intake of SSBs.

## LIMITATIONS

A Single 24-hour dietary recall was used to assess the SSB intake of the students on a given day. This is unable to capture all those who consumed SSBs less than daily (Anderson et al, 2020; Gemming et al, 2014; Novotny et al, 2003; Raina, 2013). The measured variables were categorised, limiting precision and detailed analysis of results. SSB consumption status was determined by whether one had or did not have an SSB drink instead of an exact measurement in ml or quantity of sugar consumed. The study was a snap shot and the situations we examined may change with time. The reliability levels of perceived susceptibility and cues were below the acceptable levels, and this did not allow for the holistic use of the HBM.

The results reported here could be biased, as only the students who were interested in the research participated. Students with particularly high intake of SSBs may have chosen not to participate. This may have contributed to an underestimation of the prevalence of SSB consumption in the universe of young adult students from which this sample was drawn

## CONCLUSION

A high percentage of young adult students consumed SSBs in a day indicating that targeted initiatives at this group is required. In a sample of young adult students from one university, this study provided evidence that SSB

consumption status was associated with the level of self-efficacy to control SSB intake and with perceived severity of diseases from a high intake of SSBs.

A more comprehensive research on SSB consumption in young adults using the HBM is recommended. In particular, a validated questionnaire that has included the six constructs of the HBM all within the acceptable reliability levels is required for young adults, as this is lacking in literature.

#### AUTHOR CONTRIBUTIONS

Goodluck C. Ndubuisi: Conceptualisation, Methodology, Software, Formal analysis, Investigation, Resources, Data curation, Writing - Original Draft, Writing - Reviewing and Editing, Visualisation. Stephen Fallows: Validation, Supervision, Project administration.

#### CONFLICT OF INTEREST

None.

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