



Educational Level Differences in Knowledge and Perceptions of Sugar-Sweetened Beverages in Central Semarang

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Abstract

Indonesia is ranked third with the highest level of Sugar-Sweetened Beverages (SSB) consumption in Southeast Asia in 2020. SSB consumption is one of the factors in the increase in cases of Diabetes Mellitus (DM) in society, especially in children. The research purpose is to get an overview of knowledge and perceptions related to SSB consumption at various levels of education (elementary school, middle school, high school, and university students). A quantitative method was used with a target population of 19,880 students across elementary, middle, high schools, and universities in Central Semarang. Proportional stratified random sampling yielded a sample size of 376 participants using the Isaac and Michael formula. The study used an SSB knowledge and perception questionnaire along with FGD guidelines. Chi-square and ANOVA tests revealed that knowledge and perceptions significantly influence SSB consumption across education levels ($F: 28.053$, $\text{sig } 0.000$), indicating that greater awareness could encourage healthier choices. The lack of knowledge about SSB consumption was most evident among elementary school children, with 72.19% reporting excessive intake. Negative perceptions were primarily found among students, followed by 56.16% in the student group, 43.48% in junior high, and 18.39% in high school. In conclusion, our study contributes to the understanding of the knowledge and perceptions in this research together have a significant influence on SSB consumption at various levels of education. This research provides insights into the importance of nutritional awareness at an earlier stage of education. Future studies should address the educational intervention of SSB consumption in children.

Introduction

Sugar-Sweetened Beverages (SSB) are widely consumed worldwide and include carbonated and non-carbonated drinks, energy drinks, packaged fruit or vegetable juices, isotonic drinks, herbal and vitamin drinks, flavored milk drinks, packaged tea and coffee, syrups or concentrates, and powdered beverages (WHO, 2017). Excessive consumption of SSB has been strongly associated with unhealthy

dietary patterns, which contribute to the rising prevalence of obesity and non-communicable diseases (NCDs) such as type 2 diabetes mellitus, cardiovascular disease, hypertension, stroke, kidney damage, and cancer (Akhter *et al.*, 2021; Anggraini *et al.*, 2019; Fajarini & Sartika, 2019; Shariq & McKenzie, 2020). Lifestyle, especially related to food and drink consumption, which is formed due to habits, knowledge, environment, lack of healthy food on offer, including

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inadequate facilities and policy support, which are important factors that can then increase cases of Diabetes in the Community (Al-Sejari, 2017; Aye *et al.*, 2014; Begic *et al.*, 2016; De Silva *et al.*, 2012; Handayani *et al.*, 2020; Xu *et al.*, 2020). In response to this global health concern, the World Health Organization (WHO) has recommended reducing SSB intake as a key strategy to prevent obesity and related NCDs (WHO, 2017).

In Indonesia, the consumption of SSB has increased significantly over the past two decades, placing the country as the third-highest consumer in Southeast Asia in 2020. The Center for Indonesia's Strategic Development Initiatives (CISDI) defines SSB broadly, encompassing liquid, concentrate, and powdered forms sweetened with sugar or other sweeteners, including condensed milk and syrups (CISDI, 2022). Recent health data are alarming; the Indonesian Pediatrician Association (IDAI) reports that the prevalence of diabetes mellitus (DM) among children has increased 70-fold between 2010 and January 2023, aligning with CISDI's findings that child DM cases are rising sharply. National survey data (SKI) in 2023 also indicate that soft drink consumption is most prevalent among adolescents aged 15–19, with 3.2% consuming SSB daily and 20.3% consuming them 1–6 times per week. Several risk factors—including sedentary lifestyles, low socioeconomic status, accessibility to fast food outlets, and limited health knowledge—have been linked to increasing SSB consumption (Mazarello Paes *et al.*, 2015; Tasevska *et al.*, 2017; Wang & Chen, 2022; Zahid *et al.*, 2017).

Despite evidence showing the critical role of lifestyle, knowledge, and environment in shaping unhealthy beverage consumption patterns, limited research has explored how knowledge and perceptions of SSB differ across educational levels in Indonesia. This research gap is particularly relevant in Central Semarang, a densely populated urban area where adolescents and young adults are highly exposed to fast food outlets, convenience stores, and modern dietary patterns that increase SSB accessibility and preference. However, little is known about how students in this area perceive SSB consumption and how their

knowledge may differ across education levels. Understanding these variations is essential, as schools and universities play a central role in shaping dietary behavior. Therefore, this study aims to investigate knowledge and perceptions regarding SSB consumption among students at different levels of education (elementary, middle, high school, and university) in Central Semarang.

Method

The research was carried out using a quantitative approach using methods cross sectional. This study was conducted in Semarang City, Central Java. The independent variable in this research was the level of knowledge and perception of Packaged Sweetened Drinks (SSB). The dependent variable was the level of SSB consumption among elementary, middle school, high school, and college students in Semarang City. The population includes elementary, middle school, high school, and college students in the central area, Semarang City. The sampling technique used in this research is proportional stratified random sampling, obtained from 8 schools (10% x number of schools) determined by random sampling, namely 4 elementary schools, 3 middle schools, and 1 high school. Sample requirements are in good health, residing in the central area, Semarang City. The sample size was determined using the Isaac and Michael formula. Specifically, the sample from students was determined using an accidental sampling technique, and a total of 73 people were obtained, so the total sample was 449 people. The instrument used is the SSB knowledge and perception questionnaire, which has been tested for validity and reliability. The data was analysed using bivariate tests with chi-square and multivariate tests with ANOVA.

Results And Discussions

The results showed that knowledge about SSB among elementary, middle school, high school, and student respondents was in the lowest category, 202 people or 45%. Perceptions about SSB among elementary, middle school, high school, and college students were in the positive category at most, 415 people or 92.4%. Meanwhile, SSB consumption at various

Table 1. Distribution of Knowledge, Perception, and Consumption of SSB

Variables	n	%
1. Knowledge Category		
Not enough	202	45%
Currently	175	39%
Good	72	16%
Total	449	100%
2. Perception Category		
Negative	34	7.6%
Positive	415	92.4%
Total	449	100%
3. SSB Consumption Category		
Low	223	49.7%
Excessive	226	50.3%
Total	449	100%

Table 2. Test Results *Chi-Square* between Knowledge and SSB Consumption

Knowledge	SSB consumption						P- Value
	Low		Excessive		Total		
	n	%	n	%	n	%	
Not enough	51	25.2%	151	74.8%	202	100%	0.000*
Currently	120	68.6%	55	31.4%	175	100%	
Good	52	72.2%	20	27.8%	72	100%	
Total	223	49.7%	226	50.3%	449	100%	

*significant when p-value<0.05

levels of education in Semarang City is mostly excessive, namely 226 people or 50.3% (Table 1).

Based on the results of data analysis, it was concluded that there was a significant relationship between knowledge about SSB and SSB consumption at various levels of education in Semarang City, where the knowledge variable had a negative influence on SSB consumption with a regression coefficient of -0.289, meaning that if the Knowledge variable increased by 1 level, then SSB consumption would decrease by 0.289 levels. Knowledge is the result of human sensing or the result of a person's understanding of objects through the senses they have (eyes, nose, ears, and so on). Knowledge is very important in producing a person's attitudes and actions. The 2018 Riskesdas also shows that the level of SSB consumption ≥ 1 time a day will decrease with the higher a person's education level. Better knowledge has also been shown

to increase positive perceptions regarding SSB, which in turn can reduce the level of SSB consumption (Wang & Chen, 2022; Zahid *et al.*, 2017). Knowledge is also related to geographical location and accessibility to educational facilities (Xu *et al.*, 2020). But basically, it is not only individual knowledge that determines the level of SSB consumption, but parents' knowledge regarding diet and health also influences it (Nur Islami *et al.*, 2020). Knowledge is also related to geographical location and accessibility to educational facilities (Xu *et al.*, 2020).

Test results chi square obtained: 1) There is a significant relationship between knowledge about SSB and consumption of packaged sweetened drinks (SSB) at various levels of education in Semarang City (p-value 0.000. 2) There is a significant relationship between perceptions about SSB and consumption of packaged sweetened drinks (SSB) at various levels of education in Semarang City (p-value

0.033) (Table 2 and Table 3). The multivariate analysis used in this research is multiple linear regression analysis, and the equation for the Knowledge and Perception variables that influence SSB consumption at various levels of education in Semarang City is obtained as follows.

$$Y = 52.019 - 0.289X_1 - 0.198X_2$$

Then the following interpretation can be given: (1) The constant value is 52.019, which means that if there were no Knowledge and Perception variables that influence SSB Consumption, then SSB Consumption would have a value of 52.019. (2) The Knowledge variable has a regression coefficient of -0.289. The Knowledge variable has a negative influence on SSB Consumption, with a regression coefficient of -0.289, which means that if the Knowledge variable increases by 1 level, SSB consumption will decrease by 0.289 levels. (3) The Perception variable has a regression coefficient of -0.198. This variable has a negative influence on SSB consumption, with a regression coefficient of -0.198, which means that if the Perception variable increases by 1 percent, SSB consumption will decrease by 0.198 percent.

On the Coefficient of Determination Test (R^2), the known coefficient of determination (R^2) is 0.112, so it can be interpreted that 11.2% of SSB consumption can be explained by the two independent variables consisting of the Knowledge and Perception variables. Meanwhile, the remaining 88.8% was influenced by other variables not included in the research model. Apart from that, this is also done with an F-test, with the magnitude of F being a known count amounting to 28.053

with a significance of 0.000. This means that knowledge and perception together have a significant influence on SSB consumption at various levels of education in Semarang City.

The results of other data analysis concluded that there is a significant relationship between perceptions about SSB and SSB consumption at various levels of education in Semarang City. The perception variable has a negative influence on SSB consumption, with a regression coefficient of -0.198, which means that if the Perception variable increases by 1 percent, SSB consumption will decrease by 0.198 percent. Another study among adolescents in Indonesia and Taiwan showed there was an association between self-perception and degenerative disease (Fauzi *et al.*, 2022). Perception is the process of understanding or giving meaning to information regarding a stimulus. The stimulus itself is obtained from the process of sensing objects, events, or relationships between symptoms, which are then processed by the brain. Perception is also defined as the human ability to interpret something by distinguishing, grouping, and focusing thoughts on that thing (Alizamar & Couto, 2016).

The research results also found that 11.2% of SSB consumption was influenced by knowledge and perception variables, while the remaining 88.8% was influenced by other variables not examined in this activity, such as SSB preferences, parenting patterns, socio-economic status, age, and ease of obtaining SSB (Mazarello Paes *et al.*, 2015; Tasevska *et al.*, 2017). School environmental factors that use automatic vending machines and provide fast food restaurants cause high levels of SSB consumption (Wiecha *et al.*, 2006). Children aged 12-18 years with parents who consume SSB

Table 3. Results of the Chi-Square Test Between Perception and SSB Consumption

Perception	SSB consumption						P-value
	Low		Excessive		Total		
	n	%	n	%	n	%	
Negative	23	67.6%	11	32.4%	34	100%	0.033*
Positive	200	48.2%	215	51.8%	415	100%	
Total	223	49.7%	226	50.3%	449	100%	

*significant when p-value<0.05

and have high levels of fast food consumption are associated with excessive SSB consumption. On the other hand, children whose parents have a higher level of education and are accustomed to eating breakfast are associated with lower SSB consumption (Tasevska *et al.*, 2017). SSB consumption is also related to unhealthy eating patterns, such as consuming fast food, consuming little vegetables, and excessive consumption of French fries and sweet drinks (Tasevska *et al.*, 2017).

The knowledge and perceptions in this research together have a significant influence on SSB consumption at various levels of education. The lack of knowledge is highest among elementary school children, the most negative perception is in the student group, with the description of excessive SSB consumption being highest in the elementary school group (72.19%), then the student group 56.16%, the middle school group 43.48% and the high school group 18.39%. In the student group where good knowledge about SSB got the highest results according to the group with the highest level of education in this study, but with a high level of negative perception causing excessive consumption of SSB to be in the second highest position, this could be due to other more dominant factors such as ease of access and more facilities than other groups to get SSB, such as parenting outside of parental supervision, more pocket money.

SSB consumption is part of life style especially the habitual diet as the dominant factor in the increase in DM cases, accompanied by the limited availability of DM preventative support foods that are marketed or available in the environment, in terms of quantity and variety, as well as the rise of foods and drinks with high sugar which are trending on the market, especially those consumed by children and teenagers, such as Booba drinks (Handayani *et al.*, 2020). Health promotion models based such as health information posters, health behaviour monitor and control, and nutrition integrated in school curriculum and extracurricular can be done to optimize nutrition education in school (Handayani *et al.*, 2017) The results of another study in Finland stated that the eating patterns of teenagers who eat breakfast and dinner irregularly are at risk

of obesity and DM (Mazarello Paes *et al.*, 2015). Meanwhile, lifestyle is the main reason for the increase in diabetes cases (Tasevska *et al.*, 2017; Wang & Chen, 2022; Wiecha *et al.*, 2006; Zahid *et al.*, 2017).

Conclusion

The knowledge and perceptions in this research together have a significant influence on SSB consumption at various levels of education. The lack of knowledge is highest among elementary school children, the most negative perception is in the student group, with the description of excessive SSB consumption being highest in the elementary school group (72.19%), then the student group 56.16%, the middle school group 43.48% and the high school group 18.39%. The knowledge variable has a negative influence on SSB consumption with a regression coefficient of -0.289. The perception variable has a negative influence on SSB consumption, with a regression coefficient of -0.198. This study highlighted the significant influence of knowledge and perceptions on SSB consumption across education levels. Early intervention, especially at the elementary level, where awareness is lowest, can play a pivotal role in preventing lifestyle-related diseases and promoting healthier dietary choices among the next generation.

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