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Psychological determinants of Sugar-Sweetened Beverages consumption among Secondary School Students: An Integrated Application of Social Cognitive Theory and Perceived Barriers Structure

Nasser Sharafkhani[1], Zahra Heidari[2], Zamzam Paknahad[3], *Firoozeh Mostafavi[4]

[1] PhD Candidate, Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran.
[2] Assistant Professor, Department of Biostatistics and Epidemiology, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran.
[3] Professor of Nutrition, Department of Clinical Nutrition, School of Nutrition and Food Science, Isfahan University of Medical Sciences, Isfahan, Iran.
[4] Professor of Health Education and Promotion, Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran.

Abstract

Background: Sugar-Sweetened Beverages (SSBs) are one of the rich sources of calories from the diet, without having proper nutrients, and excessive consumption of these drinks can have adverse effects on the health of the individual and society. The purpose of this study was using the social cognitive theory (SCT) and perceived barriers to explain the adoption of preventative behaviors to consume SSBs among secondary school students.

Materials and Methods: This cross-sectional study was conducted on 607 secondary school students selected through multi-stage cluster sampling. Data collection instrument was a questionnaire including students' characteristics, students' beliefs toward SSBs based on the SCT, perceived barriers, Preventive behaviors, and the amount of daily consumption of SSBs. The collected data was analyzed using descriptive and analytical tests, Pearson's correlation coefficient and linear regression in SPSS (version 25.0).

Results: The results showed that the average age of the participants was 13.92 ± 0.78 years. The amount of SSB use among students was unsatisfactory (3.49 glasses per day). In addition, the findings indicated that students' self-regulation, perceived social support, perceived barriers and self-efficacy ($P<0.001$) had statistically significant associations with adopting preventive behaviors to reduce consumption of SSBs, and those constructs explained 40% of the variance of students' adopting preventive behaviors.

Conclusion: Among the variables related to the SCT and perceived barriers, self-regulation, perceived social support, perceived barriers and self-efficacy were effective factors on students' nutritional performance toward consumption of SSBs. Hence, by using the present findings, health care providers can plan, implement and evaluate suitable interventions to reduce the consumption of SSBs in students.

Key Words: Adolescents, Social Cognitive Theory, Sugar, Sweetened Beverages, Preventive Behaviors.

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**** Corresponding Author:***

Firoozeh Mostafavi, Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran. Email: f_mostafavi@yahoo.com

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1-INTRODUCTION

Excessive consumption of Sugar Sweetened Beverages (SSBs) is a health problem among children and adolescents (1). SSBs are drinks with minimal nutritional value, such as regular soda (not sugar free), fruit drinks, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugars. These drinks are the main source of added sugar to children's diets (2, 3). Half of the US population consumes SSBs during the day (4). Research has shown that approximately 88% of children consume SSBs from their daily diet. Consuming these beverages provides around 271 kcal of energy; and 4 to 5 percent of consumers of these drinks have more than 500 calories intake per day (5). These drinks do not create a feeling of satiety in the person; therefore, they cause high calorie intake, more than other solid foods. Therefore, children who consume high amounts of sugary drinks cannot reduce or regulate the energy intake from other meals, and this leads to high total energy intake (6, 7). Approximately 10 to 15% of the total caloric intake in young people is attributed to the consumption of these drinks (8). This amount of energy intake from the consumption of free sugars is more than that allowed by the World Health Organization, which should include less than 5% of the total energy intake by the body (9). Studies in Iran have reported the consumption of sugary sweetened beverages, about 3.87 glasses (10) and 2.95 glasses (11) per day. In fact, high sugar intake among children and adolescents is associated with less water, milk, fruits, vegetables consumption, and more sugary foods and beverages; these changes in eating behaviors are worrying (12, 13). Because excessive consumption of SSBs is associated with increased adverse health consequences, such as poor nutrition and increased risk of tooth decay, weight gain, type 2 diabetes, cardiovascular disease, kidney, liver, cancer and also other adverse medical and psychological consequences (14-17). Public health interventions aimed at reducing the consumption of SSBs and other unhealthy eating behaviors in children have increased over the past two decades, and efforts are being made to reduce obesity and other side effects of unhealthy eating habits. Most of these interventions focused on adapting educational and behavioral approaches; approaches that focus on changing children's knowledge and attitudes and subsequently their behavior toward consuming SSBs. These interventions have been done through school-based education and interactive classroom activities or through home and community-based strategies (18, 19). Other supportive interventions include environmental change, school-level policies to limit the availability of SSBs, and other foods and beverages with minimal nutritional value in the school environment (20, 21). Eating habits and preferences develop during childhood and adolescence, and continue into adulthood; therefore, childhood is recognized as an important period to begin to develop lifelong eating habits to achieve the maximum preventive effect against diet-related adverse health consequences (22). According to research, various personal, environmental, social and family factors are highly correlated with the development of healthy and unhealthy behaviors in children and adolescents (22-24). Therefore, better understanding of the factors affecting diet and nutritional behaviors over a specific period of life (adolescence and early adolescence) is essential to improve nutritional behavior and a healthy diet (25). It is noteworthy that children and adolescents construct a great percentage of the population; and due to their special physical, mental and social characteristics, they are very vulnerable. Then, proper nutrition is one of the necessary conditions to maintain their health. Therefore, according to the above,

attempts to change adolescents' eating behaviors, including improving their diet, can certainly help reduce a variety of chronic nutrition-related diseases (26). However, the determinants of behaviors are complex and have not been sufficiently studied theoretically, although there are many theoretical models for describing health behaviors. One of these theories is Social Cognitive Theory (SCT), which is used to improve diet in young people. Accordingly, social cognitive theory assumes that behavior, including nutritional behaviors, is explained by using (a) individual factors such as attitudes, beliefs, self-efficacy, health concerns, physical satisfaction, and barriers; (b) Behavioral factors such as meal patterns, weight control behaviors, participation in food preparation and participation in shopping, and (c) environmental or interpersonal factors such as access to healthy food at home, persistence in eating with family, and friends' support for healthy eating (27). Albert Bandura's social cognitive theory, while expressing the predictors and effective principles in the formation of behavior, introduces knowledge constructs, outcome expectations, outcome values, self-efficacy, social support, self-regulation and situational perception as the most important determinants and guidelines in designing educational interventions (28). Moreover, many perceived barriers at the individual, social and environmental levels for the proper management of the consumption of these drinks have been mentioned, which need attention and solutions (29). Based on the above, this study seeks to answer this key question that “To what extent the predictive power of SCT and Perceived Barriers constructs is related to the prevention of SSBs in children and adolescents?” By answering this question, we can have appropriate strategies for planning intervention programs for reducing the consumption of SSBs, in order to prevent and control the burden of diseases caused by this problem.

2-MATERIALS AND METHODS

2-1. Study design and population

This descriptive-analytical (cross-sectional) study was performed on 607 students of secondary schools in Urmia city, West Azerbaijan province, North West of Iran. The study samples were selected through a multi-stage sampling method. First, Urmia city was divided into two central and peripheral districts, then a list of secondary schools was extracted from the Urmia Education Department. Twelve boys’ schools and twelve girls’ schools were randomly selected from each district (total of 24 schools). Then, in proportion to the number of students studying at different levels of education in these schools, the study samples (607 students = 284 girls and 323 boys) were randomly selected and entered into the study by the use of a simple random sampling method.

2-2. Inclusion and exclusion criteria

Providing the written consent of parents and school administrators, and the Lack of metabolic diseases and other problems that require a special were the necessary criteria for students to be included in the study. Unwillingness of the student to continue participating in the study was considered as an exclusion criterion.

2-3. Measuring tools

The data collection tool of this study was a researcher-made questionnaire consisting of the following parts: Part 1. Demographic characteristics of the student and her/his amount of SSBs consumption. Part 2. Knowledge Questions (with 9 items), for example, "How many calories are in a glass of cola?" A correct answer received a score of 1 and an incorrect one received a score of 0. Part 3. Questions related to the various constructs of SCT and perceived barriers in order to

performing behaviors that reduce the consumption of sugary drinks in the student; outcome expectations (with 14 items) For example, "I expect that by reducing the consumption of Sugar Sweetened Beverages, I will have a fit and attractive appearance", Self-regulation (with 10 items) For example, "I know how to evaluate the consumption of different types of drinks in myself", Self-efficacy (with 8 items) For example, "I can influence my parents' decisions to buy healthy drinks for home consumption", Social Support (with 6 items) For example, "I have friends who help me replace sugary drinks with water and sugar-free drinks. Perceived barriers (with 9 questions) For example, "Healthier drinks do not taste good and attractive "; All items related to subscales of SCT and the construct of perceived barriers were scored based on a 5-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree". Part 4. Preventive behavior questions (with 6 items): "I avoid being in the service environment of SSBs such as fast foods, these items are rated on a 4-point Likert scale (0 = never, 1 = seldom, 2 = often, 3 = always). The maximum score of the questionnaire was 100 indicating the best status and 0 was the minimum. The distance between the lowest and highest test scores was conventionally classified into three categories: weak (0-50% score), medium (51-75 score) and good (76-100% score).

To determine the validity of the researcher-made questionnaire, developed based on the study of valid sources (30-35), the qualitative method of content validity was performed based on the opinions of a panel of 10 experienced experts (including health education specialists, epidemiology, nutrition and preventive and social medicine). In this method, experts were asked to examine the items of the questionnaire in terms of simplicity, clarity, relevance and necessity; and to express their opinions and suggestions. After receiving feedback and suggestions from experts, the necessary amendments were made to the study tools. Finally, the validity of the tools was confirmed.

Obesity has been defined using sex-specific *Body mass index*(BMI) for age percentile curves developed by the World Health Organization (36). Children and adolescents with a BMI > the 85th, 97th, 99th percentiles were considered overweight, obese and severe obese (36).

2-4. Data Analyses

The data were analyzed using SPSS 25 software in descriptive (means, standard deviations, and ranges) and inferential statistical methods (paired Pearson correlation coefficient and linear regression tests). P-values less than 0.05 were considered significant in all statistical analyses. Moreover, the Kolmogorov-Smirnov test showed that distribution of quantitative variables had no significant difference with normal distribution; in other words, quantitative variables followed a normal distribution ($p>0.05$).

2-5. Ethical consideration

This manuscript was extracted from a proposal with the Code of Ethics (IR.MUI.RESEARCH.REC.1399.213) approved by the Ethics Committee of Isfahan University of Medical Sciences. In addition, written consent was received from all participants; and all the principals of the research ethics related to the Helsinki Statement were respected.

3- RESULTS

In this study, 607 students with an average age of 13.92 ± 0.78 participated. 323 of them (53.2%) were boys and the remaining (46.8%) were girls. On average, daily intake of SSBs in students was 3.49 glasses (each glass is equal to 240 ml). The mean score of body mass index (BMI) in the students under study was 24.1. The overview of characteristics of the samples

is presented in **Table.1**. The mean score of different constructs of the SCT and perceived barriers of the samples in relation to preventive behaviors of excessive consumption of SSBs were not favorable; and their weakest score was in the structure of knowledge with an average of 28.42 (± 15.56). The other constructs included preventive behaviors with an average score of 31.87 (± 10.44), social support to adopt preventive behaviors with high SSBs consumption (57.58 ± 11.53), perceived barriers with a mean score of 57.74 (± 10.89) and self-efficacy in relation to reducing behaviors of SSBs with a mean score of 59.34 (± 9.11), respectively (**Table.2**).

In order to determine the correlation between the SCT constructs, perceived barriers construct and baseline characteristics with preventive behaviors to reduce the consumption of SSBs, we utilized Pearson correlation coefficient. The results of the correlation analysis indicated that there was a positive and significant correlation between the SCT constructs and preventive behaviors to reduce the consumption of sweetened beverages. Furthermore, adopting behaviors to prevent excessive consumption of SSBs showed a significant inverse relationship with perceived barriers and BMI. More information regarding the correlations between the reduction of consuming SSBs and the other constructs of SCT or the individual factors are presented in **Table.3**.

To determine the real predictors of adopting to reduce the consumption of SSBs, regression analysis with stepwise method was used. So, the significant variables in correlation analysis were entered into the regression model. The regression results showed that students' Self-regulation, Social Support, Perceived barriers and Self-efficacy were the final predictors of adopting preventive behaviors to reduce consuming SSBs. These variables were able to explain 40% (R2 = 0.400) of the variance related to preventive behaviors to reduce the consumption of SSBs (**Tables 4, 5**).

Table-1: The baseline characteristics of the participants in both genders (n=607)

Variables	Female (n=284)	Male (n=323)	Total
Categorical variables	Number (%)	Number (%)	Number (%)
Academic year			
First	102(35.9)	110(34.1)	212(34.9)
Second	113(39.8)	125(38.7)	238(39.2)
Third	69(24.3)	88(27.2)	157(25.9)
BMI (Reference: WHO 2007)(36)			
Thin/Normal	176(62.0)	180(55.7)	356(58.6)
Overweight >85th percentile[a]	73(25.7)	71(22.0)	144(23.7)
Obesity >97th percentile[a]	30(10.6)	46(14.2)	76(12.5)
Severe obesity >99th percentile[a]	5(1.8)	26(8.0)	31(5.1)
Continuous variables	Mean ± SD	Mean ± SD	Mean ± SD
Age, year	13.89 ± 0.77	13.95 ± 0.78	13.92± 0.78
Daily intake of SSBs per glass (240 ml)	3.45 ± 1.09	3.52 ± 1.16	3.49 ± 1.13

* SD: standard deviation; BMI: body mass index; ml: milliliter.

Table-2: The mean scores of the SCT constructs and perceived barriers construct towards SSBs

Variables	*Mean+ SD	Maximum	Minimum
knowledge	28.42+15.56	66.67	0
outcome expectations	63.42+4.82	75.71	47.14
Self-regulation	61.11+10.92	86	24
Social Support	57.58+11.53	73.33	20
Self-efficacy	59.34+9.11	75	25
Perceived barriers	57.74+10.89	100	33.33
preventive behaviors	31.87+10.44	60	6.67

Table-3: The correlations between the dependent and independent variables (n=607)

Variables		Age	Sex	BMI	knowledge	outcome expectations	Self-regulation	Social Support	Self-efficacy	Perceived barriers	preventive behaviors
preventive behaviors	r	-0.038	-0.037	-0.538**	0.032	0.354	0.582	0.566	0.541	0.549	1
	p	0.350	0.365	0.000	0.437	0.000	0.000	0.000	0.000	0.000	

*P < 0.01 is significant; r= Pearson Correlation Coefficient; BMI: Body Mass Index.

Table-4: The results of multivariate regression analysis in prediction of adopting preventive behaviors to reduce consumption of SSBs (n=607)

Criterion variable	Predictive variables	Correlation (R)	R^2*	Adjusted R^2**
SCT and Perceived Barriers constructs	Self-regulation	0.582	0.339	0.338
	Self-regulation and Social- Support	0.617	0.380	0.378
	Self-regulation, Social Support and Perceived barriers	0.627	0.394	0.391
	Self-regulation, Social Support, Perceived barriers and Self -efficacy	0.633	0.400	0.396

* $\mathbf{R^2}$: R-squared; **Adjusted $\mathbf{R^2}$: Adjusted R- squared.

4- DISCUSSION

The aim of this study was to investigate the predictive factors associated with the adoption of behaviors preventing high consumption of SSBs in students using a combination of social cognitive theory and perceived barriers. The result of this study was a statistical model consisting of 4 variables including self-regulatory, perceived social support, perceived barriers and self-efficacy that were able to explain about 40% of the variance of preventive behaviors associated with the consumption of SSBs. It should be noted that the above four variables showed different predictive powers for explaining the adoption of behaviors to prevent excessive consumption of SSBs.

Table-5: Results of multiple regression analysis on adopt preventive behaviors to reduce consumption of SSBs (n=607)

Model	Changes source	Non-standard coefficients		Standard coefficients	t- value	Significant level
		B	Std. Error	β		
1	Constant value	3.572-	1.911	....	1.966-	0.050
	Self-regulation	0.583	0.031	0.610	18.938	0.000*
2	Constant value	-5.570	1.912	....	-2.913	0.004
	Self-regulation	0.408	0.046	0.427	8.721	0.000*
	Social Support	0.217	0.044	0.240	4.911	0.000*
3	Constant value	8.977	5.546	....	1.619	0.106
	Self-regulation	0.344	0.052	0.360	6.654	0.000*
	Social Support	0.169	0.047	0.187	3.579	0.000*
	Perceived barriers	-1.137	0.049	-0.143	-2.792	0.005*
4	Constant value	4.870	5.861	…..	0.831	0.406*
	Self-regulation	0.305	0.055	0.319	5.550	0.000*
	Social Support	0.139	0.049	0.153	2.818	0.005*
	Perceived barriers	-0.120	0.049	-0.125	-2.429	0.015*
	Self-efficacy	0.123	0.058	0.108	2.113	0.035*

*P<0.01 is significant (2-tailed); Std.Error: Standard Error; B: Unstandardized regression Coefficient; β: Beta coefficient.

According to the results of this study, the prevalence of obesity and overweight among students was 41.4% (38% in girls and 44.3% in boys), and the consumption of SSBs was reported as 3.49 glasses per day, which probably indicates the high consumption of SSBs in students. The previous studies also confirm and support our findings. For example, the study conducted by Van De Gaar et al., highlighted that children's SSBs consumption was 0.9 liter per day (36). Over the past 20 years, the rate of calories consumed (kcal) per day increased only by SSBs from 88 to 166 calories, although the consumption of SSB varies in different age groups, 76% of teenagers consume these drinks daily (37).

Researchers have proposed that in order to increase the effectiveness of interventions for reducing the consumption of SSBs in children, it is necessary to identify the determinants of these beverages in this population (38, 39), The findings of the current study indicated that all variables of the SCT such as students' Self-regulation, Social Support, Self-efficacy have a significant positive correlation with the rate of adopting preventive behaviors to reduce the consumption of SSBs. In addition, a significant inverse relationship was observed between perceived barriers and BMI with the adoption of behaviors to prevent excessive consumption of SSBs in the sample. It should be noted that in this study, there was no correlation between the desired consumption pattern of sugary drinks and the participants' individual factors such as age and gender. Likewise, in the study by Hamilton et al., no significant relationship was shown between the effect of children's gender and age on the pattern of consumption of SSBs (40). However, Forshee considers the gender and age of children to be effective in choosing these types of drinks (13). In the present study, self-regulation is the strongest and most effective construct on the adoption of preventive behaviors that can predict the relationship between the

behavioral patterns of sugar-sweetened beverages consumption, with a variance of approximately 33% in students. Among people who have access to healthy food and tend to have a healthy diet, the content of their diet largely depends on self-regulation that is, setting goals, planning, and monitoring what they eat or buy (41). According to scientific texts in the field of nutrition, self-regulation in nutrition has received little attention and is often not properly defined (42). However, self-regulatory behavior (especially goal setting) is closely related to healthy eating (43). The present study also emphasizes the importance of paying attention to self-regulation in adopting preventive behaviors from excessive consumption of SSBs. Social support is the second construct of SCT that could explain the adoption of preventive behaviors in relation to the desired consumption pattern of sweetened beverages in students. In line with our study, Su et al., have examined the sources of social support including family, friends, peers, and teachers in relation to the pattern of SSBs consumption. They identified peers and friends as the main sources of social support, which could affect the consumption of these drinks and predict it (44). Studies have shown that social support for eating healthy foods can have a positive effect on food purchase and consumption; they have also revealed that successful interventions in improving family attitudes and behaviors and other sources of social support may lead to healthy eating behaviors. The sources of social support can lead to an increase in nutritional self-efficacy of individuals and neutralize the expectations of negative consequences, along with encouraging and directing the self-regulatory behaviors of individuals (41). The construct of perceived barriers is the third factor of the extraction model of the present study, which could describe the adoption of preventive behaviors in relation to the optimal consumption pattern of sweetened beverages in students. In the present study, barriers such as easy access to SSBs at home and school, attractive taste of SSBs compared to healthier drinks, inappropriate dietary patterns of the parent in relation to the consumption of SSBs and insufficient awareness of children about these drinks were approved by the students. Similarly, in a study by Kaitlyn et al., the adverse role of parents as a model of diet and food supply, the attractive taste of sweet drinks, easy access to these drinks at home, having extra pocket money to buy these drinks as Barriers to limit consumption of SSBs, have been reported in children. Moreover, in the social dimension, barriers such as serving these drinks at parties and special occasions such as holidays and birthdays, being forced to be equated with siblings or friends by eating these drinks, and using these drinks as a reward are mentioned (45). In various texts, the barriers mentioned in the present study have been emphasized, which requires the attention of employees and health policy makers in developing strategies to limit the negative effects of these barriers on the optimal consumption pattern of these drinks. Self-efficacy is the fourth construct of the extraction model of the present study, which could explain the adoption of preventive behaviors in relation to the optimal consumption pattern of sweetened beverages in students. The effect of self-efficacy is also emphasized in the other studies, showing that the people's confidence in their abilities to choose healthy daily foods, even if difficult, determines a person's success in achieving a healthy eating pattern (41). Therefore, based on the evidence, self-efficacy is associated with a healthy eating pattern. In the same line, the present study revealed a positive and significant correlation between the construct of outcome expectations and the adoption of preventive behaviors in relation to high consumption of SSBs in students.

However, Su et al. Have emphasized the impact of the outcome expectations on negative and positive outcomes associated with the consumption of SSBs; and have stated that this construct should be considered in the adopting strategies to limit the consumption of beverages (44).

Of course, it should be noted that children's desire to consume sugary drinks can also be influenced by some non-behavioral environmental factors such as various nutritional programs in schools, social factors, economic and cultural factors, food policies at the general level, etc. (46). It is hoped that by conducting more studies in this field and informing the community and officials, more useful policies and effective interventions would be adopted, leading to the reduction of the SSBs consumption.

4-1. Limitations of the study

This study, like other studies, has its limitations: First, this study is a cross-sectional study and cannot be used to examine the cause-and-effect relationship, and it is recommended that stronger studies be used for this purpose. Second, the results can only be generalized to populations with similar features. Finally, the data collection tool in this study is a self-report questionnaire, and the participants might have underestimated or overestimated different dimensions affecting the adoption of their nutritional preventive behaviors, which may have affected the study findings.

5-CONCLUSION

According to the results of this study, it was found that the SCT and perceived barriers constructs predict 40% of the variance of the adoption of behaviors to prevent excessive consumption of SSBs in secondary school students. self-regulation, perceived social support, perceived barriers and self-efficacy were respectively the strongest predictors of the adoption of behaviors for reducing the consumption of SSBs; and therefore, the results of this study can be beneficial in designing, implementing, and evaluating appropriate interventions and strategies for reducing SSBs intake, and subsequently control and prevent the adverse effects of consumption of these drinks on health.

6- CONFLICT OF INTEREST

The authors declare no conflict of interest.

7- ACKNOWLEDGMENT

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