



Health Belief Model Concept in Overweight Adolescents' Carbohydrate Intake

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Abstract. In recent decades, the prevalence of overweight has quadrupled. Adopting unhealthy eating habits and consuming sugar-rich foods raise the prevalence of obesity. Dietary behavior modifications are crucial for managing the excess weight. A theory is known as the Health Belief Model is employed to determine an individual's willingness to modify their behavior. The aim of this research is to examine the relationship between the HBM construct and the consumption of carbohydrates in overweight adolescents. This research has a cross-sectional design. Purposive sampling was used to choose 110 overweight adolescents from four Malang high schools for the sample. In July 2023, the research was carried out. Six HBM constructs are represented by fifty-nine sentences: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy. Every remark was scored on a Likert scale ranging from 1 to 5. A two-time repetition 24-hour recall is used to measure carbohydrate intake. Analysis was conducted using SPSS 27. The bivariate test uses the Spearman and Pearson tests. Multiple linear regression testing is used in multivariate analysis. According to the results of a Pearson correlation test, consumption of carbohydrates is strongly correlated with both perceived susceptibility and reported benefit ($p=0.007$; $r=-0.232$ and $p=0.023$; $r=-0.192$, respectively). Adolescents who consider themselves more susceptible and beneficial consume less carbohydrates overall. Adolescents' carbohydrate consumption is influenced by the HBM construct by 13%. It is necessary to provide nutrition education with HBM to give adolescents more self-assurance in managing their overweight, particularly with regard to their eating habits.

Keywords: Overweight, Carbohydrate Intake, Health Belief Model.

1 Introduction

Being overweight is a widespread issue; over the past few years, it has become more prevalent in emerging nations[1]. Globally, the prevalence of overweight or obesity among children and adolescents aged 5 to 19 more than doubled from 4% to 18% between 1975 and 2016 [2]. In Indonesia, the proportion of 16–18-year-olds who are overweight rose from 5.7% in 2013 to 9.5 per cent in 2018[3, 4]. Childhood obesity is

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likely to persist into adulthood and is linked to cardiometabolic and psychological comorbidities, as well as early death. [5]. An increase in body mass index, followed by weight gain, is linked to a higher risk of type 2 diabetes, hypertension, cardiovascular disease, and cancer. Additionally, gaining 2.25 kg or more of weight can make it harder for the body to function normally and increase body pain[6].

Genetic, behavioral, and societal factors all have a role in the development of overweight, a complex disease. Eating habits and physical activity changes are crucial for managing extra weight [7]. One of the factors contributing to the emergence of overweight in adolescents is poor eating habits. Bad eating habits, such as consuming a lot of packaged foods, soft drinks, and sweetened beverages [8]. The likelihood of an adolescent getting overweight increases with the amount of snacks and junk food ingested. These foods are heavy in fat, high in carbohydrates, and high in energy, yet poor in fiber [9]. Consumption of foods with a high proportion of carbohydrates affects body weight independently of its energy content; eating high carbohydrates can worsen overweight [10]. High sugar consumption is also associated with increased overweight rates. The rise in consumption of sugary drinks that are less energy-dense can reduce the intake of healthier foods [11]. Adolescents eat snacks with added sugar both inside and outside the household. Sweets, sweet bakery items, and desserts other than bakery items are the main causes of the rise in sugar consumption in hawker cuisines. When it comes to beverage snacks, the most important factor is the wholesome sweeteners used in drinks, soft drinks, and fruit drinks [12]. Extra carbohydrate will be stored as glycogen in the liver. Glycogen, a type of glucose, is also stored in muscle cells. This glycogen cannot be converted back to glucose and is solely used to fuel the muscles. Glycogen, which is used by the body as an energy source, can only be stored for a short period in the body. Cells can turn carbs into fat if the body's oxidative capacity and reserves are exceeded by the amount of carbohydrates consumed. The liver experiences these alterations. The fat is then transported to fat cells, which have an infinite capacity to store fat [13]. Increasing carbohydrate intake significantly affects increasing adolescent BMI and waist circumference [14].

A conceptual framework known as the Health Belief Model (HBM) can be used to determine a person's psychological readiness or intention to engage in particular health actions. HBM is the earliest conceptual model to address specific health behaviors [15]. The HBM construct is made up of cues to action, self-efficacy, perceived benefits, perceived barriers, perceived susceptibility, and perceived severity [16]. The findings from the study conducted on college students indicate a link between a number of HBM components and student body weight. In addition, HBM can forecast BMI associated with being overweight [17]. The HBM construct can also predict willingness to manage weight. People with different nutritional statuses have different perceptions regarding obesity and weight loss [18]. A negative relationship exists between perceived barriers and nutritional behavior related to cardiovascular disease prevention [19]. Self-efficacy and reducing barriers can improve health behavior related to dietary management [20]. The study's results with the provision of prevention and health programs combined with HBM for 16 weeks by reducing the intake of unhealthy foods were able to increase weight loss and body fat loss [21].

The increasing prevalence of overweight in adolescents and high carbohydrate consumption in adolescents reflects the need for research on beliefs about behavior change in adopting a healthy lifestyle through nutritional intake, especially carbohydrate intake. To our knowledge, research has yet to be done on how HBM is generally constructed in relation to carbohydrate intake in overweight adolescents. Therefore, the objective of the current investigation is to ascertain the link between adolescent carbohydrate intake and all HBM components. The findings of this study, which place a strong emphasis on adolescent's health confidence, are anticipated to be utilized as a guide in initiatives to address obesity.

1.1 Participant

The research was planned as a cross-sectional study that would take place from July to August 2023. The population of interest consists of overweight adolescents in Malang, East Java, Indonesia. The sample for this study was 110 overweight adolescents taken through purposive sampling at four schools: SMAN 2 Malang (n=27), SMAN 5 Malang (n=28), SMKN 1 Malang (n=27), and SMKN 4 Malang (n=28). Eligible participants were between 15-18 years old, BMI for age above 1 SD. Written consent from the guardian and participant. Adolescents with diseases affecting eating patterns, following specific diets, and smoking cigarettes cannot be used as participants. Before the study began, each subject gave their agreement after being fully informed.

1.2 Measure

Health Belief Model. The questionnaire for measuring HBM is an adoption of research conducted by Mc. Arthur (2017) and Saghafi-Asl (2020). HBM consists of 6 constructs. A person's perception of their susceptibility to an illness is known as perceived susceptibility. The perception of a disease's seriousness that can have an impact on a person's life is known as perceived severity. A person's view of the advantages of altering behavior is known as a perceived benefit. The perceived barrier is a person's belief in a barrier to behavior change. Cue to action is a condition that encourages a person's readiness to make a change. Self-efficacy is a person's confidence and self-confidence regarding the success of carrying out a behavior

Fifty-nine statements representing 6 HBM constructs comprised 11 statements regarding perceived susceptibility, 5 statements regarding perceived severity, 10 statements regarding perceived barriers, 12 statements regarding perceived benefits, nine statements regarding cues to action, and 12 statements regarding self-efficacy. Each comment was rated on a Likert scale of 1 (extremely improper), 2 (inappropriate), 3 (neutral), 4 (acceptable), and 5 (appropriate) (very appropriate), before being used in the study. A validity and reliability test was conducted on the questionnaire with 30 similar participants. Fifty-nine statement items passed the validity test, according to the results. The reliability test results show that each perception has a Cronbach's Alpha value between 0.706 and 0.901. These findings suggest the questionnaire is trustworthy because its Cronbach's Alpha score is above 0.7.

Carbohydrate Intake. Carbohydrate intake in adolescents was measured using 24-hour food recall interviews with two repetitions on non-consecutive days. The interview results were translated from household measurements into grams and then entered into the Nutrisurvey software to calculate daily carbohydrate intake. Analysis of carbohydrate intake used the average of the two 24-hour recall measurement results.

1.3 Statistical Analysis

SPSS version 27.0 was used to evaluate the data that had been gathered. Variables are presented using descriptive analysis. The Pearson correlation test was utilized to ascertain the link between the variables and carbohydrate consumption because perceived susceptibility, cues to action, and self-efficacy were normally distributed. The association between these variables and carbohydrate intake was examined using the Spearman test since perceived severity, perceived barriers, and perceived benefits are not normally distributed variables. The independent variable's impact on carbohydrate intake's dependent variable is examined using multiple linear regression tests. $P < 0.05$ was used to determine statistical significance.

2 Result

2.1 Sample description

Most of the participants were women (63.6%). Participants consisted of 38.2% overweight adolescents and 61.8% obese adolescents. Most participants had a family history of obesity from both father and mother (78.2%). From 110 participants specified by educational level consisting of 21 (19.1%) tenth-grade students, 55 (50%) eleventh-grade students, and 34 (30.9 %) twelfth-grade students. (Table 1)

Table 1. Characteristics of participant

Characteristics	N	Percent (%)
Sex		
Boys	40	36.4
Girls	70	63.6
Nutritional Status		
Overweight	42	38.2
Obesity	68	61.8
History of overweight in the family		
Yes	86	38.2
No	24	61.8
Grade		
Tenth grade	21	19.1
Eleventh grade	55	50.0
Twelfth grade	34	30.9

2.2 Relationship Between Variables

Although a different number of items scores each variable, we divided the individual total scores by each variable's number of things for comparison (Table 2). The findings revealed that the average scores of participants' perceived susceptibility and perceived severity of being overweight were 2.95 out of 5 (SD=0.71) and 2.78 out of 5 (SD=0.69). This shows that participants do not feel vulnerable to being overweight and feel the threat of being overweight. Perceived barriers had a relatively low mean score of 2.77 out of 5 (SD=0.7). This shows that the participants have some barriers in managing their weight. Perceived benefits had the highest average score of 3.95 out of 5 (SD=0.74). It indicated that participants felt the benefits of managing their weight. The mean scores for cues to action and self-efficacy were 3.58 (SD=0.69) and 3.36 (SD=0.58), indicating that participants had signals to manage their weight and a sense of ability. The average intake of carbohydrates in both boy and girl participants was still below the Recommended Dietary Allowances (RDA), 369 grams (SD=89.26) and 287.11 grams (SD=69.59).

Table 2. Variables' descriptive analysis

Variable	Mean \pm SD	Min	Max
Perceived susceptibility	2.95 \pm 0.71	1.00	5.00
Perceived severity	2.78 \pm 0.69	1.00	4.40
Perceived barriers	2.77 \pm 0.70	1.00	4.70
Perceived benefits	3.95 \pm 0.74	1.17	5.00
Cues to action	3.58 \pm 0.69	1.00	5.00
Self-Efficacy	3.36 \pm 0.58	1.33	4.58
Carbohydrate intake (g)			
- Boys	369.00 \pm 89.26	173.59	548.40
- Girl	287.11 \pm 69.59	107.89	469.96

The Pearson and Spearman correlation tests determined the relationship between the independent variables and carbohydrate intake (Table 3). The results showed a negative relationship between perceived susceptibility ($r = -0.232$, $p = 0.007$) and perceived benefits ($r = -0.192$, $p = 0.023$) on carbohydrate intake in participants. The higher the perceived susceptibility. The lower the carbohydrate intake, the higher the perceived benefit. The lower the carbohydrate intake. There was no significant relationship between perceived severity, perceived barriers, cues to action, and self-efficacy in carbohydrate intake. The association of perceived susceptibility and perceived benefits with carbohydrate intake was included in the low relationship.

Table 3. Correlation test between independent variable and carbohydrate intake

Variable	R	p-value
Perceived susceptibility ^a	-0.232	0.007*
Perceived severity ^b	-0.109	0.129

Perceived barriers ^b	0.084	0.191
Perceived benefits ^b	-0.192	0.023*
Cues to action ^a	-0.125	0.096
Self-Efficacy ^a	0.008	0.468

Table 4. Regression Test of Health Belief Model on Carbohydrate Intake

Variable	B	t	Sig
(Constant)	403.157	5.991	<0.001
Perceived susceptibility	-38.452	-2.588	0.011
Perceived severity	-22.934	-1.651	0.102
Perceived barriers	39.468	2.706	0.008
Perceived benefits	-17.379	-0.987	0.326
Cues to action	11.888	0.577	0.565
Self-Efficacy	2.385	0.159	0.874
R	0,361		
R square	0,130		
Adjusted R Square	0,079		
Sig F	0,023		

The results of the regression test between HBM and carbohydrate intake are presented in Table 4. The results showed that the multiple correlation coefficient obtained $R = 0.361$, which means the level of relationship between HBM and carbohydrate intake in the weak category. The R square (R^2) value is obtained at 0.13, showing 13% that HBM and other factors influencing adolescent carbohydrate intake affect the rest. Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy were correlated with nutrient intake in overweight adolescents. The variable coefficients of perceived susceptibility and perceived barriers significantly affect carbohydrate intake in overweight adolescents. Each increase of one unit of perceived susceptibility will reduce carbohydrate intake by 38.452 grams. Increasing one unit perceived barrier will increase carbohydrate intake by 39,468 grams. Table 4 shows multiple linear regression model estimates for carbohydrate intake in overweight adolescents.

$$Y = 403.157 - 38.452X_1 - 22.934 X_2 + 39.468 X_3 - 17.379 X_4 + 11.888 X_5 + 2.385X_6 + e$$

Information

- Y = carbohydrate intake
- X_1 = perceived susceptibility
- X_2 = perceived severity,
- X_4 = perceived benefits,
- X_3 = perceived barriers,
- X_5 = cues to action
- X_6 = self-efficacy

3 Discussion

The goal of this study is to ascertain how carbohydrate intake in overweight adolescents relates to the HBM construct. This research found that perceived susceptibility and perceived benefit had a negative relationship with carbohydrate intake in overweight adolescents but were unrelated to perceived severity, perceived barriers, cues to action, and self-efficacy. This is consistent with nutritional behavior regarding cardiovascular disease, unrelated to perceived severity, cues to action, and self-efficacy [19]. In contrast, weight management is related to perceived severity, perceived barrier, and self-efficacy [18].

Perceived susceptibility is a factor associated with carbohydrate intake in overweight adolescents. The possibility that someone will follow a health behavior is influenced by one of them is the perception of perceived susceptibility. The higher the perception of susceptibility, the more likely it will be stimulated to carry out the behavior immediately [22]. Perceived susceptibility can be combined with perceived severity into a perceived threat, significantly and negatively related to adolescent BMI. The greater the perceived threat to a disease, the more likely it is to behave in a way that reduces the risk [23]. Contrary to other research, where perceived susceptibility has a positive relationship with increasing BMI, this can be influenced by limited time to prepare healthy food or lack of motivation to implement healthy behavior [17].

Perceived benefit is a factor related to carbohydrate intake in overweight adolescents. It can be used to forecast someone's propensity to make worthwhile changes. It describes a person's perception of an action's relative efficacy in lowering the risk of disease [24]. The results of other studies state that perceived benefits can influence diet behavior and good dietary habits. When the perception of benefits increases, a person tends to have good eating habits [22]. Implementation of HBM increases the perceived benefits scores of overweight adolescent girls [25]. In line with the study, providing HBM-based nutrition education increased the average value of perceived benefits. This plays an important role in preventing unhealthy behaviors [26]. Implementing good dietary habits has the highest benefits on health and well-being [27].

The funding perceived severity did not affect carbohydrate intake in adolescents. This aligns with research on university students in Tehran that shows that perceived severity is not associated with nutrition-related behavior [19]. The more excessive the views that underweight and normal students may hold, the more likely it is that they will take steps to control their weight since people modify their behavior when they believe their current situation may result in major health issues [17].

It was found that perceived barriers were not significantly related to carbohydrate intake in overweight adolescents. This is in line with research in young adults, which states that perceived barriers are not significantly related to the desire to consume organic foods in young adults [24]. Furthermore, in young adults, perceptions of barriers are not related to healthy eating behavior [28]. The provision of family food that does not contain balanced nutrition, such as high-fat, junk food, and instant food, also affects the nutritional intake of overweight adolescents. Adolescents need to make food choices and tend to consume those provided by the family without regard to the nutritional content of those foods [29].

The findings of this study demonstrated that among overweight and obese adolescents, cues to action were not substantially correlated with carbohydrate intake. This is consistent with young people's preference to eat naturally grown foods that are not strongly linked to cues to action [24]. Cues to action were not significantly associated with sugar intake in adolescents but were significantly associated with diet quality scores in adolescents [30].

The findings of this study demonstrated that among overweight and obese teenagers, self-efficacy was not substantially correlated with carbohydrate intake. Research in adolescents states that self-efficacy is not significantly related to sugar consumption in adolescents [30]. Gender is also an influential factor in self-efficacy. Women have an interest in health better than men and tend to want [31]. Cultures that target women who have thin and ideal body shapes so women have a sense of will to achieve their ideal weight [32].

Dietary quality scores among teenagers were positively correlated with peers' consumption of healthy foods, parental surveillance of their eating habits, and adolescents' evaluations of their parents' nutritional attitudes [33]. Health knowledge plays an important role in behavior change and is a prerequisite for change. The results of behavior change that positively impacts health will increase a person's confidence to change.[34] Although knowledge has a significant cognitive impact on conduct, it is insufficient to alter behavior [35]. Increasing the knowledge and lifestyle of adolescents about being overweight makes them take action to protect their health [25].

3.1 Limitation

This study has the drawback of only being able to present an overview at a single point in time due to the cross-sectional studies and non-experimental research method. Researchers also did not study adolescents' food patterns, so the types of food consumed by overweight adolescents could not be known.

3.2 Implication

Further research is needed to corroborate the findings in this study with a more significant number of respondents. It is also important to include adolescent food consumption patterns to determine the types of food consumed by adolescents so that food sources that contribute nutrients can be known. These results can also be used as a reference in preparing programs for handling nutritional problems in adolescents, especially regarding overweight. Providing nutrition education to adolescents can focus on strengthening adolescents' beliefs about vulnerability to other diseases caused by being overweight. In addition, nutrition education can also increase adolescent confidence about the benefits of good food consumption behavior.

4 Conclusion

Variables significantly related to carbohydrate intake are perceived susceptibility and perceived benefits. The higher the perceived susceptibility, the lower the carbohydrate intake in adolescents. Likewise, the higher the perceived benefits, the less carbohydrate intake in adolescents. The HBM construct influences adolescents' carbohydrate intake by 13%, and other factors influence the rest. HBM-based education is needed to increase adolescents' perceptions and beliefs regarding health problems, especially overweight, to support handling overweight issues in adolescents. Further research is required to determine the relationship between adolescents' beliefs about overweight, nutritional intake, consumption patterns, and food diversity. In addition, research is also required on providing education by emphasizing adolescent confidence through adopting HBM to deal with poor dietary consumption in adolescents.

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