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DETERMINANTS OF SCIENCE TEACHERS' HEALTHY EATING BEHAVIORS: COMBINING HEALTH BELIEF MODEL AND THEORY OF PLANNED BEHAVIOR

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Abstract. *This study was conducted to provide a comprehensive understanding of determinants of science teachers' healthy eating intentions and behaviors by combining the health belief model and the theory of planned behavior into one conceptual framework and considering the mediating impact of attitude and intention on behavior. This study was conducted based on cross sectional study design between November 2019 and February 2020. A total of 13 hypotheses were tested and data collected from 563 science teachers in Turkey were analyzed using structural equation modeling. The results of the study showed that the proposed model explained the variance in intention and behavior at a more satisfactory level than existing theories. The results also revealed that all of the hypotheses were supported. In addition, the mediating role of attitude and intention in understanding science teachers' healthy eating behaviors was identified. The study can provide important implications for education stakeholders, curriculum developers and science educators.*

Keywords: *health belief model, healthy eating behavior, science education, theory of planned behavior*

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Introduction

Healthy eating is a major behavioral factor for dealing with obesity and non-communicable diseases such as some types of cancer, cardiovascular disease, and type-2 diabetes (World Health Organization; WHO, 2016) accounting for 71% of the worldwide mortality rate (WHO, 2018). In addition, the number of people who undernourished increased from 784 million to 821 million between 2015 and 2017 (UN, 2019). Thus, the implementation of a healthy eating should be encouraged. WHO (2016) expressed that a healthy eating should include small amounts of saturated fat, salt and refined carbohydrates, as well as high consumption of fruits, vegetables and whole grains. Recent data in Turkey have indicated that people do not care about their healthy eating behaviors. For example, the proportion of obese individuals was 15.2% in 2008, while it increased to 19.6% and 21.1% in 2016 and 2019, respectively (Turkish Statistical Institute, 2020).

Education of individuals is the best solution for increasing levels of problems related to healthy eating around the world since health-related topics such as healthy eating are involved in socio-scientific issues which present great opportunities for the next generations (Fensham, 2012) and has a powerful relationship with education (Kickbusch, 2001). Considering the importance of health education in socio-scientific issues, in particular, science teachers play an essential role since students are taught to decide upon related to current social issues (Zeidler et al., 2009). In addition, science teachers can be helpful by teaching basic beliefs and personal values as well as decision-making processes and by teaching the science to act health behaviors (Zeyer & Dillon, 2014). Moreover, the topics related to healthy eating may easily be integrated into science courses (Arnold, 2018) and taught by science teachers. However, to organize effective learning environments, understanding science teachers' healthy eating behaviors and its antecedents play an important role to help researchers and professionals to design influential and appropriate intervention strategies and change un-healthy eating behaviors (McEachan et al., 2011). Moreover, teachers' beliefs about healthy eating may affect the likelihood of providing health

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education or promoting healthy eating practices in the classroom and may help adjust nutrition education services and professional development to meet teachers' needs (Jones & Zidenberg-Cherr, 2015). Therefore, new studies on science education need to be examined factors affecting health behavior and allowing for the inference of useful interventions to encourage health literacy and health behaviors in science education (Arnold, 2018).

There are several behavioral theories understanding health-related behaviors such as the Health Belief Model (HBM), Theory of Planned Behavior (TPB), the Health Action Process Approach and the Framework Model of Health Literacy. Among them, HBM and TPB are the most used theories for explaining individuals' healthy eating behaviors (e.g., Ateş, 2019; Fila & Smith, 2006). Accordingly, the current study used HBM and TPB to understand science teachers' healthy eating intentions and behaviors. The most importance of TPB is that people' behavioral intentions are the determinants that best explain their behaviors (Ajzen, 1991). In the TPB, volitional and non-volitional dimensions constitute the basis of intention and behavior (Ajzen & Fishbein, 1980), while the basic premises of the HBM are threat perceptions and behavioral evaluations (Bylund et al., 2011). The proficiency of these rational theories has been tested to determine healthy eating behaviors (e.g., Kim et al., 2012; Shimazaki et al., 2017; Sun et al., 2006) and each of these theories has been shown to be useful in understanding individuals' health related decision-making process (Huang et al., 2020). However, the adequacy of these theories has often been doubted (Gerend & Shepherd 2012). Moreover, a great majority of limited number of earlier studies tested the direct effect on healthy eating behaviors, while only a few studies investigated indirect effect between constructs (e.g., Deshpande et al., 2009). Considering the insufficient number of studies, therefore, earlier researchers called for health-related studies that testing of these theories should continue to better understand the factors on healthy eating behavior (e.g., Riebl et al., 2015). It was also suggested that they converge and compare with each other to contribute more to the literature, since both the HBM and TPB alone do not completely account for complexity and multi-dimensionality of behaviors (Noar & Zimmerman, 2005). Given the lack of empirical studies that focus on combining HBM and TPB, it is needed to combine the two theories to determine particular constructs that impact specific behaviors, which will help to develop our understandings (Gerend & Shepherd 2012). Further, to the best of our knowledge, no study has investigated science teachers' healthy eating intentions and behaviors by combining two theories and proposing a theoretical conceptual framework.

To address this literature gap, the current study aimed to: a) propose a conceptual framework for understanding science teachers' healthy eating intentions and behaviors through two theories (i.e., HBM and TPB); b) determine the relative importance of the proposed model compared to the HBM and TPB; c) explore the relative importance of the constructs of HBM and TPB within the proposed model to understand the intention and behavior; d) examine the mediating role of attitude and intention on healthy eating behaviors.

Literature Review and Hypothesis Development

Science Education and Health Education

Health education has been increasingly significant context for science education (Zeyer & Dillon, 2014) and accepted as fundamental dimension of scientific literacy (Zeyer & Kyburz-Graber, 2012) since health is intimately connected with human lives (Cruz, 2009). In addition, health topics occupy an important place in science education, as scientific facts and principles are very important in understanding biological systems (Arnold, 2020). Moreover, science educators advocate that the necessary education should be given at the school in order to create awareness in students against misleading information about health-related behaviors such as healthy eating (Fine et al., 2013). However, experts in the field stated that health issues are neglected in science education (e.g., Harrison, 2005; Zeyer & Dillon, 2014). For example, in US, there is no prepared health curriculum that can be used nationwide, and, in this vein, health is presented as a separate topic, regardless of science and health education emphasizes basic subjects about health issues (Keselman et al., 2012). However, in recent years there are some initiatives related to including health to science education. Attempts have been made to link health issues with science education, socio scientific issue and decision-making process in science curricula in several countries (e.g., the Australian Curriculum for Science in Australia (ACARA), 2013; Turkish Middle School Science Curriculum, 2018). In addition, in the last decade, some attempts have been done to explain the importance of this relationship (e.g., Arnold, 2018, 2020; Zeyer & Dillon, 2014). For example, a book called "Science | Environment | Health: Towards a Renewed Pedagogy" was published in 2012 to provide well-grounded perspectives on how science education can take advantage of the challenges of health education (Zeyer & Kyburz-Graber,

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2012). In the light of the information obtained from this book, the relationship between health education and science education can be summarized as indicated below.

a) Health issues can help strengthen students' interest and motivation for science education.
b) Health education and science education can encourage informed citizenship and well-informed personal choice regarding health.
c) Incorporating health issues into science education can help promote scientific literacy.
d) Health education and science education play important role in teaching socio-scientific issues.
e) Health and science literacy both are inherently knowledge-based.

Merging of HBM and TPB and Hypotheses Development

As stated earlier, unhealthy eating and poor dietary habits such as non-consumption of vegetables and fruits, skipping breakfast, excessive weight gain, and consuming a lot of fast food (Laska et al., 2012) would conclude negative effect on the health of individuals in the short term or long term. Therefore, paying attention to individuals' eating behaviors can be considered vital to living a healthy life in terms of pro-self and pro-social concerns, since understanding the determinants of eating behaviors is regarded as an important area of research that reduces both the individual and the society. Accordingly, many researchers used the TPB and HBM to understand individuals' healthy eating behaviors. The TPB and HBM are based on expectancy-value framework (Brewer & Rimer, 2008) and suppose that healthy eating behaviors are related to deliberative and rational process in consequence of personal utility and costs (Brewer & Rimer, 2008; Conner & Sparks, 2005). Therefore, both theories focus on voluntary and non-voluntary processes, which are accepted as basic factors of rational choice theories in explaining healthy eating behaviors. However, TPB assumes that intention is influenced by attitudes, subjective norms, and perceived behavioral control (PBC), while HBM embody conflicting values, perceptions, and social interactions (Wheeler, 2008) and emphasize the importance of the influence of health beliefs on behavior (Janz & Becker 1984). However, both TPB and HBM contain overlapping variables and stress the importance of different types of beliefs in understanding human behavior. Thus, it is important to merge the two theories to determine certain variables that affect certain specific that will develop understanding related to risk prevention behaviors (Gerend & Shepherd 2012). Further, combining constructs of TPB and HBM may provide a better accountability to understand healthy eating intentions and behaviors than research that simply adopted the model or framework and may develop the explanatory power of the combined proposed model. For example, Gerend and Shepherd (2012) revealed that when tested separately, HBM and TPB accounted for 26 and 39 % of the variance in health-related behaviors, respectively, while merging HBM and TPB increased the explanatory power of the merged model by 4%. Accordingly, as often suggested in past studies (e.g., Gerend & Shepherd, 2012; Huang et al., 2020), this study postulated a proposed model that a merging TPB and NAM in one theoretical model can best explain healthy eating behaviors.

Health Belief Model

For nearly 70 years, the HBM has extensively used conceptual model as a guiding theoretical model for health-related behavioral interventions (Champion & Skinner, 2008). The HBM was developed originally in the 1950s to understand whether people attend preventive programs to prevent and determine diseases (Becker & Maiman, 1975).

The initial theory posits that health-related decision-making process is based on primary concepts including threat perceptions (perceived susceptibility and a perceived severity), behavioral evaluations (perceived benefits and perceived barriers) and cues to action (Bylund et al., 2011). Among the threat perceptions, perceived susceptibility is people's beliefs about the "*likelihood of getting a disease or condition*" and perceived severity is "*feelings about the seriousness of contracting an illness or of leaving it untreated include evaluations of both medical and clinical consequences (for example, death, disability, and pain) and possible social consequences (such as effects of the conditions on work, family life, and social relations*" (Champion & Skinner, 2008, p. 47). Furthermore, perceived benefits, one of the behavioral evaluations, can be defined as "*potential advantages of engaging in the health behavior, including the behavior's perceived efficacy in preventing the undesired outcome*" (Gerend & Shepherd, 2012, p.172) and perceived barriers are beliefs people have about "*the difficulties or hindrances associated with a target behavior*" (Orji et al., 2012, p.15). One of the other components of HBM is cues to action

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which are specific triggers that generate an individuals' sense of need for action (Champion & Skinner, 2008). Later, Becker and Rosenstock (1987) added the concept of self-efficacy, which is derived from social cognitive theory and defined as *"the conviction that one can successfully execute the behavior required to produce the outcomes"* (Bandura, 1997, p.204). In the HBM, self-efficacy reflects an individuals' reliance in her/his ability to act the health behavior (Weinstein, 1993). The predictive power of HBM has been strengthened with the inclusion of self-efficacy (Buglar et al., 2010).

Earlier empirical studies showed that the HBM is the most relevant explanatory theoretical model when examining the motivations for engaging in health behavior (Urbanovich & Bevan, 2020) and widely used to understand various health related behaviors, such as healthy eating behaviors (e.g., Deshpande et al., 2009), organic food consumption (e.g., Yazdanpanah et al., 2015), healthy risk preventative behavior (e.g., Huang et al., 2020) and human papillomavirus vaccine uptake (e.g., Gerend & Shepherd 2012). Among them, determinants of healthy eating behaviors have been tested by a few of previous studies. These studies revealed the importance of the constructs of HBM including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy on healthy eating intentions and behaviors. For example, Kim et al. (2012) found that college students' perceived severity, perceived benefit and perceived susceptibility were positively related to healthy eating intention, while a negative relationship was found between perceived barrier and healthy eating intention. In another study, Deshpande et al. (2009) found that healthy eating intentions of college students were predicted as positive by self-efficacy and as negative by perceived barriers. However, it was reported that perceived benefit did not have a significant influence on likelihood to eating healthy. In a study conducted with adult consumers, Cook (2018) found that among the constructs of HBM, perceived barrier was negatively related to healthy eating intention. In a study conducted with adult consumers, Orji et al. (2012) found that all the constructs of HBM were positively associated with healthy eating behavior except perceived barrier which was the only construct that affects healthy behaviors negatively.

Accordingly, a limited number of past studies confirmed that the constructs of HBM model played an important role to explain healthy eating intentions and behaviors. These studies reported that only perceived barriers are negatively associated with healthy eating behaviors since barriers such as knowledge, time and resource cannot be controlled by individuals and therefore may affect negatively behaviors (Gao et al., 2017). In other words, if individuals have higher control over healthy eating behaviors, their intentions to perform the behaviors will be stronger. Similarly, if a person feels easy and has relevant knowledge level and skills to eat healthily, he/she will probably intend to eat healthily. In addition, past studies reported that in case appropriate beliefs including that perceived susceptibility, severity and benefit are held, it triggers healthy eating behaviors (Vassallo et al., 2009) and different types of cues such as media campaign and social influence have an impact on healthy eating behaviors (Orji et al., 2012). However, the results of earlier studies conducted in different contexts may be less generalizable to the participants of the study, namely science teachers. Therefore, it is thought that the current study will make important contributions to the literature since there are a limited number of studies and the research aimed to study with individuals who have different cultural and educational levels. Based on the arguments, then we propose following hypotheses:

H1: Perceived susceptibility is positively related to healthy eating intentions.
H2: Perceived severity is positively related to healthy eating intentions.
H3: Perceived benefit is positively related to healthy eating intentions.
H4: Cues to action is positively related to healthy eating intentions.
H5: Perceived barrier is negatively related to healthy eating intentions.
H6: Self-efficacy is positively related to healthy eating intentions.

Theory of Planned Behavior

The theory of planned behavior (TPB; Ajzen, 1991) is extension of the theory of reasoned action (Ajzen & Fishbein, 1980) by adding a new construct called perceived behavioral control (PBC) which is non-volitional factor (Ajzen, 1991). The theory was proposed to reveal factors affecting various types of human behaviors (Conner & Armitage, 1998). According to TPB, the best predictor of human behavior is intention which is considered the motivational construct that encourages a person to engage in a certain behavior and intention is affected by attitude, subjective norm and PBC (Ajzen, 2005). Attitude refers to positive or negative evaluation of a certain behavior implying that the more positive attitudes towards behavior, the more likely it is to carry out this be-

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havior (Ajzen, 2005). Subjective norm defined by Ajzen (1991) as "*the perceived social pressure to perform or not to perform the behavior*" (p. 188) is people's perceptions related to the views that salient references, including family, relative, friend, and colleague, have on their behaviors. PBC is "*perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles*" and it is supposed to indicate *"past experience as well as anticipated impediments and obstacles*" (Ajzen, 1991, p. 188).

TPB is a widely used parsimonious model and the effectiveness of it in explaining various behaviors has been confirmed in a variety of health-related behaviors such as healthy eating behaviors (McEachan et al., 2011). Its popularity is partly due to its open operationalization with guidelines on how to measure, analyze and develop health interventions using theory (Ajzen, 2006). Empirical findings in earlier studies confirmed the positive relationships among attitude, subjective norm, PBC indicating the importance of the constructs in the TPB in explaining decision-making process of individuals related to healthy eating intentions and behaviors (e.g., Ateş, 2019). Previous studies have generally focused separately on specific sample groups such as children (e.g., Bazillier et al., 2011), adolescents (e.g., Chan et al., 2016; Grønhøj et al., 2013), and adults (e.g., Brouwer & Mosack, 2015). In addition, a majority of them aimed to understand healthy eating intention, while a few studies focused on understanding antecedents of healthy eating behavior. For example, Bazillier et al. (2011) tested the essential role of children' (aged 8–9 years old) attitude, subjective norm, and PBC in explaining their healthy eating intentions. They reported that attitude, social norms and PBC accounted for 35% of the variance in healthy eating intention and PBC was the most important predictor of intention. Grønhøj et al. (2013) revealed that perceived ease related to healthy eating behavior was the most influential determinant of adolescents' intentions towards healthy eating. In another study conducted by Fila and Smith (2006), the efficacy of the TPB was tested to predict healthy eating behaviors of Native American youths aged between 9–18 years old, it was found that subjective norm was the most predictive determinant. However, it was reported that there was no significant relationship between intention and behavior. Brouwer and Mosack (2015) studying with adult individuals revealed that PBC was the most influential factor on healthy eating behaviors. Among the limited number of studies conducted on teachers, Ateş (2019) studied with various elementary school teachers including Turkish language, mathematics, physical education, and classroom teachers and found that PBC was the strongest influence on both intention and behavior. Furthermore, positive association was found between healthy eating intentions and behaviors.

As a result, although past empirical studies contributed significantly to the literature, it is not clear which variable has a large impact on intention or behavior and, there are very few studies that specifically examine its effect on behavior. Moreover, since the studies are conducted with individuals of very different ages, cultures, income, social environment, and professional fields, there is a need to research the healthy eating behaviors of science teachers who will raise future generations as science literate and health literate individuals. Therefore, the following hypotheses were formulated:

H7: Attitude is positively related to healthy eating intentions.

H8: Subjective norm is positively related to healthy eating intentions.

H9: Perceived behavioral control is positively related to healthy eating intentions.

H10: Healthy eating intentions are positively related to healthy eating behaviors.

The Relationship Between Beliefs and Attitude

Many of contemporary social psychologists argue that cognitive or information processing approaches play a major role in forming attitude (Ajzen, 1991). One of the approaches is expectancy-value model developed by Fishbein and Ajzen (1975). The model proposed that attitudes develop rationally from beliefs people have about the object of the attitude and each belief ties a behavior to a specific result or another trait that occurs through the performance of the behavior (Ajzen, 1991). Since the attributes associated with behavior are already evaluated as positive or negative, we inevitably have an attitude towards the behavior (Ajzen, 2005).

Similarly, in the context of this study, we believe that health related beliefs including perceived susceptibility, perceived severity and perceived benefits affect attitude toward healthy eating and trigger the behavior. Perceived susceptibility reflects people's beliefs about the likelihood that a person will experience the outcome while perceived severity belief is to what extent people believe a health situation harmful (Orji et al., 2012). Accordingly, perceptions of susceptibility and severity can affect attitudes toward the health-related behavior (Zhang et al., 2018). Moreover, perceived benefits concern an individual' belief in targeted behavioral ability to decrease the likelihood of being influenced by the health threat (Champion & Skinner, 2008). Thus, people who

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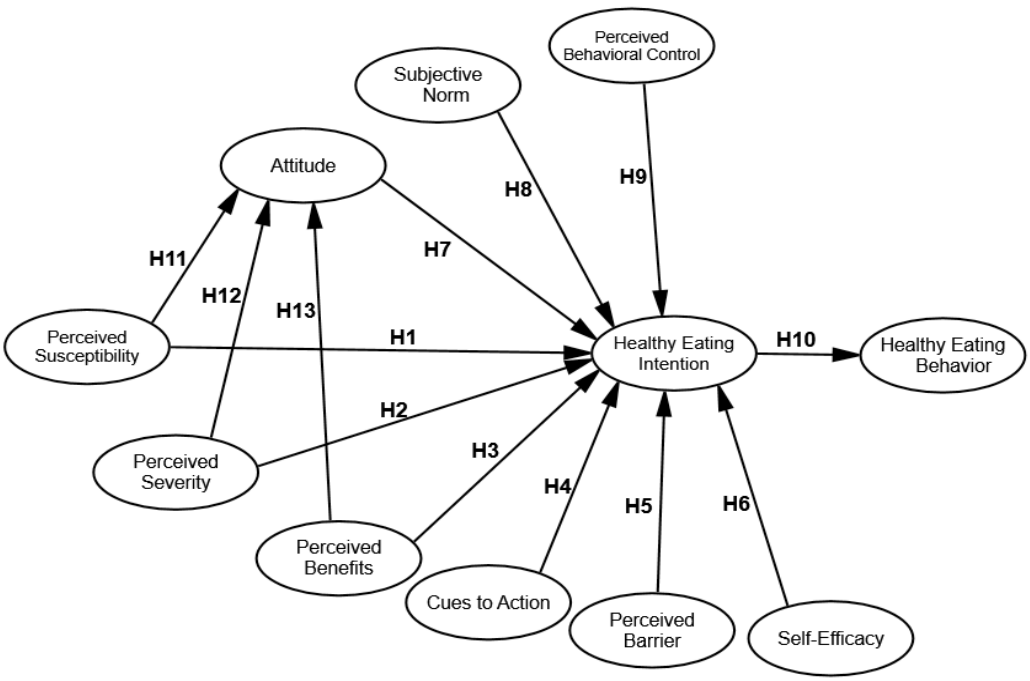
thought that the particular behavior is safer and more effective maintain a positive attitude toward this behavior (Rogers, 2010). Earlier studies confirmed the important role of perceived susceptibility, perceived severity and perceived benefits on attitude toward health-related decision-making processes (e.g., Zhang et al., 2018). For example, Zhang et al. (2018) reported that health related benefit and risk perceptions were significantly associated with attitudes. In another study conducted by Huang et al. (2020) it was found that perceived susceptibility and perceived benefit play a fundamental role on attitudes toward health, health-related preventative behaviors. However, within our knowledge, no study was conducted examining the influence of perceived susceptibility, perceived severity, and perceived benefits on attitude toward healthy eating. Therefore, in this study context, we suppose that science teachers who think that they are more likely to be exposed to risk or perceive the seriousness of the risk will have a more favorable attitude towards engaging in healthy eating behaviors. Based on the importance of beliefs on attitude as suggested in the TPB and expectancy-value model and earlier study findings, following hypotheses indicated in Figure 1 are presented:

H11: Perceived susceptibility is positively related to attitude toward healthy eating.

H12: Perceived severity is positively related to attitude toward healthy eating.

H13: Perceived benefit is positively related to attitude toward healthy eating.

Figure 1
The Proposed Model



Research Methodology

The design of the study was based on the hypothesis that, healthy eating intentions and behaviors of Turkish teachers could be explained by means of the HBM and the TPB theoretical models and theories. Depending upon this above-mentioned hypothesis, the study was conducted using cross sectional study design since data are collected from a sample that is from a pre-determined population (Fraenkel et al., 2012). Data of this study were collected on a volunteer basis between November 2019 and February 2020. The data analysis was conducted through path analysis to examine whether the HBM and the TPB statistically explain teachers' healthy eating intentions and behaviors.

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Participants

The participants of the study consist of science teachers in six cities located in different regions of Turkey. In the first application, the data were collected from 603 science teachers. However, due to some reasons such as items not filled in the questionnaire, multicollinearity and some participants delivering the instrument without completing it, 40 of the participants were excluded from the data. Finally, a total of 563 science teachers attended the study (age ranged from 22 to 68; *M* = 39.22, *SD* = 11.22; *MBody Mass Index*=25.12). Among the participants, 53.93% were male and 46.7% were female. Their average teaching experience was 19 years and 18.20% of them held a graduate degree. 55.13% of them were married, while 44.87% of them were single.

Healthy education was provided by science teachers at middle schools in Turkey. In the science curriculum, there are some objectives to be reached about healthy eating within the scope of the science lesson. For example, in the unit of 'Our Foods', it is aimed to create awareness in students about the types of food, healthy and balanced diet, the damages of smoking and alcohol use, and the benefits of healthy eating (Turkish Ministry of Education 2018). In addition, pre-service science teachers take healthy eating-based courses such as 'Nutrition and Health' during undergraduate education (The Higher Education Council of Turkey, 2018).

Instruments

Measurement instruments of the study were adopted from earlier studies described in the extant literature. Then, the instruments were changed to make them suitable for the current study setting. These instruments have been used extensively in many studies of theory expansion and deepening in various contexts, and the validity of such tools has been proven many times in these studies (e.g., Astrom & Rise, 2001; Brouwer & Mosack, 2015). The first version of the instruments was pre-tested and reviewed by health education and science education academicians. Minor revisions were made in accordance with their feedback (e.g., miswriting, spelling error, survey layout). The last version of the instruments consisted of demographic information queries and items of the proposed model.

A total of 11 scales and 40 items including three TPB constructs (attitude; seven items, subjective norm; three items, PBC; four items), six HBM constructs (perceived severity; three items, perceived susceptibility; two items, perceived barriers; two items, perceived benefits; four items, self-efficacy; four items, and cues to action; three items), intention (three items) and behavior (five items) are involved in the study. All the items were rated with 7-point Likert Type scale from "strongly disagree" to "strongly agree". Information related to the constructs, items and sources is presented in Table 1.

Table 1
The Items, Adoption Sources and Data of Convergent Validity

Construct	Item no	Statements	Source	Factor Loading	α	AVE	CR
Perceived Severity	PSV 1	My feelings about myself would change if I ate unhealthy	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.725	.71	.51	.76
	PSV 2	I am afraid to even think about eating unhealthy		.714			
	PSV 3	If I eat unhealthy, my entire life would change		.706			
Perceived Susceptibility	PS 1	My chances of eating healthy are great	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.792	.74	.64	.78
	PS 2	It is likely that I eat healthy		.813			
Perceived Barriers	PBR 1	I feel like I am not strong enough to eating healthy	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.788	.70	.59	.74
	PBR 2	Eating healthy requires adopting a new habit, which is difficult		.748			

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Construct	Item no	Statements	Source	Factor Loading	α	AVE	CR
Perceived Benefits	PB 1	I care to look attractive	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.702	.72	.57	.84
	PB 2	I care to have right weight		.788			
	PB 3	I believe that eating healthy improves the way my body looks		.774			
	PB 4	I believe that eating healthy prevents diseases		.744			
Self-Efficacy	SE 1	I feel better when eating healthy	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.711	.76	.54	.82
	SE 2	I usually eat the healthy I choose for myself		.702			
	SE 3	I am able to often eat healthy		.768			
	SE 4	I do eat the healthy that I planned		.744			
Cues to Action	CA 1	Teacher, Academic Staff or Doctor recommendations prompted me to eat healthy	Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974; Samoggia & Riedel, 2020	.739	.74	.52	.77
	CA 2	Campaigns (e.g., media: press, TV, and radio) prompted me to eat healthy		.722			
	CA 3	Family members or friends with illnesses prompted me to eat healthy		.703			
Attitude (For me, healthy eating is…)	ATT 1	Good	Armitage & Conner, 1999; Astrom & Rise, 2001; Ateş, 2019; Brouwer & Mosack, 2015	.779	.71	.53	.89
	ATT 2	Useful		.741			
	ATT 3	Cheap		.735			
	ATT 4	Pleasant		.722			
	ATT 5	Enjoyable		.712			
	ATT 6	Wise		.703			
	ATT 7	Necessary		.697			
Subjective Norm	SN 1	People who are important to me think I should eat healthy.	Armitage & Conner, 1999; Astrom & Rise, 2001; Brouwer & Mosack, 2015	.703	.77	.57	.80
	SN 2	People who are important to me would approve of my healthy eating		.788			
	SN 3	People who are important to me want me to eat healthy		.777			
Perceived Behavioral Control	PBC 1	I have control over whether or not I eat healthy	Ajzen, 2002; Ateş, 2021; Fila & Smith, 2006	.791	.79	.64	.88
	PBC 2	If I want, I can easily eat healthy.		.823			
	PBC 3	I think healthy eating is easy for me.		.812			
	PBC 4	Whether or not I eat healthy is mostly up to me.		.780			
Intention	INT 1	I intend to eat a healthy over the next week	Armitage & Conner, 1999; Astrom & Rise, 2001; Brouwer & Mosack, 2015	.713	.70	.54	.78
	INT 2	I plan to eat a healthy over the next week		.760			
	INT 3	I want to eat a healthy over the next week		.741			
Behavior	BEH 1	I mostly eat healthy foods.	Fila & Smith, 2006	.815	.75	.67	.91
	BEH 2	I eat healthy to keep me from getting diabetes		.823			
	BEH 3	I eat healthy foods when I watch TV.		.772			
	BEH 4	I eat fruits.		.855			
	BEH 5	I eat vegetables.		.837			

Note. "α = Cronbach's Alpha AVE: Average Variance Extracted, CR: Composite Reliability; Negatively worded items were reverse-scored."

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Data Analysis

SPSS was used to conduct descriptive statistics. Reliability analysis and exploratory factor analysis (EFA) and AMOS was used to perform confirmatory factor analysis (CFA) and path analysis. The data process included two stages: Measurement and structural models (Byrne, 2016). Before carrying out the measurement model, the EFA (see Table 2) was conducted to identify the factors using principal component analysis (PCA). Firstly, items were tested whether they are appropriate to factor analysis. It was found that since Bartlett's test of sphericity was significant and Kaiser-Meyer-Olkin value (.902) was higher than .60 (Tabachnick et al., 2018), EFA is suitable for extracting salient factors. Finally, PCA revealed that total variance was explained with 79.12%, the eigenvalues were above 1.0 and factor loading of items in HBM and TPM were more than .50.

Table 2
Factor Loadings Obtained from Exploratory Factor Analysis

Constructs	Items	Factor component										
		1	2	3	4	5	6	7	8	9	10	11
Perceived Severity	PSV 1	.80										
	PSV 2	.78										
	PSV 3	.78										
Perceived Susceptibility	PS 1		.80									
	PS 2		.78									
Perceived Barriers	PBR 1			.81								
	PBR 2			.78								
Perceived Benefits	PB 1				.81							
	PB 2				.76							
	PB 3				.74							
	PB 4				.72							
Self-Efficacy	SE 1					.75						
	SE 2					.81						
	SE 3					.71						
	SE 4					.77						
Cues to Action	CA 1						.77					
	CA 2						.76					
	CA 3						.71					
Attitude	ATT 1							.72				
	ATT 2							.81				
	ATT 3							.79				
	ATT 4							.74				
	ATT 5							.71				
	ATT 6							.85				
	ATT 7							.81				
Subjective Norm	SN 1								.77			
	SN 2								.72			
	SN 3								.76			
Perceived Behavioral Control	PBC 1									.88		
	PBC 2									.79		
	PBC 3									.82		
	PBC 4									.81		

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Intention	INT 1										.81	
	INT 2										.82	
	INT 3										.79	
Behavior	BEH 1											.81
	BEH 2											.82
	BEH 3											.71
	BEH 4											.79
	BEH 5											.80

Note. PSV= Perceived Severity, PS= Perceived Susceptibility, PBR= Perceived Barriers, PB= Perceived Benefits, SE= Self-Efficacy, CA= Cues to Action, ATT= Attitude, SN= Subjective Norm, INT= Intention, BEH=Behavior

The measurement model consists of reliability including Cronbach Alpha (α) and Composite Reliability (CR) and validity including convergent and divergent validity (Bagozzi & Yi, 2012), while structural model tests the goodness of fit statistics of the proposed model (Anderson & Gerbing, 1988). The analysis of measurement model using maximum likelihood estimation method revealed acceptable goodness of fit indices (χ^2=416.15, *df*=145; $p < .05$; χ^2/df=2.87; *GFI*=.90 *TFI*=.92; *CFI*=.91; *RMSEA*=.07; *SRMR*= .06). In addition, since the value of factor loadings and Average Variance Extracted (AVE) were higher than .05, reliabilities of constructs, and CR were above than .70 (Bagozzi & Yi, 2012) and the square root of the AVE was bigger than correlation values (Carmines & Zeller, 1979), convergent (Table 1) and discriminant validity (Table 3) were established.

Table 3
Descriptive Values, Correlations and Discriminant Validity

	M	SD	PSV	PS	PBR	PB	SE	CA	ATT	SN	PBC	INT	BEH
PSV	4.29	.99	.71										
PS	4.19	.92	.67	.80									
PBR	4.08	1.01	-.60	-.67	.77								
PB	4.16	1.18	.43	.72	-.69	.75							
SE	4.57	1.02	.52	.71	-.65	.62	.73						
CA	4.49	.88	.39	.71	-.54	.66	.54	.72					
ATT	4.85	1.96	.60	.68	-.67	.69	.47	.65	.73				
SN	4.72	1.14	.67	.65	-.63	.68	.67	.54	.55	.75			
PBC	4.88	1.06	.38	.42	-.45	.55	.69	.35	.42	.35	.80		
INT	4.66	.94	.53	.74	-.54	.66	.36	.36	.47	.54	.42	.73	
BEH	4.59	1.12	.49	.69	-.47	.60	.31	.32	.41	.49	.35	.68	.82

Note. The bold values are indicator of square root of AVE for each variable. PSV= Perceived Severity, PS= Perceived Susceptibility, PBR= Perceived Barriers, PB= Perceived Benefits, SE= Self-Efficacy, CA= Cues to Action, ATT= Attitude, SN= Subjective Norm, INT= Intention, BEH=Behavior

Research Results

Structural Equation Modeling

Structural equation modeling (SEM) indicated the structured models of HBM, TPB and proposed model satisfactorily fit the data (See Table 4). The proposed model (χ^2/df=2.65) had a better fit than the TPB (χ^2/df=2.85) and HBM (χ^2/df=2.92). In addition, the proposed model had more predictive ability for intention and behavior (R^2int=.532; R^2beh=.483) than TPB (R^2int=.511; R^2beh=.419) and HBM (R^2int=.463; R^2beh=.354).

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Table 4
Goodness Fit Data for HBM, TPB and Proposed Model

Goodness Fit Statistics & R^2	HBM	TPB	Proposed Model
χ^2	557.72	547.20	498.20
df	191	192	188
χ^2/df	2.92	2.85	2.65
CFI	.90	.92	.94
GFI	.91	.91	.93
TLI	.91	.93	.95
SRMR	.05	.04	.03
RMSEA	.05	.05	.04
R^2 (Adjusted)			
Intention	.46	.51	.53
Behavior	.35	.42	.48

Results of path analysis showed that, among HBM constructs, perceptions of susceptibility (β= .48), severity (β= .44), benefit (β= .42), cues to action (β= .31), and self-efficacy (β= .39) had a positive relationship with intention to eat healthy. However, the relationship between perception barriers and intention was negative (β= -.32). Therefore, Hypotheses 1-6 were supported (p<.05). The association among the TPB constructs demonstrated that attitude toward healthy eating (β= .35), subjective norm (β= .28) and PBC (β= .49) had a significant influence on intention. Finally, there was a significant relationship between healthy eating intention and behavior (β= .40). Hence, hypotheses 7, 8, 9 and 10 were all supported. In addition, the path between attitude toward healthy eating and perceptions of susceptibility (β= .38), severity (β= .36) and benefit (β= .47) was significant. These findings supported Hypotheses 11-13 (p<.05). With regards to total variance explained, it was revealed that 34% of variance in attitude was explained by perceived susceptibility, perceived severity, and perceived benefit. In addition, constructs of HBM and TPB explained 53% of the variance in healthy eating intention. Lastly, 48% of the variance in healthy eating behavior was explained by intention. A summary of the results is displayed in Table 5 and Figure 2.

Table 5
SEM Results of the Conceptual Proposed Model

Hypothesis	Pathway	Standardized estimate (β)	t-value	Hypothesis situation
H1	PS → INT	.48	10.689	Supported
H2	PSV → INT	.44	10.158	Supported
H3	PB → INT	.42	9.874	Supported
H4	CA → INT	.31	7.358	Supported
H5	PBR → INT	-.32	7.598	Supported
H6	SE → INT	.39	9.125	Supported
H7	ATT → INT	.35	8.025	Supported
H8	SN → INT	.29	6.899	Supported
H9	PBC → INT	.49	10.789	Supported
H10	INT → BEH	.40	9.598	Supported
H11	PS → ATT	.38	8.741	Supported
H12	PSV → ATT	.36	8.301	Supported
H13	PB → ATT	.47	10.489	Supported

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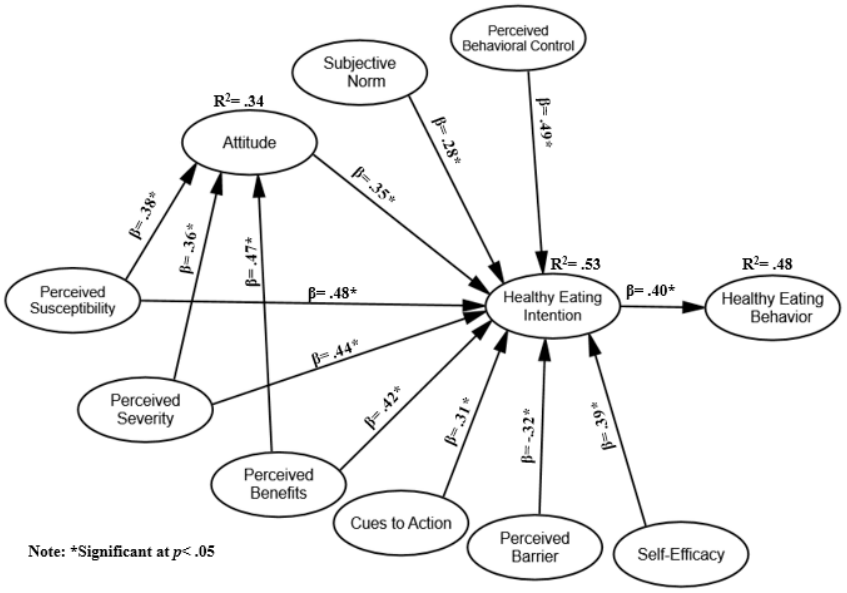
Figure 2
Result of the Structural Equation Modeling



Testing the Indirect Effects

The results of the indirect relationship between the constructs in the proposed model showed that perceived susceptibility (β= .29, p < .01), perceived severity (β= .26, p < .01), and perceived benefit (β= .24, p < .01) had significant indirect influence on healthy eating intention through attitude. In addition, healthy eating behaviors were indirectly influenced by both constructs of HBM (βPS=.23, p<.01; βPSV=.21, p<.01; βPB=.18, p<.05; βCA=.11, p<.05; βSE=.17, p<.05, βPBR= -.13, p<.05) and TPB (βATT=.15, p<.05; βSN=.10, p<.05; βPBC=.24, p<.01) via intention. More detail related to the indirect relationship is involved in Table 6.

Table 6
Indirect Relationships

Indirect effect of	On	
	Intention	Behavior
Perceived Susceptibility	.29*	.23*
Perceived Severity	.26*	.21*
Perceived Benefits	.24*	.18**
Cues to Action	-	.11**
Self-Efficacy	-	.10**
Perceived Barriers	-	-.13**
Attitude	-	.15**
Subjective Norm	-	.10**
PBC	-	.24*

Note. *Significant at .01, ** Significant at .05

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Discussion

In the current study, a comprehensive theoretical framework was prepared based on HBM and TPB to provide an understanding of science teachers' healthy eating intentions and behaviors. These two theories were combined into a model by considering the interrelation among their main constructs. The proposed model was supported by the data as a comprehensive model of science teachers' healthy eating intentions and behaviors, and this had important implications for demonstrating how pro-social and rational antecedents drive such a health-related decision. The results of the study revealed that the proposed model (R^2int=.53; R^2beh=.48) had better explanatory power to explain intention and behavior than TPB (R^2int=.51; R^2beh=.42) and HBM (R^2int=.46; R^2beh=.35). This caused to be an increase in intention and behavior (2 % and 6%, respectively) in variance accounted for by constructs of HBM over and above that accounted for by constructs of TPB. Moreover, 34% of attitude was explained by perceived susceptibility, perceived severity, and perceived benefit. Therefore, the findings showed that the conceptual model is wide-ranging, adequate, effective and functional in understanding science teachers' healthy eating intentions and behaviors. The comprehensive model can also be an important tool for a clear understanding of science teachers' complex decision formation regarding healthy eating in science, health, and nutrition education literature.

Regarding the relative criticality of used constructs in the model, the prominent importance of PBC was identified. Particularly, the non-volitional construct together with other constructs had a significant influence on healthy eating intentions and behaviors, and this construct was found to be the most effective when compared with other constructs in the proposed model. The finding is in line with the earlier study results that emphasized the importance of perceived ease or difficulty of performing the healthy eating behavior (e.g., Ateş, 2019; Bazillier et al., 2011; Brouwer & Mosack, 2015; Grønhøj et al., 2013). Moreover, the salient role of perceived barrier and self-efficacy variables, which were frequently associated with PBC and were emphasized to be significantly related to health-related behaviors in previous studies (e.g., Cook, 2018; Gerend & Shepherd 2012; Huang et al., 2020) was proven in this study. It implies that the perceived difficulties or hindrances related to the target behavior and the confidences in their ability to engage in the behaviors towards different barriers play an essential role on science teachers' healthy eating behavior. In addition, the main results demonstrated that perceived susceptibility, perceived severity, and perceived benefit and cues to action predicted healthy eating intentions. The findings implied that healthy eating intentions were explained by people's beliefs about the seriousness of the results of healthy eating behaviors, potential advantages of displaying healthy eating behaviors, and triggers of healthy eating behaviors including teacher, doctor, family, and friend. Such similar findings were obtained to be consistent with the results of other researchers (e.g., Kim et al., 2012; Orji et al., 2012). In addition, the current study has an original contribution to the literature since it explored the certain antecedent beliefs which were important in affecting science teachers' attitudes toward healthy eating. Examining antecedent beliefs is scarce in earlier study testing the HBM and TPB for health-related behavior context (e.g., Huang et al., 2020), and the use of antecedent beliefs has not been investigated in the context of healthy eating behavior and science education. Moreover, attitude successfully predicted healthy eating intentions. This indicates the importance of positive attitude towards healthy eating among science teachers during behavior. Therefore, a favorable attitude could be a good beginning to motivate science teachers' healthy eating behaviors. Last but not least, science teachers' intention to eat healthy was also determined by their subjective norm implying that behaving in accordance with a healthy eating became a social norm. Furthermore, receiving approvals of people who are important to science teachers in Turkey is very important for healthy eating. For example, in the school setting, since other teachers or school administrators are often considered important persons to teachers, science teachers are more likely to act according to their approval. This result also approves the importance of subjective norm in influencing healthy eating intentions in earlier studies (e.g., Ateş, 2019; Fila & Smith, 2006; Shimazaki et al., 2017).

Results of the testing of the indirect influence of constructs of study showed that attitude and healthy eating intention played an essential mediating role in the proposed framework. Among the constructs, perceived susceptibility, perceived severity, and perceived benefit had indirect impact on intention and behavior through attitude toward healthy eating. In addition, all variables of the HBM and TBP were indirectly related to healthy eating behaviors. The results were in line with those from earlier studies which is quite rare on health-related decisions, which merged the HBM and TBP (e.g., Huang et al., 2020).

The results have also some practical implications for education stakeholders, curriculum developers and science educators. The results can be reported that attitude towards healthy eating behaviors, subjective norm, perception of severity, susceptibility, barriers and benefits and beliefs of self-efficacy and cues to action were found to be

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significant antecedents in motivating science teachers' healthy eating intentions. Accordingly, it is essential for the ministry of national education, and provincial directorate of national education to design and launch influential nutrition-related promotional programs to increase the above-mentioned factors to achieve substantial social change towards a healthy eating lifestyle. For example, in-service health promotion training programs designed by school management and provincial directorate of national education for science teachers can play an important role in developing their beliefs, attitudes, intentions and behaviors. In the education of pre-service science teachers, who have a very important role in the education of future generations, more courses can be included in the curriculum they take at the university, aimed at gaining the awareness of healthy eating.

Limitations and Future Studies

Although the study made important contributions to the literature, it has several limitations and suggestions for future studies. First of all, the study is limited to several data collection tools, hypotheses and educated respondents using the convenience sampling method in several cities in Turkey. Therefore, as generation beyond the sample in the study is limited, this may be resulted in a demographic bias, may decrease external validity, and therefore give rise to sampling bias. Future researchers should extend their studies with more appropriate instruments and hypotheses using larger sample groups in different cultures. Individuals' eating beliefs and motivations may change according to the cultural characteristics, since individuals are likely to have particular beliefs and needs affected by cultural values (Seegebarth et al., 2016). In the study, the data collection tools relied on self-report measures rather than the actual behavior, thus the findings should be taken with caution, participants may not desire to express their true views due to the social desirability and ethical pressure to indicate their intentions to act toward the common good (Kiatkawsin & Han, 2017). Therefore, it is suggested to consider the results in the study with this understanding that future researchers can use other data sources such as supervisory ratings (Zhang et al., 2017). Finally, since the study focused on constructs of the HBM and TPB, some important constructs can be overlooked. For example, the constructs of the proposed model are based on expectancy-value framework developed in accordance with rational considerations. Therefore, the proposed model ignores non-rational motives in understanding healthy eating behaviors. Therefore, the validity and effectiveness of the theoretical framework can be questioned when explaining healthy eating behaviors. In future studies, more theories or models such as social cognitive theory, protection motivation theory, health action process approach and model of health literacy can be tested to examine the influence of different psychological constructs such as outcome expectancy, value of action, motivational and moral considerations on healthy eating intentions and behaviors which can provide more comprehensive understanding of the topic.

Conclusions and Implications

Decision-making process of individuals regarding healthy eating has not been investigated much in the extant literature. This study added several important elements to the existing nutrition, science and health education literature. Firstly, this study is probably the first attempt to determine antecedents of science teachers' healthy eating intentions and behaviors combining HBM and TPB in Turkish context. Secondly, the combined model determined that nine predictors had a significant impact on science teachers' healthy eating intentions which was a strong determinant of healthy eating behavior. Thirdly, attitude toward healthy eating derived from the TPB was successfully influenced by perceived susceptibility, perceived severity and perceived benefit, constructs of the HBM. Fourthly, attitude toward healthy eating, and intention to eat healthy as mediators were influential in building a framework explaining that science teachers make decisions that give importance to healthy eating. Considering the successful results of this study, the theoretical and practical importance of the proposed conceptual framework including high efficiency, comprehensiveness and applicability is remarkable.

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