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Cognitive Determinants of Functional Fiber Food Consumption among the Students in Birjand University of Medical Sciences in 2018

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ABSTRACT

Background: This study aims to investigate cognitive determinants of functional foods (FF) consumption which contain fiber among Iranian students based on the theory of planned behavior (TPB). **Methods:** A cross-sectional study was carried out between March and May 2018 on the students of Birjand University of Medical Sciences (BUMS). A structured questionnaire was used which was validated with Cronbach's alpha of 0.78. **Results:** 515 questionnaires were completed, and the majority of the respondents were females. 20% of the participants were the primary household food purchasers, and familiarity with functional foods was the only effective factor regarding consumption. Subjective norms could predict the students' consumption of the macaroni which contained fiber. In addition, monthly income of the family had a major effect on having the macaroni containing fiber. The parents' education also impacted the consumption of these foods. **Conclusion**: Attitudes and perceived control had a poorer effect on choosing the food containing fiber rather than subjective norms.

Keywords: *Behavior; Attitude; Functional food; Dietary fiber.*

Introduction

In recent years, public interest in health-enhancing foods has increased due to the increasing evidence regarding the effects of nutrition on chronic diseases (Chen, 2011, World Health Organization and Food and Agriculture Organization, 2003). In line with the burden of nutrition-related chronic diseases worldwide, functional food (FF) (Gill *et al.*) was developed to meet the consumers' demand for healthy eating (Urala and Lähteenmäki, 2007). FF has been described as food with potentially specific health benefits (Carrillo *et al.*, 2013, Chen, 2011, Keservani *et al.*, 2010). Generally, these foods may be potentially used to prevent and treat diseases and improve the general condition of the body (Keservani *et al.*, 2010). One of the most important categories of FF is functional fiber products. Dietary fiber intake has many health benefits

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(Anderson *et al.*, 2009). For example, scientific evidence shows that dietary fiber consumption may reduce the risk of developing coronary heart disease (Liu *et al.*, 1999), hypertension (Whelton *et al.*, 2005), and diabetes (Montonen *et al.*, 2003).

In spite of health benefits of FF, familiarity with FF and its subsequent use is not satisfactory in both Iran and other parts of the world (Annunziata and Vecchio, 2011, Bazhan *et al.*, 2017, Christidis *et al.*, 2011, Salmani *et al.*, 2020). According to the review of literature, the consumers' willingness to functional products is closely related to their attitudes towards FF, especially the belief in health benefits of FF, confidence in its safety and perceived reward, and the necessity of such foods (Bimbo *et al.*, 2017, Chen, 2011, Nystrand and Olsen, 2020, Salmani *et al.*, 2020, Urala and Lähteenmäki, 2007, Verbeke, 2005). The results of many studies also showed that consumers' acceptance of functional products was explained by their socio-demographic characteristics (Bimbo *et al.*, 2017, Karelakis *et al.*, 2020, Salmani *et al.*, 2020, Verbeke, 2005). For example, women and older consumers were more likely to try both nutrition-modified and functional dairy products in their diet (Bimbo *et al.*, 2017).

In recent years, the market for FF has grown considerably in Iran. So, more information is needed regarding the aspects that influence Iranian consumers' decision-making process related to spending behavior towards FF for consumer-led product development (Verbeke, 2005, Weststrate *et al.*, 2002). The Theory of Planned Behavior (TPB) is one of the most frequently used and influential theories for predicting healthy behaviors such as food choice (Ajzen, 2011, Chen, 2007, Kim *et al.*, 2014, Salmani *et al.*, 2020). According to TPB, the best predictor of a behavior is behavioral intention, which in turn is determined by attitude towards the behavior, subjective norms regarding it, and perceived control over performance of the behavior (Ajzen, 1991).

In spite of the growing body of research that considered TPB as a theoretical framework for studying FF and its determinants, to the authors' knowledge, no research study has dealt with the influence of cognitive factors on FF consumption among Iranian consumers. Therefore, the aim of this study is to investigate theory-based determinants of FF consumption among Iranian students' consumers in Birjand University of Medical Sciences (BUMS) in 2018.

Material and Methods

Sampling: This was a cross-sectional study carried out between March and May 2018. A random sample of students above 18 years old from five faculties was recruited. The students who orally agreed to participate filled out the questionnaire. The sample size based on the Somehagen *et al.*'s study was calculated as 524 (Somehagen *et al.*, 2013).

Inclusion and exclusion criteria: Inclusion criteria consisted of the students from five schools in Birjand University of Medical Sciences (Medicine, Dentistry, Nursing and Midwifery, Health, and Allied Medicine), who consented to participate in the study and were able to understand Persian. Students who could not understand Persian and did not consent to participate in the study were excluded from the study.

Questionnaire: A valid and structured questionnaire was developed by Salmani (Salmani *et al.*, 2020). Some available FF containing fiber in Birjand's market was entered in the questionnaire, which included bread and macaroni enriched with fiber. Most of the questions were close-ended. The first part of the questionnaire comprised socio-demographic characteristics of the respondents, such as age, gender, monthly income, income evaluation, parents' education level, primary food purchasers, living location, familiarity with FF, and definition of FF. The second part focused on different food-consumption frequencies of bread and macaroni enriched with fiber. The third part compromised questions related to the components of theory of planned behavior, including attitudes, subjective norms, and perceived behavioral control related to functional foods using a 5-point Likert scale. The Cronbach's α of the questionnaire was 0.78 (Salmani *et al.*, 2020).

Ethical considerations: This study was

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confirmed by ethical committee and institutional review board of BUMS (IR.bums.REC.1397.138). The questionnaires were completed voluntarily and anonymously, and informed consent was obtained writtenlly from all the participants.

Data analysis: The collected data were coded and analyzed using SPSS version 16. Descriptive data were presented as mean ± standard deviation and number (percent). In addition, Chi-square test was used to compare the demographic variable between user and non-users of foods containing fiber. The components of TPB were compared by T-test. Then, Multifactor Dimensionality Reduction (MDR) Analysis was used to determine the factors regarding consumption FF by glmnet package of R3.6.3. P-value <0.05 was considered significant.

Results

A total of 600 questionnaires were distributed, 515 of which were fully completed. The mean age of the participants was 22.45 ± 4.54 years, and female constituted 64% of the respondents. 19% had a monthly income of lower than 237.02 $, and 31.8% earned more than 711.07 $ every month. Almost one in five respondents was the primary food purchasers of the family, and 90% were urban residence. Regarding the students' parents' education, 16.7% of the fathers had MS, MA, or Ph.D. Most of the mothers had high school diploma or were at a lower education level. 33% and 9% of them had a BA/BS, MS/MA, or Ph.D. 58% of the participants were familiar with FF. The majority (71.8%) of the respondents defined FF as "foods with some additional constituents that enhance health status of the consumer". Demographic characteristics of the respondents based on the consumption of FF containing fiber are presented in **Table 1**. As presented in **Table 1**, there was no difference between consumers and non-consumers of FF containing fiber regarding socio-demographic factors. However, familiarity with FF affected the consumption.

Table 1. Demographic characteristics of the respondents.

Variables		Macaroni		P-value[a]	Bread		P-value[a]
		Non-user (n=239)	User (n=270)		Non-user (n=165)	User (n=350)	
Sex	Female	144(60.3)[b]	183(68.0)	0.68	100(60.6)	230(65.9)	0.24
	Male	95(39.7)	86(32.0)		65(39.4)	119(34.1)	
Income ($)	<237.02	50(21.6)	47(19.7)		33(20.6)	66(19.4)	
	237.02-711.07	116(50.2)	119(45.2)	0.11	76(47.5)	161(47.4)	0.93
	>711.07	65(28.1)	97(36.9)		51(31.9)	113(33.2)	
Income classification	Good	40(17.4)	51(19.5)		26(16.5)	66(19.5)	
	Medium	124(53.9)	149(57.1)	0.39	89(56.3)	187(55.2)	0.71
	Poor	66(28.7)	61(23.4)		43(27.2)	86(25.4)	
Father's education level	High school and lower level	101(42.6)	110(41.4)	0.79	66(40.2)	150(43.5)	0.74
	BS/BA	94(39.7)	113(42.5)		68(41.5)	139(40.3)	
	MS/MA or Ph.D.	42(17.7)	43(16.2)		30(18.3)	56(16.2)	
Mother's education level	High school and lower level	144(61.0)	148(55.4)	0.45	94(57.7)	202(58.4)	0.97
	BS/BA	73(30.9)	94(35.2)		54(33.1)	114(32.9)	
	MS/MA or Ph.D	19(8.1)	25(9.4)		15(9.2)	30(8.7)	
Primary food purchasers	Yes	56(29.3)	63(27.9)	0.74	44(32.8)	75(26.)	0.15
	No	135(70.7)	163(72.1)		90(67.2)	213(74.0)	
Place of residence	Urban	211(89.4)	249(92.6)	0.21	144(87.8)	320(92.2)	0.1
	Rural	25(10.6)	20(7.4)		20(12.2)	27(7.8)	
Familiarity with enriched foods	Yes	110(46.6)	179(67.5)	<0.001	77(47.8)	215(62.1)	0.002
	No	126(53.4)	86(32.5)		84(52.2)	131(37.9)	

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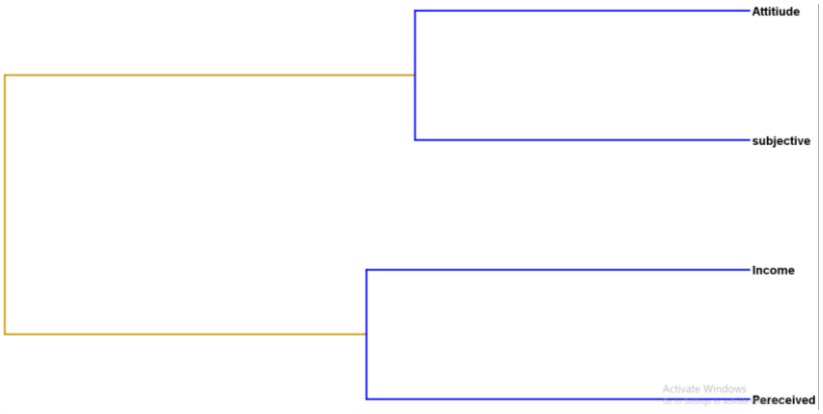
MS/MA: Master of Science/Art; Ph.D: Doctor of Philosophy; [a]: Chi-square test; [b]: n(%)..

Table 2 presents the role of the components of TPB in predicting the consumption of macaroni and bread containing fiber. According to **Table 2**, subjective norms could predict the use of macaroni with fiber in students. The interaction of different factors can influence the consumption of FF. Hence, in the current study, the authors used multifactor dimensionality reduction method to evaluate effective factors. As presented in **Figure 1a**, there was an interactive effect between attitudes and subjective norms in eating bread containing fiber. Furthermore, perceived control and monthly income were the predictors in this case. Blue color indicated a strong relationship between predictors. The main effects were presented in **Figure 1b**; attitude, subjective norm, and perceived control were 5.86%, 6.07%, and 3.91%, respectively. **Figure 2a** shows the interactive effects of attitude, subjective norm, and perceived control regarding macaroni containing fiber, the main effects of which were 7.64%, 10.87%, and 8.83%, respectively. The monthly income of family had a great effect of 4.19% in consuming macaroni containing fiber The parents' education also influenced the consumption (**Figure 2b**).

(a)



(b)

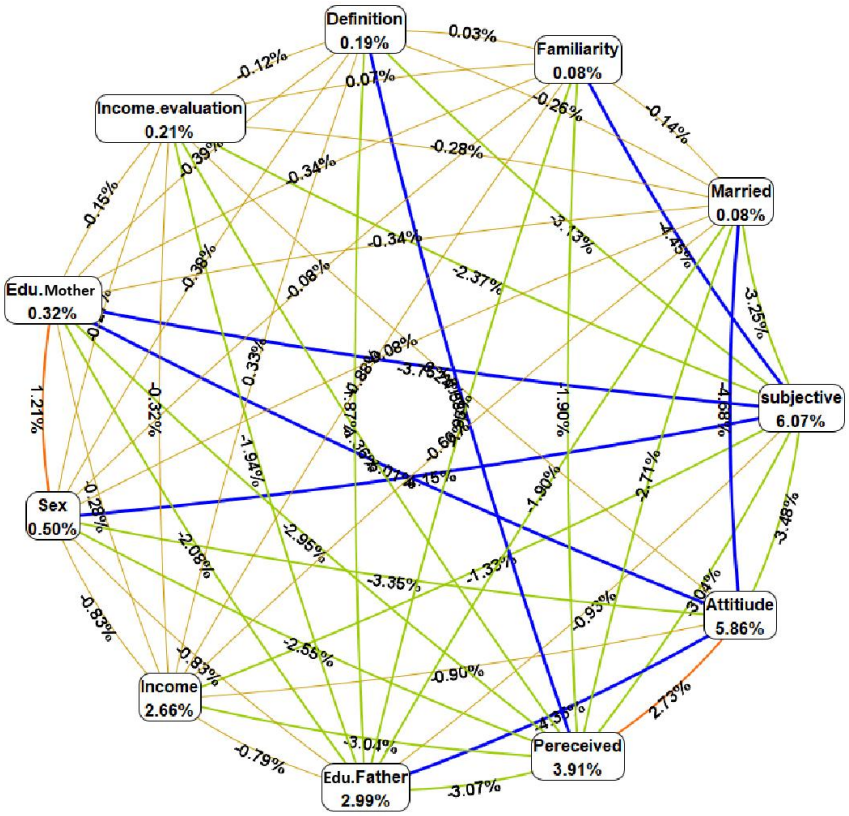


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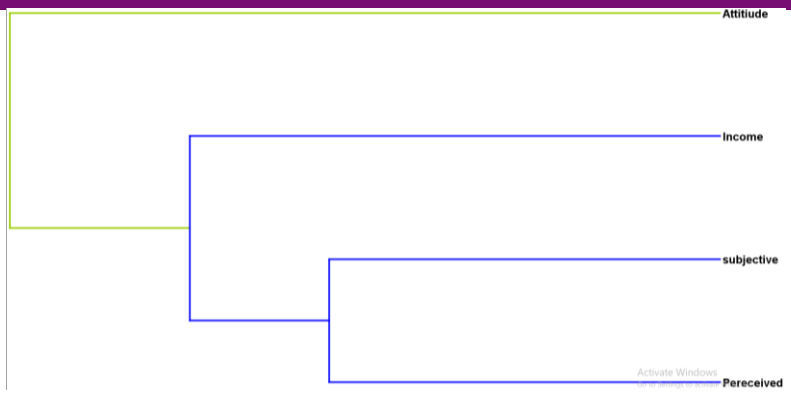
Figure 1. The interaction of factors affecting the consumption of bread containing fiber.

(a)



(b)

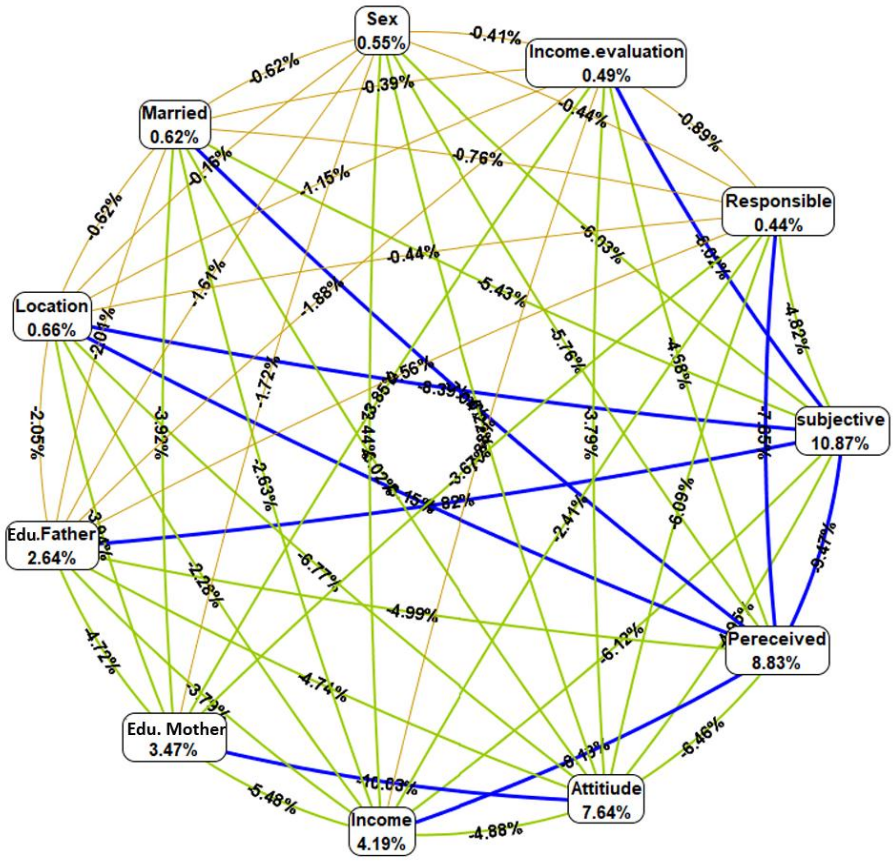


Figure 2. The interaction of factors affecting the consumption of macaroni containing fiber.

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Table 2. Predicting the consumption of FF containing fiber by components of TPB

Components of TPB	Macaroni		P-value[a]	Bread		P-value[a]
	Non-user (n=239)	User (n=270)		Non-User (n=165)	User (n=350)	
Attitudes	18.08±4.09	18.71±3.58	0.06	18.15±4.06	18.52±3.75	0.35
Subjective norms	20.60±4.72	21.58±4.08	0.01	20.81±4.35	21.25±4.47	0.30
Perceived control	15.73±3.42	15.80±3.01	0.82	15.78±3.15	15.75±322	0.92

TPB: Theory of Planned Behavior; [a]: Independent t-test.

Discussion

The main purpose of developing FF is improvement of healthy diet and inhibition of special diseases (Nguyen *et al.*, 2020). This study was an initial attempt to explore the determinants of FF consumption with a specific focus on bread and macaroni containing fiber based on TPB constructs among Iranian students.

In this study, more than 58% of consumers were familiar with FF. This was in line with the study conducted by Wahba *et al.* in Egypt, where 64.5% were aware of the term "functional foods" (Wahba *et al.*, 2006). In a study in Finland by Urala *et al*, the percentage of people who were familiar with FF was 69% (Urala and Lähteenmäki, 2007). This was while this rate was reported to be 40.6% by Chammas *et al.* in Lebanon (Chammas *et al.*, 2019), 33% in Greece, based on Christidis *et al*'s study (Christidis *et al.*, 2011), and 39.45% in China by Markovina's research (Markovina *et al.*, 2011). In addition, in a qualitative research on 66 Iranian women, Bazhan *et al.* reported that almost all the women were unfamiliar with the term "functional dairy products" (Bazhan *et al.*, 2017). The results of this and previous studies emphasized that health knowledge promoted the probability of consuming FF (Ares *et al.*, 2008, Naylor *et al.*, 2009), and there were documents that providing information about FF products increased consumption of such food products (Ares *et al.*, 2008, Hellyer *et al.*, 2012). Therefore, marketing and educational programs are essential to enhance people's awareness about FF especially in a developing country such as Iran (Moodi *et al.*, 2021, Salmani *et al.*, 2020).

The findings indicated that subjective norm was a predictor of consuming macaroni with fiber in students. The multifactor dimensionality reduction method also showed interactive effects of attitudes, subjective norms, and perceived control in those who eat macaroni containing fiber, and attitudes and subjective norms in subjects who consume bread containing fiber. Many studies demonstrated that the most influential factors influencing consumption of FF were subjective norms followed by attitude (Nguyen *et al.*, 2020, Nguyen *et al.*, 2019, O'Connor and White, 2010, Paul *et al.*, 2016, Rezai *et al.*, 2014, Sukboonyasatit, 2009, Tarkiainen and Sundqvist, 2005). Moreover, Carfora *et al.* emphasized that perceived behavioral control was also a good predictor of consuming FF (Carfora *et al.*, 2019) which was consistent with the findings of this study. This result was not in line with the results of Salmani *et al.* and O'Connor *et al.'s* research who found no relationship between perceived behavioral control and consumption of FF (O'Connor and White, 2010, Salmani *et al.*, 2020). According to the TPB, subjective norm is an individual's perception of a certain behavior, which is influenced by the judgment of a significant person or a group of people who will approve and support behavior (e.g., parents, friends, and others) (Ham *et al.*, 2015); perceived behavioral control refers to the perception of the individual's capability to perform the behavior which is assumed to be relevant to both external control (perceptions of controllability) and internal control (self-efficacy) (Nystrand and Olsen, 2020). A possible explanation is that one of the influencing factors related to the choice of new food is the recommendation of family, friends, or other important individuals in one's life (Lalor *et al.*,

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2011). Students are very interested in new foods and can cook macaroni much faster in dormitory. Thus, they are more affected by subjective norms such as friends, which seem to have a positive attitude and also a more perceived control for consumption of this food.

The analysis of data revealed no gender difference in the use of FF containing fiber. This finding was in agreement with several studies such as O'Connor *et al*. (O'Connor and White, 2010), Ares *et al.* (Ares *et al.*, 2010), Cox *et al.* (Cox *et al.*, 2011), Dogan *et al.* (Dogan *et al.*, 2011), Ali and Rahut's study (Ali and Rahut, 2019).On the other hand, the results were inconsistent with the studies that stated women were more willing to consume FF (Carrillo *et al.*, 2013, Chen, 2011, Ridler and Ridler, 2011, Schnettler *et al.*, 2016). It should be also noted that although some studies stated that women were more inclined to buy new and healthier foods such as FF (Ridler and Ridler, 2011, Sääksjärvi *et al.*, 2009, Vecchio *et al.*, 2016, Vicentini *et al.*, 2016), the participants in this study were the students who were mostly less involved in choosing the type of food due to living in dormitories. The final result of the current study was that family income and parents' education had a major effect on having the macaroni containing fiber. Several studies found similar findings in consumers of functional dairy products (Moodi *et al.*, 2021), such as probiotics (Aguirre, 2014), vitamin-enriched foods (Salmani *et al.*, 2020), and FF (Ali and Rahut, 2019, Urala and Lähteenmäki, 2007). Indeed, parents with higher level of education and income had more awareness and financial ability to purchase FF.

One of the limitations of this study was the focus on cognitive and socio-demographic variables underlying the consumption of foods containing fiber. However, food consumption is a complex behavior under the influence of various factors. Moreover, the population of the current study was not actively involved in the selection of their food. Finally, It is necessary to mention that the participants were exclusively students from medical university. Thus, further research in a more nationally representative sample is needed before generalizing the results.

Conclusion

Among TPB constructs, only subjective norms could predict the consumption of FF containing fiber among the study population, as students are under the influence of their friend and family members for choosing their food. Attitudes and perceived control had a poor effect on choosing FF due to the nature of target sample of the study and the complex behavior of food consumption. The authors suggest having more specific foods for future studies regarding other populations like housewives or women employees.

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Authors' contributions

Salmani F, Norozi E, Moodi M, and Zeinali T designed the research; Norozi E, Moodi M, and Zeinali T conducted the study; Salmani F analyzed data; Salmani F, Norozi E, Moodi M, and Zeinali T wrote paper, and all the authors read and approved the final manuscript.

Conflict of interests

The authors declared no conflict of interests.

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