



# Determinants of organic food purchases intention: the application of an extended theory of planned behaviour

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## Keywords

Organic products; students; theory of planned behaviour; structural equations model.

This study investigated the application of the extended theory of planned behaviour (TPB) to determine Iranian students intention to purchase organic food products. The statistical population comprised all students in the field of agriculture sciences at Mohaghegh Ardabili University, Ardabil, Iran. Data were collected from 340 participants. The research instrument was a questionnaire developed through a comprehensive literature study. Content validity of the instrument was ascertained by a panel of university professors and its reliability by Cronbach's alpha. Data were analysed using SPSS v22 and LISREL8.80 software packages. The results of structural equations model (SEM) showed that the variables of attitude, subjective norms, perceived behavioural control, moral norms, health consciousness, and environmental concern could account for 86 per cent of the variance of students intention to purchase organic products. In addition, results revealed that environmental concern and health consciousness highly influenced (41 per cent) attitude towards organic food products. Based on the results recommendations are made.

## 1. Introduction

The application of chemical pesticides and fertilisers to crop production systems enhances crop yields and quality. However, it has devastating impacts that cannot be ignored (Ghorbani *et al.*, 2014). The main impacts of these chemicals are, among others, the resistance of pests, diseases and weeds to chemical pesticides, poisoning, severe soil degradation and erosion, water pollution, human health hazards, the occurrence of skin diseases, cancer, neural disorders, diabetes, respiratory disorders, embryo disorders and diseases, birth disorders, fertility problems, genetic

disorders, and severe poisoning and environmental degradation (Bondori *et al.*, 2018a, b; Bondori *et al.*, 2019). Consumer concerns on the use of chemicals, insecticides, and pesticides, among others, in food production systems will influence markets so that demand for certain foodstuffs will be influenced. Therefore, consumer preferences, their concerns for food quality, and the demand for chemical-free foods will affect the policy and production processes of producers, including wholesalers and retailers (Ghorbani *et al.*, 2014). In recent years, interest in organic agricul-

ture in most developed and developing countries has been provoked along with the increase in public concerns over food quality and population health, as well as the degradation of natural resources (Karimy *et al.*, 2012).

Organic agriculture is a production system that ensures the health of soils, ecotourism, and people and considers environmentally friendly processes and biodiversity. This system attempts to protect the environment and improve quality in contrast to the use of inputs that have side effects (Shams & Najafabadi, 2014). Presently, approximately 69.8 million ha of arable land in the world is managed organically (Willer & Lernoud, 2019; Yazdanpanah & Forouzani, 2015). Although the production and consumption of organic foods have been more prevalent in developed countries in the past, they are now promoted and accepted more in developing countries (Voon *et al.*, 2011). Presently, almost one-third of organic food-producing lands are located in developing countries (Willer & Lernoud, 2019).

In Iran, traditional agriculture has focused on food safety for thousands of years, but following population growth and the reduction of suitable lands, pesticides and chemical fertilisers are applied to a greater extent to increase returns per unit area (Sobhani *et al.*, 2018). As a result of inattention to the principles of optimal use of chemical fertilisers and pesticides, the application of chemical hormones, and their harmful residues in crops in Iran, the country has been ranked 123rd in this regard among 180 countries of the world by the World Health Organization (Mojaradi *et al.*, 2014).

People's growing awareness of chemical inputs used for increasing crop production, the increasing rate of diseases, and environmental problems have revealed the significance of organic food production and consumption more than ever (Sobhani *et al.*, 2018). Therefore, it is of crucial importance to explore consumer willingness to use organic products in an attempt to develop production and consumption plans (Yazdanpanah & Hasheminezhad, 2016).

The practise of organic agriculture in Iran dates back to 2000 on pistachio. It was aimed to enhance the knowledge of users and farmers in order to make them aware of the harmful effects of fertilisers and pesti-

cides that were used for crop production (Mousavi *et al.*, 2015). Presently, some crops are produced organically, including fig, date, pistachio, peanut, medicinal plants, pomegranate, rose water, saffron, and animal products, as well as date palm gardens in the centre and south of Iran that are mostly managed in accordance with the principles of organic farming (Koocheki *et al.*, 2013).

It has been documented that Iran is the leading country in Asia in producing and exporting most organic agricultural products. While there is no precise statistic of per-capita organic food consumption of Iran, because most organic products are exported (Sobhani *et al.*, 2018), domestic consumers also display willingness towards the use of organic foodstuffs. Therefore, it appears logical to study the behaviour of the target population, i.e., consumers, as an important ring of an economic system (Yazdanpanah & Hasheminezhad, 2016). Social science researchers recommend the use of the theory of planned behaviour (TPB) (Yazdanpanah *et al.*, 2015; Sobhani *et al.*, 2018) as an approach to investigate the behaviour of consumers.

TPB is a major psychological model to explain people's behaviour (Ajzen, 1991). Overall, TPB focuses on studying three factors, namely, attitude towards behaviour, subjective norms, and perceived behavioural control. According to this theory, all these factors lead an individual towards shaping specific behavioural tendencies (Ajzen, 1985). As such, internal attitudes and tendencies towards purchasing a specific product that is the least harmful to the environment and society define the willingness to purchase organic products (Yadav & Pathak, 2016a, b; Sobhani *et al.*, 2018).

Although the model has proved to be valid in forecasting behaviours (Yazdanpanah & Hasheminezhad, 2016), some researchers of different disciplines have added extra constructs to the theory to increase its robustness in behaviour prediction (Burton, 2004; Yazdanpanah & Hasheminezhad, 2016). Moral norm is one of these variables that significantly contribute to accurately comprehending an individual's intention (Kaiser & Scheuthle, 2003). Moral norms are internal moral rules or values that are provoked by self-regulating rewards and/or punishments (Arvola *et al.*, 2008). It has been considered a perceived commitment that affects both intention and behaviour. Another component that has been included in this model is environ-

mental concern. Environmentally-friendly behaviour is an influential factor in environmental conservation, and it depends on environmental awareness to a great extent (Sobhani *et al.*, 2018).

After a review of the literature, the current study included two new components – health consciousness and environmental concerns – to TPB. Environmental concerns are regarded as a component that influences the behaviour of citizens. Environmentally friendly behaviour is a useful parameter underpinning environmental conservation and is mainly dependent on people's environmental awareness (Sobhani *et al.*, 2018). Previous research reported that environmental concern can promote people's attitude towards the purchase of organic products (Yadav & Pathak, 2016; Rahminia *et al.*, 2017; Sabzehei *et al.*, 2016; Haghjou *et al.*, 2013). Power *et al.* (2013) revealed that organic farmers had better environmental attitudes, were more aware of the relevant problems, and exhibited a more positive attitude towards the environment than conventional farmers did. Therefore, this may imply that environmental considerations have a direct impact on producers' willingness to purchase environmentally-friendly organic products (De Leeuw *et al.*, 2015). In addition, the environmental concern can increase the willingness to purchase organic products indirectly through other components like health consciousness and moral norms (Sabzehei *et al.*, 2016; Rahimnia *et al.*, 2017).

Health awareness and consciousness can be expressed as the degree of an individual's attention to health in everyday activities, especially the extent to which students and educated people consider the health and safety of foodstuffs when they are purchasing them (Sobhani *et al.*, 2018). Research has revealed that consumers who take more care of their health exhibit more optimal attitude towards organic purchases (Michaelidou & Hassan, 2008). Furthermore, it has been documented that such consumers show more willingness to purchase organic products (Yadav & Pathak, 2016; Yazdanpanah & Hasheminezhad, 2016; Haghjou *et al.*, 2013; Michaelidou & Hassan, 2008). Therefore, health consciousness is involved as a major factor in enhancing attitude and fostering a willingness to purchase organic foodstuffs (Sobhani *et al.*, 2018).

The preceding indicates that it is essential to address

students' intention to purchase organic foodstuffs for two reasons: firstly, they are supposed to gain status in society in future (e.g., as a teacher, a lawyer, a policymaker, a researcher, etc.) who can directly or indirectly have implications for the purchase of organic products; secondly, they should take responsibility for promoting the advantages of organic food. According to the theoretical framework of the research, which is based on TPB, it was hypothesised that:

**H1:** Students' attitudes influence their intention to purchase organic products.

**H2:** Students' environmental concerns influence their intention to purchase organic products.

**H3:** Students' subjective norms influence their intention to purchase organic products.

**H4:** Students' perceived behavioural control influences their intention to purchase organic products.

**H5:** Students' moral norms influence their intention to purchase organic products.

**H6:** Students' health consciousness influences their intention to purchase organic products.

**H7:** Students' health consciousness influences their attitude towards purchasing organic products.

**H8:** Students' environmental concerns influence their attitude towards purchasing organic products.

The present study aims to develop a systematic model to assess the use of the extended theory of planned behaviour (ETPB) to examine Iranian students' intention to purchase organic foodstuffs.

## 2. Materials and methods

### 2.1. Sample selection

The research was a survey conducted in a correlational descriptive design. The statistical population comprised all 2018-2019 Bachelors, Masters, and PhD students from the Faculty of Agricultural Sciences registered at Mohaghegh-e Ardabili University because a similar study has not been conducted in this area yet. The university is located in Ardabil city in the northwest of Iran. The sample size was determined to be 315, according to Morghan's table (Cochran, 1977), but it was increased to 340 individuals to increase the reliability of the results. A random stratified sampling method was used to ensure a proportional allocation to the different educational levels.

## 2.2. Data collection

The research instrument was a two-section questionnaire developed through a comprehensive literature review (Sobhani *et al.*, 2018; Yadav & Pathak, 2016; Yazdanpanah *et al.*, 2015). The first section requested demographic information such as age, marital status, educational level, and residential area. The second section included 26 closed-ended items to measure six components of the research model on the five-point Likert type scale ranging from 1 (completely disagree) to 5 (completely agree). A panel of academic teachers confirmed the content validity of the questionnaire, and its reliability was estimated and confirmed by Cronbach's alpha. Also, to determine the reliability of the model, combined reliability (CR) index above 0.6 was assumed, which indicates the intensity of measurement error control in SEM. Average variance extracted (AVE) indicator shows how much of the variance of the studied component was affected by the indicator variables. MacKenzie *et al.* (2005) considered the value of 0.4 to be sufficient for AVE, and it should be higher than 0.5 for each component. The components and their items are presented in Table 1.

## 2.3. Data Analysis

Data were captured from the completed questionnaires and coded. LISREL8.80 and SPSS v.22 software packages were then used for statistical analysis, which included descriptive and inferential statistics. Descriptive statistics included frequency distribution, mean, and standard deviation. The inferential statistics included the tests of means difference and correlation coefficients using the LISREL8.80 software package. The SPSS v.22 software package was used to conduct structural equations modelling (SEM) within two approaches of confirmatory factor analysis (CFA) and path analysis to find out the effect of independent variables on the dependent variable and to test the research hypotheses (Bondori *et al.*, 2018a). When using SEM, it is necessary to analyse the model fit with the observed data. Researchers usually use goodness-of-fit indices, among which the most famous and widely used is  $\chi^2$  (Ping, 2004; Bondori *et al.*, 2018). The  $\chi^2$  test is sensitive to sample size so that it increases with the sample size. Consequently, it is always significant for very large samples. To adjust this test for sample size error and to enhance its reliability, it is necessary

to divide it by the degree of freedom (Jöreskog & Sörbom, 1996). According to the SEM results, the ratio of  $\chi^2$  to the degree of freedom is 1.82, showing the acceptability of the model (Ping, 2004). Standardised root mean squared residual (SRMR) was estimated to be 0.052. Models show very high fit if this value is  $<0.05$  and a good fit if it is in the range of 0.05 to 0.08 (Byrne, 2013; Giles, 2002). A major index evaluated here was the root-mean-square error of approximation (RMSEA), showing acceptable, relatively good, moderate, and weak fit if its value is  $<0.05$ , 0.05-0.08, 0.08-0.1, and  $>0.1$ , respectively. This index was estimated to be 0.048 for this model, implying its acceptable fit. Other indices are NNFI (0.97), NFI (0.96), CFI (0.98), IFI (0.98), GFI (0.87), and AGFI (0.84) that show the optimal fit of a model in SEM, including path analysis if their values are close to 1 (Bondori *et al.*, 2018; Ping, 2004).

## 3. Results and discussion

The average age of the students was 25 years, with a standard deviation (SD) of six years. The youngest was 18, and the oldest was 41 years old. Females accounted for 51.2 per cent and males for 48.8 per cent of the participants. Furthermore, students at Bachelors, Masters, and PhD levels accounted for 59.4, 27.1, and 13.5 per cent of the participants, respectively. The results in the table reveal that 67.1 per cent of the students were residents of urban areas, and 32.9 per cent were residing in rural areas (Table 2).

### 3.1. Descriptive statistics

According to Table 1, mean and standard deviation were found to be  $M = 3.45$  and  $SD = 1.08$ , respectively, for environmental concern,  $M = 3.27$  and  $SD = 1.01$  for attitude,  $M = 3.48$  and  $SD = 1.12$  for subjective norms,  $M = 3.61$  and  $SD = 1.00$  for moral norms,  $M = 3.17$  and  $SD = 1.06$  for perceived behavioural control,  $M = 3.84$  and  $SD = 0.946$  for health consciousness, and  $M = 3.72$  and  $SD = 0.908$  for intention to purchase organic food. All these means are relatively optimal.

### 3.2. Inferential statistics

#### 3.2.1. Correlation of students' intention to purchase organic food

**Table 1.** Indices and items measured by the questionnaire

Construct	Cronbach's alpha	Combined Reliability	AVE	Items	Mean	SD
Intention	0.87	0.91	0.73	I intend to consume organic products if they are available.	3.54	0.941
				If organic products are available when I am shopping, I will prefer to purchase them.	3.73	0.952
				I prefer eating organic products.	3.67	0.900
				If organic products are good for me, I will try to buy them	3.94	0.847
					3.72	0.91
Attitude	0.90	0.92	0.67	I think that purchasing organic food is interesting.	3.29	1.06
				I think that purchasing organic food is a good idea.	3.21	1.01
				I think that purchasing organic food is important.	3.30	0.946
				I think that purchasing organic food is beneficial	3.19	1.04
				I think that purchasing organic food is wise.	3.29	1.01
				I think that purchasing organic food is favourable.	3.39	1.01
					3.27	1.01
Subjective norms	0.74	0.84	0.56	My family thinks that I should buy organic food rather than inorganic food.	3.54	1.11
				Most people I value would buy organic food rather than inorganic food.	3.59	1.05
				People I value (e.g., my teacher) think that you should buy organic food.	3.72	1.14
				My close friends, whose opinions regarding diet are important to me, think that I should buy organic food.	3.07	1.20
					3.48	1.12
Perceived behavioural control	0.83	0.89	0.66	If I wanted to, I could buy organic food instead of inorganic food	3.11	0.978
				I think it is easy for me to buy organic food.	3.00	1.06
				Purchasing or not purchasing organic food is just related to me.	3.16	1.13
				I do have adequate (economic) resources and time to buy organic food.	3.43	1.10
					3.17	1.06

**Continue Table 1.** Indices and items measured by the questionnaire

Construct	Cronbach's alpha	Combined Reliability	AVE	Items	Mean	SD
Moral norms	0.71	0.87	0.78	Consuming organic food rather than inorganic food makes me feel like a better person.	3.56	1.06
				If I consume organic food rather than inorganic food, I will feel as if I am making a personal contribution to something better.	3.67	0.945
					3.61	1.00
Environmental concern	0.80	0.85	0.65	The balance of nature cycle is critical and may be disrupted even with a small mistake.	3.51	1.08
				To survive, mankind should protect the balance and life of nature.	3.51	1.05
				Mankind misuses the environment severely.	3.34	1.11
					3.45	1.08
Health consciousness	0.75	0.86	0.67	I am careful in choosing food to ensure my health.	4.03	0.848
				I think that I am an informed consumer about health aspects.	3.80	1.01
				I usually think about health-related issues.	3.69	0.981
					3.84	0.946

Scale: 1=completely disagree to 5=completely agree, AVE: Average variance extracted; SD: Standard deviation

Source: (Yazdanpanah & Hasheminezhad, 2016; Yazdanpanah & Forouzani, 2015; Yazdanpanah, M., Forouzani, M., & Hojjati, M., 2015).

**Table 2.** Demographic characteristics of respondents

Variable	Frequency	Percentage
Age (years)		
M=25, SD=6		
<20	96	28.2
20-35	208	61.2
>35	36	10.6
Sex		
Male	166	48.8
Female	174	51.2
Residential place		
Rural area	112	37.9
Urban area	228	67.1
Education level		
Bachelors	202	59.4
Masters	92	27.1
PhD	46	13.5



The results of the correlation analysis (Table 3) reveal that students' intention to purchase organic food was significant ( $p < 0.01$ ) and had a moderate to a substantial association (Daivis, 1971) with health consciousness, environmental concern, attitude, subjective norms, perceived behavioural control, and moral norms. In addition, the studied constructs were related to each other significantly ( $p < 0.01$ ). These findings are consistent with those of Sobhani et al. (2018), Yazdanpanah and Hasheminezhad (2016) and Yazdanpanah et al. (2015).

### 3.2.2. Analysis of the relationships between the constructs of the students' intention to purchase organic food

SEM was used to identify the effects on the students' intention to purchase organic food. Based on the theoretical framework of the study, path analysis was applied by the LISREL8.80 software package to analyse the relationship between the variables.

All the variables were regarded as the observed variables of the model. The results indicated that the effect of attitude on the intention to purchase organic food was significant ( $\beta = 0.17$ ;  $p < 0.01$ ). Vermeir and Verbeke (2008) state that attitude is a strong predictor of people's intention to use organic food. It is, therefore, necessary to have a correct understanding of the youth's attitude towards organic food in order to increase their willingness to consume it (Yazdanpanah & Hasheminezhad, 2016). Intention to use organic products was also significantly influenced by perceived behaviour control ( $\beta = 0.17$ ,  $p < 0.01$ ). The effect of subjective norms was also found to be significant ( $\beta = 0.23$ ,  $p < 0.01$ ). Subjective values and beliefs of people are the factors that dictate the display of certain behaviour by them. Accordingly, by enhancing personal and social norms within an educational context, improvements can be made in developing optimal behaviours by students such as improving their nutrition. Therefore, hypotheses 1, 3 and 4 are accepted. These findings corroborate those of Tarkiainen and Sundqvist (2005), Chen, (2007), Vermeir and Verbeke

**Table 3.** Correlation of the constructs of factors influencing students' intention to purchase organic food

Variable	Intention	Attitude	Subjective norms	Moral norms	Perceived behavioural control	Environmental concern	Health consciousness
Intention	-	-					
Attitude	0.618**	-					
Subjective norms	0.663**	0.466**	-				
Moral norms	0.543**	0.378**	0.460**	-			
Perceived behavioural control	0.649**	0.483**	0.504**	0.523**	-		
Environmental concern	0.643**	0.483**	0.502**	0.429**	0.498**	-	
Health consciousness	0.619**	0.435**	0.461**	0.287**	0.451**	0.494**	-

\*\*  $p < 0.01$

(2008), Yadav and Pathak (2016), Smith and Paladino (2010), Voon et al. (2011), Zagata (2012), Yazdanpanah and Forouzani (2015), and Paul et al. (2016).

The results for the extended TPB showed that moral norms had a significant effect on the intention to purchase organic products ( $\beta = 0.14$ ). The purchase of organic foodstuffs by students provokes a better feeling about their personality and society (Sobhani *et al.*, 2018). Our finding of the effect of moral norms on motivating students to consume organic products confirms the findings of previous studies (Yazdanpanah *et al.*, 2015; Yazdanpanah & Hasheminezhad, 2016; Sandoghi & Raheli, 2017; Sobhani *et al.*, 2018; Yadav & Pathak, 2016 a, b; Arvola *et al.*, 2008; Michaelidou & Hassan, 2008). We found that environmental concerns influenced the students' intention to buy organic products significantly ( $\beta = 0.17$ ). It has been reported that farmers who grow organic crops have a more positive attitude towards environmental conservation than those who grow conventional crops (Power *et al.*, 2013). This finding is consistent with that of De Leeuw et al. (2015) but contradicts that of Sobhani et al. (2018) and Shams and Najafabadi (2014). Given the significant role of environmental concern on the students' attitude ( $\beta = 0.40$ ), the indirect impact of these considerations and concerns of students on their behaviour towards the purchase of organic food may be regarded to be important (Rahimnia *et al.*, 2017; Sabzehei *et al.*, 2016; Haghjou *et al.*, 2013; Sobhani *et al.*, 2018).

Among the variables included in the extended TPB, health consciousness was highly influential on the students' intention to purchase organic products ( $\beta = 0.26$ ;  $p < 0.01$ ). This finding implies that an individual's awareness of the benefits of organic products influences his or her intention to consume them. Previous research has also noted the specific role that this variable plays in behavioural models, such as the health beliefs model (Yazdanpanah & Hasheminezhad, 2016; Yazdanpanah *et al.*, 2015), and has asserted its role in the intention to purchase organic foodstuffs (Sobhani *et al.*, 2018). Students purchase organic food to enhance their own and their family's health; therefore, the higher their health consciousness is, the higher their intention to purchase organic products will be.

The effect of health consciousness was also significant

( $\beta = 0.31$ ;  $p < 0.01$ ) on the students' attitude towards organic products (Fig. 1).

According to the results of SEM, the variables of health consciousness, environmental concern, attitude, perceived behavioural control, moral norms, and subjective norms captured 86 per cent of the variance of the students' intention to purchase organic foodstuffs. Since the students' attitude towards organic products influenced their intention to consume them, it can be said that an individual's positive attitude towards organic products will enhance his/her intention to consume organic products. The results revealed that environmental concern and health consciousness were highly (41 per cent) influential on students' intention to consume organic foods (Table 4).

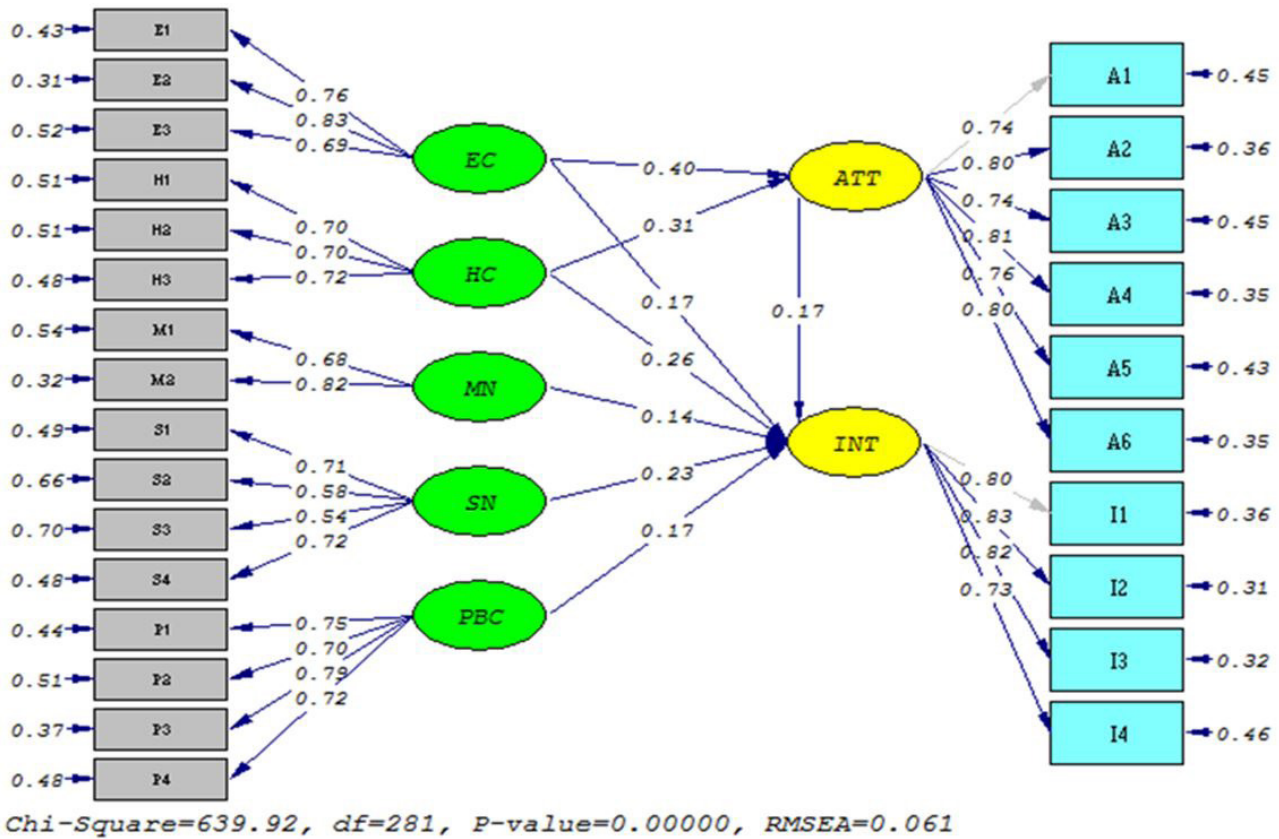
#### 4. Conclusion and recommendations

The purpose of this study was to investigate Iranian students' desire to purchase organic food products. Overall, the results show that the theory of planned behaviour model was an appropriate model for investigating the factors influencing the willingness of students to use organic food products and had high potential predictive power. From the findings of the study, one could conclude that variables such as attitude, mental norms, perceived behaviour control, ethical norms, health motivation and environmental concern influence students' desire to purchase organic food products. Based on the results of the TPB, health motivation has the most significant impact on their willingness to consume these products. This variable also influenced the attitude of students towards purchasing organic food products.

Based on the findings of the study, a few recommendations are made. Health centres, health counselling and nutrition centres can be set up at the university to provide individual education for students to improve their knowledge and attitudes toward the benefits of organic food.

As moral norms influenced students' attitudes towards purchasing organic food products, it is recommended that organisations use this to market organic food products. As the effect of attitude on intention to purchase organic food was significant, more attempts should be made to improve attitude and institutional-





**Figure 1.** Path analysis model for students’ intention to purchase organic food (HC = health consciousness; EC = environmental concern; SN = subjective norms; MN = moral norms; PBC = perceived behavioural control; ATT = attitude; INT = intention to purchase organic food)

**Table 4.** The direct effects on student’s intention to purchase organic food: The application of the extended theory of planned behaviour

Dependent variable	Independent variable	Direct effect	Indirect effect	Total effect	t-value	R <sup>2</sup>
Attitude	Environmental concern	0.40	-	0.40	4.73**	0.41
	Health consciousness	0.31	-	0.31	3.71**	
Intention	Attitude	0.17	-	0.17	3.59**	0.86
	Subjective norms	0.23	-	0.23	2.42**	
	Perceived behavioural control	0.16	-	0.16	2.77**	
	Moral norms	0.14	-	0.14	2.11**	
	Environmental concern	0.17	0.068	0.23	2.46**	
	Health consciousness	0.26	0.052	0.31	3.73**	

\*\*p<0.01

ise subjective concepts about the use of organic food-stuffs among students.

Since TPB showed that health consciousness was the

most influential factor on students’ intention and it also influenced their attitude towards the purchase of organic food, it is recommended that healthcare and nutrition consulting centres in universities provide

general personal training to students to enhance their knowledge and attitude about the advantages of organic food.

As an individual's positive attitude towards organic product will enhance his/her intention to consume organic products, a culture of consumption of organic crops should be created among students, including the improvement of their awareness and attitudes. It is recommended to concentrate on informing and creating a positive attitude towards the consumption of organic products in training programmes through public media and universities. Furthermore, since moral norms are another component of TPB that affects students' intention to consume organic products, it is recommended that commercial organisations adopt strategies that rely on environmental friendliness in their marketing of products, thereby paving the way for increasing their consumption. Therefore, the more an individual perceives that the consumption of organic foods is a moral norm, the more he or she will show a willingness to consume them.

Since the variable of environmental concerns affects purchase behaviour indirectly, it is recommended to mention the practical benefits of organic agriculture on human life in curriculums and training courses. Furthermore, to facilitate the transit of the effect of this variable from attitude to behaviour, it is recommended to emphasise the challenges and crises of pesticide and chemical fertiliser application for the health of humans and the environment in the technical courses of universities and public media. In this way, greater awareness of environmental concerns may be developed in students.

### Conflict of interest

The authors declare no conflict of interest. Furthermore, the funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; and in the decision to publish the results.

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