

Assessment of socio-demographic factors, health status and the knowledge on probiotic dairy products

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ABSTRACT

The probiotic dairy products have become the fastest growing in functional foods market in response to the increasing numbers of consumers interested in improving their health. Therefore, data collected from 314 participants in the city of Bursa, Turkey, were analyzed with the aim to assess the socio-demographic characteristics and health status as well as the consumer's knowledge and awareness of probiotic dairy products in order to gain a better understanding of consumers' attitudes. It was observed that socio-demographic characteristics of the participants were not significantly associated with the degree of knowledge or awareness and purchasing frequencies of probiotic dairy products. Having a higher educational level, higher income level and being a woman indicated an increased the awareness, knowledge and purchase probability of probiotic dairy products. This study emphasized that consumers should be more informed about the positive relationship between a healthier life and the consumption of probiotic dairy products.

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1. Introduction

Nowadays consumers are more concerned about improving their quality of life and personal health, thus they are demanding more information on how to achieve a healthier life through a diet. As a result of this emerging demand, food companies and academia have focused on developing novel healthy products or renewing current products by improving their health benefits. Functional foods are defined as foods which are regularly consumed within a varied diet at efficacious levels and have potential health benefits beyond basic nutrition. For an ingredient or food to be considered functional, the main criteria must be met food safety regulations, free to access without a medical prescription and evidence of health beneficial effects when regularly consumed in a balanced diet. The examples of functional foods include those enriched with substances such as probiotics, prebiotics, antioxidants, polyunsaturated

fatty acids, dietary fiber, phytochemicals vitamins or specific minerals [1–13].

Probiotics are considered one of the most important functional food substances. Probiotics are defined as live microorganisms that, when consumed in adequate amounts, confer a beneficial health effects on the host. According to this definition, probiotics must be a viable microorganism and beneficial to host health [14]. The health benefits accredited to probiotics when consumed in the food matrix include the inhibition of the growth of intestinal pathogens [15–17], an enhanced immune system [18,19], a lowered risk of diverse cancer types [20,21], an improved lactose digestion [22], the reduction of oxidative stress and postprandial glycaemia [23,24] a hypolipidemic potential [25], as well as treatment/prevention of obesity, diabetes, osteoporosis, cardiovascular diseases and some allergic reactions [26–33].

Probiotic microorganisms are available in a variety of foods such as dairy, chocolate, cereals, beverages, fruit and vegetable products, dietary supplements and drugs [34–39]. Among these foods with alleged health claims which have been widely promoted, fermented dairy products like yogurt, cheese, beverages and desserts are the most preferred delivery vehicles for probiotics, mainly due to their specific nutritional, physico-chemical properties and higher buffering capacity to acidic conditions in the stomach which allows probiotic bacteria to reach the gut in sufficient numbers (from 6 to 8 log CFU/gram or mL) to exert their therapeutic effects

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[40–47]. The majority of commercially available probiotic dairy products in the market place contain species of *Lactobacillus* and *Bifidobacterium* [34,48,49].

The global market value for probiotic foods in 2017 was 40.09 billion USD and is expected to reach 65.87 billion by 2024, according to Zion Market Research Inc. Dairy products account for 69% of this market value. The Asia-Pacific region dominates the market. In Europe, the probiotic market is experiencing a low growth rate due to health claim regulations of EU. The Turkish functional food market has increased over the last years and 33.5% consists of dairy products, however, the markets are only 0.3% within the total food consumption. Thus, based on significant health claims of probiotics a better understanding of consumer choice, behavior and attitudes is needed to develop a successful marketing strategy among Turkish consumers, regarding pricing, product placement, design, positioning and promotion of the product [50–54].

Many studies about probiotics have focused on consumption and health benefits [55–57], consumer's perceptions and attitudes [11,58–60], factors affecting purchasing intentions [61–63], the awareness and knowledge of healthcare professionals such as dentists and college students [52,64–67]. These studies have shown that the decisive factors effective on probiotic product acceptability are intrinsic and extrinsic food attributes (appearance, taste, pleasure, safety, efficacy, familiarity), consumer-related factors (socio-demographic, lifestyle, perceived values, psychological characteristics) and marketing environment-related factors (economic, cultural, natural, technological, political and social determinants). Other key determinants in the decision of purchasing were stated as knowledge, cognitive factors, trust, neophobia, neophilia, process technology, convenience and price [68].

In recent years with the consumer's interest in health and dietary issues as well as growing global trends and challenges, probiotic dairy products experienced a rapid market growth in Türkiye. A great number of studies emphasizing the beneficial effects of probiotics have increased the awareness among consumers and their consumption. Understanding the consumer's expectations and preferences towards probiotic dairy products, could be beneficial for both manufacturers and consumers. However, there are limited studies that focus on the consumer's perceptions, beliefs and knowledge on probiotic dairy products. Therefore, the present study was planned to analyze the consumer's opinions on probiotic dairy products and the factors effective on their decision making process, such as socio-demographic variables, cognitive and attitudinal determinants of the consumers.

2. Material and methods

A quantitative-descriptive study was performed using a structured de novo questionnaire, based on the behaviors and expectations of the consumers along with the consumption attitudes of probiotic dairy products. The questionnaire consisted of 17 questions and each question had a number of options for the participants to choose a reply irrespective of the gender. The questionnaires were administered at Bursa, situated in the southwest of Türkiye, between the months of January and April 2018, by non-random sampling method.

Since sample size is directly related to data quality and survey precision, considering a level of precision of $D = 0.05$, a confidence interval of 95% and a proportion of 50%, the final sample size calculated was $n = 314$ participants using the standard error formula ($n = Nt^2 pq / d^2(N-1) + t^2 pq$). The direct approach method was chosen, in which, the respondent is invited to provide answers through face-to-face interviewing in different hours of the day at small-, medium- and large-scale supermarkets, shopping malls, and pub-

lic places located in various regions of the city. The participants completed the questionnaires within 15–20 min.

The results were tabulated and graphs were constructed using the Microsoft Excel 7.0, version 2000. The mean and chi-square (χ^2) analysis were used to understand the influence of the variables on probiotic dairy food knowledge with the aid of the software SPSS 22.0. According to chi-square analysis, the differences and/or correlations between each variable (17 columns) and its effect on the dependent variable (314 rows) were determined by converting the data into a 2×2 table. Hierarchical cluster analysis (HCA; clustering) was conducted in order to evaluate the normality and non-normality between each variable (17 columns) and participant's responses (314 rows). The Ward Method with square Euclidean distance, was used to determine the preliminary number of clusters. Pearson's correlation coefficient was performed to measure the association between variables.

3. Result and discussion

In order to find out the socio-demographic features of the 314 individuals who participated the study, frequency analysis was used and the results were shown in Table 1. 26.20% of these participants were men, 73.80% were women, and predominantly married (57.82%) individuals. Many researchers mentioned that females were the main decision-maker of food-purchasing in the house-hold, had higher levels of health awareness and were more knowledgeable about nutrition than men [69,70]. 57.51% of the sample included respondents aged 21–40 years which could be explained by the fact that it was easier to contact with adults, hence they had a higher survey response rate. With respect to the education level, 86 (27.47%) participants had only completed their primary education, 87 (27.79%) had completed their high school education and 138 (44.08%) had their bachelor or graduate degree. This proportionality indicated that the vast amount of participants were educated. When education and gender characteristics are taken into account it could be said that greater frequency of women shop for food products in supermarkets and they had higher education degrees in relation to the male sex, as shown by various surveys carried out previously. A total of 32.59% of unemployed (housewives or students) individuals were inspected. Probiotic dairy products have relatively higher market prices than other alternatives in Türkiye, therefore, monthly 42.17% of respondents were working in private sector as workers or engineers, followed by household income and product price which may be key determinants for participant's purchasing decision. In Türkiye, a minimum monthly income of 3000 TL (~420 Euro) is generally considered as low income, and in regards of monthly income 180 (57.50%) respondents reported having an income higher than this amount [71].

Although there are few studies focusing specifically on probiotic dairy products, a study by Schultz et al. [72] illustrated that women were more interested in buying or consuming probiotic food products than men. According to a study done by Al-Nabulsi et al. [52], females were significantly more knowledgeable than men about the definition of probiotics, their health benefits and more interested in following dietary guidelines and tended to have more knowledge about nutrition. Aguirre [73] found that income level, education level, number of family members, perception of healthy lifestyles and general perception were important determinants of consumption of probiotics. In our study, a high percentage of the respondents who answered questions about probiotics had a higher educational level, higher income level and being a woman increased. Thus, it was thought that education, income level and gender affected both the decision to purchase and awareness of probiotic dairy products.

Table 1
Socio-demographic profile of the respondents.

		Frequency (n)	Percentage (%)
Gender	Female	231	73.80
	Male	82	26.20
Age Group (years)	20 and younger	36	11.50
	41 and older	180	57.51
Marital Status	Married	107	30.98
	Single	181	57.82
Educational Status	Literate & Secondary School	132	42.17
	High School	86	27.47
Occupation	Bachelor	87	27.79
	Graduate	113	36.10
Family Income (Monthly)	Officer	25	7.98
	Private Sector (worker, engineer etc.)	53	16.93
	Self-employed	132	42.17
	Unemployed (housewife + student)	17	5.43
	Pension	102	32.59
	1 000 TL and lower (140 € and lower)	9	2.87
	1 001–2 000 TL (141–280 €)	7	2.24
	2 001–3 000 TL (281–420 €)	59	18.85
	3 001–4 000 TL (421–560 €)	67	21.40
	4 001–5 000 TL (561–700 €)	55	17.57
	5 001 TL and higher (701€ and higher)	45	14.37
		80	25.56

Table 2
General responses about health status of participants.

Variables	Responses	Frequency (n)	Percentage (%)
How do you define your weight?	Low	15	4.78
	Normal	221	70.38
	Overweight	78	24.84
How do you define your daily physical activity?	Sufficient	148	47.13
	Insufficient	166	52.87
	Obesity	12	3.82
Do you have any disease?	Diabetes	13	4.14
	Hypertension	11	3.50
	Coronary heart disease	8	2.55
	Cholesterol	10	3.18
	Osteoporosis	4	1.27
Do you have gastro-intestinal disease?	Allergy	28	8.92
	No disease	228	72.62
	Yes	55	17.52
	No	259	82.48

As pointed out by Figueroa and Sánchez [74] and Aschemann-Witzel and Hamm [75], health improvement is one of the main variables in consumer behavior studies towards functional foods. Since physical activity, weight and diet are common issues related to good health and wellness, consumption of probiotics along with exercise is thought to be an alternative for improvement of health [76–79]. However, this is an erroneous perception of some consumers as they only concentrate on probiotic consumption and exercise without taking into consideration optimum nutrition and genetic factors. Experience with illnesses and relatives' who have lost their good health along with associated economic and social consequences have been reported to act as an incentive to adopt disease preventative food habits and to increase probabilities of functional food acceptance [70,80,81]. Consequently, it can logically be hypothesized that a healthy lifestyle has an effect on the attitude towards or consumption of functional foods. Similarly, Aguirre [73] reported that Costa Rican consumers preferred to consume probiotics in order to solve the problem of low physical activity and improve their health and well-being. When assessing the respondent's weight and physical activity characteristics, it was found that most of the respondents (70.38%) evaluated their weight as "normal" (Table 2). Since the existence of any specific nutrition requirement related to health problems may affect the food purchasing decision and consumption habits, the participants were asked whether they have specific diseases. About 72.62% of

respondents stated high percentages for the "none" option, however, 27.38% stated that they have specific disorders (obesity: 3.82%, diabetes: 4.14%, hypertension: 3.50%, coronary heart disease: 2.55%; cholesterol: 3.18%, osteoporosis: 1.27%, and allergy: 8.92%) (Table 2). Raihng and Mageshwari [82] reported that a majority (58%) of the consumers perceived probiotic foods as beneficial for weight management, 49% associated probiotics with reduction of cholesterol level where as only 19% associated with reduction of cancer. Most of the studies reported that there is a great interest among the sporting community about the potential benefits of probiotics on gastrointestinal diseases [59,76,83–85]. The vast majority of respondents (82.48%) stated that they had no gastro-intestinal disease.

About 43.95% of the participants stated that they had an idea about probiotic dairy products, however, more than half of the respondents (56.05%) had not heard this term before (Table 3). Although the respondents were familiar with the probiotic dairy products, they did not think that they were adequately informed about these products. Only 23.25% mentioned that they were well informed about the categories of products and the majority of participants stated that very little information had been provided about these products. They emphasized that due to no or scarce knowledge of the products, their preferences were low. Moreover, the main theme which emerged from the data analysis on participant's perception, was that they believed if people were aware

Table 3
Perception, knowledge and consumption habits about probiotic dairy foods.

Variables	Response	Frequency (n)	Percentage (%)
Do you have any idea about probiotic dairy products?	Yes	73	43.95
	No	241	56.05
Do you think you are well informed about probiotic dairy products?	Yes	138	23.25
	No	176	76.75
Are probiotic dairy products readily available for purchase?	Yes	90	28.66
	No	224	71.34
	Once a day	24	7.64
	Two or three times a day	6	1.90
	Once a week	36	11.45
How often do you consume probiotic dairy products?	Two or three	30	9.54
	Every fifteen days	29	9.23
	Never tried	192	60.24

of the nutritional and health benefits arising from the ingestion of probiotic foods that people would be more likely to consume the products (Table 3). Although, there is an increasing number of probiotic products available in the Turkish market, these products may be under-utilized due to a lack of public familiarity, lack of belief in product necessity, distrust in the product due to apparent distrust in food manufacturers, limited advertisement and high prices. Many researches mentioned that knowledge could contribute positively in consumer's decision-making about probiotic foods [11,52,55,65,67,86–90].

The dietary supplements and foods such as yoghurt, cheese, fruit juices and cereals are the most important probiotic carriers. However, it has been mentioned that the commercial value of dietary supplements is even greater in foods [91]. Meybodi and Mortazavian [92] studied different aspects between supplements and foods containing probiotics by using a comparative approach. They mentioned that although probiotic foods including high viable microorganisms are superior to supplements, supplements are preferred due to their more efficient properties for specific therapeutic applications. During the survey, the respondents were asked about the frequency of consuming probiotic dairy products. 9.54% of the respondents consume probiotics on a daily basis, such as once or more in a day, while 60.24% of respondents stated that they never tried these products (Table 3). The frequency of purchasing probiotic dairy foods indicated that almost 39.76% of the respondents in fact preferred/tried these food products. With respect to the level of availability in the market, 28.66% of the respondents mentioned that they regularly purchase probiotic dairy products, whilst the vast majority showed no interest for purchase even in the case of their availability in the market (Table 3).

For examination of the influence of socio-demographic characteristics on frequencies of knowledge and consumption behavior of probiotic dairy products a cross-analysis was performed with the χ^2 -test (data not shown). Socio-demographic characteristics of respondents (gender, age, marital status, occupation and income) were not significantly associated with the degree of knowledge and consumption frequencies of probiotic dairy products. Payahoo et al. [93] also observed no significant differences in the awareness of products related to gender.

The reasons for consuming probiotic dairy products were also asked to the interviewees. They explained their various reasons for consuming probiotic dairy products such as awareness and information on the benefits of these products through various channels such as media, training classes or recommendations, and having health problems. Among all the reasons “health benefits of probiotics” with 55.96% had the highest score, followed by “taste” (21.24%), “diet/eating habit/lifestyle” (11.40%), “MD recommendation/advice” (7.25%) and “advertisement/promotion” (4.15%) in Fig. 1. Similarly, Spanish consumers considered that probiotic

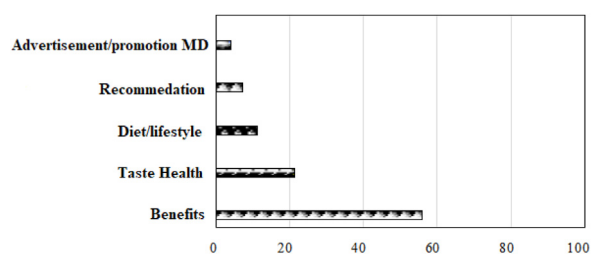


Fig. 1. The reasons* for consuming probiotic dairy products (%).
* the respondents were able to choose only one reason.

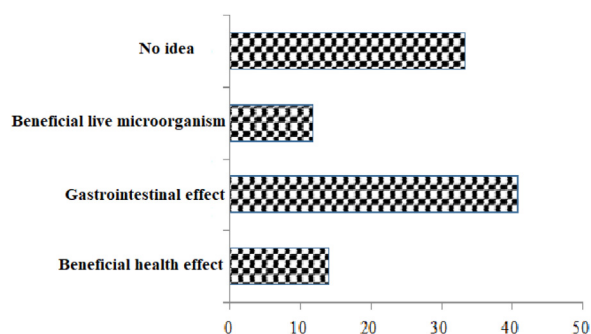


Fig. 2. The perception* of consumers about definition and benefits of probiotic dairy foods (%).
* the respondents were able to choose only one reason.

foods had a beneficial effect on health and this awareness boosted their preference [94]. Al-Nabulsi et al. [52] reported that among students' probiotics were consumed for their “intestinal benefits (48.1%)”, “improved immune system response (18.5%)”, “preventative activity (14.8%)” and “taste/ flavor (11.1%)”. Thirunavakarasu [47] mentioned that consumers had chosen the option of improved gastrointestinal condition (83.5%) as a result of probiotic consumption.

Taking into consideration the benefits of probiotics, most respondents considered that probiotics had gastrointestinal (40.76%) and health benefits (14.11%), showed in Fig. 2, which indicated the importance of health for consumers. In order to maintain a healthy life-style, they were aware of the necessity for the practice of regular physical exercise along with the consumption of adequate food, including the consumption of probiotic foods. Fig. 2 showed that 11.74% of participants were able to correctly identify probiotics as “beneficial live microorganisms”. Although a certain advance was shown by the participants in their responses, 33.39% failed to relate neither the definition nor consumption of probiotic dairy products to any of the benefits mentioned in the question.

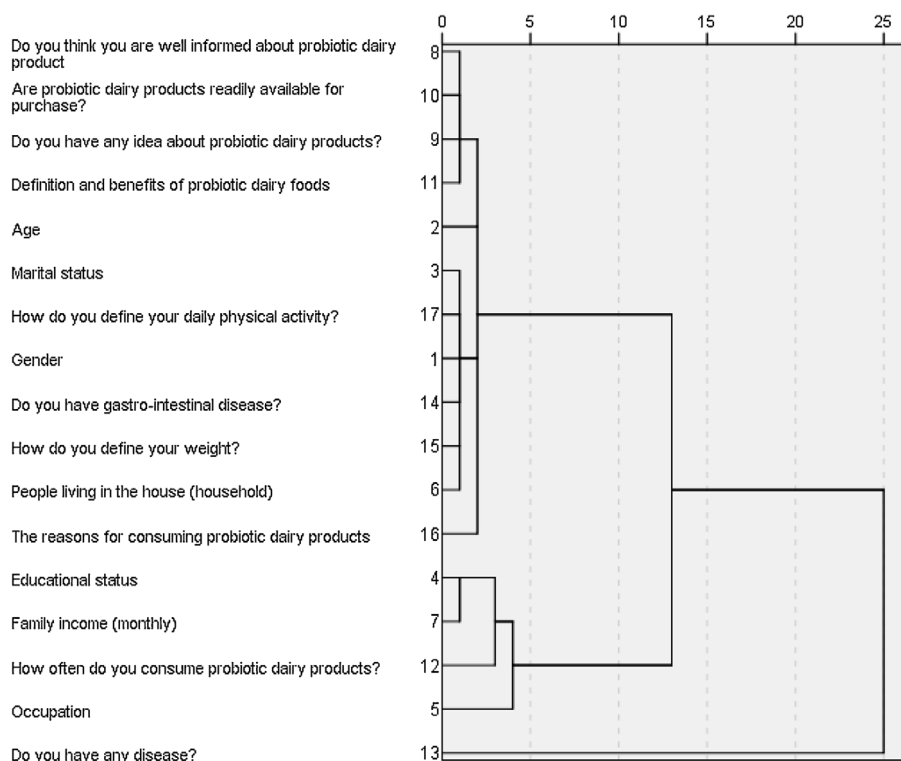


Fig. 3. Classification of the consumer preferences for probiotic dairy products by HCA on the evaluated variables.

Fig. 3 showed the dendrogram obtained from the Hierarchical Cluster Analysis performed to classify the data obtained on consumer's preference for probiotic dairy products. 17 determinants were grouped into two big clusters based on the mean values generated from the unweighted pair group mean method of analysis. The results obtained showed that "Do you think you are well informed about probiotic dairy products?", "Are probiotic dairy products readily available for purchase?", "Do you have any idea about probiotic dairy products?" and "Do you access enough of the probiotic dairy products?" were in the same cluster. This cluster included the respondent's level of information about probiotic dairy products and purchasing attributes, which determined that information and price might also be an important determinant on the consumer's decision. In other words, if a probiotic product is more expensive, consumers are less likely to buy it. The cluster stated that manufacturers and marketers should exert more effort on informing consumers about probiotic foods. The other cluster is composed of socio-demographic variables and health status such as "Gender", "Marital status", "People living in the house?", "How do you define your daily physical activity?", "Do you have a gastro-intestinal disease?" and "How do you define your weight?". "Educational status", "Family income", "Occupation" and "How often do you consume probiotic dairy products?" belonged to the same cluster. Thus, it was considered that education, income and occupation were important determinants affecting the consumption of probiotic product. The members of this cluster were well educated with higher income levels and might be more willing to frequently consume probiotic dairy products. "Do you think you are well informed about probiotic dairy products?" and "Do you have any disease?" was the furthest group, which most reflected that healthy consumers showed less attention to probiotic products than others.

Pearson's correlation coefficients among all the variables of this study were presented in Table 4. The strongest relation-

ship was between level of "education" and "monthly income" ($r = 0.399, P < 0.01$), indicating that participants with higher income also had higher levels of education. There was a strong positive relation between "having idea about probiotic dairy products" and "well informed about probiotic dairy products" ($r = 0.545, P < 0.01$), "having idea about probiotic dairy products" and "accessibility to products" ($r = 0.498, P < 0.01$), "having idea about probiotic dairy products" and "consideration about probiotic dairy products" ($r = 0.499, P < 0.01$). It should be highlighted that people informed about probiotic products have a high degree level of education, high monthly income and low household. Level of education was negatively correlated to "household" ($r = -0.174, P < 0.01$), having idea about probiotic dairy products" ($r = -0.339, P < 0.01$), "well informed about probiotic dairy products" ($r = -0.300, P < 0.01$), and "accessibility to products" ($r = -0.203, P < 0.01$), which showed that consumers with lower levels of education were less interested in these products. At 5% significance level, positive correlations were observed between: "marital status" and "physical activity", "marital status" and "monthly income", "household" and "occupation", "household" and "accessibility to products", "physical activity" and "monthly income", "weight" and "well informed about probiotic dairy products". The data showed that married respondents had higher monthly income and physical activity. According to the positive relation between "weight" and "well informed about probiotic dairy products", as consumers have information about the association of weight to a healthier lifestyle, they are more interested in probiotic dairy products. The detected differences could be related to educational differences or monthly income amount of the respondents. Probiotic dairy product manufacturers should focus on consumers who are predominantly single, poorly educated and have limited income levels. They should coordinate marketing campaigns to inform these consumers about the health benefits of probiotics.

Table 4
Pearson's correlation coefficients among all the variables.

	Gender	Age	Marital	Education	Occupation	Household	Income	Weight	Physical activity	Disease	Gastro-intestinal	Idea	Informed	Reachability	Consumption frequency	Reason of consumption
Age	0.177**															
Marital	0.141**	0.672**														
Education	0.240**	-0.122*	-0.166**													
Occupation	-0.172**	-0.225**	-0.163**	0.070												
Household	-0.143**	0.152**	-0.174**	-0.129*	0.129*											
Income	0.239**	0.136**	0.129*	0.399**	-0.117*	-0.131**										
Weight	-0.010	0.241**	0.186**	-0.064	0.035	-0.030	0.105									
Physical activity	-0.043	0.187**	0.117*	-0.048	-0.137**	-0.014	0.122*	0.266**								
Disease	0.011	-0.348**	-0.146**	0.039	-0.025	0.028	0.027	-0.311**	-0.043							
Gastrointestinal disease	-0.003	-0.121*	0.012	-0.000	-0.018	0.019	-0.104	0.008	-0.075	0.025**						
Idea	-0.02	-0.030	0.051	-0.339**	-0.151**	0.098	-0.237**	-0.027	-0.031	0.083	0.080					
Informed	0.003	-0.001	0.081	-0.300**	-0.040	0.138**	-0.163**	0.107*	0.013	0.090	0.117	0.545**				
Reachability	0.094	0.065	0.068	-0.203**	-0.027	0.125*	-0.125*	0.082	0.073	0.077	0.043	0.498**	0.679**			
Consumption frequency	0.142**	-0.020	0.062	-0.140**	0.011	0.071	-0.057	-0.002	0.074	0.149**	0.063	0.300**	0.341**	0.407**		
Reason of consumption	-0.120*	-0.077	-0.050	-0.008	-0.0042	-0.014*	-0.091	-0.006	0.026	0.041	-0.186**	-0.112*	-0.199**	-0.312**		
Consideration	0.080	-0.106	-0.011	-0.158**	0.003	0.063	-0.139**	-0.034	-0.005	0.084	-0.053	0.499**	0.359**	0.385**	0.192**	-0.257**

* $P < 0.05$; ** $P < 0.01$.

4. Conclusion

Probiotic dairy products have been reported as one of the top trends within the food industry. The development of these products is expensive and needs special requirements, technological hurdles, legislative regulations, as well as consumer acceptance. Therefore, a considerable amount of consumer research on consumer beliefs, awareness, preferences and socio-demographic profiling must be under taken. Understanding the consumers' attention and demand for such products may provide benefits for manufacturers to develop a novel probiotic food and to design marketing strategies, which means developing a practical and new approach to attain consumers who want to improve their health, well-being and quality of life. Manufacturers have to consider that the key to success for the development of novel functional foods lies in the mind of the consumer. However, the studies about consumer characteristics, preferences, awareness and knowledge on probiotic dairy foods are very limited. The present work was conducted to determine the influential factors on consumers' intention for purchasing probiotic dairy products such as socio-demographic profile, product knowledge and health status. The survey results indicated that educational strategies are needed to teach the health benefits of probiotic dairy products and to increase their acceptability and consumption. As a result, many studies about i) the relationship between consumer knowledge and food-related well-being, ii) the socio-demographic factors influencing consumers' food purchasing and ii) the evaluation of consumer acceptance of probiotic dairy products are needed. These studies will give an idea to scientists, manufacturers, retailers, marketers, health workers and government managers for designing healthier life policies and consumer awareness education.

Declaration of Competing Interest

We declare that there are no conflicts of interest.

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