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Research

Perception of Malaysian Consumers Towards Probiotics in Fermented Foods and Their Benefits to Human Health

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ABSTRACT

Consumers demonstrated an increase in awareness and interest in food that are closely associated with health benefits. As such, consumers are interested in consuming probiotic products and foods. Probiotics are bacteria that offer various benefits to human health when consumed in sufficient quantities. Numerous probiotic products have been listed, including fermented foods that contain probiotics that are beneficial to human health. Hence, consumers should be aware of these products. This study aimed to analyze the knowledge and awareness of consumers about probiotics and their benefits to human health and to evaluate the perception of consumers towards probiotics in fermented foods based on the socio-demographic profiles. The questionnaire was developed using Google Forms and distributed through social media. The data was analyzed using SPSS software. 150 respondents were involved, but only 133 of the data were selected. Descriptive analysis was conducted to determine the frequency of data from the socio-demographic profiles. Meanwhile, statistical analyses using chi-square analysis was conducted to identify significant difference at p-value < 0.05 between consumers' socio-demographic profile and their awareness, knowledge, and perceptions of probiotics and probiotics in fermented food. Overall, the survey indicated that consumers were well aware of, and had the knowledge and good perceptions towards probiotics and their presence in fermented foods.

Key words: Awareness, fermented food, perceptions, probiotics, socio-demographic

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INTRODUCTION

Consumers in Malaysia have shown greater health awareness than other developing countries due to improved literacy rates when they are willingly paying and consuming supplement nutrition and functional foods when they are provided with knowledge and information on nutrition and health benefits (Chong & Teh, 2020). According to Bell *et al*. (2017), fermented foods can be categorized as functional foods since fermented food contains bioactive components which are probiotics that can exhibit good effects on consumers' health.

Until now, there is the existence of a long list of traditional fermented foods that are being produced and consumed globally that can be regarded as the genesis of non-dairy probiotic products (Dey, 2018). Furthermore, bacteria used to ferment traditional foods are probiotics (Bell *et al*., 2017). Thus, fermented foods and probiotics are strongly connected and co-exist despite increased commercial interest in probiotics because of health attributes related to them (Bell *et al*., 2017). Some examples of fermented foods that contain probiotics are the fermented shrimp paste (belacan) and fermented fish (budu).

Probiotics are bacteria that provide advantages to human health when consumed in sufficient amounts (Sivansakari *et al*., 2013). Commonly, probiotics are members of Bifidobacteria and Lactobacillus genera (Ragul *et al*., 2017). A few advantages of probiotics for health that have been asserted are such as probiotics help humans regulate the gastrointestinal tract microbial balance, alleviate lactose

intolerance symptoms, and decrease the colon cancer risk (Tokatl *et al*., 2015). Pirbaglou *et al*. (2016) believe that probiotic supplementation had a beneficial impact on decreasing anxiety and depressive symptoms in a few previous studies despite there is existence of limitations and inconsistencies in the findings.

However, most consumers were still unaware and not well-informed about the existence of probiotics in fermented foods and their benefits to human health. This may be due to the less exposure and lack of understanding of the knowledge in both probiotics and the benefits of those probiotics to their health. So, this results in either underconsumption or intake of the wrong type of probiotics or in wrong doses, wherein they might not act as desired (Sharma *et al*., 2019). Besides, there are also limited studies that focus on perceptions, knowledge, and consumption of fermented foods among consumers especially in Malaysia.

The findings of this study will be a great contribution to the vast knowledge in evaluating current perceptions in terms of knowledge and awareness towards probiotics in fermented foods among consumers and its benefits to human health. By emphasizing the beneficial effect of probiotics, the perception in terms of awareness and knowledge among consumers and their consumption could be increased. Furthermore, this evaluation of perception could also help manufacturers of the food industry to determine the current status of consumer buying behaviors in term of self-purchasing and willingness to use probiotic products and develops food technology that uses potential probiotics in their food products. The objective of this study is to evaluate the perception of consumers towards probiotics in Malaysian fermented foods based on socio-demographic factors. Besides, this study also aims to analyze the knowledge and awareness of consumers about probiotics and their benefits to human health.

MATERIALS AND METHODS

Questionnaire development

An 18-question, cross-sectional, online questionnaire was designed (Wilson & Whitehead, 2019). The questionnaire participant's data was collected using Google Form, a survey administration software offered by Google (Pradito *et al*., 2020). The questionnaire was divided into three sections which is Section 1: Socio-Demographic Profile, Section 2: Awareness and Knowledge of Probiotics, and Section 3: Perception of Probiotics in Fermented Foods with every section composed of six questions. The first section was a questionnaire consisting of socio-demographic data including gender, age, education level, employment, demographic area, and health status (Sharma *et al*., 2019). The second section was about basic knowledge and awareness regarding probiotics (Sharma *et al*., 2019). Meanwhile, the third section was questions about probiotics in fermented food. The survey was conducted for two weeks between March 2021 and April 2021.

Participants

The survey was conducted among consumers in Malaysia (Rijkers *et al*., 2013). Participants were given links to the questionnaire which was randomly distributed through online social media such as WhatsApp, Twitter, and Facebook to obtain at least 100 respondents (Faden *et al*., 2018). They also were requested to distribute the link to the questionnaire to either their family, friends or any of their acquaintances. Then, the survey no longer accepted responses after 150 respondents were obtained.

Statistical analysis

Data from the current study was analyzed using IBM Statistical Package for the Social Sciences (SPSS), Version 26 (Arora *et al*., 2020). Descriptive statistics such as frequency and percentage were used to analyze all variables for socio-demographic profile data, knowledge and awareness about probiotics, and perception of probiotics in fermented foods (Sahib *et al*., 2016). Then, chi-squared tests were performed (Arora *et al*., 2020). All the data that presented a p-value < 0.05 were regarded as having a significant difference which means there are relationship between the variables (Arora *et al*., 2020).

RESULTS AND DISCUSSION

Respondents' socio-demographic profiles

The online survey was completed by a total of 150 participants. However, after data exclusion, there are 133 participants' data were included in the data analysis of the present study. From Table 1, most of the participants are female with 103 (77.40%). Besides, for age, there are 98 which is 73.70% of the respondents are aged 21 - 40 years which is the highest. This is explained by Yilmaz-Ersan *et al*. (2020) that aged 21 - 40 were easier to contact since they were an adult, hence they had a higher survey response rate. Regarding the educational level, Bachelor's Degree recorded the highest data which is with 82 (61.70%) respondents. As for employment status, students recorded the highest participation in this survey with 81 (60.90%) respondents. Most of the respondents which are 91 (68.40%) respondents

are live in the city area of Malaysia. Besides, the majority of the respondents which is 111 (83.50%) have good health status and did not have any diseases.

Table 1. Socio-demographic profile of the respondents.

	Characteristics	Frequency (*n*)	Percentage (%)
Gender	Male	30	22.60
	Female	103	77.40
Age	20 and below	11	8.30
	21 - 40	98	73.70
	41 and above	24	18.00
Educational level	SPM and below	18	13.50
	Matriculation/ Foundation/ STPM	22	16.50
	Bachelor Degree	82	61.70
	Master Degree	9	6.80
	Philosophy of Doctorate/ Professional	2	1.50
Employment status	Employed (in the health field)	5	3.80
	Employed (not in the health field)	32	24.10
	Unemployed	15	11.30
	Student	81	60.90
Demographic area	City	91	68.40
	Rural	42	31.60
Health status (Do you have any disease?)	Yes	22	16.50
	No	111	83.50

Awareness of term 'probiotic'

From the survey conducted, it is revealed that the majority of respondents which is 80.5% which corresponds to 107 respondents were aware of the term 'probiotic'. This result might be due to the consumers are frequently exposed to various ranges of delivery formats of probiotics both in foods and drinks and these probiotic products were being marketed on many health's enhancing platforms that could catch the eye of the consumers and increase the awareness (Arora & Baldi, 2017). Meanwhile, there are 19.5% which correspond to 26 participants were not aware of the term 'probiotic' which might be due to a lack of awareness of the current trend of consuming probiotic products or not paying attention to matters related to probiotics.

66.7% of male and 84.5% of female respondents are aware of the term 'probiotic'. This shows that females scored higher on awareness about probiotics than males since according to Yilmaz-Ersan *et al*. (2020), females were frequently fascinated with buying or consuming probiotic food products than males, so indirectly they were more aware of the existence of probiotics itself. From Table 2, there are statistically significant differences between the association of gender and awareness about the term 'probiotic' because the p-value = 0.031 < 0.05.

Of respondents who owned a Master's Degree and Philosophy of Doctorate/ Professional, all those respondents were aware of the term 'probiotic' 100.0%. This can be supported by a study by Betz *et al*. (2015) on hospitalized patients in which they mentioned that patients with more years of education which can be regarded as a high level of education were more likely to be familiar with the term 'probiotic' than those with less year of education.

Among respondents who have any disease, there are 63.5% were aware of the term 'probiotic'. Meanwhile, there are 83.8% were aware of the term 'probiotic' among respondents who did not have any disease which might be because individuals who have encountered illnesses before or had relatives that have disease as well as economics and social ramifications tend to practice disease-preventive eating habits and their acceptance towards functional food increased (Yilmaz-Ersan *et al*., 2020). Thus, they become more aware of the term 'probiotic'. From the analysis, there are also significant differences between the association of health status and awareness about the term 'probiotic' since p-value = 0.029 < 0.05.

Awareness of probiotic safety

Most of the respondents which is 101 (75.9%) of the respondents are agree that probiotics are safe to consume. The safety of the probiotics can be trusted when LAB which has been used widely as probiotics has attained Qualified Presumption of Safety (QPS) status and is Generally Recognized as Safe (GRAS) by the European Food Safety Authority Scientific Committee (EFSA) (Khalil *et al*., 2018). However, there are 5 (3.8%) do not agree and 27 (20.3%) respondents do not know about probiotic safety. This may indicate that those who do not think or does not know that consuming probiotic is safe might be due to the insufficient clinical trials that questioned the safety of probiotics, thus challenging

general trust that probiotics are indeed safe to be consumed (Žuntar *et al*., 2020).

In terms of gender, there are 60.0% of male respondents and 80.6% of female respondents think and aware that probiotics are safe to consume. From Table 3, there are relationship between gender with consumers' awareness about the safety of consuming probiotic products since the *p*-value = 0.000 < 0.05.

Students are the highest because a student may have been more advanced in research and informed on probiotic matter (Sorensen *et al*., 2019). From the analysis, the *p*-value obtained was *p*-value = 0.042 < 0.05, thus it indicates that employment status does influence the consumer's awareness about the safety to consume probiotic products.

For the health status, 68.2% of respondents who have the disease and 77.5% of respondents who do not have the disease were aware that probiotics were safe to consume. Health status was statistically found that it does influence consumers' awareness about the safety of consuming probiotic products since *p*-value = 0.029 < 0.05.

Table 2. Chi-square analysis between socio-demographic profiles and awareness of the term 'probiotic'

	Socio-demographic profiles	Total	Awareness about the term 'probiotic'		*p*-value
			Yes (%)	No (%)	
Gender	Male	30	66.7	33.3	0.031
	Female	103	84.5	15.5	
Age	20 and below	11	63.6	36.4	0.316
	21 - 40	98	82.7	17.3	
	41 and above	24	79.2	20.8	
Educational level	SPM and below	18	72.2	27.8	0.471
	Matriculation/ Foundation/ STPM	22	81.8	18.2	
	Bachelor Degree	82	79.3	20.7	
	Master Degree	9	100.0	0	
	Philosophy of Doctorate/ Professional	2	100.0	0	
Employment status	Employed (in the health field)	5	80.0	20.0	0.371
	Employed (not in the health field)	32	71.9	28.1	
	Unemployed	15	73.3	26.7	
	Student	81	85.2	14.8	
Demographic area	City	91	80.2	19.8	0.921
	Rural	42	81.0	19.0	
Health status (Do you have any disease?)	Yes	22	63.6	36.4	0.029
	No	111	83.8	16.2	

Perception of benefits of probiotics to human health

There 87 (65.4%) of the respondents which is the highest have good perceptions towards probiotic benefits to human health. This result corresponds to the study by Arora and Baldi (2017) where they stated that consumers' awareness towards therapeutic applications of probiotics that could give health benefit to them are increasing rapidly. These probiotic delivers wide therapeutic benefits such as prevention and treatment of antibiotic-associated diarrhea, and alleviation of lactose intolerance and Crohn's syndrome (Arora & Baldi, 2017).

The number of respondents who have negative perceptions towards probiotic benefits was 6 (4.5%) and there is quite a high number of respondents who do not know about the benefits of probiotics which were 40 (30.1%). This may indicate that consumers are initially ignorant about probiotics and their mode of action (Macouzet, 2012). Hence, even though probiotic awareness among consumers seems high, it is still vital to continue educating consumers about the benefits of probiotics to human health either by trustworthy experts or third-party institutions instead of only food company marketing or technical staff (Macouzet, 2012).

Table 3. Chi-square analysis between socio-demographic profiles and awareness about probiotic safety

	Socio-demographic profiles	Total	Knowledge and Awareness about Probiotic Safety			*p*-value
			Yes (%)	No (%)	Do not know (%)	
Gender	Male	30	60.0	16.7	23.3	0.000
	Female	103	80.6	0.0	19.4	
Age	20 and below	11	72.7	9.1	18.2	0.840
	21 - 40	98	77.6	3.1	19.4	
	41 and above	24	70.8	4.2	25.0	
Educational level	SPM and below	18	61.1	11.1	27.8	0.688
	Matriculation/ Foundation/ STPM	22	77.3	4.5	18.2	
	Bachelor Degree	82	76.8	2.4	20.7	
	Master Degree	9	88.9	0.0	11.1	
	Philosophy of Doctorate/ Professional	2	100.0	0.0	0.0	
Employment status	Employed (in the health field)	5	80.0	20.0	0.0	0.042
	Employed (not in the health field)	32	68.8	9.4	21.9	
	Unemployed	15	60.0	6.7	33.3	
	Student	81	81.5	0.0	18.5	
Demographic area	City	91	78.0	1.1	20.9	0.060
	Rural	42	71.4	9.5	19.0	
Health status (Do you have any disease?)	Yes	22	68.2	13.6	18.2	0.029
	No	111	77.5	1.8	20.7	

Based on the statistical analysis, there are 60.0% of male respondents and 67.0% of females have a good perception of probiotics that could deliver benefits to human health. These differences between genders may be related to the differences in perception of healthiness and willingness to try probiotic products (Sorensen *et al*., 2019).

Matriculation/ Foundation/ STPM has a slightly high percentage of respondents that has a good perception towards probiotic with 72.7% and Bachelor's Degree only 67.1% of them. The differences in knowledge regarding probiotics might be due to the study major and particularly higher among health science majors compared to those in basic sciences, engineering, and others (Sorensen *et al*., 2019). Their curriculum and exposure to current nutritional findings might also be different from faculty and colleagues (Sorensen *et al*., 2019). From Table 4, there are significant differences between educational level with the consumer's perception of the benefits of probiotics to human health because the *p*-value of this socio-demographic profile was p-value = 0.026 < 0.05.

Also, a respondent who has a disease has 50.0% of them, and with no disease, 68.5% of them have good perceptions. There are significant differences between health status with the consumer's perception of the benefits of probiotics to human health because the p-value of these socio-demographic profiles were p-value = 0.046 < 0.05.

Source of information about probiotic

There are a variety of mass media and sources that can give information to consumers such as electronic media, printed media, or people that know probiotics. As a result, most of the respondents which is 99 (74.4%) get information about probiotics from electronic mediums internet, or social media. These results indicate that showing advertisements about the health benefits of probiotic food products through social platforms such as YouTube, Facebook, and shopping websites gives better outreach and information transfer (Arora *et al*., 2020). Figure 1 shows the bar chart of the source of information on probiotics.

Table 4. Chi-square analysis between socio-demographic profiles and perception of benefits of probiotics to human health

	Socio-demographic profiles	Total	Perception of Benefits of Probiotics to Human Health			*p*-value
			Yes (%)	No (%)	Do not know (%)	
Gender	Male	30	60.0	10.0	30.0	0.252
	Female	103	67.0	2.9	30.1	
Age	20 and below	11	63.6	9.1	27.3	0.651
	21 - 40	98	68.4	4.1	27.6	
	41 and above	24	54.2	4.2	41.7	
Educational level	SPM and below	18	50.0	5.6	44.4	0.026
	Matriculation/ Foundation/ STPM	22	72.7	0.0	27.3	
	Bachelor Degree	82	67.1	6.1	26.8	
	Master Degree	9	55.6	0.0	44.4	
	Philosophy of Doctorate/ Professional	2	100.0	0.0	0.0	
Employment status	Employed (in the health field)	5	80.0	20.0	0.0	0.026
	Employed (not in the health field)	32	46.9	6.3	46.9	
	Unemployed	15	53.3	0.0	46.7	
	Student	81	74.1	3.7	22.2	
Demographic area	City	91	68.1	2.2	29.7	0.153
	Rural	42	59.5	9.5	31.0	
Health status (Do you have any disease?)	Yes	22	50.0	13.6	36.4	0.046
	No	111	68.5	3.7	28.8	

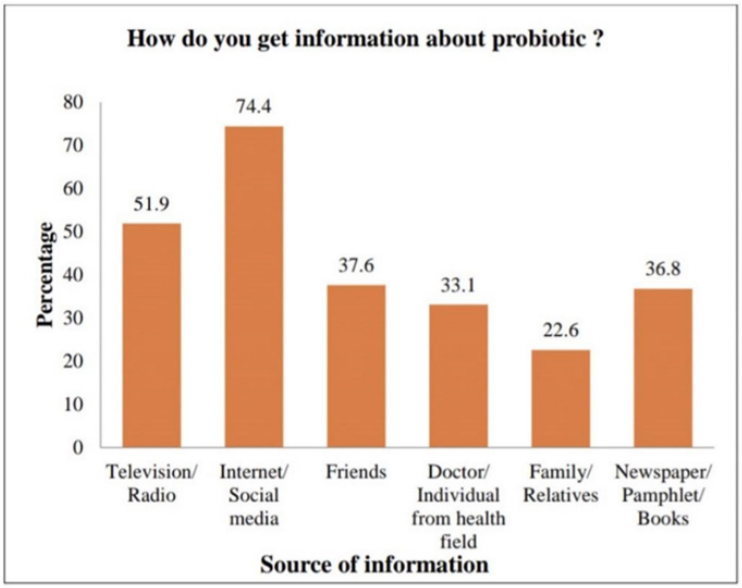

Fig. 1. Source of information about probiotics.

Consumption of probiotic products

From Figure 2, most of the respondents which is 50 (37.6%) consumed yogurt as a probiotic product and this shows that yogurt was the most preferable probiotic product among the consumers. Yogurt was known to be a probiotic product and became a source of probiotics that were commonly available (Payahoo *et al*., 2012). Furthermore, probiotic yogurt accounts for 78% of all probiotic sales worldwide and is regarded as one of the most usual foods that consumers associate with probiotics (Sorensen *et al*., 2019). Respondents who preferred to consume fermented food were also slightly high which is with 44 (33.1%) respondents. This result may occur because fermented food products are fundamentally linked to the local environment and the daily life of the consumers (Lee & Kim, 2013). According to Lee and Kim (2013), fermented food was tightly engaged to produce, local environment, ways of life, and eating habits of different regions. Thus, this is the reason why consumers also prefer to consume fermented food as a source of probiotics. The least preferable to consume was probiotic capsules which is 6 (4.5%) respondents. This might be because consumers perceived capsules which is a probiotic supplementation as a 'drug' (Nguyen *et al*., 2019).

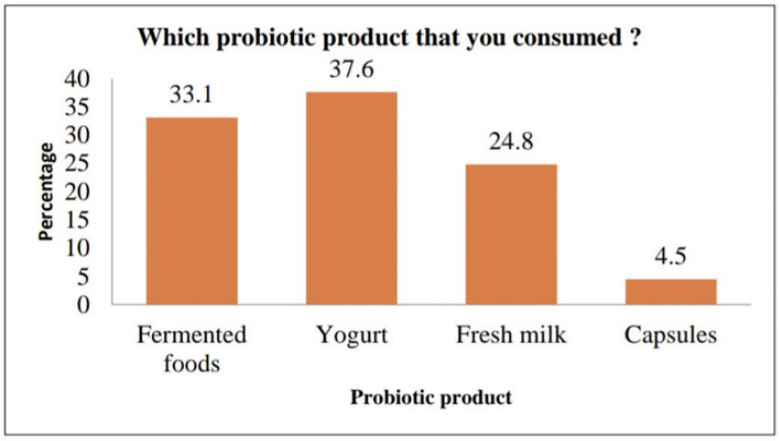

Fig. 2. Consumption of probiotic products.

Opinion on benefits of probiotics to health based on knowledge

From Figure 3, a great number of respondents which is 91 (68.4%) agree and think that by consuming probiotics, they could improve food digestion. When harmful microbes occupy in digestive system, they will ferment food in the wrong ways and might lead to the production of toxins that will affect human health (Amara & Shibl, 2013). Thus, probiotics will regenerate the digestive system with good microbes which will neutralize the harmful microbes (Amara & Shibl, 2013). So, Amara & Shibl (2013) highlighted that these useful microbes will ferment food correctly and increase healthiness by improving the digestive system. Besides, according to Divya *et al*. (2012), LAB will induce immune responses and intestinal barrier integrity. Immunomodulation roles involve the activation of specific and non-specific immune responses. Probiotics have cell walls that are composed of peptidoglycans, polysaccharides, and teichoic acid which are highlighted to have immunostimulatory effects. According to Behera *et al*. (2020), a supplemented diet containing probiotics such as *Lactobacillus casei* and *Lactobacillus acidophilus* significantly will slow down hyperglycemia, hyperinsulinemia, dyslipidemia, glucose intolerance, and oxidative stress which reported to have to show lower risk of diabetes and its complications. The least is only 6 (4.5%) respondents think that probiotics could decrease the risk of hypertension. According to Alves *et al*. (2016), there were experimental and clinical reports that reported probiotic supplementation might contribute to the reduction of blood pressure in hypertension conditions. For example, probiotics *Lactobacillus plantarum* reduce systolic and diastolic blood pressure, improve metabolic alterations, and decrease in generation of reactive oxygen species (Alves *et al*., 2016).

Willingness to consume fermented food

As for the outcome, a vast number of respondents answered which is 108 (81.2%) were like to consume fermented foods willingly. This might be due to the traditional fermented foods are still being produced at home and still rely on traditional fermentation methods (Tamang *et al*., 2020). Thus, this might influence their taste liking since they are always familiar with fermented food and always include fermented foods in their daily meals. However, several respondents do not like to eat fermented foods which is 25 (18.8%) respondents. This might be because these products may be under-used due to insufficiency of public familiarity, lack of belief in product necessity, and doubtful towards the product because of the visible distrust in food manufacturers, deficient advertisement, and high-priced (Yilmaz-Ersan *et al*., 2020).

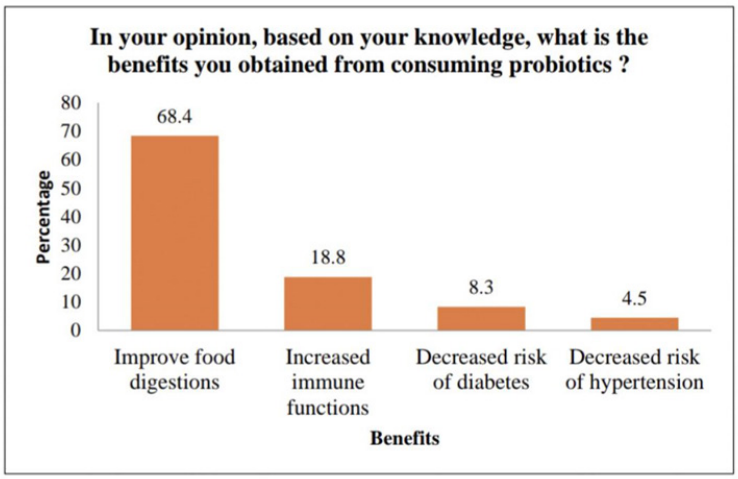

Fig. 3. Opinions on benefits of probiotics to human health based on knowledge.

From the chi-square analysis, the number of female respondents that willing to consume fermented food was higher than male respondents with 83.5% of female respondents compared to 73.3% of male respondents. Thus, this shows that the behavior of females and males was contradictory, especially in terms of healthy foods (Faden *et al*., 2018). Faden *et al*. (2018) also highlighted that females show higher eagerness to follow dietary guidelines and have more knowledge about food and nutrition than males since they are more engaged and concerned about their health and appearance.

Unfortunately, the age group 20 and below recorded the lowest willingness to consume fermented food which is 63.6%. This might be due to the younger generation's lack of interest in inheriting the indigenous knowledge of fermented foods because of the rapid increase of urbanization and industrialization nowadays, thus the knowledge cannot be transferred to the next generation (Sahoo *et al*., 2017).

In terms of health status, the majority of the respondents who had the disease (86.4%) willingly consumed fermented food and those who did not have the disease (80.2%) were willing to consume fermented foods. This shows that both groups become people with good health consciousness when they are willing to consume beneficial fermented foods. This is supported by a statement those who are health conscious are more probably to practice preventative healthcare behaviors which include the consumption of probiotic-rich foods (Nguyen *et al*., 2019). From Table 5, there are no socio-demographic profiles that have an association with the willingness to consume fermented food since all the *p*-values obtained were *p*-values> 0.05.

Perception about probiotics in fermented foods

From Table 6, 98 (73.7%) of the respondents know that there was probiotic contained in fermented food This is due to consumers nowadays becoming more and more conscious of the food products they purchase and consume which results in the notable trend towards food selection that are beneficial to health (Liang *et al*., 2016). Unfortunately, a minority of the respondents which is 35 (26.3%) do not know or are well-informed that fermented foods contain probiotics that are good for their health.

From the analysis, female respondents 77.7% were higher than male respondents with 60.0% that knew probiotics contained in fermented foods. This may be due to females being more dominant decision-makers when purchasing food in the household, hence they had better awareness and knowledge of health and nutrition than males (Yilmaz-Ersan *et al*., 2020).

Furthermore, respondents who own a Philosophy of Doctorate/ Professional and Master Degree were the highest recorded compared to another educational level with 100.0% and 88.9% respectively for their positive perception towards probiotics in fermented food. This is supported by Nguyen *et al*. (2019) who believe more educated people are more probably to make preventive healthcare decisions and look for useful information to guide their purchase, while people with less education rely more on advertised benefits.

For the health status, the percentage of respondents who have good perceptions towards probiotics in fermented food among those who do not have a disease was higher compared to the percentage of respondents who have a disease with 74.8% compared to 68.2% respectively. This might be because the ability of healthcare workers to provide precise, practical, and consistent dietary advice that is suitable to the needs of patients is limited which may be due to they have little knowledge about probiotics (Soni *et al*., 2018). Thus, the consumption of fermented food in patient dietary cannot be adopted due to patients having insufficient information about probiotics in fermented food from healthcare providers.

Table 5. Chi-square analysis between socio-demographic profiles and consumers' willingness to consume fermented food

	Socio-demographic profiles	Total	Willingness to Consume Fermented Food		*p*-value
			Yes (%)	No (%)	
Gender	Male	30	73.3	26.7	0.210
	Female	103	83.5	16.5	
Age	20 and below	11	63.6	36.4	0.262
	21 - 40	98	83.7	16.3	
	41 and above	24	79.2	20.8	
Educational level	SPM and below	18	72.2	27.8	0.453
	Matriculation/ Foundation/ STPM	22	90.9	9.1	
	Bachelor Degree	82	81.7	18.3	
	Master Degree	9	77.8	22.2	
	Philosophy of Doctorate/ Professional	2	50.0	50.0	
Employment status	Employed (in the health field)	5	80.0	20.0	0.747
	Employed (not in the health field)	32	75.0	25.0	
	Unemployed	15	86.7	13.3	
	Student	81	82.7	17.3	
Demographic area	City	91	82.4	17.6	0.598
	Rural	42	78.6	21.4	
Health status (Do you have any disease?)	Yes	22	86.4	13.6	0.498
	No	111	80.2	19.8	

Practices of fermented food

Based on Figure 4, the majority of the respondents which is 58 (43.6%) consumed fermented foods once a week or once a month and 11 (8.3%) of the respondents consumed fermented food every day. This might be due to an increase in advertisements and marketing efforts by probiotic manufacturers using the results from the research and development in probiotic research of the public and private sectors and the increase of acceptance towards probiotics among physicians in the last few years contributes to the increase in awareness and use of probiotics among consumers (Kolady *et al*., 2018). However, there are very few respondents who never consumed fermented food which is 6 (4.5%). It shows that the respondents were not comfortable feeding fermented foods to their family members because they lacked knowledge about the advantages of fermented foods to health (Sahoo *et al*., 2017).

Reasons to consume fermented food

Yilmaz-Ersan *et al*. (2020) revealed that numerous crucial factors influence purchasing intentions and probiotic product acceptance some of them are the extrinsic and intrinsic food characteristics including safety, familiarity, taste, pleasure, efficacy, and appearance. Other fundamental aspects that determine purchasing decisions are cognitive factors, knowledge, belief, neophobia, neophilia, technology, price, and satisfaction (Yilmaz-Ersan *et al*., 2020).

From Figure 5, most of the consumers which is 50 (37.6%) consumed fermented food because they just like the taste, smell, and texture of that certain fermented food. This is because according to Conti-silva and Souza-Borges (2018), intrinsic sensory features are fundamental to the overall liking of fermented products. Consumer choice, purchase, repurchase, acceptability, and preference form an action that requires the sensory features of products that greatly affect consumers' acceptance of fermented foods (Conti-silva & Souza-Borges, 2018). Meanwhile, 43 (32.3%) of the respondents consumed fermented food because they believe that fermented food can help to give more healthy health due to the nutrition contained in those foods. This might be due to the health claim of many probiotic food products by food manufacturers that claim that their product gives many health benefits (Macouzet, 2012). Besides, all these health claims also being supported by significant clinical and scientific evidence that could gradually increase the consumer's beliefs (Macouzet, 2012).

Table 6. Chi-square analysis between socio-demographic profiles and consumers' perceptions about probiotics contained in fermented food

	Socio-demographic profiles	Total	Perceptions about Probiotics in Fermented Food		*p*-value
			Yes (%)	No (%)	
Gender	Male	30	60.0	40.0	0.053
	Female	103	77.7	22.3	
Age	20 and below	11	72.7	27.3	0.375
	21 - 40	98	76.5	23.5	
	41 and above	24	62.5	37.5	
Educational level	SPM and below	18	55.6	44.4	0.287
	Matriculation/ Foundation/ STPM	22	72.7	27.3	
	Bachelor Degree	82	75.6	24.4	
	Master Degree	9	88.9	11.1	
	Philosophy of Doctorate/ Professional	2	100.0	0.0	
Employment status	Employed (in the health field)	5	80.0	20.0	0.180
	Employed (not in the health field)	32	68.8	31.3	
	Unemployed	15	53.3	46.7	
	Student	81	79,0	21.0	
Demographic area	City	91	75.8	24.2	0.409
	Rural	42	69.0	31.0	
Health status (Do you have any disease?)	Yes	22	68.2	31.8	0.521
	No	111	74.8	25.2	

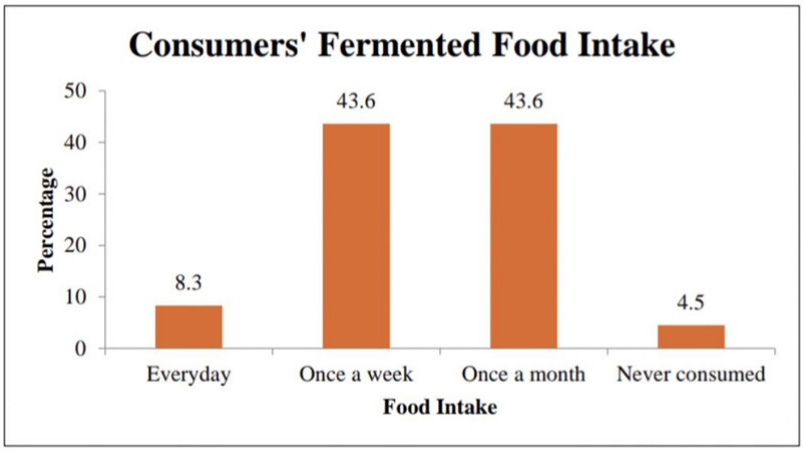

Fig. 4. Practices of fermented food.

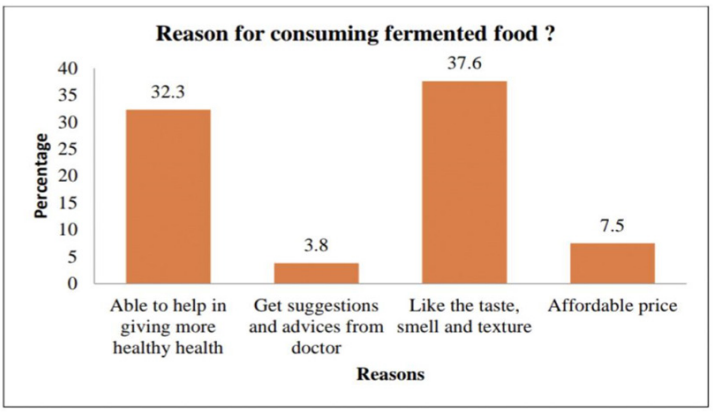

Fig. 5. Reasons to consume fermented food.

Reasons to Reject Consuming Fermented Food

Based on Figure 6, 13 (9.8%) of respondents do not consume fermented food because they do not like the taste, smell, or texture of the fermented food. This is because few fermented foods are known to have very strong smell and taste and are not very preferable to certain consumers. 7 (5.3%) of the respondents are unfortunately not aware of the benefits of probiotics to their health that are contained in fermented foods. This might be because the consumers appeared to be ignorant about the benefits of probiotics in fermented food, thus making them reluctant to purchase and consume probiotic products (Macouzet, 2012). Then, there are 5 (3.8%) of respondents feel that there is no need or not important to consume probiotics that already contained in fermented food. Due to the confusion among consumers about the names of probiotic organisms and the many health benefits associated with those probiotics, they appear to foster skepticism towards fermented foods (Macouzet, 2012).

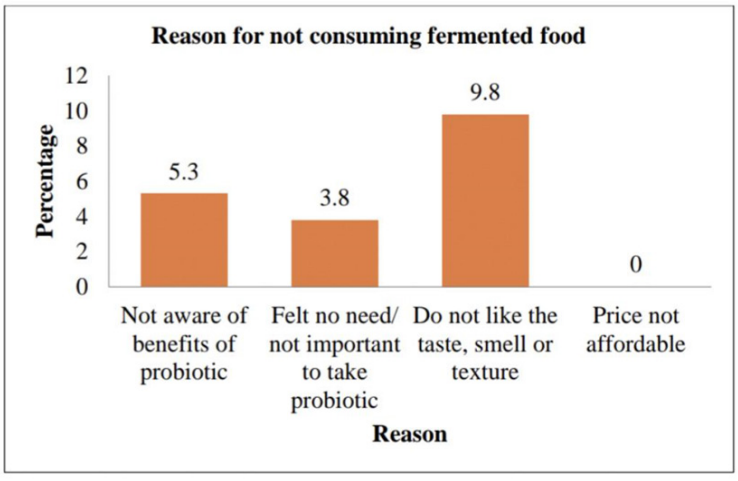

Fig. 6. Reasons to reject consuming fermented food.

Fermented food consumption

From Figure 7, 83 (62.4%) of the respondents which is the highest consumed 'Tempeh' as fermented food, and this might be because 'Tempeh' is one of the popular ingredients used in Malaysian dishes. Tempeh was made by coagulation of soy milk by using lactic acid bacteria such *as Lactobacillus rhamnosus* and *Bifidobacterium* and it is believed to have a reasonable portion of probiotic bacteria in it (Panghal *et al*., 2018). Few respondents consumed 'Tapai' which is 15 (11.3%). However, 'Tapai' is one of the popular fermented foods in Asian countries such as Indonesia and Malaysia (Lim *et al*., 2020). Lim *et al*. (2020) described that 'Tapai' was made through the fermentation of cassava, white rice, or glutinous rice and is known as a great source of potentially beneficial LAB such as *Lactobacillus plantarum*. The respondents who choose to consume 'Tapai' might have because it has a unique taste in which there is a sweet and sour taste with a mild alcoholic flavor that developed by the presence of LAB such as *Pediococcus pentosaceus* and *Weissella sp.* (Lim *et al*., 2020).

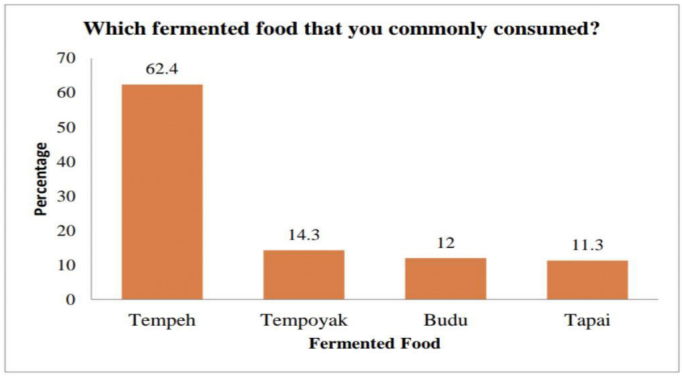

Fig. 7. Fermented food consumption

Overall findings and significant contribution

The findings of this study show that Malaysian consumers have awareness, knowledge, and good perceptions of probiotics and their presence in fermented foods. This is because the majority of the consumers are aware of the term probiotic and know that there are probiotics in fermented foods. According to Betz *et al*. (2015), high familiarity with probiotics was due to marketing and advertising for probiotics having surged rapidly, thus they were more aware of the term 'Probiotic'. Besides, this awareness of probiotics also leads to the majority of the consumers being aware of the safety of probiotics to be used in daily consumption even though are minority of the consumers have limited knowledge and awareness of probiotics safety. This same goes for the study conducted among Americans in 2011 in which there are nearly a quarter of respondents believed that all bacteria can make people sick (Macouzet, 2012). Fortunately, most consumers have good perceptions that probiotics offer many benefits to human health in this study, consumers know that consuming probiotic products could improve food digestion. The good perceptions about probiotics among consumers and the awareness about the presence of probiotics in fermented foods were developed by they are gaining information from various reliable sources. In addition, consumers have many choices of probiotic products such as yogurt, fermented foods, fresh milk, and in the form of capsules. However, in this study, most of the consumers consumed yogurt as their source of probiotics. Furthermore, in this study, most Malaysian consumers were willing to consume fermented foods, and most of them consumed 'Tempeh' as fermented foods that contain probiotics. The reasons may be because they are always familiar with fermented food and always include fermented foods in their daily meals. However, the taste, smell, and texture of fermented foods and the health claim supported by clinical evidence are strongly believed to be influencing the consumption of fermented foods. Thus, this study may help manufacturers especially those who produce fermented foods and probiotic products to improve their products based on consumers' preferences to attract more consumers to purchase their products.

CONCLUSION

In conclusion, the result shows that the majority of the respondents have relatively reliable awareness, knowledge, and good perceptions towards probiotics in fermented food and its benefits. However, a minority of the respondents have poor awareness and knowledge and negative perceptions towards probiotics. This shows that it is necessary to further educate and promote probiotics to people (Faden *et al*., 2018) such as organizing an effective program to introduce probiotic products (Rezai *et al*., 2017). An experiment on intrinsic sensory characteristics assessment of the sensory methodologies using the free listing and comment analysis that investigates consumer perception by covering large participants should also be done (Arora *et al*., 2020). Advertisements, public relations, and promotion should be used by creating messages that are relevant in terms of potential health benefits which can increase the impact of their product and increase the consumer's knowledge about probiotics (Sorensen *et al*., 2019).

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ETHICAL STATEMENT

This study is aproved by School of Biology, reference number 500-KNS(HEA.23/4). Consent was obtained from all respondents.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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