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Evaluation of the Effect of Probiotic Consumption on Gastrointestinal Symptoms among Adults Aged 30-60 Attending a Private Nutrition and Diet Center in Trabzon

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Abstract
Objective: *Probiotics are significant nutritional components known for their health benefits. This study aims to assess the impact of probiotic food or supplement consumption on gastrointestinal symptoms among adults aged 30-60.*
Methods: *The research was conducted at a private nutrition and diet center in Trabzon, involving 280 adults aged 30-60. Participants were surveyed on sociodemographic characteristics, probiotic knowledge, consumption patterns, and gastrointestinal symptoms using a rating scale. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 22.0 for Windows.*
Findings: *The study found that 59.3% of the participants were aware of what probiotics are, and 55.7% reported consuming probiotic foods or supplements. A significant percentage of participants cited healthcare professionals, such as doctors or dietitians, as both their source of information on probiotics and their reason for consumption. The most commonly consumed probiotic food was identified as pickles, with a frequency of once daily.*
Conclusion: *The level of awareness and consumption of probiotic foods or supplements among adults is found to be approximately equal. Attention to recommendations from doctors or dietitians as sources of information and reasons for consumption is prevalent. The lack of knowledge about probiotics and the high cost of such products appear to reduce their consumption. Therefore, public awareness through mass communication and encouragement of product usage are recommended.*
Keywords: Probiotics, Nutrition, Health, Gastrointestinal Symptoms

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I. INTRODUCTION

Probiotics, derived from the Latin "***pro***" and Greek "***βιοσ***" meaning "for life," were introduced in 1953 by German scientist Werner Kollath to denote "active substances essential for the healthy development of life." The foundation of modern probiotics research is attributed to the work of Elie Metchnikoff, a future Nobel laureate scientist at the Pasteur Institute in Paris in the early 1900s (Gasbarrini et al., 2016). A probiotic must remain viable, rapidly colonize, positively affect host health without producing toxic effects, resist stomach and bile enzymes, and possess a high capability to adhere to the mucous layer (Khare et al., 2018). Popular probiotics include strains of *Lactobacillus, Bifidobacteria, and Saccharomyces* boulardii (yeast) (Chieng and Pan, 2022). Probiotics are classified by genus (Lactobacillus), species (acidophilus), and strain (NCFM), exhibiting varied effects based on strain codes. For instance, while the E. coli strain 0157:H7 can cause harmful effects leading to hemorrhagic diarrhea, kidney failure, and potentially death, the *E. coli strain Nissle 1917* has been shown to offer beneficial effects in improving conditions such as inflammatory bowel diseases and irritable bowel syndrome. The efficacy of probiotics is measured in colony-forming units (CFU) and varies according to genus, species, strain, and the specific condition being addressed (Parker et al., 2018).

Probiotics must be deemed safe for both human and animal health. It is crucial that they possess the Generally Recognized as Safe (GRAS) status as defined by the United States Food and Drug Administration (FDA) (Markowiak and Ślizewska, 2017). Although the most comprehensive systematic reviews to date indicate that evidence from randomized trials does not suggest an increased risk, many publications still raise concerns regarding the safety of probiotics. Among the few reported adverse effects, one case involved the development of sepsis in infants with short bowel syndrome, while another case reported an unexplained increase in mortality among individuals with acute pancreatitis who were administered a probiotic mixture (Whelan and Quigley, 2013).

Probiotics reduce intestinal permeability by secreting mucus when gut permeability is compromised (Halloren and Underwood, 2019). They must adhere to the intestinal mucosa to colonize and activate the

immune system. Through the molecules they secrete, probiotics eliminate harmful microorganisms. By undergoing fermentation, they produce short-chain fatty acids. It has been determined that probiotics interact with immune cells to exert a therapeutic effect on conditions such as antibiotic-associated diarrhea, allergies, acute infectious diarrhea, and irritable bowel syndrome (Bajaj et al., 2021).

A systematic review and meta-analysis of 14 randomized controlled trials involving approximately 1,182 participants have demonstrated that probiotics improve stool frequency and consistency while reducing intestinal transit time in adults with constipation. The study identified strains of B. lactis as the primary source of benefit, whereas the L. casei Shirota strain did not show any advantage (Dimidi et al., 2017). In the meta-analysis of 8 clinical trials with 1,163 patients, formulations containing Lactobacillus species were found to eradicate Helicobacter pylori (Sharifi-Rad et al., 2020). Another study reported that L. reuteri, used in conjunction with a stomach protector but without antibiotic treatment, showed a 12.5% improvement rate in treating Helicobacter pylori infection (Ji and Yang, 2020). The first systematic review of randomized trials investigating the use of probiotics in the management of IBS was conducted in 2009 by Brenner et al. It revealed that the strain Bifidobacterium infantis (35,624) was effective compared to placebo. In one study, a group of IBS patients received a daily 400 ml fruity drink containing 5 x 107 CFU/ml Lb plantarum 299v, resulting in reduced complaints of pain and gas compared to the placebo group (Seddik et al., 2017). In a placebo-controlled, randomized double-blind study on patients with ulcerative colitis, the Bifidobacterium longum 536 strain was tested, showing a decrease in the disease index with no positive effect observed in the placebo group (Compare et al., 2022). Most randomized controlled trials on Crohn's disease have involved patients in remission, with no significant results reported regarding the improvement of the condition through probiotic use (Domingo, 2017).

The World Gastroenterology Organisation guidelines highlight the use of probiotics L. rhamnosus GG and S. boulardii CNCM I-745 for the treatment of antibiotic-associated illnesses (Chieng and Pan, 2022). A Cochrane review, including 63 randomized controlled trials (RCTs) and quasi-RCTs, demonstrated that probiotics effectively reduce the duration and frequency of diarrhea in 8,014 infants, children, and adults with acute infectious diarrhea (Wilkins and Sequoia, 2017). The European Food Safety Authority (EFSA) concluded that the consumption of live yogurt cultures containing L. delbrueckii subsp. bulgaricus and S. thermophilus improves digestion in individuals with lactose intolerance, based on 14 intervention studies in humans (Valdovinos et al., 2017). Clinical trials in humans have reported that administration of the Lactobacillus casei probiotic in individuals with hypertension resulted in decreased systolic/diastolic blood pressure and heart rate (Pavlidou et al., 2022). In two randomized, placebo-controlled, double-blind, parallel-arm, multicentric studies, the consumption of yogurt and L. Reuteri NCIMB 30242 significantly reduced low-density lipoprotein cholesterol and total cholesterol levels compared to placebo (DiRienzo, 2014).

II. MATERIALS AND METHODS

This study was conducted on a voluntary basis with 280 adult participants aged 30-60 who visited a private nutrition and diet center in Trabzon. Individuals were included in the study based on their probiotic food or supplement consumption status. Data were collected through face-to-face interviews. Participants were administered a questionnaire consisting of 21 questions measuring sociodemographic characteristics, probiotic knowledge, and consumption levels, along with a gastrointestinal symptom rating scale.

The Gastrointestinal Symptom Rating Scale (GSRS), developed by Revicki et al. (1998) and validated in Turkish by Turan et al. (2017), queries how individuals have felt about their gastrointestinal problems over the past week. The scale comprises 15 items and is divided into five subdimensions: 1, 4, and 5 (Abdominal Pain: abdominal pain, hunger pains, and nausea); 2 and 3 (Reflux: heartburn and acid regurgitation); 6 to 9 (Indigestion: borborygmus, abdominal bloating, belching, and increased gas); 11, 12, and 14 (Diarrhea: diarrhea, loose stool, and urgent need for defecation); and 10, 13, and 15 (Constipation: constipation, hard stools, and incomplete evacuation) (Revicki et al., 1998). Items on the scale are rated on a Likert-type scale ranging from "no discomfort" to "very severe discomfort." Higher scores on the scale indicate more severe symptoms (Revicki et al., 1998; Turan et al., 2017).

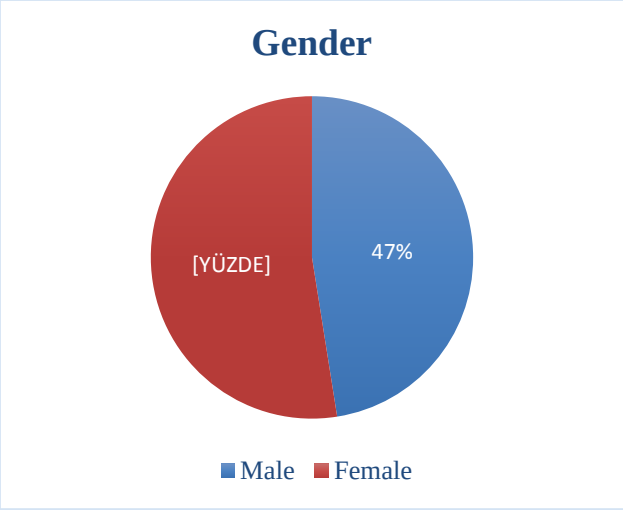
All statistical analyses of the data collected from the study were performed using SPSS software.

Ethical Statement: The study commenced after receiving ethical approval from the Istanbul Aydın University Clinical Research Ethics Committee on 26.07.2023, decision number 2023/79.

III. FINDINGS

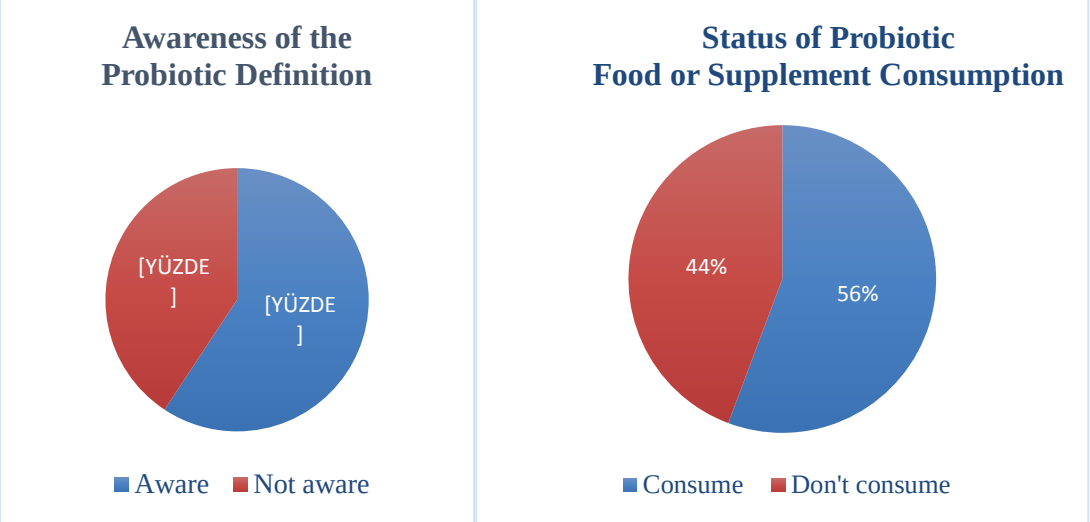
The gender distribution of the participants is presented in Graph 1.

Graph 1. Distribution of Participants by Gender (%)



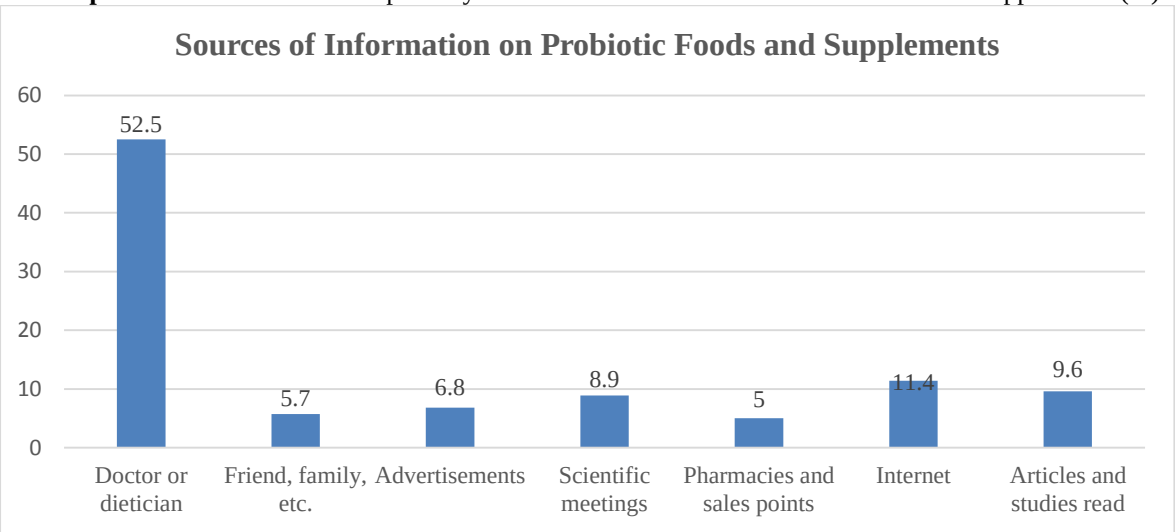
The distribution of participants based on their knowledge of the definition of probiotics and their consumption status is illustrated in Graph 2.

Graph 2. Distribution of Participants by Their Knowledge of Probiotics and Consumption Status (%)



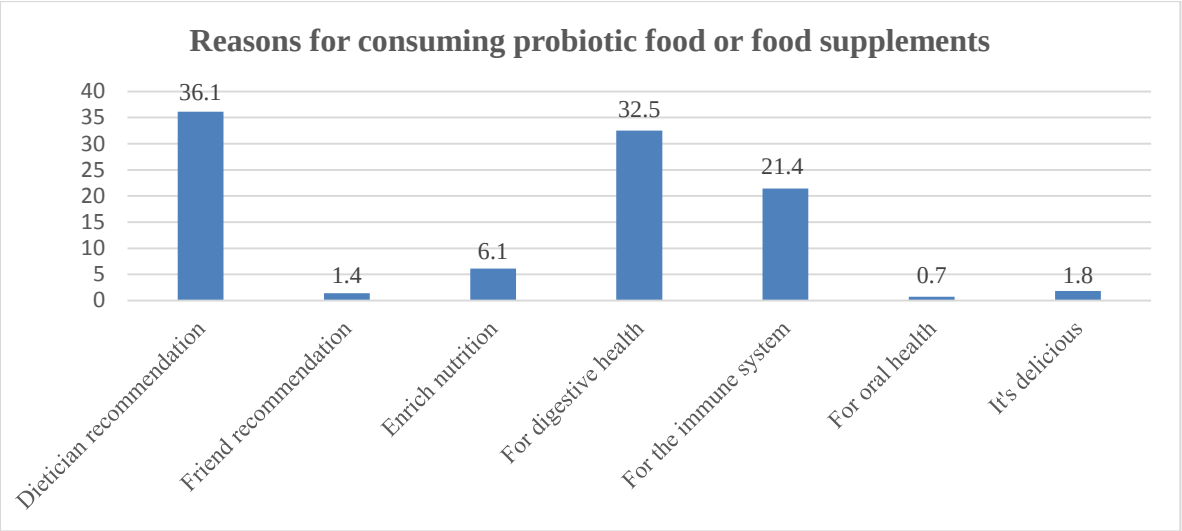
Graph 3 shows the distribution of participants according to their sources of information on probiotic foods or supplements.

Graph 3. Distribution of Participants by Sources of Information on Probiotic Foods or Supplements (%)



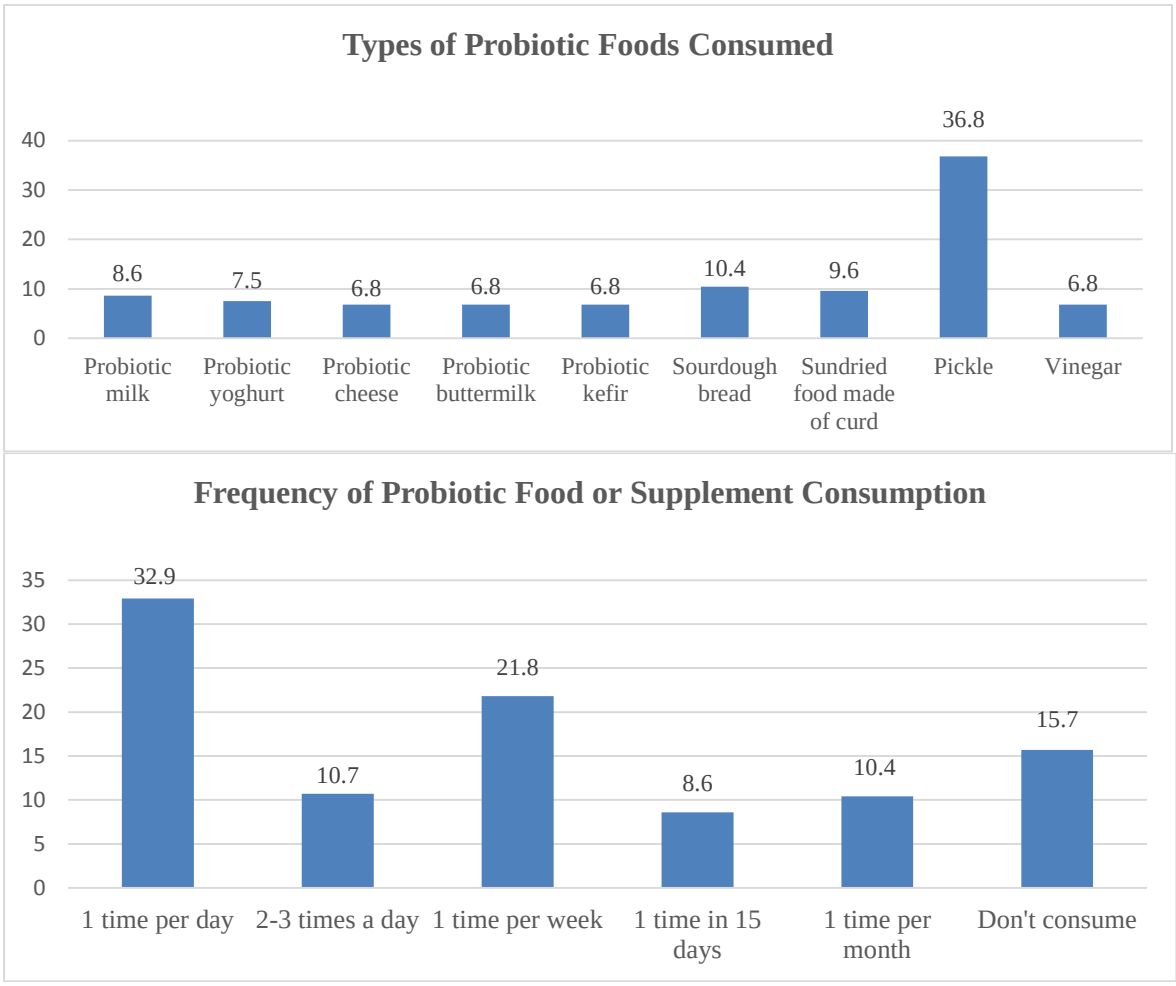
The distribution of participants by their reasons for consuming probiotic foods and supplements is given in Graph 4.

Graph 4. Distribution of Participants by Reasons for Consuming Probiotic Foods and Supplements (%)



Graph 5 depicts the distribution of participants by the types of probiotic foods consumed and their frequency of consumption.

Graph 5. Distribution of Participants by Types of Probiotic Foods Consumed and Consumption Frequency (%)



The distribution of participants' responses regarding the health problems alleviated by consuming probiotic foods or supplements is shown in Graph 6.

Graph 6. Distribution of Participants by Health Problems Alleviated by Probiotic Foods or Supplements (%)

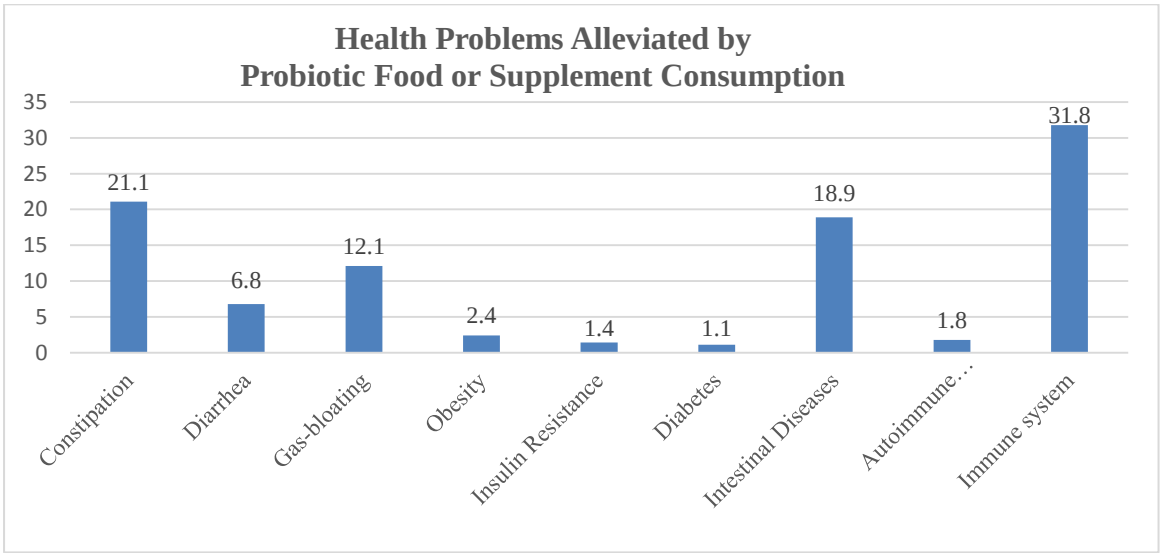


Table 1: Distribution of Participants based on their Probiotic Food or Supplement Usage and the Conditions for which They are Used

The conditions under which probiotic foods or supplements are used	Conditions for Using Probiotic Foods or Supplements and Usage Status			
	Yes		No	
	n	%	n	%
Always	54	91,5	5	8,5
When feeling gastrointestinal discomfort	25	64,1	14	35,9
When experiencing constipation issues	26	68,4	12	31,6
When dietary habits are disrupted	25	83,3	5	16,7
After antibiotic treatment	11	73,3	4	26,7
Do not use	3	3,61	80	96,39
Other	11	69	5	31

Upon examining the relationship between the usage status of probiotic foods or supplements and the conditions under which they are used, it was found that 91.5% of probiotic users always use them, 64.1% use them when feeling gastrointestinal discomfort, 68.4% when experiencing constipation issues, 83.3% when dietary habits are disrupted, and 73.3% after antibiotic treatment. There is a statistically significant difference between the usage status of probiotic foods or supplements and the conditions under which they are used ($p<0.05$).

IV. DISCUSSION

The most scientifically accepted definition of probiotics, as recognized by institutions such as the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO), is "live microorganisms that, when administered in adequate amounts, confer a health benefit on the host." Based on data from studies in this field, it is arguable that probiotics can provide health benefits in the improvement of conditions such as inflammatory bowel disease, diarrhea, irritable bowel syndrome, eradication of Helicobacter pylori, allergic diseases (e.g., atopic dermatitis), obesity, and insulin resistance (Maftei et al., 2024).

In a study conducted in Turkey with 150 postmenopausal women aged 50 and above, it was found that 66.7% of the women were aware of the concept of probiotics (Küçük & Yıbar, 2021). In contrast, our study found that 59.3% of participants were aware of the term 'probiotic,' while 40.7% were not. Zeren's thesis reported that 66.4% of participants consumed probiotic foods (Zeren, 2020). Another study found that 82.4% of participants consumed probiotic foods (Zemzemoğlu et al., 2019). However, our study concluded that 55.7% of participants consumed probiotic foods or supplements, while 44.3% did not.

In a study conducted in Turkey among 110 adults aged 18-45, when asked about the source from which they heard about probiotics, 21.6% mentioned professionals (dietitians/doctors), 27% cited family-friends-acquaintances, 32.4% pointed to advertisements (newspapers/magazines), 9.5% referred to conferences-scientific meetings, and 9.5% identified pharmacies-sales points as their sources (Kağan et al., 2019). In Cevahir's thesis, 86% of participants stated they learned about probiotics from articles and studies they read, 79.4% from scientific meetings, 24.6% from social media, and 4.7% mentioned public awareness campaigns as their source (Cevahir, 2020). Our study found that participants learned about probiotics from experts (doctors, dietitians) at a rate of 52.5%, friends, family, acquaintances at 5.7%, advertisements at 6.8%, education, conferences, scientific meetings at 8.9%, pharmacies at 5%, the internet at 11.4%, and reading articles and studies at 9.6%.

A study found that 73.8% of participants consumed probiotic foods because they are beneficial to the digestive system (Horasan, 2021). In Öztürk's thesis, it was observed that 37.5% of participants consumed probiotics on recommendation, 87.5% reported seeing benefits, and 50% consumed them due to digestive system issues (Öztürk, 2018). In this study, consumption based on dietitian or doctor recommendations was 36.1%, due to recommendations from relatives was 1.4%, because of a poor diet in terms of probiotics was 6.1%, for digestive system benefits was 32.5%, and for immune system benefits was 21%.

In Fındık's thesis examining the frequency of probiotic consumption among participants, 46.5% consumed probiotics once a day, 28.6% 2-3 times a day, 10.2% once a week, 3.5% 1-3 times a month, and 11.2% rarely consumed them (Fındık, 2019). A study in Turkey found that participants consumed probiotics at a rate of 41% once a week (Yücel Şengün, 2019). Our study concluded that 32.9% of participants consumed probiotics once a day, 10.7% 2-3 times a day, 21.8% once a week, 8.6% once every 15 days, and 10.4% once a month.

In a study conducted in Turkey, participants reported consuming kefir (88%), pickles (60%), boza (52%), vinegar (20%), and kumis (20%) (Özgül, 2020). Another study identified the most frequently consumed probiotic products as cheese, yogurt, buttermilk, apple vinegar, and cucumber/cabbage pickles, while probiotic supplements, boza, and kombucha tea were among the least consumed (Çelik et al., 2022). In our study, we found that 8.6% of participants consumed probiotic milk, 7.5% probiotic yogurt, 10.4% sourdough bread, 9.6% sundried food made of curd, tomato and flour, 36.8% pickles, and 6.8% vinegar.

When examining the health problems for which participants believe probiotics are beneficial, 70.21% mentioned constipation, 19.15% diarrhea, 9.93% lactose intolerance, 24.82% obesity, 3.55% cancer, 1.42% Helicobacter pylori infection, 10.64% high cholesterol, 4.96% allergic diseases and skin conditions, and 9.22% inflammatory bowel diseases (Aydın et al., 2024). Our study found that participants reported benefits for constipation (21.1%), diarrhea (6.8%), gas-bloating (12.1%), obesity (2.5%), bowel diseases (18.9%), and the immune system (31.8%). There is a need for more comprehensive studies on the societal awareness level and consumption quantities of probiotic foods and supplements, highlighting the need for more qualitative research in this area.

V. CONCLUSIONS AND RECOMMENDATIONS

Despite increasing studies on the beneficial effects of probiotics on the gastrointestinal system, immune system, obesity, diabetes, hypertension, hypercholesterolemia, and overall quality of life, about half of the participants were found to consume probiotic products. More than half of the survey respondents were aware of the term 'probiotic.' The most common sources of probiotic information were identified as doctors or dietitians, with 'always' and 'when experiencing gastrointestinal discomfort' being the most frequent times of consumption. Pickles and sourdough bread were identified as the most commonly consumed probiotic foods, primarily consumed once a day. The use of probiotic foods or supplements is predominantly motivated by the belief in their benefits for the immune system, with constipation and bowel diseases also considered significant reasons for consumption.

Adequate and balanced nutrition is fundamental to health, and a healthy individual constitutes a healthy society. Lack of knowledge about probiotics and the high cost of products limit their consumption. Probiotic food producers could encourage more consumption by clearly labeling the health benefits on products rather than focusing on scientific claims. Companies could increase the variety and availability of probiotic foods considering consumer needs. Public awareness should be enhanced through mass media such as television and the internet, encouraging the use of products. During consumption, supplement products supported by scientific studies with high levels of evidence should be preferred.

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