T.C

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF NUTRITION AND DIETETICS

INVESTIGATION OF THE RELATIONSHIP BETWEEN INDIVIDUALS' PROBIOTIC AND PREBIOTIC FOOD CONSUMPTION FREQUENCY AND BODY MASS INDEX

MASTER THESIS

GAMZE FINDIK

Istanbul, 2020

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SUPERVISOR

Dr. Lecturer Member of Hülya DEMİR

İstanbul, 2020

APPROVAL

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Director of Institute of Health Sciences

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

Tarih: 10/12/2020

İmza

Gamze Fındık

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Dyt. Gamze FINDIK

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LIST OF SYMBOLS AND ABBREVIATIONS

AUC	Area Under Curve
BMI	Body Mass Index
CRP	C-reactive Protein
FAO	Food and Agriculture Organization
FBG	Fasting Blood Glucose
FOS	Fructo-oligosaccharides
GIP	Gastric Inhibitor Polypeptide
GLP-1	Glucagon-like Peptide-1
GPR41	G-Protein-Coupled Receptor 43
GPR43	G-Protein-Coupled Receptor 43
HbA1c	Hemoglobin A1c
HDL	High Density Lipoprotein
LDL	Low Density Lipoprotein
LPS	Lipopolysaccharides
LMCT	Ligand Metal Charge Transfer
NCSS	Number Cruncher Statistical System
NHANES	National Health and Nutrition Examination Survey
OGTT	Oral Glucose Tolerance Test
PYY	Peptide YY
SCFA	Short Chain Fatty Acid
TC	Total Cholestrol
T2D	Type 2 Diabetes
TG	Triglyceride
TGR5	The Bile Acid Membrane Receptor5
WHO	World Health Organization

ABSTRACT

Fındık, G. (2020). Investigation of the Relationship Between Individuals' Probiotic and Prebiotic Food Consumption Frequency and Body Mass Index. Yeditepe University Institute of Health Sciences, Department of Nutrition and Dietetics, Master of Science Thesis, Istanbul.

This study was conducted to examine the relationship between the consumption frequency of foods known to have probiotic and prebiotic effects and body mass indexes. We enrolled 225 women and 77 men, a total of 302 participants aged between 18-65 years. Patients with diagnosed cancer, Type 2 Diabetes and complications with one or more of the gastrointestinal system diseases, individuals who were vegan or vegetarian in the last 1 year, those who followed an elimination diet, pregnant or breastfeeding mothers, lactose and/or gluten intolerant were excluded from the study. A questionnaire including socio-demographic characteristics and health information was applied to the participants. Anthropometric measurements were taken by measuring height and weight, and BMIs were calculated. To determine the probiotic and prebiotic food consumption frequencies of individuals, we adapted the food frequency questionnaire (FFQ) prepared by the National Health and Nutrition Examination Survey (NHANES) to the study and applied a questionnaire consisting of 34 items to the participants using one-on-one interview technique. The survey consisted of a 5-Point Likert scale with options "I do not consume," "2-3 times a month or less," "3-4 times a week," "once every day" and "2-3 times every day" for every food. We found that according to the BMIs of participants, 26 (8.6%) were underweight, 174 (57.6%) were normal, 80 (26.5%) overweight and 22 (7.3%) were obese. Accordingly, when we examined the relationship between the consumption frequency of probiotic and prebiotic foods and BMI values of the participants; we found a statistically significant difference ($p <0.05$) between the BMI values and the consumption rates of cereal ($p=0.015$,) pickled cabbage or pickled cucumber ($p=0.045$) and red wine ($p=0.015$.) When we examined the relationship between the consumption frequency of probiotic and prebiotic foods and the BMI values according to the participants gender, we found that women consumed more raw green leafy vegetables ($p=0.002$), pickled cabbage and/or pickled cucumbers ($p=0.034$), and kefir ($p=0.013$) and we found statistically significant difference ($p <0.05$). We found men consumed more white meat varieties ($p=0.025$), fermented sausage ($o=0.025$), dried meat and meat products ($p=0.001$) and beer ($p=0.001$) than women and we found statistically significant difference ($p>0.05$). We found no significant correlation between consumption frequency of other foods and BMI. More studies on humans are needed to investigate the effects of probiotic and prebiotic foods on weight control. Increasing functional food varieties and making food with probiotic and prebiotic effects more accessible can be used effectively in the nutrition treatment of obesity and obesity related diseases.

Key words: Body Mass Index, Probiotic, Prebiotic, Food Consumption Frequency

ÖZET

Fındık, G. (2020). Bireylerin Probiyotik ve Prebiyotik Besinleri Tüketim Sıklıkları ile Beden Kitle İndeksleri Arasındaki İlişkinin İncelenmesi. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Bölümü, Yüksek Lisans Tezi, İstanbul.

Bu çalışma bireylerin probiyotik ve prebiyotik etkisi olduğu bilinen besinleri tüketim sıklıkları ile beden kitle indeksleri arasında ilişkinin incelenmesi amacıyla yapılmıştır. Çalışma 18-65 yaş arası 225 kadın, 7 erkek toplam 302 birey ile gerçekleştirilmiştir. Tanı konmuş kanser, Tip 2 Diyabet ve gastrointestinal sistem hastalıklarından bir ve daha fazlasına sahip komplikasyon gelişmiş hastalar, son 1 yıl içerisinde vegan, vejeteryan beslenen bireyler, eliminasyon diyeti uygulayanlar, gebeler veya emziren anneler, laktoz ve/veya gluten intoleransı olanlar çalışma dışı bırakılmıştır. Bireylere sosyo-demografik özelliklerini ve sağık bilgilerini içeren anket formu uygulanmıştır. Boy ve ağırlıkları ölçülerek antropometrik ölç ümleri alınmıştır ve BKİ'leri hesaplanmıştır. Bireylerin probiyotik ve prebiyotik besin tüketim sıklıklarını belirlemek için National Health and Nutrition Examination Survey (NHANES) tarafından hazırlanan tüketim sıklıkları anketi (FFQ) çalışmaya uyarlanarak 34 maddeden oluşan bir anket araştırmacı tarafından katılımcılara birebir görüşme tekniği ile uygulanmıştır. Ankette her besin için tüketmiyorum, ayda 2-3 kez veya daha az, haftada 3-4 kez, günde 1 kez ve günde 2-3 kez seçeneklerini içeren 5'li likert ölçeği kullanılmıştır. Araştırmaya katılan 302 bireyin BKİ değerlerine göre 26'sının (%8.6) zayıf, 174'ünün (%57.6) normal, 80'inin (26.5) fazla kilolu ve 22'sinin (%7.3) obez olduğu belirlenmiştir. Sonuç olarak; Bireylerin cinsiyetlerine göre probiyotik ve prebiyotik besinleri tüketim sıklıkları ile BKİ değerleri arasındaki ilişki incelendiğinde; kadınların çiğ yeşil yapraklı sebzeler (p=0.002), lahana veya salatalık turşusu (p=0.034) ve kefir (p=0.013) tüketimleri erkeklere oranla daha fazladır ve istatistiksel olarak anlamlı farklılık saptanmıştır (p <0.05). Bireylerin cinsiyetlerine göre probiyotik ve prebiyotik besinleri tüketim sıklıkları ile BKİ değerleri arasındaki ilişki incelendiğinde; kadınların çiğ yeşil yapraklı sebzeler (p=0.002), lahana veya salatalık turşusu (p=0.034) ve kefir (p=0.013) tüketimleri erkeklere oranla daha fazladır ve istatistiksel olarak anlamlı farklılık saptanmıştır (p <0.05). Erkeklerin ise beyaz et çeşitleri (p=0.025), fermente sucuk (p=0.025), kurutulmuş et ve et ürünleri (p= p=0.001) ve bira (p=0.001) tüketimleri kadın bireylere oranla daha fazladır ve istatistiksel olarak anlamlı farklılık saptanmıştır (p <0.05). Diğer besinlerin tüketim sıklıkları ile BKİ

arasında anlamlı bir korelasyon bulunamamıştır. Probiyotik ve prebiyotik besinlerin ağırlık denetimi üzerine etkilerini araştırmak için insanlar üzerinde daha fazla çalışma yapılması gerekmektedir. Fonksiyonel besin çeşitlerinin arttırılması, probiyotik ve prebiyotik etkili besinlerin daha ulaşılabilir hale getirilmesi, başta obezite olmak üzere diğer tüm obeziteye bağlı hastalıkların beslenme tedavisinde etkili olarak kullanılabilir.

Anahtar kelimeler: Beden kitle indeksi, probiyotik, prebiyotik, besin tüketim sıklığı

1. INTRODUCTION AND PURPOSE

1.1. Human Gut Microbiota and Microbiota Health

The human gut microbiota contains a crowded and heterogeneous microbial ecosystem of at least 10 trillion to 100 trillion microbial cells belonging to more than 2,000 species, weighing a total of 1.5 kilograms. While older studies have shown that there are at least 800 types of bacteria on average in our digestive tract, recent data suggest that the actual figure may actually be as much as 40,000 (1). There is a symbiotic relationship between the human (host) that hosts this variety of bacteria and the intestinal microbiota (guest). While human provides the nutrients necessary for its survival and proliferation to the microbiota that it hosts, guest bacteria in the microbiota take on multiple important tasks of improving human health, such as protecting the host from enteropathogenic organisms, regulate energy metabolism, extracting indigestible dietary components, modulating the immune system and synthesizing essential vitamins (2).

The composition of the microbiota is influenced by many endogenous and exogenous factors such as genetics, physiology of the home host (age, diseases, stress conditions) and environmental factors (lifestyle, drug use, pesticides, contaminants, diet) (3). Since the human gut microbiota depends on the metabolism of dietary contents, diet is one of the most researched and decisive factors for understanding the microbiota and its effects on health. Among these dietary components, consumption of prebiotics is known to positively affect the composition of gut microbiota and metabolic functions at the level of the small intestine and colon (4). Probiotics are defined by the FAO and WHO as "living microorganisms that, when administered in sufficient quantities, can benefit the health of the host” (5). Some studies of probiotic Lactobacillus and Bifidobacterium that have been done on animals and humans have been reported to have beneficial health-beneficial effects on many health issues associated with metabolic syndrome such as weight loss, reduced visceral fat, improved glucose tolerance (6). However, some studies have reported that the application of probiotics alone may not show the beneficial effects on health as it alone may not be able to change the gut microbiota, and it has been noted that prebiotics taken together with probiotics may be more beneficial in improving microbiota composition (6). Today, prebiotics are defined as "an indigestible food component that can improve the health of the host by selectively stimulating the growth and/or activity of one or more bacteria in the colon" (7). Consumption of prebiotic-rich diets increases microbial diversity by affecting both microbial metabolic activity and the formation of fermentative end products such as short-chain fatty acids (SCFAs), branched fatty acids, organic acids, peptides, ammonia, amines, phenolic compounds and gases (8-9).

One of the strategies used in the control and treatment of metabolic diseases is the prebiotic or probiotic consumption of beneficial bacteria using a single type of gut microbiota. For example, the bacterium Akkermansia muciniphila degrades mucin and can be used as a prebiotic to reduce obesity and diabetes risks. This bacterium is more found in the gut microbiota of healthy individuals than those who are obese or diabetic (10).

Body Mass Index (BMI) is a method used to define obesity when it is not practically possible to directly measure the amount of body fat. BMI is achieved by dividing the body weight in kilograms by the square of the body height in meters and its unit is kg/m2. BMI between 25-29.9 kg/m2 is defined overweight, BMI ≥ 30 kg/m2 is obese, BMI ≥ 40 kg/m2 is morbidly obese, BMI ≥ 50 kg/m2 is defined as super obese (11). BMI benefits in population-based studies because it is used and accepted to identify health problems by creating specific categories according to body mass, but it is an insufficient scale to inform us about the body fat percentage of the individual. Skinfold caliper, which is a method used to determine fat ratio by measuring skin fold thickness, was not preferred in this study because it feels uncomfortable in some individuals.

There have been many studies on human and animal subjects about the effect of probiotics and prebiotics on body weight and diseases, but in the vast majority of these studies probiotics and prebiotics are given as food supplements or preparates. The main purpose of this study and the contribution it is intended to make to the literature is to investigate whether foods known to have a probiotic and prebiotic effect have a significant relationship between consumption frequency in daily life and body mass indexes of individuals, and as a result bring a new perspective to the dietary approaches used in the treatment of obesity and metabolic diseases related to obesity.

1.2. Purpose of the Research

This study aims to examine if there is a significant relationship between the consumption frequency of foods known to have probiotic and prebiotic effects and body mass indexes. Intestinal microbiota and metabolites associated with the microbiota play an important role in the control of glucose and energy homeostasis. Studies on animals also support increasing the amount of studies in this topic by clearly showing that it plays a key role in food absorption of intestinal microbiota and metabolism control, while at the same time clearly showing that it affects the hormonal status, adipogenesis, intestinal barrier integrity, energy metabolism of the host (12). The basis of this study is that diet is an important factor in shaping gut microbiota and that the microbiota often responds to changes in the diet in as little as 1-2 days, changing the composition and function of the microbiota (13-14).

1.3. Research Hypotheses

The composition of human gut microbiota and the production of microbial metabolites vary between individuals and throughout life. It can also change the composition and functionality of gut microbiota in endogenic and exogenic factors such as lifestyle conditions, disease, medications, stress and diet. One of the main reasons behind these changes is the decreases in the diversity of bacteria found in the microbiota, also known as dysbiosis, and imbalance in the microbiota as a result of changes in the abundance of microbial genes and functions. Apart from these, it causes changes in the composition and function of microbiota in the presence of diseases such as inflammatory bowel disease, autism, colorectal cancer (15). Dietary modulation has created an opportunity for the use of functional foods as drug alternatives for improving human intestinal health and treating aforementioned diseases due to the presence of side effects such as diarrhea from antibiotics and similar drugs used in the treatment of diseases (16). The term functional food includes dietary fiber, prebiotics and probiotics, which are beneficial effects of microbiota composition and metabolism (17). Many of the health effects of prebiotics and dietary fibers are based on the production of metabolites from carbohydrate fermentation (18). Therefore, in societies that consume high-fat Western diets poor in terms of dietary fiber, it has been reported that in the long term, a number of intestinal disease incidences due to the imbalance of the microbial environment have increased (19). In one of the studies supporting this hypothesis, it was reported that children from Florence who grew up feeding on a typical high-fat, low-fiber Western-type diet had significantly less diversity in the fecal microbiota than those of children who were fed herbal polysaccharides and a pulp-rich diet in a village in Burkina Faso, Africa (20). Another study examining the effects of probiotic consumption on obesity and microbiota health found that when 87 overweight individuals were given fermented milk containing 200 g of probiotics (Lactobacillus gasseri SBT2055) per day for 12 weeks, their body weight, abdominal and subcutaneous fat decreased while none of these parameters changed for the control group that were given probiotic-free fermented milk (21). In another study, it was reported that giving Lactobacillus rhamnosus to mothers on their last month of pregnancy and to infants for 6 months after birth prevented the baby from gaining extra weight in the period until the age of 10 (22).

2. GENERAL INFORMATION

2.1. Human Gut Microbiota and Factors Affecting the Microbiota

Today, 16S ribosomal DNA method can detect dominant bacterial phyla in the gut microbiota. Six bacterial phyla dominate the gut microbiota of healthy adult individuals. These are; Firmicutes (Clostridium, Enterococcus, Lactobacillus species), Bacteroidetes (Bacteroides species), Proteobacteria, Actinobacteria, Fusobacteria, Verrucomicrobia. However, in this microbial diversity, Firmicutes and Bacteroidetes phyla make up approximately 90% of all intestinal microbial cells, while the proportion of other phylum representatives varies between 2% and 10%. The number and rate of microbiota presence of Firmicutes (Gram+) and Bacteroidetes (Gram-) bacteria is a pioneer in affecting gut health, so it gives us a lot of information about the overall health of the host (23,24,25).

The intestinal microbiota of the fetus is formed at the time of birth by bacteria from the mother and the environment. The endogenous and exogenous factors the baby is exposed to during and after birth with even the way baby is born (vaginal, caesarean section) affect the composition of bacteria that will colonize the microbiota (26-27). For this reason, even if there is no difference in the dominant phyla, microbial diversity is reported to vary from person to person in the few months after birth. For example, in infants' intestinal microbiota, bifidobacteria is generally dominant at the beginning, while enterobacteria is more prevalent in children between the ages of 1 and 7 (25). There is no noticeable difference in bacterial diversity in children and adolescent microbiota between the ages of 2 and 18 (28). In a recent study comparing adolescent and adult microbiota compositions, it was observed that the types of Bifidobacterium and Clostridium were statistically significantly more found in adolescent microbiota samples than adult intestinal microbiota samples. When individuals reached adulthood, it was seen that the intestinal microbiota became relatively stable and microbial diversity among individuals decreased (29).

There are some factors and physical mechanisms that affect the growth and health of the microbiota in adulthood. Among the physical mechanisms are: Epithelial cells have rapid movement of epithelial cells from the intestinal crypt to villus, intestinal peristalsis, the formation of a thick layer of mucus that limits bacteria' access to the intestinal epithelium. In addition to these mechanisms, the immune system also has an important role to play in the selection of the gut microbiota (12). In addition, adult intestinal microflora is affected by various factors such as diet, aging, eating habits, geographical origin, lifestyle, regularly used drugs and antibiotic use (30).

2.2. Microbiota, Obesity and Metabolism Relationship

Of the more than 1,000 species of bacteria identified in the human gut microbial, home to a large and complex microbial community, 160 are found in almost every individual. This microbial diverse community also has a metabolic repertoire that provides liver and intestinal mucosa enzyme activities (31). The link between the regulation of fat stores in the gut microbiota, obesity and the development of diseases linked to obesity is explained by the mechanism of 'metabolic endotoxemia' (32). Intestinal microbiota plays an important role in changes in intestinal barrier function concerning obesity and Type 2 Diabetes (T2D). Obesity, diabetes and insulin resistance are linked to intestinal permeability, which causes abnormal translocation of the intestinal bacteria and components from intestinal lumen to blood and tissues. Lipopolysaccharide (LPS), a gram-negative bacterium, causes changes in the intestinal barrier as cell wall components increase in plasma level. Metallic endotoxemia is defined as an increase in plasma LPS levels and has been reported to trigger low-grade inflammation and metabolic disorders linked to insulin resistance, obesity and Type 2 Diabetes (T2D) (33-34). It can trigger chronic low-grade inflammation, which makes the host of abnormal intestinal microbiota composition particularly susceptible to systemic LPS exposure (24). In the first study examining the relationship between intestinal microbiota and metabolic diseases, it was reported that gut microbiota of the mice with excessive appetite and severe obesity with leptin deficiency had fewer Bacteroidetes and more Firmicutes than control group mice (35). This study provided the first evidence to show that microbiota compositions of thin and obese animals are different. A follow-up study to support this study found that obese individuals contained fewer Bacteroidetes and more Firmicutes in the microbial environment than the control group (36).

2.2.1. Effect of Short Chain Fatty Acids on Microbiota

One of the effect mechanisms of the microbiota on obesity and energy homeostasis is short-chain fatty acids (SCFAs). Monosaccharides and short-chain fatty acids (SCFAs) produced by fermentation of complex carbohydrates by bacteria found in the microbiota are one of the energy storage ways of host life (37). Acetate, propionate and butyrate, the three most found SCFA species in feces, contribute approximately 5%

to 10% of human energy sources and play different but important roles in the body (31,38).

Butyrate is considered to be the most important SCFA within these SCFAs for human health in terms of creating the main source of energy for colonocytes and also having potential anti-cancer activity (31). There is also evidence that butyrate can have beneficial effects on glucose and energy homeostasis by activating intestinal gluconeogenesis with cAMP-related mechanism. Propionate, another SCFA, is also an energy source for epithelial cells, but it is also transferred to the liver, where it also plays a role in gluconeogenesis. The conversion of propionate to glucose in the intestinal gluconeogenesis promotes direct energy homeostasis by reducing hepatic glucose production and ultimately reduces adiposity. (39). Acetate is the most found SCFA in the colon and is an important cofactor from the growth of other bacteria in the colon. Acetate is transported to peripheral tissues in the body and used in cholesterol metabolism and lipogenesis. Recent studies on mice have reported that acetate plays an important role in central appetite metabolism (40).

Apart from the use of short-chain fatty acids as energy substrates, it is also designed to be connected to G protein-coupled receptors (GPR41 and GPR43) that can contribute to the development of nutrient absorption and/or fat tissue mass (41). Acetate preferably activates GPR43 as in vitro, while butyrate has a strong effect on GPR41. Propionate is selective for both GPR41 and GPR43, and the energy regulatory effects of these two receptors depend on the microbiota (42, 43). Studies in mice with Gpr41 deficiency found that GPR41, which is activated by short-chain fatty acids, is responsible for the release of the hormone Peptide YY (PYY), also known as the satiety hormone, from the intestines. This peptide has an effect on reducing the rate at which nutrients pass through the intestine and increasing the absorption of all nutrients, mostly glucose (41). The activated GPR43 has been shown to cause increased adipogenesis through propionate and acetate (44). Metabolites such as SCFAs, bile acid and bioactive lipids found in the intestinal microbiota help regulate the hormone release of incretin by activating receptors such as GPR41, GPR43, GPR119 and bile acid receptor 5 (TGR5), which are expressed in enteroendocrine L cells. Activated enteroendocrine L cells secrete incretin hormone peptides that stimulate insulin release such as Glucagon-like peptide-1 (GLP-1), Glucagon-like peptide-2 (GLP-2) and gastric inhibitor polypeptide (GIP) and PYY, and these peptides also regulate blood sugar. The fact that metabolites found or synthesized in the gut microbiota cause improvements in glucose and energy homeostasis through various mechanisms, regulation of intestinal barrier function allows it to have a protective effect against metabolic disorders such as obesity and T2D (32,33,45,46)

2.3. Probiotics' Relationship with Microbiota and Obesity

Probiotics identify as living microorganisms that, when taken in sufficient amounts, are seen to positively affect the health of the host (47). Research shows that probiotics are effective agents for changing the composition of intestinal microbiota, and contributions of probiotic intake to treatment of intestinal diseases such as colitis, inflammatory bowel diseases, Crohn's disease and antibiotic-related diarrhea are also supported by new studies (48). Studies on the effects of probiotics on adiposity, body weight and nutrient consumption have been conducted on the interaction of probiotics with the gut microbiota and its potential to positively affect obesity through the regulation of energy homeostasis. In the gut microbiota of obese individuals, there was a higher group of bacteria populations belonging to the Firmicutes species that produced energy by converting dieted and indigestible polysaccharides into SCFAs compared to healthy individuals (49).

Species of bacteria known to be probiotics such as Lactobacilli and Bifidobacteria positively change the balance of the gut microbiota by increasing the number of bacteria that improve health for the better (50). Lactobacillus ferment, produced by wheat and barley flour's fermentation with multiple lactic acid bacteria, reduced body weight increase, perirenal and epididymal fat pads, total serum cholesterol and total triacylglycerol levels in animals fed on a high-fat diet (61). The effect of probiotics on colonization and intestinal microbiota members is quite specific (48). For this reason, methods of oral treatment of live bacterial strains (probiotics) that are subsequently included in the gut ecosystem are used to encourage specific changes in microbiota composition. One of the most commonly used probiotic species, lactobacillus, has more than 90 species and further study is needed on which of these sub-species can be effective in adiposity control. Therefore, it is not possible to say with certainty which types of bacteria are responsible for improving metabolism in obesity patients currently treated with probiotic or prebiotic preparates (12).

2.3.1. Probiotics' Effect on Human Health

Among a limited number of studies on the antiobesity effect of probiotics, a 10-year follow-up study reported that excessive weight gain in children was prevented in an intervention given L. rhamnosus GG ($1x10^{10}$ CFU) before and after birth (62). As a result of a series of studies conducted in healthy pregnant women, probiotic (L. rhamnosus GG and B. lactis) intervention and dietary counselling showed that blood glucose levels decreased (63), gestational diabetes mellitus and central abdominal adiposity frequency decreased (64,65), and colostrum adiponectin levels increased (66). A review of studies that show the application of different Lactobacilli strains on obese individuals reduce fat mass, risk of T2D and insulin resistance is shown in Table 2.1. Table 2.1 also summarizes several intervention studies examining the potential health impact of carbohydrates with prebiotic properties in patients that are overweight, obese or T2D (12).

Although there are literature and studies supporting the obesity preventive effects of probiotics, the underlying mechanisms of these effects are far from clear. The antiobesity effects of probiotics can be inherently multi-factor and therefore result in the regulation of general metabolism. However, in order to talk about antiobesity-effective products or foods, to control body weight and to use them for treatment purposes in various diseases, it is important to better understand the metabolic pathways involved in energy homeostasis.

2.3.2. Probiotic Foods and Fermented Products with Probiotic Effect Potential

In order for a food to be probiotic, probiotic microorganisms must be able to survive both as they pass through the digestive tract and have the capacity to multiply in the intestine. This also means that microorganisms must be resistant to stomach acid and bile acid in the intestines during digestion. Bacteria with these properties are two gram-positive bacteria and are mainly included in the genus Lactobacillus and Bifidobacterium (67, 68).

Some bacteria that are important for microbiota health are linked to acetobacteria that produce acetic acid associated with fermentation of fruits and vegetables, and Bacillus associated with fermentation of legumes. Yeast plays an important role in the food industry as it is able to produce enzymes that result in desirable biochemical reactions. It plays a role in the production of ethanol in wine and beer and in the fermentation of bread. Therefore, it is useful for the industrial development of probiotic products. Table 2.2 shows some foods known to have probiotic effects and by which types of bacteria they are produced (69). Probiotics traditionally add yogurt, kefir and other fermented dairy products and make them functional foods (74,75). Probiotics are commercially sold worldwide in the form of fermented foods and fermented dairy products, which constitute the main sources of probiotics in daily food consumption (76).

However, increasing health concerns such as lactose intolerance, milk protein allergy, cholesterol disease because of high levels of saturated fatty acids in milk-based foods cause probiotics to turn to non-dairy foods such as fermented grains, fruit and vegetable juices (77). Some non-dairy probiotic foods are shown in Table 2.3 (78). Grains can be considered probiotic foods because they do not have the disadvantages of fermented dairy products (95). Another benefit of consuming fermented grain-based foods is that it contains dietary fiber and can be a probiotic that can stimulate the growth of probiotic lactic acid bacteria with the presence of non-digestible carbohydrates such as oligosaccharides (96).

The increase and more accessible functional nutrient diversity with probiotics may make it possible to draw attention to the importance of nutrition by providing a different approach to the treatment of obesity and obesity-related diseases with daily food consumption and a correct dietary approach without the need for supplement and/or drug use in the improvement and development of microbiota in the future.

Table 2.1. Effects of probiotics or carbohydrates with prebiotic effect in overweight or T2D patients (12)

Microbiota	Work Order	Number of people (n)	Time	Applied Treatment	Results
Probiotic Applications					
Lactobacillus acidophilus NCFM [51]	Randomized double blind intervention	45 individuals with glucose intolerance and/or T2D	4 weeks	Probiotic (10^{10} CFU/day) or SiO2/lactose (placebo)	-Systemic inflammation via LPS in both groups -Probiotics prevented loss of insulin sensitivity observed in placebo group
Lactobacillus gasseri SBT2055[52]	Randomized, multi-centre, double blind, placebo controlled Intervention	BMI 24,2–37.0 kg / m2 and 87 individuals that are observed visceral fat gain	12 weeks	Fermented milk with probiotics (1011 CFU/day) or without probiotics (placebo)	Low body weight, BMI, waist and hip circumference, visceral and subcutaneous fat mass decrease compared to placebo group in probiotic group
Prebiotic (Non-Digestible Carbohydrates) Applications					
Arabinoxylan[*53]	Randomized cross-over intervention	15 individuals with T2D	5 weeks	Breads and buns containing 14% arabinoxylan (0% for placebo)	-Decreased fasting glycemia, glycemia and insulinemia after OGTT -No difference in blood lipid level, fat mass and blood pressure
Arabinoxylan[54-55]	Single blind, controlled, cross-over intervention	11 individuals with impaired glucose tolerance	6 weeks	Daily 15g arabinoxylan, bread and powder form or arabinoxylan-free isocaloric bread rolls (placebo)	-Decreased hunger and post-LMCT glycemia and triglycerides -Post-LMCT total ghrelin reduction No difference in levels of Leptin, adiponectin, insulin, resistin
Inulin-type fructans[**56]	Randomized, double blind, placebo controlled intervention	48 individuals who are overweight or obese	12 weeks	Daily 21g oligofructose or maltodextrin (placebo)	-Reduced body weight, calorie intake, GIP -No difference in fasting glucose, insulin, ghrelin, GLP - 1, PYY and leptin levels - After MTT: decreased glycemia, AUC for insulin, ghrelin, AUC for PYY, AUC for leptin, but no difference in GIP level or AUC for GLP - 1
Inulin-type fructans[57]	Randomized, double blind, cross overintervention	10 individuals with T2D	4 weeks	20 g short chain fructan or 20 g sucrose (placebo)	No difference in calorie intake, body weight, glucose levels, insulin, HDL, LDL and total cholesterol, triglycerides, apolipoprotein A1 and B, lipoprotein (a), hepatic glucose production, insulin-stimulated glucose metabolism
Inulin-type fructans[58]	Randomized double blind, cross-over placebo controlled intervention	7 overweight patients with non-alcoholic steatohepatitis	8 weeks	16 g oligofructose or maltodextrin per day (placebo)	-Decreased aspartate aminotransferase and fasting insulin levels -No difference in triglycerides, fasting blood sugar and cholesterol levels

*** Arabinoxylans are complex carbohydrates found in endosperm and aleurone layer and pericarp tissues of grains. It's fermentation is associated with the proliferation of Bifidobacteria and Lactobacilli (59).**
**** Inulin-type fructans are well-established prebiotics that can selectively stimulate the growth of bifidobacteria and, in some cases, Lactobacilli, which significantly alters the composition of the intestinal microbiota (60).**

Table 2.2. Foods with probiotic effect and producer bacteria (69)

Bacteriocin	Source Food	Producer Bacteria Type	The type of bacteria it affects
Bacteriocin ST8KF	Kefir	L.bacillus plantarum ST8KF	Lactobacillus casei, L. salivarius, L. curvatus and Listeria innocua[70]
Lactococcin 972	Cheese(Uncultured, from raw milk)	L.coccus lactis subsp. lactis Q1-2, Q1-6,	Lactobacillus sakei and L. lactis subsp. lactis some types of cremoris [71]
Lactococcin G	Cheese(Uncultured, from raw milk)	L.coccus lactis subsp. Cremoris 2A27	Lactobacillus sakei and L. lactis subsp. lactis and some types of cremoris[71]
Nisin A	Cheese(Uncultured, from raw milk)	Lactococcus lactis subsp. lactis	Staphylococcus aureus, Listeria innocua, L.bacillus sakei, L.bacillus plantarum, L. lactis subsp. lactis[71]
Nisin Z	Cheese (Uncultured, from raw milk)	Lactococcus lactis subsp. lactis 1AA17 and 2BB9	Staphylococcus aureus, Listeria innocua, Lactobacillus sakei, Lactobacillus plantarum, L. lactis subsp. lacti[71]
Bacteriocin MA23	Boza	Lactococcus lactis subsp. lactis MA23	Many grams of positive bacteria, as well as nisin, lacticin and lactococcin producing breeds[72]
Lactococcin BZ	Boza	Lactococcus lactis subsp. lactis BZ	Lactobacillus, Enterococcus, Leuconostocs, Listeria, Bacillus, Enterobacter, Escherichia, Rhodococcus, Salmonella[73]

Table 2.3. List of some non-dairy probiotic foods (78)

Category	Food
Vegetable and Fruit Based Products	Vegetable Juices[79]
	Tomato juice[80]
	Many dried fruits[81]
	Blueberry, pineapple and orange juice[82]
	Onion[83]
	Olive[84]
Soy Based	Soy milk[85]
	Soy yogurt[86]
	Soy-based foods[87]
Grain Based Products	Oat based products[88]
	Oat milk[89]
	Boza[90]
	Bread and bakery products[91]
Other	Meat products[92]
	Meat-based products[93]
	Sucuk[94]

2.4. Prebiotics and Their Effect on Human Health

The concept of prebiotics was first proposed in 1995 based on the observation that carbohydrates that cannot be digested after fermented by bacteria can lead to qualitative and selective changes in the composition of the intestinal microbiota, which have beneficial effects on the host's health (97). Today, prebiotics are defined as "an indigestible food component that can improve host health by selectively stimulating the growth and/or activity of one or more bacteria in the colon" (98). In order for a food to be defined as prebiotic and effective in the colon, it must have 3 criteria. These are; resisting the host organism’s processes of digestion, absorption and absorption, getting fermented by the microflora colonizing the gastrointestinal tract and selectively stimulating the growth and/or activity of one or more bacteria within the gastrointestinal tract (99). Prebiotics have possible positive effects on health such as improved lactose tolerance, protection from gastroenteritis (100), reduction of toxins (101), lowering cholesterol levels, vitamin synthesis, development of digestive and intestinal functions, regulation of immune system, increased mineral bioavailability (102). Dietary carbohydrates such as fibers are prebiotic candidates, but oligosaccharides, which cannot be digested in particular, are the most promising compounds for their ability to become prebiotic due to their metabolism. In particular, consumption of fructo-oligosaccharides (FOS) is known to stimulate bifidobacteria in the lower intestine (98). Breast milk, which contains oligosaccharides and has prebiotic features, contributes to the increase in the number of bifidobacteria, enabling the development of the neonatal gut microbiota (12). In adults, the number of Bifidobacteria (and most Firmicutes groups) is lower in individuals with obesity compared to normal individuals. (103). The number of these bacteria decreases in patients with T2D compared to non-diabetic patients (104). These findings show that Bifidobacteria plays a role in the development of obesity and obesity-related diseases. Diet fructans found in various fruits and vegetables and added to food products, are used as an energy substrate by bacteria that support its development in the intestine, such as Bifidobacterium spp. (105). A study showed a remarkable increase in the number of Bifidobacterium species when genetically or diet-related obese mice were supported with inulin-type fructan (106, 107). Another result of the study is that the number of Bifidobacteria is inversely proportional to fat mass, glucose intolerance and development of LPS levels (106). This positive contribution of prebiotics to metabolic markers by changing the composition of the microbiota is due to changes induced by

SCFAs (108). The effects of bacterial phyla dominant in the microbiota on obesity are given in Table 2.4 (33). Although not all dietary fibers have the same effect on the intestine, plant roots typically contain short chain (oligofructose) and long chain (polyfructose such as inulin) fructans (114). Sufficient fiber consumption, especially high viscosity plant-derived fibers such as glucomannan or inulin, has been shown to reduce serum triacylglycerol in humans (115). A review of the effects of prebiotics on the human body is shown in Table 2.5 (116).

Table 2.4. Effects of dominant phyla found in microbiota on obesity metabolism

Bacteria	Effects on The Body
Bacteroidetes /Firmicutes ratio ↓	Increases the amount of energy from nutrients[35-36]
Methanobrevibacter smithii ↓	Increase energy harvest (from intestines)[109]
Bacteroidetes /Firmicutes ratio ↑	Increases SCFA level[110]
Bacteroides (B.) cellulosilyticus ↓ B. vulgatus ↓ B. thetaiotaomicron ↓ B. caccae √ B. uniformis √	High level of spread in the intestinal microbiota[111]
Akkermansia muciniphila ^	Improves glucose homeostasis[112]
Bacteroides acidifacients ↓	Activates lipid oxidation [113]

Table 2.5. Prebiotic applications and their effects on the human body

Dietary Fiber	Time	Population: M/F	Work Order	Results
Oligofructose enriched inulin (8g/day)	16 weeks	42 volunteers 24 M / 18 F	Single-centre, double-blind, placebo controlled	Decreased body weight z-score, body fat percentage and serum interleukin 6 level[117]
Low calorie diet +10g inulin	12 weeks	59 female volunteers	Randomized controlled	Decreased triglycerides and improved micronutrient intake[118]
Galactooligosaccharide (5.5g)	12 weeks	45 volunteers 16M/ 29F	Double blind, randomized, placebo controlled, cross-over	Decrease in fasting insulin, TC, TG, CRP and calprotectin in feces[119]
Inulin (10g)	8 weeks	49 female volunteers	Randomized, three blind, controlled	Decreased FBG, Alc, malondialdehyde; Increased antioxidant defense[120]
Inulin (10g)	8 weeks	49 female volunteers	Randomized controlled	Decrease in FBS, HbA1c, total cholesterol, triglycerides, LDL-c, LDL-c/ HDL-c ratio and TC/HDL-c ratio, increasing HDL-c[121]
Oligofructose-enriched inulin (10g/day)	8 weeks	52 female volunteers	Double blind, randomized, controlled	Decreased fasting plasma glucose, glycosylated hemoglobin, interleukin-6, tumor necrosis factor-a and plasma lipopolysaccharide[122]

2.4.1. Prebiotic Foods

Prebiotics pass from the small intestine to the lower intestine and become accessible to probiotic bacteria without being used by other gut bacteria. Lactulose, galactooligosaccharides, fructooligosaccharides, inulins and hydrolysates, maltooligosaccharides and resistant starch are prebiotics normally used in the human diet. The main end components of carbohydrate metabolism are found in different sources such as acetic acid, propionic acid and butyric acid, which are short chain fatty acids used by the host organism as a source of energy and chicory, onion, garlic, asparagus, artichokes, leeks, bananas, tomatoes and many other plants (123). Inulin and inulin type fructans are known soluble dietary fibers. In addition to these fibers, dietary fibers containing several non-starch polysaccharides such as cellulose, dextrins, pectins, beta-glucans and lignin can adjust the time it takes nutrients to reach the intestines like inulin-type fructans and offer the same beneficial effects (124, 125). Various types and sources of prebiotics are summarized in Table 2.6 (17). In addition, there are studies on how red wine containing polyphenols and beer containing β-glucan may also show prebiotic effective benefits on microbiota (138, 139).

Table 2.6. Various types and sources of prebiotics

Prebiotic Type	Prebiotic Source
Fructooligosaccharides	Asparagus, sugar beet, garlic, chicory, onion, artichoke, wheat, honey, banana, barley, tomato and rye[126]
Isomaltulose	Honey, sugar cane juice[127]
Xylooligosaccharide	Bamboo sprouts, fruits, vegetables, milk, honey and wheat bran[128]
Galactooligosaccharides	Human milk and cow's milk[129]
Cyclodextrins	Water soluble glucans/ Beta-glucans (Mushrooms, dates, oats and whole grains)[130]
Raffinose oligosaccharides	Pulses, lentils, peas, bean seeds, chickpeas, hibiscus and mustard[131]
Soybeans oligosaccharides	Soybeans[132]
Lactulose	Lactose (Milk)[133]
Lactosucrose	Lactose[134]
Isomaltulose	Sucrose[127]
Maltooligosaccharides	Starch [135]
Isomaltooligosaccharides	Starch[135]
Arabinoxylooligosaccharides	Wheat bran[136]
Enzyme-resistant dextrin	Potato starch[137]

3. MATERIALS AND METHODS

3.1. Place and Time of the Research

This study was carried out between June 5, 2020 and July 15, 2020 to members of a private gym in Istanbul and to 225 females and 77 males, a total of 302 individuals aging 18-65 that are taking diet and nutrition counselling in the aforementioned gym.

3.2. The Universe and Sample of the Research

The universe of the research is composed of The Pilates Lab Studio, a private gym in Istanbul's members between dates 05.06.2020 - 15.06.2020, and 225 females and 77 males, a total of 302 individuals aging 18-65 that are receiving diet and nutrition counselling services at the same institution. Patients with diagnosed cancer, Type 2 Diabetes and complications with one or more diseases of the gastrointestinal tract, individuals that were vegan, vegetarian-fed in the last 1 year, individuals that followed an elimination diet, pregnant women or nursing mothers, lactose and/or gluten intolerant individuals were left out of the study.

3.2.1. Inclusion Criteria of the Research

Over-18s and under-65s, individuals that aren't diagnosed with cancer, diabetes or gastrointestinal diseases (irritable bowel syndrome, inflammatory bowel disease, celiac, crohn's, ulcerative colitis), women that are not pregnant or not in lactation, individuals that do not have food tolerances that cause gastrointestinal symptoms (lactose, gluten intolerance), those who did not eat vegan/vegetarian diets or did not take an elimination diet in the last year, who consumed weekly <15 alcoholic drinks for men and <10 for women, and those that do not actively use probiotics were included in the study.

3.2.2. Not Inclusion Criteria of the Research

Under-18s or over 65s, individuals diagnosed with cancer, diabetes or gastrointestinal diseases (irritable bowel syndrome, inflammatory bowel disease, Individuals with complications with any of the celiac, crohn's, ulcerative colitis), pregnant and lactating women, individuals with food tolerances that cause gastrointestinal symptoms (lactose, gluten intolerance), who have been vegan/vegetarian fed over the past year, those on an elimination diet, those who consume weekly >15 alcoholic drinks for men and >10 for women and individuals actively using probiotics have not been included in the study.

3.3. Type and Pattern of the Research

This study is a cross-sectional type of study. Before the study, Ethics Committee permission was obtained (APPENDIX 1) from the Ethics Committee of the Healthy Sciences Institute of T.C. Yeditepe University on the date of 03.06.2019 People who agreed to participate in the study were read and signed the Informed Consent Form for Research Purposes (APPENDIX 2), which explained the purpose and practices of the study. A survey consisting of 2 (two) sections was conducted, one including sociodemographic characteristics (age, educational status, working conditions, etc.), general health questions (cancer, Type 2 Diabetes, gastrointestinal tract diseases) in which the criteria for inclusion in the study were questioned, and diet, pregnancy/lactation period, alcohol consumption frequency on a weekly basis and two including a Food Consumption Frequency survey. For the Probiotic and Prebiotic Food Consumption Frequency, The consumption frequency survey (FFQ) prepared by the National Health and Nutrition Examination Survey (NHANNES) was adapted to the study and applied by the researcher to the participants with a one-to-one interview technique. Length and body weight were determined from anthropometric measurements of the participants and body mass index (BMI) was calculated.

3.3.1. Evaluation of Anthropometric Measurements

The body weight of the participants was measured using standard scales without shoes. The lengths of the participants were measured with a measuring tape in the frankfort plane at the upright posture, with the feet side by side and the heel and the occipital area touching the wall.

Body mass index (BMI): BMI is calculated by dividing body weight by square meters of length, body weight (kg) / length^2 (m). In Table 3.1, the body mass index was evaluated according to the World Health Organization (WHO) class.

Table 3.1. WHO's Body Mass Index (BMI) classification

Classification	BMI (Kg/m^2)
Underweight	<18.50
Severely underweight	<16.00
Underweight	16.00-16.99
Slightly underweight	17.00-18.49
Normal	18.50-24.99
Overweight (obese)	**≥25.00**
Pre-obese	25.00-29.99
Obese	**≥30.00**
Obese I.	30.00-34.99
Obese II.	35.00-39.99
Obese III.	**≥40.00**

3.3.2. Personal Information Form (Annex-3)

This form questions the demographic characteristics of the participants and other independent data of the research. These questions are; age, gender, weight, height, marital status, educational status, diagnosed cancer, Type 2 Diabetes, diseases of the gastrointestinal tract, the presence of diagnosed lactose and/or gluten intolerance, pregnancy and lactation status, probiotic supplementation status and alcohol consumption status.

3.3.3. Probiotic and Prebiotic Food Consumption Frequency Questionnaire

Includes a table to determine the probiotic and prebiotic food consumption frequency and it includes five options for 34 foods, the options are I do not consume, 2-3 times a month or less, 3-4 times a week or less, once daily and 2-3 times daily. BMI is calculated by dividing the weight in kilograms into the square of the body height in meters. People who are 18.49 and below are grouped as underweight, those between 18.50 and 24.99 are normal, those between 25.00-29.99 are slightly overweight and those with values of 30.00 and above are grouped as overweight.

The consumption frequency survey used in the study was prepared using the National Health and Nutrition Examination Survey (NHANES) food consumption frequency survey. This survey collects the same information as known food consumption frequency surveys but does not question the portion amounts of nutrients. NHANES food consumption frequency survey aims to predict the usual intake distribution of a food for a population or a subpopulation and to evaluate the effects of non-dietary variables on normal consumption. In the NHANES food consumption frequency survey, consumption frequency was applied using 5 to 11 different consumption frequency options according to the type of food asked, but in this study the survey was changed to 5 options, I do not consume, 2-3 times a month or less, 3-4 times a week, 1 time a day and 2-3 times a day, with the aim of making it easier and faster to apply and fit the purpose of the study.

3.3.4. Statistical Analysis

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis of the data found in the study. Descriptive statistical methods (average, standard deviation, median, frequency, ratio, minimum, maximum) were used when analysing the study data. Pearson Ki-Square test and Fisher-Freeman-Halton Exact test were used to compare qualitative data. The significance was evaluated at $p<0.05$.

4. RESULTS

Table 4.1. Distribution of Demographic Characteristics of Individuals by Gender (n=302)

	Total (n=302)	Gender	
		Female (n=225; 74.5%)	Male (n=77; 25.5%)
Weight (kg)			
Min-Max (Median)	42-115 (65)	42-110 (60)	61-115 (80)
Avg±Ss	66,86±14,59	61,96±11,70	81,17±12,69
Height (cm)			
Min-Max (Median)	150-194 (167)	150-180 (164)	167-194 (178)
Avg±Ss	168,09±8,63	164,28±5,69	
BMI (kg/m^2)			
Min-Max (Median)	15,5-39 (23)	15,5-39 (22)	19,2-36,3 (25,2)
Avg±Ss	23,56±4,28	22,98±4,32	25,25±3,70
Underweight	26 (8,6)	26 (11,6)	0 (0)
Normal weight	174 (57,6)	138 (61,3)	36 (46,8)
Overweight	80 (26,5)	46 (20,4)	34 (44,2)
Obese	22 (7,3)	15 (6,7)	7 (9,1)
Marital status			
Single	198 (65,6)	146 (64,9)	52 (67,5)
Married	104 (34,44)	79 (35,1)	25 (32,5)
Educational status			
High school and less	42 (13,9)	32 (14,2)	10 (13,0)
University and higher	260 (86,1)	193 (85,8)	67 (87,0)
Weekly alcohol consumption			
Does not consume alcohol	165 (54,6)	145 (64,4)	20 (26,0)
1-5 units per week	112 (37,1)	67 (29,8)	45 (58,4)
5-10 units per week	18 (6,0)	10 (4,4)	8 (10,4)
10-15 units per week	7 (2,3)	3 (1,3)	4 (5,2)

4.1. Distribution of Demographic Characteristics of Individuals by Gender

The distribution of demographic characteristics of individuals by gender is given in Table 4.1. 77 males (25.5%) and 225 females (74.5%), a total of 302 volunteers between the ages of 18 and 65 participated in the study. BMI measurements of participants vary between 15.6 and 39 kg/m^2 and the average for women is22.98±4.32

kg/m^2 and for men it is25.25±3.70 kg/m$^{2;}$8.6% (n=26) are underweight, 57.6% (n=174) are normal weight, 26.5%(n=80) are overweight and 7.3% (n=22) are obese. When their marital status is examined; It was determined that 65.6% (n=198) were single and 34.4% (n=104) were married. When the educational status of the participants was examined, it was found that 13.9% (n=42) were high school and less, and 86.1% (n=260) were university and higher. When the weekly alcohol consumption frequency of the participants was examined, 54.6% (n=165) did not consume alcohol, 37.1% (n=112) consumed 1-5 units of alcohol per week, 6.0% (n=18) consumed 5-10 units of alcohol per week and 2.3% (n=7) consumed 10-15 units of alcohol per week.

4.2. Distribution of Probiotic and Prebiotic Food Consumption Frequencies of Individuals

The consumption frequencies of foods that are known to have probiotic and prebiotic effects are given in Table 4.2.

Table 4.2. Distribution of Probiotic and Prebiotic Food Consumption Frequencies of Individuals

Nutrients	I don't consume		2-3 times a month or less		3-4 times a week		Once a day		2-3 times a day	
	n	%	n	%	n	%	n	%	n	%
Oat based food	130	43,0	114	37,7	47	15,6	9	3,0	2	0,7
Cereal bar	148	49,0	126	41,7	21	7,0	5	1,7	2	0,7
Breakfast cereal	153	50,7	92	30,5	48	15,9	7	2,3	2	0,7
Whole grain bread derivatives	48	15,9	97	32,1	79	26,2	46	15,2	32	10,6
Assorted nuts	12	4,0	111	36,8	119	39,4	43	14,2	17	5,6
Banana	18	6,0	183	60,6	85	28,1	16	5,3	0	0,0
Pineapple	133	44,0	153	50,7	14	4,6	2	0,7	0	0,0
Red plum	143	47,4	138	45,7	21	7,0	0	0,0	0	0,0
Fresh-squeezed fruit juice	83	27,5	161	53,3	48	15,9	9	3,0	1	0,3
Dried fruit	65	21,5	136	45,0	76	25,2	16	5,3	9	3,0
Raw green leafy vegetables	21	7,0	101	33,4	125	41,4	45	14,9	10	3,3
Onion	11	3,6	39	12,9	111	36,8	101	33,4	40	13,2
Pea	54	17,9	178	58,9	61	20,2	8	2,6	1	0,3
Tomato	7	2,3	30	9,9	91	30,1	105	34,8	69	22,8
Fresh-squeezed vegetable juice	228	75,5	49	16,2	20	6,6	4	1,3	1	0,3
Pickled cabbage or cucumber	57	18,9	146	48,3	76	25,2	19	6,3	4	1,3
Cow's milk	27	8,9	72	23,8	116	38,4	63	20,9	24	7,9
Soy milk	276	91,4	19	6,3	7	2,3	0	0,0	0	0,0
Soy containing products	278	92,1	20	6,6	4	1,3	0	0,0	0	0,0
Yogurt	5	1,7	34	11,3	114	37,7	99	32,8	50	16,6
Probiotic yogurt	212	70,2	58	19,2	17	5,6	11	3,6	4	1,3
Instant drinks with probiotic effect	261	86,4	28	9,3	8	2,6	3	1,0	2	0,7

Table 4.2. Distribution of Probiotic and Prebiotic Food Consumption Frequencies of Individuals (Continued)

Nutrients	I don't consume		2-3 times a month or less		3-4 times a week		Once a day		2-3 times a day	
	n	%	n	%	n	%	n	%	n	%
Types of cheeses	9	3,0	21	7,0	80	26,5	146	48,3	46	15,2
Breakfast olives	24	7,9	31	10,3	91	30,1	121	40,1	35	11,6
Kefir	181	59,9	71	23,5	27	8,9	19	6,3	4	1,3
Ice cream	27	8,9	157	52,0	84	27,8	28	9,3	6	2,0
Boza	208	68,9	67	22,2	19	6,3	6	2,0		0,7
Red meat	5	1,7	123	40,7	152	50,3	18	6,0	4	1,3
Types of white meats	9	3,0	129	42,7	150	49,7	14	4,6	0	0,0
Fermented sucuk (Fermented meat product)	66	21,9	171	56,6	64	21,2	1	0,3	0	0,0
Dried meat and meat products	191	63,2	82	27,2	27	8,9	1	0,3	1	0,3
Coffee	11	3,6	28	9,3	74	24,5	96	31,8	93	30,8
Beer	144	47,7	120	39,7	34	11,3	3	1,0	1	0,3
Red wine	179	59,3	106	35,1	14	4,6	2	0,7	1	0,3

Table 4.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels

Nutrients	Answers	Individuals' BMI Levels				p
		Underweight (n=26)	Normal weight (n=174)	Overweight (n=80)	Obese (n=22)	
		n (%)	n (%)	n (%)	n (%)	
Oat based food	Does not consume Consumes occasionally Consumes	12 (46,2) 10 (38,5) 4 (15.4)	66 (37,9) 71 (40,8) 37 (21,3)	40 (50) 27 (33.8) 13 (16.3)	12 (54,5) 6 (27,3) 4 (18,2)	*[a]0.536*
Cereal bar	Does not consume Consumes occasionally Consumes	10 (38,5) 15 (57,7) 1 (3,8)	82 (47,1) 73 (42) 19 (10.9)	43 (53.8) 29 (36,3) 8 (10)	13 (59,1) 9 (40,9) 0 (0)	*[a]0.309*
Breakfast cereal	Does not consume Consumes occasionally Consumes	7 (26,9) 15 (57,7) 4 (15.4)	89 (51,1) 47 (27) 38 (21,8)	47 (58.8) 20 (25) 13 (16.3)	10 (45,5) 10 (45,5) 2 (9,1)	*[a]0.015**
Whole grain bread derivatives	Does not consume Consumes occasionally Consumes	6 (23.1) 8 (30,8) 12 (46,2)	27 (15.5) 57 (32,8) 90 (51,7)	11 (13.8) 21 (26.3) 48 (60)	4 (18,2) 11 (50) 7 (31,8)	*[a]0.309*
Assorted nuts	Does not consume Consumes occasionally Consumes	1 (3,8) 8 (30,8) 17 (65.4)	9 (5,2) 61 (35,1) 104 (59,8)	1 (1.3) 32 (40) 47 (58.8)	1 (4,5) 10 (45,5) 11 (50)	*[b]0.644*
Banana	Does not consume Consumes occasionally Consumes	3 (11,5) 14 (53,8) 9 (34.6)	6 (3,4) 105 (60,3) 63 (36,2	6 (7,5) 52 (65) 22 (27,5)	3 (13,6) 12 (54,5) 7 (31,8)	*[b]0.195*
Pineapple	Does not consume Consumes occasionally Consumes	10 (38,5) 14 (53,8) 2 (7,7)	75 (43.1) 86 (49,4) 13 (7,5)	39 (48.8) 41 (51.3) 0 (0)	9 (40,9) 12 (54,5) 1 (4,5)	*[b]0.169*
Red plum	Does not consume Consumes occasionally Consumes	13 (50) 13 (50) 0 (0)	82 (47,1) 79 (45.4) 13 (7,5)	39 (48.8) 36 (45) 5 (6,3)	9 (40,9) 10 (45,5) 3 (13,6)	*[a]0.713*
Fresh-squeezed fruit juice	Does not consume Consumes occasionally Consumes	2 (7,7) 17 (65.4) 7 (26,9)	51 (29.3) 94 (54) 29 (16,7)	24 (30) 39 (48.8) 17 (21,3)	6 (27,3) 11 (50) 5 (22.7)	*[a]0.331*
Dried fruit	Does not consume Consumes occasionally Consumes	12 (46,2) 6 (23.1) 8 (30,8)	33 (19) 84 (48.3) 57 (32,8)	33 (19) 84 (48.3) 57 (32,8)	5 (22.7) 11 (50) 6 (27,3)	*[a]0.057*

Table 4.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels (Continued)

Nutrients	Answers	Individuals' BMI Levels				p
		Underweight (n=26)	Normal weight (n=174)	Overweight (n=80)	Obese (n=22)	
		n (%)	n (%)	n (%)	n (%)	
Fresh-squeezed fruit juice	**Does not consume**	2 (7,7)	51 (29.3)	24 (30)	6 (27,3)	***a*0.331**
	Consumes occasionally	17 (65.4)	94 (54)	39 (48.8)	11 (50)	
	Consumes	7 (26,9)	29 (16,7)	17 (21,3)	5 (22.7)	
Dried fruit	**Does not consume**	12 (46,2)	33 (19)	33 (19)	5 (22.7)	***a*0.057**
	Consumes occasionally	6 (23.1)	84 (48.3)	84 (48.3)	11 (50)	
	Consumes	8 (30,8)	57 (32,8)	57 (32,8)	6 (27,3)	
Raw green leafy vegetables	**Does not consume**	2 (7,7)	14 (8)	5 (6,3)	0 (0)	***a*0.816**
	Consumes occasionally	9 (34.6)	54 (31)	30 (37.5)	8 (36,4)	
	Consumes	15 (57,7)	106 (60.9)	45 (56.3)	14 (63.6)	
Onion	**Does not consume**	2 (7,7)	8 (4,6)	1 (1.3)	0 (0)	***b*0.071**
	Consumes occasionally	6 (23.1)	18 (10,3)	9 (11,3)	6 (27,3)	
	Consumes	18 (69,2)	148 (85,1)	70 (87.5)	16 (72.7)	
Pea	**Does not consume**	8 (30,8)	29 (16,7)	13 (16.3)	4 (18,2)	***a*0.306**
	Consumes occasionally	14 (53,8)	102 (58.6)	52 (65)	10 (45,5)	
	Consumes	4 (15.4)	43 (24,7)	15 (18,8)	8 (36,4)	
Tomato	**Does not consume**	1 (3,8)	2 (1,1)	2 (2,5)	2 (9,1)	***b*0.049***
	Consumes occasionally	5 (19,2)	13 (7,5)	11 (13.8)	1 (4,5)	
	Consumes	20 (76,9)	159 (91,4)	67 (83,8)	19 (86,4)	
Fresh-squeezed vegetable juice	**Does not consume**	23 (88.5)	130 (74.7)	60 (75)	15 (68,2)	***a*0.501**
	Consumes occasionally	3 (11,5)	27 (15.5)	15 (18,8)	4 (18,2)	
	Consumes	0 (0)	17 (9,8)	5 (6,3)	3 (13,6)	
Pickled cabbage or cucumber	**Does not consume**	9 (34.6)	25 (14,4)	20 (25)	3 (13,6)	***a*0.045***
	Consumes occasionally	12 (46,2)	87 (50)	39 (48.8)	8 (36,4)	
	Consumes	5 (19,2)	62 (35.6)	21 (26.3)	11 (50)	
Cow's milk	**Does not consume**	1 (3,8)	12 (6,9)	10 (12.5)	4 (18,2)	***a*0.483**
	Consumes occasionally	7 (26,9)	42 (24,1)	19 (23,8)	4 (18,2)	
	Consumes	18 (69,2)	120 (69)	51 (63,8)	14 (63.6)	
Soy milk	**Does not consume**	23 (88.5)	157 (90,2)	75 (93,8)	75 (93,8)	***b*0.438**
	Consumes occasionally	2 (7,7)	12 (6,9)	5 (6,3)	5 (6,3)	
	Consumes	1 (3,8)	5 (2,9)	0 (0)	0 (0)	

Table 4.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels (Continued)

Nutrients	Answers	Individuals' BMI Levels				p
		Underweight (n=26)	Normal weight (n=174)	Overweight (n=80)	Obese (n=22)	
		n (%)	n (%)	n (%)	n (%)	
Soy containing products	Does not consume	26 (100)	26 (100)	73 (91.3)	21 (95,5)	b0.298
	Consumes occasionally	0 (0)	0 (0)	7 (8,8)	0 (0)	
	Consumes	0 (0)	0 (0)	0 (0)	1 (4,5)	
Yogurt	Does not consume	0 (0)	3 (1,7)	2 (2,5)	0 (0)	b0.979
	Consumes occasionally	3 (11,5)	20 (11,5)	8 (10)	3 (13,6)	
	Consumes	23 (88.5)	151 (86,8)	70 (87.5)	19 (86,4)	
Probiotic yogurt	Does not consume	19 (73.1)	118 (67.8)	60 (75)	15 (68,2)	b0.944
	Consumes occasionally	5 (19,2)	36 (20.7)	13 (16.3)	4 (18,2)	
	Consumes	2 (7,7)	20 (11,5)	7 (8,8)	3 (13,6)	
Instant drinks with probiotic effect	Does not consume	23 (88.5)	149 (85.6)	70 (87.5)	19 (86,4)	b0.752
	Consumes occasionally	2 (7,7)	15 (8.6)	9 (11,3)	2 (9,1)	
	Consumes	1 (3,8)	10 (5.7)	1 (1.3)	1 (4,5)	
Types of cheeses	Does not consume	2 (7,7)	5 (2,9)	2 (2,5)	0 (0)	b0.353
	Consumes occasionally	4 (15.4)	10 (5.7)	6 (7,5)	1 (4,5)	
	Consumes	20 (76,9)	159 (91,4)	72 (90)	21 (95,5)	
Breakfast olives	Does not consume	2 (7,7)	18 (10,3)	4 (5)	0 (0)	b0.369
	Consumes occasionally	5 (19,2)	17 (9,8)	7 (8,8)	2 (9,1)	
	Consumes	19 (73.1)	139 (79.9)	69 (86,3)	20 (90,9)	
Kefir	Does not consume	13 (50)	103 (59,2)	48 (60)	17 (77,3)	a0.593
	Consumes occasionally	7 (26,9)	42 (24,1)	20 (25)	2 (9,1)	
	Consumes	6 (23.1)	29 (16,7)	12 (15)	3 (13,6)	
Ice cream	Does not consume	2 (7,7)	14 (8)	10 (12.5)	1 (4,5)	a0.529
	Consumes occasionally	16 (61,5)	94 (54)	38 (47,5)	9 (40,9)	
	Consumes	8 (30,8)	66 (37,9)	32 (40)	12 (54,5)	
Boza	Does not consume	23 (88.5)	121 (69,5)	49 (61.3)	15 (68,2)	b0,188
	Consumes occasionally	3 (11,5)	35 (20,1)	23 (28.8)	6 (27,3)	
	Consumes	0 (0)	18 (10,3)	8 (10)	1 (4,5)	
Red meat	Does not consume	0 (0)	3 (1,7)	2 (2,5)	0 (0)	b0.811
	Consumes occasionally	12 (46,2)	68 (39,1)	31 (38.8)	12 (54,5)	
	Consumes	14 (53,8)	103 (59,2)	47 (58.8)	10 (45,5)	

Table 4.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels (Continued)

Nutrients	Answers	Individuals' BMI Levels				*p*
		Underweight (n=26)	Normal weight (n=174)	Overweight (n=80)	Obese (n=22)	
		n (%)	n (%)	n (%)	n (%)	
Types of white meats	**Does not consume**	1 (3,8)	4 (2,3)	3 (3,8)	1 (4,5)	***b*0.915**
	Consumes occasionally	11 (42.3)	77 (44,3)	32 (40)	9 (40,9)	
	Consumes	14 (53,8)	93 (53,4)	45 (56.3)	12 (54,5)	
Fermented sucuk (Fermented meat product)	**Does not consume**	7 (26,9)	42 (24,1)	17 (21,3)	0 (0)	***a*0.141**
	Consumes occasionally	12 (46,2)	93 (53,4)	50 (62.5)	16 (72.7)	
	Consumes	7 (26,9)	39 (22,4)	13 (16.3)	6 (27,3)	
Dried meat and meat products	**Does not consume**	21 (80,8)	106 (60.9)	49 (61.3)	15 (68,2)	***a*0.513**
	Consumes occasionally	3 (11,5)	49 (28.2)	24 (30)	6 (27,3)	
	Consumes	2 (7,7)	19 (10.9)	7 (8,8)	1 (4,5)	
Coffee	**Does not consume**	0 (0)	10 (5.7)	1 (1.3)	0 (0)	***b*0.638**
	Consumes occasionally	3 (11,5)	15 (8.6)	8 (10)	2 (9,1)	
	Consumes	23 (88.5)	149 (85.6)	71 (88.8)	20 (90,9)	
Beer	**Does not consume**	12 (46,2)	85 (48.9)	33 (41.3)	14 (63.6)	***a*0.330**
	Consumes occasionally	9 (34.6)	66 (37,9)	37 (46,3)	8 (36,4)	
	Consumes	5 (19,2)	23 (13.2)	10 (12.5)	0 (0)	
Red wine	**Does not consume**	12 (46,2)	100 (57.5)	47 (58.8)	20 (90,9)	***b*0.015***
	Consumes occasionally	14 (53,8)	64 (36,8)	26 (32.5)	2 (9,1)	
	Consumes	0 (0)	10 (5.7)	7 (8,8)	0 (0)	
***a*Pearson's Chi-Square Test, *b*Fisher Freeman Halton Exact Test, *p<0.05**						

4.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels

In Table 4.3, the consumption frequencies of probiotic and prebiotic foods included in the questionnaire were evaluated. No statistically significant difference was shown between individuals BMI levels and the consumption of Oat-based foods, cereal bar, whole grain bread derivatives, types of nuts, banana, pineapple, red plum, fresh-squeezed fruit juice, dried fruit, raw green leafy vegetables, onion, peas, fresh-squeezed vegetable juice, cow's milk, soy milk, soy-containing products, yogurt, probiotic yogurt, instant drinks with probiotic effect, cheese varieties, breakfast olives, kefir, ice cream, boza, red meat, white meat varieties, fermented sucuk(fermented meat product), dried meat and meat products, coffee, beer ($p>0.05$). A statistically significant difference was found between the BMI levels of individuals and their breakfast cereal consumption rates ($p = 0.015$; $p <0.05$). As a result of the paired comparisons; it was found meaningful that these ratios were higher; underweight individuals consumed breakfast cereal occasionally (57.7%), while normal weight and overweight individuals did not consume it (51.1% and 58.8%, respectively.) There was no significant difference between the breakfast cereal consumption rates of the other groups. A statistically significant difference was found between the consumption rates of pickled cabbage or cucumber according to the BMI levels of the individuals ($p=0.045$; $p<0.05$). As a result of the paired comparisons; The rates of obese individuals consuming pickled cabbage or cucumbers (50%) were found to be higher than the consumption rates of underweight and overweight individuals (19.2% and 26.3%, respectively). The rates of not consuming pickled cabbage or cucumbers (34.6% and 25%, respectively) of underweight and overweight individuals were also found higher than normal weight individuals (14.4%). There was no significant difference between the consumption rates of pickled cabbage or cucumber among the other groups. A statistically significant difference was found between the consumption of red wine according to the BMI levels of the individuals ($p=0.015$; $p<0.05$). As a result of the paired comparisons; The rates of red wine consumption of underweight, normal weight and overweight individuals (53.8%, 36.8% and 32.5%, respectively) were higher than obese individuals (9.1%). There was no significant difference between the red wine consumption rates of the other groups.

Table 4.4. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to Their Gender

Nutrients	Answers	Gender		
		Woman (n=225)	Male (n=77)	
		n (%)	n (%)	*p*
Oat based food	Does not consume Consumes occasionally Consumes	97 (43.1) 86 (38,2) 42 (18.7)	33 (42,9) 28 (36,4) 16 (20.8)	*[a]0.911*
Cereal bar	Does not consume Consumes occasionally Consumes	105 (46,7) 97 (43.1) 23 (10.2)	43 (55.8) 29 (37,7) 5 (6,5)	*[a]0,324*
Breakfast cereal	Does not consume Consumes occasionally Consumes	110 (48,9) 75 (33,3) 40 (17.8)	43 (55.8) 17 (22,1) 17 (22,1)	*[a]0,174*
Whole grain bread derivatives	Does not consume Consumes occasionally Consumes	30 (13,3) 72 (32) 123 (54.7)	30 (13,3) 72 (32) 123 (54.7)	*[a]0.088*
Assorted nuts	Does not consume Consumes occasionally Consumes	11 (4,9) 79 (35,1) 135 (60)	1 (1.3) 32 (41.6) 44 (57,1)	*[a]0.274*
Banana	Does not consume Consumes occasionally Consumes	14 (6,2) 128 (56,9) 83 (36,9)	4 (5,2) 55 (71,4) 18 (23,4)	*[a]0.073*
Pineapple	Does not consume Consumes occasionally Consumes	94 (41.8) 118 (52,4) 13 (5.8)	39 (50.6) 35 (45,5) 3 (3,9)	*[a]0.375*
Red plum	Does not consume Consumes occasionally Consumes	102 (45.3) 105 (46,7) 18 (8)	41 (53,2) 33 (42,9) 3 (3,9)	*[a]0.312*
Fresh-squeezed fruit juice	Does not consume Consumes occasionally Consumes	63 (28) 119 (52,9) 43 (19,1)	20 (26) 42 (54.5) 15 (19,5)	*[a]0.942*
Dried fruit	Does not consume Consumes occasionally Consumes	48 (21.3) 93 (41,3) 84 (37,3)	17 (22,1) 43 (55.8) 17 (22,1)	*[a]0.035**
Raw green leafy vegetables	Does not consume Consumes occasionally Consumes	11 (4,9) 68 (30,2) 146 (64,9)	10 (13) 33 (42,9) 34 (44,2)	*[a]0.002***
Onion	Does not consume Consumes occasionally Consumes	9 (4) 23 (10.2) 193 (85.8)	2 (2,6) 16 (20.8) 59 (76.6)	*[a]0.054*
Pea	Does not consume Consumes occasionally Consumes	46 (20.4) 127 (56,4) 52 (23.1)	8 (10,4) 51 (66,2) 18 (23,4)	*[a]0.124*
Tomato	Does not consume Consumes occasionally Consumes	4 (1,8) 24 (10.7) 197 (87.6)	3 (3,9) 6 (7,8) 68 (88,3)	*[a]0.451*
Fresh-squeezed vegetable juice	Does not consume Consumes occasionally Consumes	172 (76,4) 34 (15,1) 19 (8,4)	56 (72.7) 15 (19,5) 6 (7,8)	*[a]0.667*
Pickled cabbage or cucumber	Does not consume Consumes occasionally Consumes	40 (17.8) 102 (45.3) 83 (36,9)	17 (22,1) 44 (57,1) 16 (20.8)	*[a]0.034**

Table 4.4. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to Their Gender (Continued)

Nutrients	Answers	Gender		
		Woman (n=225)	Male (n=77)	
		n (%)	n (%)	*p*
Cow's milk	**Does not consume** **Consumes occasionally** **Consumes**	20 (8,9) 51 (22.7) 154 (68,4)	7 (9,1) 21 (27,3) 49 (63.6)	***a*0.701**
Soy milk	**Does not consume** **Consumes occasionally** **Consumes**	203 (90,2) 15 (6,7) 7 (3,1)	73 (94.8) 4 (5,2) 0 (0)	***b*0.333**
Soy containing products	**Does not consume** **Consumes occasionally** **Consumes**	209 (92,9) 12 (5.3) 4 (1,8)	69 (89.6) 8 (10,4) 0 (0)	***b*0.175**
Yogurt	**Does not consume** **Consumes occasionally** **Consumes**	4 (1,8) 20 (8,9) 201 (89,3)	1 (1.3) 14 (18,2) 62 (80,5	***b*0.073**
Probiotic yogurt	**Does not consume** **Consumes occasionally** **Consumes**	151 (67,1) 48 (21.3) 26 (11.6)	61 (79.2) 10 (13) 6 (7,8)	***a*0,132**
Instant drinks with probiotic effect	**Does not consume** **Consumes occasionally** **Consumes**	193 (85.8) 20 (8,9) 12 (5.3)	68 (88,3) 8 (10,4) 1 (1.3)	***a*0.309**
Types of cheeses	**Does not consume** **Consumes occasionally** **Consumes**	8 (3,6) 14 (6,2) 203 (90,2)	1 (1.3) 7 (9,1) 69 (89.6)	***a*0.436**
Breakfast olives	**Does not consume** **Consumes occasionally** **Consumes**	18 (8) 23 (10.2) 184 (81,8)	6 (7,8) 8 (10,4) 63 (81,8)	***a*0,998**
Kefir	**Does not consume** **Consumes occasionally** **Consumes**	124 (55,1) 60 (26.7) 41 (18,2)	57 (74) 11 (14.3) 9 (11.7)	***a*0.013***
Ice cream	**Does not consume** **Consumes occasionally** **Consumes**	18 (8) 113 (50,2) 94 (41.8)	9 (11.7) 44 (57,1) 24 (31,2)	***a*0.217**
Boza	**Does not consume** **Consumes occasionally** **Consumes**	150 (66,7) 54 (24) 21 (9,3)	58 (75,3) 13 (16.9) 6 (7,8)	***a*0.352**
Red meat	**Does not consume** **Consumes occasionally** **Consumes**	5 (2,2) 95 (42,2) 125 (55.6)	0 (0) 28 (36,4) 49 (63.6)	***b*0.308**
Types of white meats	**Does not consume** **Consumes occasionally** **Consumes**	7 (3,1) 106 (47,1) 112 (49,8)	2 (2,6) 23 (29.9) 52 (67,5)	***a*0.025***
Fermented sucuk (Fermented meat product)	**Does not consume** **Consumes occasionally** **Consumes**	51 (22.7) 134 (59.6) 40 (17.8)	15 (19,5) 37 (48,1) 25 (32,5)	***a*0.025***
Dried meat and meat products	**Does not consume** **Consumes occasionally** **Consumes**	153 (68) 55 (24,4) 17 (7.6)	38 (49,4) 27 (35,1) 12 (15.6)	***a*0.009****
Coffee	**Does not consume** **Consumes occasionally** **Consumes**	8 (3,6) 20 (8,9) 197 (87.6)	3 (3,9) 8 (10,4) 66 (85,7)	***a*0.914**
Beer	**Does not consume** **Consumes occasionally** **Consumes**	126 (56) 76 (33.8) 23 (10.2)	18 (23,4) 44 (57,1) 15 (19,5)	***a*0.001****
Red wine	**Does not consume** **Consumes occasionally** **Consumes**	140 (62,2) 73 (32,4) 12 (5.3)	39 (50.6) 33 (42,9) 5 (6,5)	***a*0,201**
***a*Pearson's Chi-Square Test *b*Fisher Freeman Halton Exact Test**p<0.01*p<0.05**				

4.4. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to Their Gender

There is no statistically significant difference between individuals genders and their consumption rate of cereal bar, breakfast cereal, whole grain bread derivatives, types of nuts, banana, pineapple, red plum, freshly squeezed fruit juice, onion, pea, tomato, freshly squeezed vegetable juice, cow The consumption rates of milk, soy milk, soy-containing products, yoghurt, probiotic yogurt, probiotic-effect instant drinks, cheese varieties, breakfast olives, ice cream, boza, red meat, coffee and red wine ($p > 0.05$). A statistically significant difference was found between the ratios of raw green leafy vegetables consumed by males and females ($p=0.002$; $p<0.05$). The rate of consuming raw green leafy vegetables (64.9%) of females is higher than that of males (44.2%). The rate of consuming pickled cabbage or cucumber (36.9%) of female individuals was higher than that of male individuals (20.8%), and a significant difference was found between consumption depending on gender ($p=0.034$; $p<0.05$). According to kefir consumption rates, 44.9% of female individuals consumed kefir, while this rate was 26% for males, and a statistically significant difference was found in kefir consumption depending on gender ($p=0.013$; $p<0.05$). When the ratio of white meat types consumed by individuals according to their gender was examined, 47.1% of female individuals occasionally consumed white meat varieties, while the rate of male individuals consuming white meat varieties was 67.5%, and a statistically significant difference was found between them ($p=0.025$; $p<0.05$). The rate of consumption of sucuk (fermented meat product) was found to be higher in men than women (32.5%, 17.8%, respectively) and a statistically significant difference was found between ($p=0.025$; $p<0.05$). A statistically significant difference was found between the consumption of dried meat and meat products according to their gender ($p=0.009$; $p<0.05$). The rate of consuming dried meat and meat products was higher for males (50.7%), and the rate of not consuming dried meat and meat products for females (68%). The rates of consumption and occasional consumption of beer (19.5%, 57.1%, respectively) of male individuals are higher than the consumption and sometimes consumption rates of women (respectively; 10.2%, 33.8%), and a statistically significant difference was found between consumption rates by gender ($p=0.001$. $p<0.05$).

5. DISCUSSION

The discussion part of this study, which is a cross-sectional study conducted to determine the relationship between the consumption frequency of probiotic and prebiotic foods and body mass index of individuals, will be evaluated by proceeding in the same order with the titles in the results, respectively.

5.1. Evaluation of Individuals' Demographic Characteristics According to Gender

The ages of the individuals participating in this study are between the ages of 18 and 65, and the average weight in females is 61.96 ±11.70 kg, and in males it is 81.17±12.69 kg. While 54.6% (n=165) of the individuals did not consume alcohol, it was observed that 37.1% (n=112) consumed 1-5 units of alcohol per week. There are studies showing that polyphenols and β - glucan found in alcoholic beverages obtained by fermentation, such as beer and red wine, may show prebiotic benefits (138, 139). However, there are factors affecting the health of gut microbiota due to regular alcohol use for a long time. In a study conducted with 89 alcoholic cirrhosis patients and a control group of 40, which examined the relationship between alcohol consumption and gut microbiota, 30.3% of the patients with alcoholic cirrhosis had excessive bacterial growth in the intestine, whereas this was not observed in any healthy individuals (140). The imbalance in the gut microflora and the decrease in stomach acid together with the excessive bacterial growth in the intestine affect the metabolism by causing nutrient absorption, gas, diarrhea and, in rare cases, constipation.

5.2. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals

The most common types of probiotic and prebiotic foods consumed by the individuals surveyed are; Whole grain bread derivatives, dried fruits, onion, tomato, peas, cow's milk, yogurt, types of cheese, breakfast olives, ice cream, white meat varieties and coffee. Among the foods that are consumed least or not at all include; Oat-based foods, Cereal bar, breakfast cereal, pineapple, red plum, fresh-squeezed fruit juice, fresh-squeezed vegetable juice, soy milk, soy-containing products, probiotic yogurt, probiotic ready drinks, kefir, sucuk (fermented meat product), dried meat and meat products, beer and red wine. The variables that affect the association of the survey results with BMI are the specific selection of the foods in the survey to show probiotic or prebiotic characteristics, and the individuals participating in the survey show different socio-demographic, socio-economic and socio-cultural characteristics. In addition, the fact that the frequency and prices of the foods in the survey vary in our country is among the reasons for consuming or not consuming these foods.

5.3. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to their BMI Levels

The average weight of 302 individuals participating in this study was 66.86±14.59 kg and their average BMI was 23.56±4.28 kg/m^2. While the average weight in females is found to be 61.96 ± 11.70 kg and the average BMI is 22.98 ± 4.32 kg/m^2, the average weight in males is found to be 81.17 ± 12.69 kg and the average BMI is 25.25 ± 3.70 kg/m^2. The effects of probiotic foods and prebiotics containing dietary fiber on energy homeostasis and nutrient absorption also play a role in body weight control. In a study where 87 individuals with BMI ranging from observed 24.2--37.0 kg / m2 and with visceral fat gain were given Lactobacillus gasseri SBT2055 for 12 weeks, patients were observed to have lower BMI and body mass, waist and hip circumference, cisceral and subcutaneous fat mass decrease compared to the place group (52). There are studies showing that the application of different Lactobacilli strains on obese individuals reduces fat mass, T2D and insulin resistance risk (Table 2.1.). However, in a study examining the correlation between BMI and gut concentrations of Lactobacillus reuteri, Bifidobacterium animalis, Methanobrevibacter smithii and Escherichia coli species, a higher prevalence of Lactobacillus in obese subjects were observed compared to lean individuals (respectively; 32%, 20%; $p=0.06$) and BMI>25 individuals had higher Lactobacillus prevalence compared to individuals with a BMI of <25 (respectively; 32%, 20.8%; $p=0.06$) (141). Therefore, these two different results obtained from different studies show us that there may be a dose-dependent relationship between certain bacterial species in the gut and BMI.

No statistically significant difference was shown between individuals BMI levels and the consumption of Oat-based foods, cereal bar, whole grain bread derivatives, types of nuts, banana, pineapple, red plum, fresh-squeezed fruit juice, dried fruit, raw green leafy vegetables, onion, peas, fresh-squeezed vegetable juice, cow's milk, soy milk, soy-containing products, yogurt, probiotic yogurt, instant drinks with probiotic effect, cheese varieties, breakfast olives, kefir, ice cream, boza, red meat, white meat varieties, fermented sucuk(fermented meat product), dried meat and meat products, coffee, beer ($p>0.05$). The variety of foods included in the survey and the demographic, cultural and economic reasons underlying the reasons for consuming or not consuming these foods in daily life may be effective in the inability of finding a significant relationship between BMI and consumption frequency of these foods.

In this study, only the consumption frequency of probiotic and prebiotic foods was questioned regardless of the amount, and it is in line with the results of the above-mentioned studies that the amount of consumption, namely the portion size, has an effect on the BMI as well as the consumption frequency of the foods.

5.4. Evaluation of Probiotic and Prebiotic Food Consumption Frequency of Individuals According to Their Gender

When the probiotic and prebiotic food consumption frequencies of 225 female and 77 male volunteers who participated in this study were examined; The rate of consumption of raw green leafy vegetables, cabbage or pickled cucumbers and kefir of women was significantly higher than that of men ($p<0.05$). The consumption rates of white meat, fermented sucuk (fermented meat product), dried meat and meat products and beer were found to be significantly higher in male individuals compared to women ($p <0.05$). In a study examining the gender differences in meat, fruit and vegetable consumption, the consumption frequencies of these foods were compared between males and females in Finland and Baltic countries. According to the results of the study; in all countries included in the study, meat consumption rates of males were found to be higher than females. When fruit and vegetable consumption was examined, in all countries included in the study, fruit and vegetable consumption of females was found to be higher than males. In all three cases, the gender model has not been changed by other socio-demographic factors (142). In another study examining gender differences in fruit and vegetable consumption using data obtained from the National Cancer Institute's Food Attitudes and Behaviors Research, a questionnaire was applied to the participants asking how often they ate various fruits and vegetables in the previous month and participants have responded on a scale ranging from “Never” to “5 times a day or more.” The result of the study resulted in females consuming more fruits and vegetables than males, similar to the other study ($p<.001$) (143). The results of both studies show similarities with the difference in the consumption of meat and vegetables, which are among the foods included in this study, by gender.

6. CONCLUSIONS AND RECOMMENDATIONS

The results obtained from this study conducted with 225 female and 77 male total 302 volunteers in order to examine the relationship between probiotic and prebiotic food consumption frequency and body mass index of individuals are given below.

6.1. Results

1. The average weight of males was 81.17±12.69 kg, while the average weight of females was 61.96±11.70 kg.
2. Average height was 179.23±5.54 cm for males and 164.28±5.69 cm for females.
3. The average BMI of the individuals was 23.56±4.28 kg/m^2. Of all individuals, 8.6% were underweight (n 26), 57.6% were normal weight (n=74), 26.5% were overweight (n=80) and 7.3% were obese (n=22).
4. Looking at the average BMI of male individuals, it was found to be 25.25±3.70 kg/m^2. According to BMI evaluation of male individuals, 0% were underweight (n=0), 46.8% were normal weight (n=36), 44.2% were overweight (n=34) and 7% (n=7) were obese.
5. The average BMI of females is 22.98±4.32 kg/m^2. According to BMI evaluation of female individuals, 11.6% were underweight (n=26), 61.3% were normal weight (n=138), 20.4% were overweight (n = 46) and 6.7% were obese (n=15).
6. 64.4% of the females participating in the study are single (n=146) and 35.1% are married (n=79). Considering the marital status of the males, 67.5% are single (n=57) and 32.5% are married (n=25).
7. 13.9% (n=42) of the participants have high school or less, 86.1% (n=260) have a university or higher education level.
8. When the weekly alcohol consumption of the participants is examined; While 54.6% (n=165) did not consume alcohol, 37.1% (n=112) consumed 1-5 units of alcohol per week, 6.0% (n=18) consumed 5-10 units of alcohol per week, and 2.3% (n=7) consumed 10-15 units of alcohol per week.
9. A statistically significant difference was found between the BMI levels of individuals and their breakfast cereal consumption rates ($p = 0.015$; $p <0.05$). As a result of the paired comparisons; it was found meaningful that these ratios were higher; underweight individuals consumed breakfast cereal occasionally (57.7%), while normal weight and overweight individuals did not consume it (51.1% and 58.8%, respectively.) There was

no significant difference between the breakfast cereal consumption rates of the other groups.

10. A statistically significant difference was found between the consumption rates of pickled cabbage or cucumber according to the BMI levels of the individuals ($p=0.045$; $p<0.05$). As a result of the paired comparisons; The rates of obese individuals consuming pickled cabbage or cucumbers (50%) were found to be higher than the consumption rates of underweight and overweight individuals (19.2% and 26.3%, respectively). The rates of not consuming pickled cabbage or cucumbers (34.6% and 25%, respectively) of underweight and overweight individuals were also found higher than normal weight individuals (14.4%). There was no significant difference between the consumption rates of pickled cabbage or cucumber among the other groups.
11. A statistically significant difference was found between the consumption of red wine according to the BMI levels of the individuals ($p=0.015$; $p<0.05$). As a result of the paired comparisons; The rates of red wine consumption of underweight, normal weight and overweight individuals (53.8%, 36.8% and 32.5%, respectively) were higher than obese individuals (9.1%). There was no significant difference between the red wine consumption rates of the other groups.
12. A statistically significant difference was found between the ratios of raw green leafy vegetables consumed by males and females ($p=0.002$; $p<0.05$). The rate of consuming raw green leafy vegetables (64.9%) of females is higher than that of males (44.2%).
13. The rate of consuming pickled cabbage or cucumber (36.9%) of female individuals was higher than that of male individuals (20.8%), and a significant difference was found between consumption depending on gender ($p=0.034$; $p<0.05$).
14. According to kefir consumption rates, 44.9% of female individuals consumed kefir, while this rate was 26% for males, and a statistically significant difference was found in kefir consumption depending on gender ($p=0.013$; $p<0.05$).
15. When the ratio of white meat types consumed by individuals according to their gender was examined, 47.1% of female individuals occasionally consumed white meat varieties, while the rate of male individuals consuming white meat varieties was 67.5%, and a statistically significant difference was found between them ($p=0.025$; $p<0.05$).

16. The rate of consumption of sucuk (fermented meat product) was found to be higher in men than women (32.5%, 17.8%, respectively) and a statistically significant difference was found between ($p=0.025$; $p<0.05$).
17. A statistically significant difference was found between the consumption of dried meat and meat products according to their gender ($p=0.009$; $p<0.05$). The rate of consuming dried meat and meat products was higher for males (50.7%), and the rate of not consuming dried meat and meat products for females (68%).
18. The rates of consumption and occasional consumption of beer (19.5%, 57.1%, respectively) of male individuals are higher than the consumption and sometimes consumption rates of women (respectively; 10.2%, 33.8%), and a statistically significant difference was found between consumption rates by gender ($p=0.001$. $p<0.05$).

6.2. Recommendations

Intestinal microbiota, which has more than one important role in improving and enhancing human health, such as regulating energy metabolism in the human body, sorting out non-digestible dietary components, modulating the immune system and synthesizing essential vitamins, is recently seen as a key role in the treatment of many diseases, especially obesity and metabolic diseases related to obesity. The mechanism underlying in these key roles that microbiota plays in the human body is not yet fully understood, but more and more studies on both humans and animals show us more and more about microbiota.

The most important factor affecting microbiota health is a healthy diet. Studies report that the microbiota responds to different nutritional patterns in less than 72 hours, causing changes in the microflora. However, seeing the positive effects of a healthy microflora on the human body is possible with a healthy diet plan in the long term.

The effects of prebiotics and probiotics in improving and enhancing microbiota health are proven by studies. However, in most of the studies conducted in this direction, results are obtained by giving prebiotics and probiotics to patients in the form of supplements in the form of sachets, powder or tablets. There are not many studies on which foods contain prebiotics and probiotics naturally and in what amount they should be consumed. In addition, the effect of prebiotic and probiotic consumption on body weight has not been fully proven yet, and not enough studies have been done yet on these people. Increasing studies in this direction can positively affect public health by supporting the food sector to add probiotic and prebiotic bacteria to the basic foods that individuals consume in their daily lives and to make these foods functional and increase their accessibility. In addition, individuals can be made aware of the presence of natural foods with probiotic and prebiotic effects, and many diseases caused by bad microflora can be prevented by nutrition.

Considering the diversity and availability of prebiotic and probiotic foods included in this study and the fact that the individuals participating in this study are from different segments in socio-demographic, socio-cultural and socio-economic terms, it can be explained that why there is not a statistically significant difference between most of the foods on the survey and BMI of the individuals. In addition, the fact that BMI does not give us enough information about the body fat ratios of individuals and working with devices that measure body fat and muscle amount and/or waist-hip measurements in such studies may be a more accurate method to reveal the relationship of the study with obesity. Finally; A study in which a nutritional questionnaire with more specific food groups (such as milk and dairy products with only probiotic effect or fibrous vegetables with prebiotic effect) is applied on individuals with the same demographic characteristics can give us more accurate and meaningful results about the effects of probiotics and prebiotics on body weight.

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8. APPENDIXS

8.1. Ethical Committee Declaration

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 1898 **04/06/2020**
Konu: Klinik Araştırmalar
Etik Kurul Başvurusu hk.

İlgili Makama (Gamze Fındık)

Yeditepe Üniversitesi Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümüm Dr. Öğr. Üyesi Hülya Demir'in sorumlu araştırmacı olduğu **''Bireylerin Probiyotik ve Prebiyotik Besin Tüketim Sıklıkları İle Beden Kitle İndeksleri Arasındaki İlişkinin İncelenmesi''** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(1884)** kayıtlı Numaralı KAEK Başvuru Dosyası , Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **03.06.2020** tarihli toplantıda incelenmiştir.

Sağlık Bakanlığı'nın Covid-19 pandemisi nedeniyle uygulamakta olduğu ''toplumsal izolasyon veya karantina'' uygulamalarının bitiminde başlanması şartıyla;

Kurul tarafından yapılan inceleme sonucu,yukarıdaki isim belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir. **(KAEK Karar No:1235)**

Prof. Dr. Turgay Çelik

Yeditepe Üniversitesi
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8.2. Informed Consent Form for Research Purposes

Araştırmanın Adı: Bireylerin Probiyotik ve Prebiyotik Besinleri Tüketim Sıklıkları ile Beden Kitle İndeksleri Arasındaki İlişkinin İncelenmesi.

Sayın Katılımcı,

Yukarıda adı yazılı araştırmaya katılmak üzere davet edilmiş bulunmaktasınız. Bu araştırmada yer almayı kabul etmeden önce, araştırmanın ne amaçla yapılmak istendiğini anlamanız ve bu bilgilendirme sonucunda kararınızı vermeniz gerekmektedir. Aşağıdaki bilgileri lütfen dikkatlice okuyunuz, sorularınız olursa sorunuz ve açık yanıtlar isteyiniz.

Çalışmaya katılması beklenen tahmini gönüllü sayısı 400 olup, gönüllünün araştırmaya devam etmesi için öngörülen süre ise 1 aydır. Gönüllü olan kişilere herhangi bir tedavi uygulanmayacaktır; ilk olarak 11 soruluk genel bilgiler ve personel kurum ve sağlık bilgilerinin hepsini prebiyotik ve probiyotik besinleri içeren 37 soruluk bir anket formu doldurulacaktır. Araştırma sadece anket kullanılarak yapılacağı için deneysel bir kısım içermemekte olup gönüllerin maruz kalabileceği herhangi bir risk veya rahatsızlık bulunmamaktadır. Gönüllülere anket ve hijyen ölçeği dışında uygulanabilecek herhangi bir alternatif yöntem yoktur. Gönüllülerin tüm soruları eksiksiz ve hatasız yanıtlaması gerekmektedir. Gönüllünün araştırmaya katılımı isteğe bağlıdır ve gönüllü istediği zaman, herhangi bir cezaya veya yaptırıma maruz kalmaksızın, hiçbir hakkını kaybetmeksizin araştırmaya katılmayı reddedebilir veya araştırmadan çekilebilir. Her türlü bilgi ve kayıtların araştırma sonuçları yayımlanması halinde dahi gönüllülerin kimlik bilgileri gizli kalacaktır. Gönüllüler, yazılı bilgilendirilmiş gönüllü olur formunun imzalanmasıyla yalnızca gönüllü veya kanuni temsilcisinin söz konusu erişime izin vermiş olacaktır. Sağlık otoriteleri (yoklama yapan kişiler, etik kurul, kurum vb.) gönüllünün orijinal kayıtlara doğrudan erişimde bulunabilecektir, ancak bu bilgiler gizli tutulacaktır. Araştırma konusu ile ilgili veya gönüllünün araştırmaya katılmaya devam etme isteğini etkileyebilecek yeni bilgiler elde edildiğinde gönüllü zamanında bilgilendirilecektir. Gönüllünün anket sorularına eksik, yanlış veya birden fazla yanıt verilmemesi gereken bölümlere birden fazla yanıt vermesi ile istatistiksel olarak yanlış bilgiler elde edileceği ve araştırma sonucunu yanlış yönde etkileyebileceği için bu gibi durumlarda katılımın sona erdirilmesi gerekecektir.

Araştırma ile ilgili daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya gamze_findik@hotmail.com e-posta adresi veya 0507 244 29 96 numaralı telefondan ulaşabilirsiniz.

"Bilgilendirilmiş Gönüllü Onam Formundaki tüm açıklamaları okudum. Bana, konusu ve amacı belirtilen araştırma ile ilgili yazılı ve sözlü açıklama, aşağıda adı belirtilen kişi tarafından yapıldı. Araştırmaya hiçbir baskı ve zorlama olmaksızın gönüllü olarak katıldığımı, istediğim zaman gerekçeli veya gerekçesiz olarak araştırmadan ayrılabileceğimi ve kendi isteğime bakılmaksızın araştırmacı tarafından araştırma dışı bırakılabileceğimi biliyorum".

"Söz konusu araştırmaya, hiçbir baskı ve zorlama olmaksızın, kendi rızamla katılmayı kabul ediyorum".

Gönüllünün Adı:

Soyadı:

İmzası:

Tarih:

8.3. Personal Information Form

YEDİTEPE ÜNİVERSİTESİ

SAĞLIK BİLİMLERİ FAKÜLTESİ

BESLENME VE DİYETETİK BÖLÜMÜ

Bireylerin Probiyotik ve Prebiyotik Besin Tüketim Sıklıkları ile Beden Kitle İndeksleri Arasındaki İlişkinin İncelenmesi

Değerli anket katılımcısı; bu araştırma Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Bölümü Dr. Öğr. Üyesi Hülya DEMİR danışmanlığında yürütülen "Bireylerin Probiyotik ve Prebiyotik Besin Tüketim Sıklıkları ile Beden Kitle İndeksleri Arasındaki İlişkini İncelenmesi'' konulu yüksek lisans tezine ilişkin bir çalışmadır. Bu amaçla hazırlanmış olan anket formunda verdiğiniz bilgiler araştırma kapsamında kullanılacaktır. Değerli katkılarınız için teşekkür ederim.

Dyt. Gamze Fındık
Yeditepe Üniversitesi
Beslenme ve Diyetetik Bölümü Yüksek Lisans Öğrencisi

1. **Cinsiyetiniz:** Kadın / Erkek
2. **Yaşınız:**
3. **Boy (cm):**
4. **Ağırlık (kg):**
5. **Medeni Durumunuz:** Bekar / Evli
6. **Eğitim Durumunuz:** Lise ve altı / Üniversite ve üzeri
7. **Aşağıdaki hastalıklardan biri ya da birkaçına sahipseniz hastalığın yanında bulunan kutucuğu işaretleyiniz.**

- ❑ Tip 2 Diyabet (Şeker Hastalığı)
- ❑ Kanser
- ❑ Gastrointestinal Hastalıklar (İrritabl bağırsak sendromu, Enflamatuar bağırsak hastalığı,
- ❑ Çölyak hastalığı, Crohn hastalığı, Ülseratif Kolit vb)
- ❑ Laktoz İntoleransı

8- Son 1 yıl içerisinde aşağıdaki durumlardan biri ya da birkaçına sahipseniz lütfen durumunuzu bildiren ifadenin yanında bulunan kutucuğu işaretleyiniz.

- ❑ - Hamilelik
- ❑ - Loğusalık
- ❑ - Vegan veya vejetaryen beslenmek
- ❑ - Gluten veya laktozdan sınırlı beslenme

9- Son 6 ay içerisinde düzenli olarak herhangi bir formda (toz, kapsül vs.) probiyotik takviyesi kullandınız mı?

- ❑ Evet, kullanıyorum
- ❑ Hayır

10- Haftalık bazda alkol tüketim sıklığınız:

- ❑ Alkol tüketmiyorum
- ❑ Haftada 1-5 birim alkol
- ❑ Haftada 5-10 birim alkol
- ❑ Haftada 10-15 birim alkol
- ❑ Haftada 15 birim ve üstü alkol

8.4. Probiotic and Prebiotic Food Consumption Frequency Questionnaire

Aşağıdaki sorularda belirtilen besin ve besin gruplarını son 1 sene içinde ne sıklıkla tükettiğinizi her soru için tek bir seçeneği işaretleyerek belirtiniz.

TAHIL ve KURUYEMİŞ	**Tüketmem**	**Ayda 2-3 kez veya daha az**	**Haftada 3-4 kez**	**Günde 1 kez**	**Günde 2-3 kez**
Yulaf, yulaf unu ve yulaf bazlı yiyecekler					
Tahıllı bar (granola bar, yulaf, çavdar gibi tam tahıllar içeren bar)					
Kahvaltılık tahıl/gevrek					
Tam tahıllı ekmek türevleri(Çavdar, tam buğday, kepek, yulaf unlarından yapılmış esmer ekmek çeşitleri)					
Kuruyemiş türleri (yer fıstığı, ceviz, badem, fındık vs.)					
SEBZELER VE MEYVELER					
Muz					
Ananas					
Kırmızı erik					
Taze sıkılmış portakal, mandalina veya greyfurt suyu					
Kuru meyve (kurutulmuş incir, kayısı, hurma vs.)					
Çiğ yeşil yapraklı sebzeler (ıspanak, karalahana, pazı, marul vs.)					
Kuru soğan (yemek ve salatalarınıza giren miktarı da dahil ediniz)					
Bezelye (taze, konserve veya dondurulmuş)					
Domates					
Taze sıkılmış sebze suyu					
Lahana veya salatalık turşusu					
SÜT VE FERMENTE ÜRÜNLER					
Tam yağlı, yarım yağlı veya yağsız inek sütü (Kahvaltılık gevrek ve					

kahvelerinize kattığınız sütü de dahil ediniz.)					
Soya sütü					
Tofu, soya peyniri gibi soya içeren ürünler					
Yoğurt (Ev yapımı veya hazır)					
Probiyotik yoğurt					
Probiyotik etkili veya sonradan probiyotik eklenmiş hazır içecekler (Kombucha, probiyotik süt vs.)					
Peynir çeşitleri (yağlı, yağsız, az yağlı peynir türlerini ve sandviç, tost gibi öğünlerinize eklediğiniz peynirleri de dahil ediniz)					
Kahvaltılık zeytin					
Kefir					
Dondurma (Sadece süt ve süt ürünleri içeren dondurmaları dahil ediniz)					
Boza (Kış mevsimi boyunca)					
ET GRUBU					
Kırmızı et (Kıyma ve parça et olarak tükettiklerinizi de dahil ediniz)					
Beyaz et çeşitleri (Tavuk, hindi)					
Fermente sucuk					
Kurutulmuş et ve et ürünleri					
İÇECEKLER					
Kahve (Türk kahvesi, filtre kahve gibi kafein içeren tüm kahve türlerini dahil ediniz)					
Bira					
Kırmızı şarap					

8.5. Curriculum Vitae

Personal Informations

Name	GAMZE	**Surname**	FINDIK
Place of Birth	İSTANBUL	**Date of Birth**	02.10.1994
Nationality	T.C.	**TR ID Number**	
E-mail	gamze_findik@hotmail.com	**Phone number**	05072442996

Education

Degree	**Department**	**The name of the Institution Graduated From**	**Graduation year**
Master	Nutrition and Dietetics	Yeditepe University	2020
University	Nutrition and Dietetics	T.C İstanbul Arel University	2016
High school	Science High School	Halkalı Toplu Konut Lisesi	2012
Languages		Grades (#)	

All the grades must be listed if there is more than one (KPDS, ÜDS, TOEFL; EELTS vs),

Work Experience (Sort from present to past)

Position	**Institute**	**Duration (Year - Year)**
Pilates instructor- Dietician	Seven Pilates Studio	October 2020- ongoing
Pilates instructor	Pilates Lab Studio	November 2019- March 2020
Dietician	OnlyHealth.Co Well-Aging Center	April 2019 - September 2019

Computer Skills

Program	**Level**
SPSS	Good
Microsoft Office Programs	Excellent

Scientific works

The articles published in the journals indexed by SCI, SSCI, AHCI

Articles published in other journals

Proceedings presented in international scientific meetings and published in proceedings book.

Journals in the proceedings book of the refereed conference / symposium