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MICROBIOTA AWARENESS LEVEL OF UNIVERSITY STUDENTS

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Abstract:
Single-celled microorganisms have existed on Earth since the early periods of life. Microbiota refers to the community of microorganisms living in an organism. The human body has different microbiota in the skin, mouth, intestines, skin, and other areas. These microbiotas have very important duties in terms of protecting the health of living things. The intestinal microbiota includes probiotics, prebiotics, and their combination synbiotics, which are beneficial to health. Microbiota is affected by many environmental factors. As a result of these factors, the disruption of the balance of beneficial and harmful microorganisms in the microbiota is called "dysbiosis ". Dysbiosis can affect the formation of many conditions such as obesity, allergens, diabetes, celiac disease, and cardiac diseases. In this context, individuals' knowledge of the positive and negative factors of the microbiota will be an important step in protecting health. The purpose of this study, which we conducted on healthcare worker candidates, is to measure the candidates' knowledge level about microbiota and to develop projects that will help them gain awareness.

Keywords: microbiota, probiotic, prebiotic

1. Introduction

Single-celled microorganisms appeared on Earth approximately 3-4 billion years ago as one of the first forms of life. Such microorganisms started their lives as simple single-celled organisms and later transformed into different species through various evolutionary processes. These microorganisms persisted on Earth during the early stages of life and adapted to various ecological niches during the course of evolution. Single-celled microorganisms play an important role in different ecosystems of the Earth today and constitute one of the cornerstones of biodiversity.

Microbiota refers to the community of microorganisms living on or within an organism (e.g. human). These microorganisms may include bacteria, viruses, fungi, and other microbes. The human body has different microbiota in the skin, mouth, intestines,

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skin, and other areas. These microbiotas can affect many processes such as human health and the immune system (Belkaid and Hand, 2014).

Various internal and external factors such as the host's genetics, dietary content, antibiotic use, and microbial exposure create the microbiota by affecting the amount and functionality of different microorganism species (Hamurcu and İsmailoğlu, 2022). Healthy microbiota is called "eubiosis" (Karatay, 2019). The condition in which the homeostasis of the microbiota (the ratio of beneficial/harmful microorganisms) is disrupted is called "dysbiosis". Dysbiosis is associated with the formation of many conditions such as obesity, allergens, diabetes, celiac, cardiac diseases, inflammatory bowel diseases, and cancer (İsmailoğlu, 2019; Yılmaz, 2019).

The community of microorganisms such as many non-pathogenic bacteria, eukaryotes, archaea, and viruses found in the intestines of living beings is called intestinal microbiota. (Lupp C., & Finlay B.B., 2005). The intestinal microbiota of healthy individuals basically consists of six groups of microorganisms. These are Firmicutes, Bacteroidetes, Proteobacteria, Actinobacteria, Fusobacteria, and Verrucomicrobia (Tekin, 2018). The predominant gram-positive bacteria of the intestinal microbiota are "Firmicutes" and the predominant gram-negative bacteria are "Bacteroidetes" phylum (İsmailoğlu and Yılmaz, 2019).

The microbiota has many different functions. These functions are described in Table 1.

Table 1: Functions of microbiota (Taşkırmaz, 2017)

Protective Functions	- Pathogen Displacement - Food Competition - Receptor Competition - Antimicrobial Effect - Anti Allergic Effect
Metabolic Functions	- Nutrition of Intestinal Cells - Conjugation of Linoleic Acid - Vitamin Synthesis - Digestion Aid - Amino Synthesis - Fermentation of Indigestible Foods - Drug Metabolism - Carcinogen Metabolization - Aid to Absorption - Effect on the Endocrine System - Intestinal Differentiation and Proliferation of Epithelial Cells
Structural Functions	- Barrier Strengthening Immunoglobulin A (IgA) Induction - Improving the Immune System
Genetic Functions	- Gene Pool

2. Microbiota and Breast Milk

Microbiota formation in the human body begins in the prenatal period and takes its basic form in the first three years of life. During this period, the baby's nutrition style is very

important for the formation of a healthy microbiota (Guney, 2017). The first dietary factor affecting the microbiota is breast milk. Breast milk is a synbiotic food that contains prebiotics and probiotics together. Therefore, it positively affects the intestinal microbiota (Özdemir, 2017).

2.1 Microbiota and Nutrition

Another issue related to microbiota is nutrition. To examine this situation, research has been conducted on the diets of societies living in different geographies. In the study conducted by De Flippo the microbiota of children living in Italy and Africa were compared, and the diversity of microorganisms in the microbiota of African children fed with fiber and vegetable protein was found to be higher than that of Italian children fed a diet rich in animal protein and fat. In another study conducted by Sonnerburg and colleagues on mice, it was concluded that insufficient fiber intake caused changes in the microbiota and reduced microorganism diversity (Özdemir, 2017).

2.2 Microbiota and Obesity

Obesity is transmitted to our brains to ensure that the diet has an impact on the microbiota. As a result of changes in the microbiota in the intestine, an increase in the outflow permeability and the distribution of short-chain fatty acids can be observed. This paves the way for healthy individuals (Tekin, 2018). It was observed that the use of probiotics, which are beneficial for some exit microbiota, decreased blood glucose level, visceral fat ratio, body weight, and body mass index (Taşkırmaz, 2017). Therefore, the use of probiotics may be beneficial in treating obesity by improving the microbiota.

2.3 Microbiota Diabetes

High fat and fructose diet affects the microbiota causing dysbiosis. However, gram-negative bacteria increase in number and the amount of lipopolysaccharide secreted by the bacteria increases. Increased intestinal permeability as a result of deterioration in the intestinal epithelium causes inflammation. As a result, eating behavior anomalies, insulin resistance, and pancreatic beta cell deterioration are observed. The deterioration of pancreatic beta cells, which occurs as a result of changes in the microbiota, is associated with Type 1 diabetes, and the occurrence of insulin resistance is associated with Type 2 diabetes (Taşkırmaz, 2017).

2.4 Microbiota Diarrhea and Constipation

The World Health Organization defines watery stools more than three times a day as diarrhea. In diarrhea, the intestinal mucosa layer is damaged. Therefore, probiotics that are beneficial for the microbiota play a role in the prevention and treatment of diarrhea with its various functions in the body (Karatay, 2019). Constipation is when the stool is extremely hard, dry and the number of defecations is less than once in three days. Nutrition is important in the treatment of constipation. Consumption of fruits and vegetables with high fiber content is recommended. In constipation, probiotic treatment is also applied. Various probiotics help in the treatment of constipation by normalizing

bowel movements with its effects on the microbiota and its metabolites (İsmailoğlu, 2019; Öztürk, 2020).

2.5 Microbiota Celiac

Celiac is an autoimmune disease that causes gluten sensitivity. Changes in the intestinal microbiota are among the environmental factors in the development of the disease. Differences have been detected between the intestinal compositions of celiac and healthy individuals. Studies on vineyard microbiota homeostasis show that it is linked to autoimmune diseases such as celiac (Erdem, 2019).

2.6 Microbiota and Antibiotics

Another factor that affects microbiota content is the use of antibiotics. Intensive and broad-spectrum antibiotic use puts pressure on the microbiota, and as a result, microbiota diversity and protection against pathogenic microorganisms decrease. homeostasis is disrupted (Kılıç, 2017). Continuous use of antibiotics can also turn the microbiota into a state where pathogenic microorganisms with antibiotic-resistant genes can live and develop (Karatay, 2019).

2.7 Microbiota and Cancer

It has been defined that pathogenic microorganisms are effective in approximately 15% of all cancer formations. Studies show that especially the intestinal microbiota is associated with cancer. Microbiota plays a role in carcinogenesis through the damage to the gastrointestinal mucosa, the increase in microbial species that trigger carcinogenesis, and the products formed as a result of microbial metabolism (Genç, 2017).

2.8 Microbiota Depression and Alzheimer's

The mucosa involved in the protection of the intestinal barrier is produced by microorganisms. Disruption of this mucosa and leakage of certain nutrients into the bloodstream has been shown to cause the inflammatory pathophysiology of depression. There are studies showing that changes in the gut microbiota affect circulating metabolites and can trigger inflammation. This suggests that Alzheimer's disease, which is associated with inflammation and circulating metabolites, is affected by microorganisms (Ercan, 2018).

2.9 Probiotics and Prebiotics

Probiotic, prebiotic, and synbiotic additives are used to strengthen the beneficial microflora of the intestine (Karatay, 2019). According to the World Health Organization, probiotics are defined as "*live microorganisms that provide health benefits to the host*". Prebiotics are nutritional compounds that support the growth and proliferation of beneficial microorganisms in the intestine and reduce pathogens. Another term, synbiotics, is the name given to the combination of probiotics and prebiotics (Karatay, 2019). Foods such as yogurt, kefir, and boza are among the leading probiotics. Vegetables,

fruits, and whole grain products such as garlic, onion, banana, and Jerusalem artichoke are examples of prebiotic products.

Probiotics its most important benefit to the microbiota is its effect in maintaining homeostasis. gut microbiota; appropriate doses of probiotics can be used to benefit the microbiota for the treatment of some diseases that develop as a result of dysbiosis (İsmailoğlu, 2019). Other effects of probiotics on living things are given in the table.

Table 2: Effects of probiotics on living things (İsmailoğlu and Yılmaz, 2019)

Immunological benefits	- Activating macrophages to increase antigen presentation to B lymphocytes and immunoglobulin A (IgA) production - Cytokine edit profiles - Increasing tolerance to food antigens
Non-immunological benefits	- Competing with pathogens for nutrients - Changing pH to create an unfavorable environment for pathogens - Producing bacteriocins to inhibit pathogens - Scavenging superoxide radicals - Epithelial stimulates mucin production - Improving intestinal barrier function - Competing with pathogens to adhere to the intestinal lumen - Developing pathogen-derived toxins

3. Method

A survey consisting of two parts was applied in the study. The first part includes demographic characteristics. The second part includes the "Microbiota Awareness Scale". The 18-item, 5-point Likert scale developed by Külcü (2022) was used in the study. The reliability of the microbiota awareness scale is α= .85. 595 university students studying in various health departments (such as Undergraduate: Nursing, Anesthesia, Medical Laboratory Techniques, Oral and Dental Health) participated in the research. The SPSS program was used in the research.

The homogeneity of the data was tested with the Kolmogorov-Smirnov test. Since the data did not show a normal distribution, nonparametric tests were used. Since it does not show a normal distribution, statistical tests such as Mann-Whitney U and Kruskal Wallis were applied.

The hypotheses of the research are as follows:

- **H1:** Microbiota characteristics of students studying in health departments There is a significant difference between awareness.
- **H2:** There is a significant difference between the internship status of students studying in health departments and their microbiota awareness.
- **H3:** There is a significant difference in microbiota awareness of students studying in health departments depending on whether they take Microbiology courses or not.
- **H4:** There is a significant difference between the age ranges of students studying in health departments and microbiota awareness.

- **H5:** There is a significant difference between the education levels of students studying in health departments and microbiota awareness.

4. Results

As a result of the study, the following data was obtained.

Table 3: The descriptive table

	Number (n)	Percentage (%)
Age		
16-20	368	61.8
21-24	199	33.4
25-29	28	4.8
Gender		
Woman	425	71.4
Male	167	28.6
School		
High school	95	15.9
Front License	440	73.9
License	60	10.2

Skewness according to normality analysis results value was .241 and the kurtosis value was 1.277. Kurtosis and skewness values are between -1.5 and +1.5, and this finding shows that the data exhibits a normal distribution. Tabachnik has a reference to the range -1.5 +1.5 being a normal distribution.

According to the results of the reliability analysis, Cronbach alpha, value was .780. The reliability level of our scale was high.

Table 4: Gender

	Gender	N	$\bar{x}$	SS	df	t	P.
Microbiota awareness	Woman	425	3.5525	,40653	.590	1,776	0.76
	Male	167	3.4862	.41500			

Microbiota awareness scores do not differ significantly according to gender (p>.05).

Table 5: Internship status

	Internship status	N	$\bar{x}$	SS	df	t	P.
Microbiota awareness	Done	143	3.5708	.43195	.593	1,198	0.231
	Not done	452	3.5238	,40147			

Microbiota awareness scores do not differ significantly according to internship status (p>.05).

Table 6: Taking a microbiology course

	Taking a microbiology course	**N**	**x^-**	**SS**	**df**	**t**	**P.**
Microbiota awareness	Yes	67	3.6651	.43195	.593	2,777	0.006
	No	528	3.5186	,40147			

Microbiota awareness scores differ significantly depending on taking a microbiology course (p <.05). The awareness of those who took microbiology courses was higher than those who did not.

Table 7: Age

	Age	**N**	**X^-**	**SS**	**F**	**p**
Microbiota awareness	16-20	368	3.4990	,38309	11,336	0.000
	21-24	199	3.5550	,41650		
	25-29	28	3.8683	.52878		

Microbiota awareness scores differ significantly according to age (p <.05). When comparing between groups, it was seen that individuals between the ages of 25-29 had higher microbiota awareness than other age groups.

Table 8: Education

	Education	**N**	**X^-**	**SS**	**F**	**p**
Microbiota awareness	High school	95	3.5513	,42634	3,099	.046
	Associate degree	440	3.5155	,40776		
	License	60	3.6531	,37543		

Microbiota awareness varies significantly according to education levels (p <.05). When comparing the groups, it was seen that the microbiota awareness of undergraduate students was higher compared to associate degree and high school students.

4.1 Argument

According to the research results, there is no difference between microbiota and awareness in terms of gender roles. Similarly, in the Microbiota awareness research conducted by Hamurcu on Nutrition and Dietetics students in 2022, there is no difference in terms of gender. Again, looking at the literature, no statistically significant difference was found between male and female students in their knowledge levels on these subjects (Abu-Humaidan, 2021; Fijian, 2019).

Microbiota knowledge varies according to the age of the students and the level of knowledge increases as age increases. It has been determined that individuals especially between the ages of 25-29 have a higher microbiota awareness compared to other age groups. It was observed that this increase was significant, especially in 2nd-grade students. Similarly, similar trends have been observed in studies on the effect of pre-probiotics. For example, in a study conducted with 196 adults, it was determined that the highest level of microbiota knowledge was in the 22-24 age group. Similarly, in different studies, it has been determined that the 18-29 age range and the 18-25 age range have the highest level of knowledge (Yücelşengün, 2019). If we look at other studies, it has been

seen that microbiological awareness is high in the 18-29 age range (Barqawi, 2021) and the 18-25 age range (Allah, 2019). These findings indicate that age may be an important factor in the level of microbiota knowledge and that young adulthood may be a period when the level of microbiota knowledge is high. Based on such information, it can be recommended that educational programs focus on certain age groups or that efforts to increase the level of knowledge about microbiota focus on certain age groups.

It shows that the level of education has a significant impact on microbiota awareness. It was determined that the microbiota awareness of individuals with undergraduate education was statistically significantly higher compared to those with associate and high school education. In a similar study, it was determined that education levels and microbiota knowledge have a linear relationship and as the education level increases, microbiota awareness also increases (Rahman, 2021).

The microbiota awareness level of individuals who take microbiology courses is statistically significantly higher than those who do not take microbiology courses. This shows that the microbiology course increases knowledge and awareness about microbiota. A similar study shows that students who receive training on pre-probiotics and microbiology and those who have a medical degree have higher levels of microbiota awareness (Ayyash, 2021). This can be attributed to the fact that these groups are more interested in these issues or have more knowledge. Such findings highlight the importance of the impact of microbiota-related educational programs and the knowledge level of healthcare personnel. In order to increase awareness about microbiota, it may be necessary to develop training programs and give importance to the continuous education of healthcare personnel.

Microbiota awareness scores do not differ significantly according to internship status. Similarly, the study conducted by Arshald shows that internships or practices do not make any difference in microbiota knowledge.

5. Conclusion

- **H1:** There is a significant difference between the gender of students studying in health departments and microbiota awareness: **Rejected.**
- **H2:** There is a significant difference between the internship status of students studying in health departments and their microbiota awareness: **Rejected.**
- **H3:** Microbiota awareness among students studying in health departments depending on whether they take Microbiology courses or not: **Accepted.**
- **H4:** There is a significant difference between the age ranges of students studying in health departments and microbiota awareness: **Accepted.**
- **H5:** There is a significant difference between the education levels of students studying in health departments and Microbiota awareness: **Accepted.**

Conflict of Interest Statement

The authors declare no conflicts of interest.

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