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ANALYSIS OF KNOWLEDGE ON PROBIOTICS AMONG ADULTS LIVING IN THE BIAŁA PODLASKA COUNTY (LUBLIN VOIVODSHIP)

ANALIZA WIEDZY DOTYCZĄCEJ PROBIOTYKÓW WŚRÓD DOROSŁYCH MIESZKAŃCÓW POWIATU BIALSKIEGO (WOJ. LUBELSKIE)

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Wkład autorów:
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B. Data collection/entry
zebranie danych
C. Data analysis/statistics
dane – analiza i statystyki
D. Data interpretation
interpretacja danych
E. Preparation of manuscript
przygotowanie artykułu
F. Literature analysis/search
wyszukiwanie i analiza literatury
G. Funds collection
zebranie funduszy

Summary

Background. Lactic acid bacteria of the *Lactobacillus* and *Bifidobacterium* genera are mainly used as probiotics. Their effect on the human organism is multidirectional, hence they are used both in prevention and treatment of many disease entities. The aim of the study was to analyze the level of knowledge about probiotics among adult residents of the city of Biała Podlaska and Biała Podlaska County (Lublin Voivodship, Poland).

Material and methods. The survey was conducted among 116 adults meeting the criterion of place of residence. An original survey questionnaire was used as a research tool.

Results. The majority of the respondents knew the definition of probiotics; food products which are their source were also correctly indicated. Probiotics were most commonly used during antibiotic therapy, with dietary supplements being the preferred form of probiotic use. The overwhelming majority of the respondents believe that probiotics have a positive impact on the human body, mainly through their effect on intestinal regulation. No one indicated that probiotics could have a negative effect on health. More than half of the respondents also know what prebiotics are and only a few use synbiotics.

Conclusions. The vast majority of the adults participating in the survey use probiotics, know their beneficial effects on the human body, and are familiar with their natural dietary sources. Knowledge of the negative effects of probiotic supplementation and the use of prebiotics and synbiotics is less widespread; therefore, it is important to strive to continuously raise public awareness of these issues by undertaking educational and informational activities.

Keywords: synbiotics, prebiotics, microbiota, health

Streszczenie

Wprowadzenie. Jako probiotyki stosowane są głównie bakterie wytwarzające kwas mlekowy z rodzajów *Lactobacillus* i *Bifidobacterium*. Ich działanie na organizm człowieka jest wielokierunkowe, stąd też znajdują one zastosowanie zarówno w profilaktyce, jak i w leczeniu wielu jednostek chorobowych. Celem pracy była analiza poziomu wiedzy na temat probiotyków wśród dorosłych mieszkańców miasta Biała Podlaska i powiatu bialskiego (woj. lubelskie).

Materiał i metody. Badania ankietowe przeprowadzono wśród 116 dorosłych osób, spełniających kryterium, jakim było miejsce zamieszkania. Jako narzędzie badawcze zastosowano autorski kwestionariusz ankiety.

Wyniki. Większość respondentów znała definicję probiotyków, trafnie wskazywano również produkty spożywcze będące ich źródłem. Najczęściej sięgano po probiotyki przy antybiotykoterapii, przy czym preferowaną formą stosowania probiotyków były suplementy diety. Przeważająca większość respondentów uważa, że probiotyki mają pozytywny wpływ na organizm człowieka, głównie poprzez wpływ na regulację pracy jelit. Nikt nie wskazał na możliwość negatywnego działania probiotyków na zdrowie. Ponad połowa badanych wie także czym są prebiotyki, a tylko nieliczni stosują synbiotyki.

Wnioski. Zdecydowana większość osób dorosłych biorących udział w badaniu stosuje probiotyki, zna ich korzystny wpływ na organizm człowieka, jak również zna ich naturalne źródła pokarmowe. Wiedza na temat ujemnych skutków suplementacji probiotyków oraz stosowania prebiotyków i synbiotyków jest mniej powszechna dlatego ważne jest dążenie do ciągłego podnoszenia świadomości społecznej w tym zakresie poprzez podejmowanie działań edukacyjno-informacyjnych.

Słowa kluczowe: synbiotyki, prebiotyki, mikrobiota, zdrowie

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Introduction

Probiotics are defined as products or preparations containing a defined number of live, well-defined microorganisms that, through colonization or implantation, affect the microflora of a specific area of the host organism and consequently show a positive effect on its health [1-5]. In 2001, The Food and Agriculture Organization of the United Nations and the World Health Organization (FAO/WHO) provided a definition indicating that probiotics are live microorganisms that, when administered in adequate amounts, exert a beneficial effect on the health of the host [6]. The report of the FAO/WHO expert consultation on the evaluation of the health and nutritional properties of probiotics in food is included in the document 'Probiotics in food' published in 2006 [7].

Probiotic microorganisms include mainly lactic acid bacteria (LAB) of the *Lactobacillus* (*L. acidophilus, L. casei, L. reuteri, L. rhamnosus*) and *Bifidobacterium* genera (*B. animalis*), but also *Lactococcus, Leuconostoc, Pediococcus, Streptococcus, Enterococcus, Carnobacterium, Oenococcus, Tetragenococcus, Vagococcus, Weissella* and *Bacillus*. Other microorganisms classified as probiotics are yeasts, including *Saccharomyces boulardii* [1,2,8-10]. The use of a given microorganism for probiotic therapy is preceded by studies confirming that it meets complex criteria for probiotics, including strain safety, functionality, efficacy of administration, dose and technological suitability [1,2]. The probiotic properties of microorganisms are strain-dependent, necessitating that individual strains be tested for their efficacy in specific clinical conditions observed in patients and for the effective dose [5,11-13]. Strains can be used individually or in various combinations, depending on the degree of dysbiosis [5]. The action of bacteria of the *Lactobacillus* genus is mainly to counteract the negative consequences of presence of pathogens in the gastrointestinal tract by producing lactic acid and bacteriocins. Bacteria of the *Bifidobacterium* genus (*Bifidobacterum bifidum, Bifidobacterium breve* Yakult) influence maintaining the balance of the intestinal microbiota, enable better nutrient absorption, facilitate synthesis of enzymes and vitamins, and show immunostimulating effects. *Saccharomyces boulardii* is used in the prevention and treatment of post-antibiotic diarrhea in children and adults, support the removal of bacterial toxins and influence the sealing of the intestinal epithelium. The efficacy of probiotics in treating bacterial and viral diarrhea, constipation, relieving intestinal inflammation, reducing the risk of irritable bowel syndrome, preventing and treating genitourinary tract infections in women, and strengthening the intestinal barrier has been confirmed [1,5,8,10,13-16]. Probiotics have also been credited with contributing to the regulation of the immune system, respiratory system, treatment of atopic dermatitis, and inhibition of pathogenic bacteria, including *Clostridium perfringens, Campylobacter jejuni, Salmonella enteritidis, Escherichia coli* [1,4,16]. Studies also indicate an association of gut microflora composition with psychiatric disorders, including autism spectrum disorders and depression [13].

Prebiotics constitute another important factor for the functioning of the gut microbiota. The definition given by FAO/WHO defines them as non-living organisms and non-digestible food components that exert a beneficial effect on the host by modulating the microbiota [1,16]. To qualify as a prebiotic, a compound must selectively stimulate the growth and activity of intestinal bacteria, inhibit the activity of harmful intestinal microflora, lower the pH of the intestinal content, show resistance to hydrolysis and the action of gastrointestinal enzymes, not be absorbed in the gastrointestinal tract and be stable during food processing [17]. Prebiotics are mainly carbohydrates that are not digested in the gastrointestinal tract and include oligosaccharides such as fructooligosaccharides (FOS), galactooligosaccharides (GOS), oligosaccharides derived from starch and glucose, and pectin oligosaccharides (POS). Another group of prebiotics includes polysaccharides such as inulin, cellulose, hemicelluloses and pectin [17-19]. Many milk constituents such as lactose, phosphates, oligosaccharides, nucleotides, lactoperoxidase, lysozyme, α-lactalbumin and lactoferrin have prebiotic properties [16]. In addition to carbohydrates, other compounds also meet the definition of prebiotics, e.g. flavonols derived from cocoa, polyphenols, among them resveratrol found for example in grape skin [17,20]. Prebiotics are not digested in the human body and reach the large intestine in virtually unchanged form, where they undergo fermentation.

Its products help maintain the balance of the colon microbiota by stimulating the growth of *Bifidobacterium* and *Lactobacillus* [18]. It is possible to combine one or more probiotics with prebiotic substances (synbiotics). Synbiotic preparations include: *Lactobacillus rhamnosus* GG and Fructooligosaccharides*; Lactobacillus rhamnosus* GG, *Lactobacillus reuteri, Lactobacillus gasseri* and Inulin*; Bifidobacterium infantis* M-63, *Lactobacillus fermentum* CECT5716, *Lactobacillus rhamnosus* GG and Inulin*; Lactobacillus rhamnosus* GG, *Bifidobacterium lactis* BS01, *Saccharomyces bouardii* and Fructooligosaccharides [20].

The knowledge of probiotics is extensive and still evolving based on numerous scientific experiments and clinical studies, so the public's awareness of them may vary. The aim of the study was to analyze the level of knowledge about probiotics of adult residents of the city of Biała Podlaska and Biała Podlaska County (Poland): the impact on human health and knowledge of their sources in food products.

Material and methods

Research tools

An original survey questionnaire was used as a research tool, including: metric questions on sex, age, place of residence, education, occupational activity and having children; essential questions concerned knowledge of definitions of probiotics, prebiotics and synbiotics, types of microorganisms used in probiotic preparations, their impact on health and factors determining their consumption and purchase. The study was conducted among adults meeting the criterion of residence in the city of Biała Podlaska (52°01'56"N; 23°06'59"E) or in the Biała Podlaska County (Lublin Voivodship, Poland). Data were collected during face-to-face meetings with respondents between November 2020 and January 2021. Participation in the study was anonymous and voluntary. Statistical analysis of the obtained data was performed using the STATISTICA v.13 software. Pearson's Chi square test was applied to detect statistically significant differences. In all cases analyzed, a significance level of $p<0.05$ was assumed.

Group studied

The survey was conducted among 116 adult residents of Biała Podlaska city (74.1%) and Biała Podlaska County (25.9%). The majority of the respondents were women (68.1%): aged 18-30 (29.3%) or 31-45 (29.3%), with graduate (31.9%) or undergraduate (25.0%) degree. An overwhelming number of the respondents had no medical or related education (81.9%). Those who were employed accounted for 72.4% and those who were pupils or students constituted 11.2% of all the respondents. 83.6% of the respondents lived with their family, while one in three respondents had no children (35.3%), whereas 34.5% had adult children. Detailed data on the characteristics of the respondents are presented in Table 1.

Table 1. Characteristics of the studied group

Question	No. of respondents	%
Sex		
female	79	68.1
male	37	31.9
Age (in years)		
18-30	34	29.3
31-45	34	29.3
46-60	32	27.6
above 60	16	13.8

Place of residence		
Biała Podlaska city	86	74.1
Biała Podlaska County	30	25.9
Education		
vocational	22	19.0
secondary	28	24.1
undergraduate	29	25.0
graduate	37	31.9
Medical degree or related degree		
yes	21	18.1
no	95	81.9
Current employment status		
pupil/student	13	11.2
employed	84	72.4
unemployed	5	4.3
pensioned/retired	14	12.1
Residing with family		
yes	97	83.6
no	19	16.4
Having children		
yes, infant	2	1.7
yes, toddler	6	5.2
yes, preschooler	10	8.6
yes, early school age	13	11.2
yes, above 10 years old	23	19.8
yes, adult	40	34.5
not applicable	41	35.3

Results

The majority of the respondents (88.3%) answered that probiotics are live microorganisms, mainly bacteria, which, when administered in adequate amounts, have beneficial health effects. A more frequent, correct definition of probiotics was indicated by women (93.7%; p=0.0150) compared to the men surveyed (78.4%). Detailed results of the analysis with regard to the definition of probiotics according to sex, age and education are provided in Figure 1. The definition of prebiotics was significantly more frequently (p=0.0024) known by women (71.4%) in relation to the surveyed men (41.7%) and by those with a medical or related education (85.7%; p=0.0129) in relation to the other subjects (56.5%) (Figure 2).

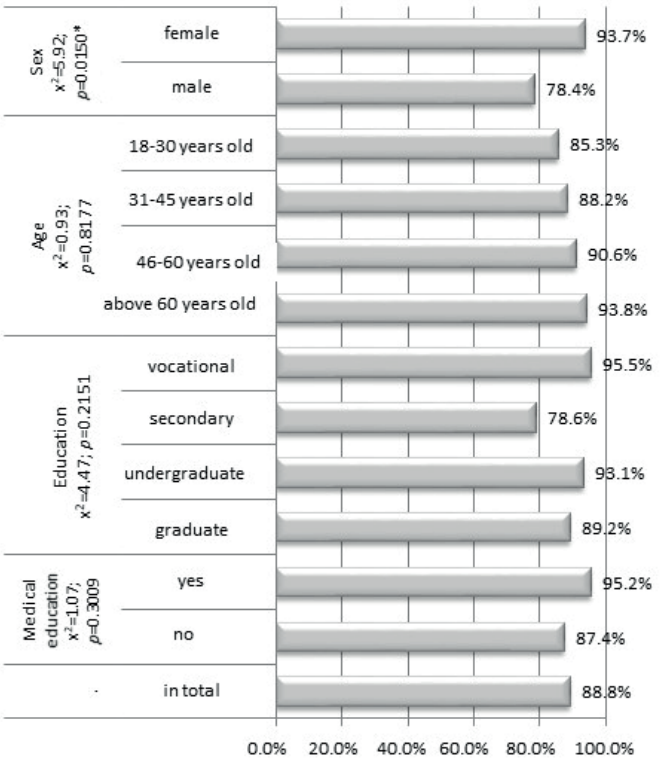

Figure 1. Correct definition of probiotics according to sex, age and education

Notes: χ^2 – Pearson's Chi square test value; * – significant variation at p<0.05.

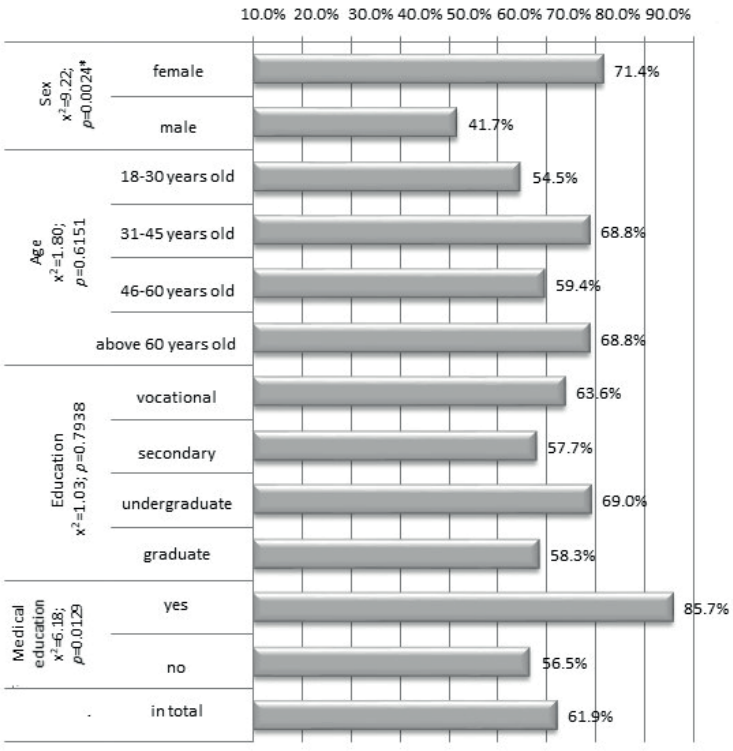

Figure 2. Correct definition of prebiotics according to sex, age and education

Notes: χ^2 – Pearson's Chi square test value; * – significant variation at p<0.05.

Declared data shows that the respondents most often buy probiotics for themselves (40.5%), for family members (26.7%) or for their children (11.2%), and only 12.9% reported that they do not use them at all. More than half of the adults surveyed (53.0%) use probiotics occasionally, e.g. after a doctor's recommendation, 2.6% use them daily and 20.0% use them several times a week. The respondents declare giving probiotics to their children after a doctor's recommendation (38.8%) or making this decision on their own (12.1%). The respondents mainly use probiotics during antibiotic therapy (81.0%), diarrhea (48.3%), intestinal diseases (26.7%) or take them prophylactically (16.4%).

Age was shown to influence the reasons for reaching for probiotics, and the importance of this factor was found to be significant in case of diarrhea (p=0.0426). In such cases, probiotics were used significantly more often by those aged 31-45 years (67.6%) than those aged 18-30 years (35.3%), 46-60 years (40.6%), or over 60 years (50.0%) (Figure 3).

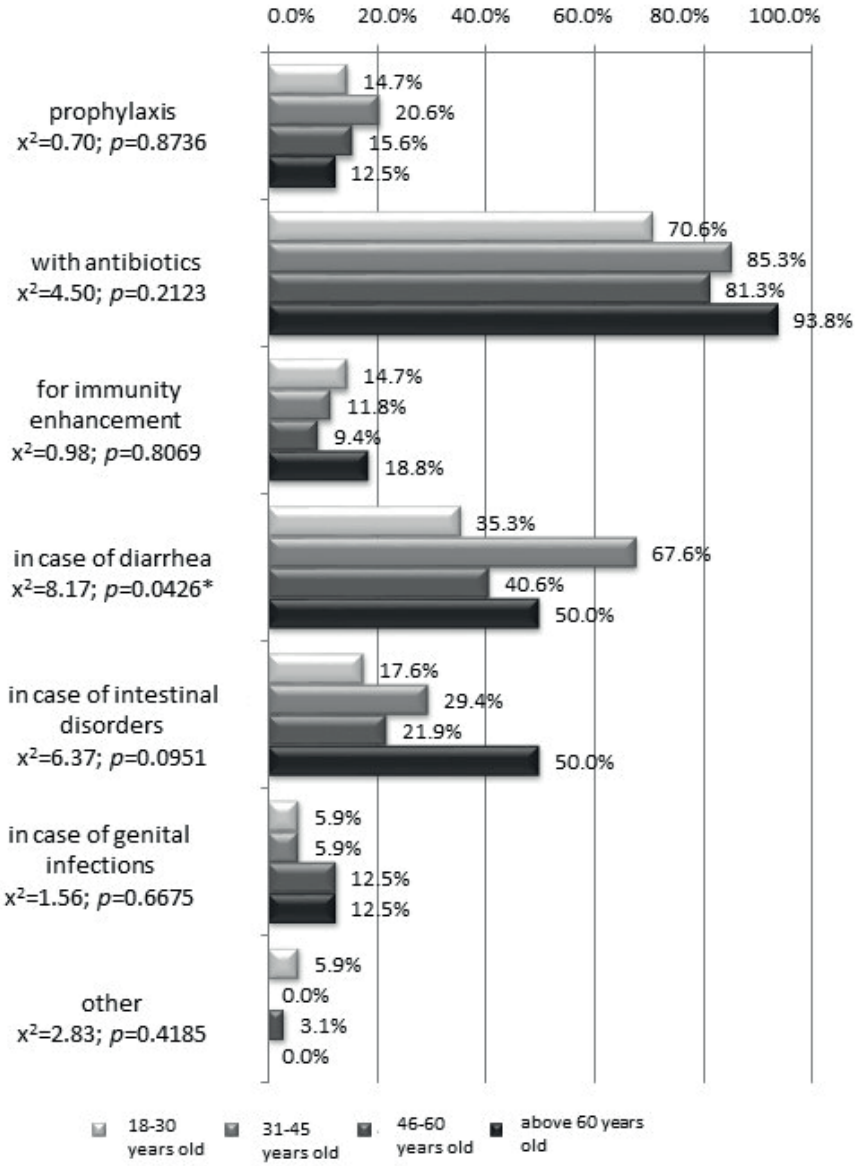

Figure 3. Reasons for probiotic use categorized by the age of the respondents

Notes: χ^2 – Pearson's Chi square test value; * – significant variation at p<0.05.

Probiotics were used more frequently by those with medical or related education (47.6%; p=0.0168) than those with non-medical education (22.1%) in the event of intestinal disorders (Figure 4). Only more than half of the respondents (56.0%) reported that they always received a recommendation from their doctor to use probiotics with antibiotic therapy, one in three (37.1%) received them sometimes and 6.9% never did. The highest percentage of adults use probiotics in the form of dietary supplements (41.4%), medicines (31.9%) or natural food products (31.9%). According to the respondents, foods with probiotic properties include: milk and dairy products, especially fermented ones (89.7%) and pickled fruit and vegetables (75.9%). Only 12.9% of the respondents use synbiotics and women (p=0.0247) (17.7%) do so significantly more often than men (2.7%). In contrast, those with a medical or related background were significantly more likely to consider the use of prebiotics together with probiotics to be legitimate (33.3%; p=0.0081).

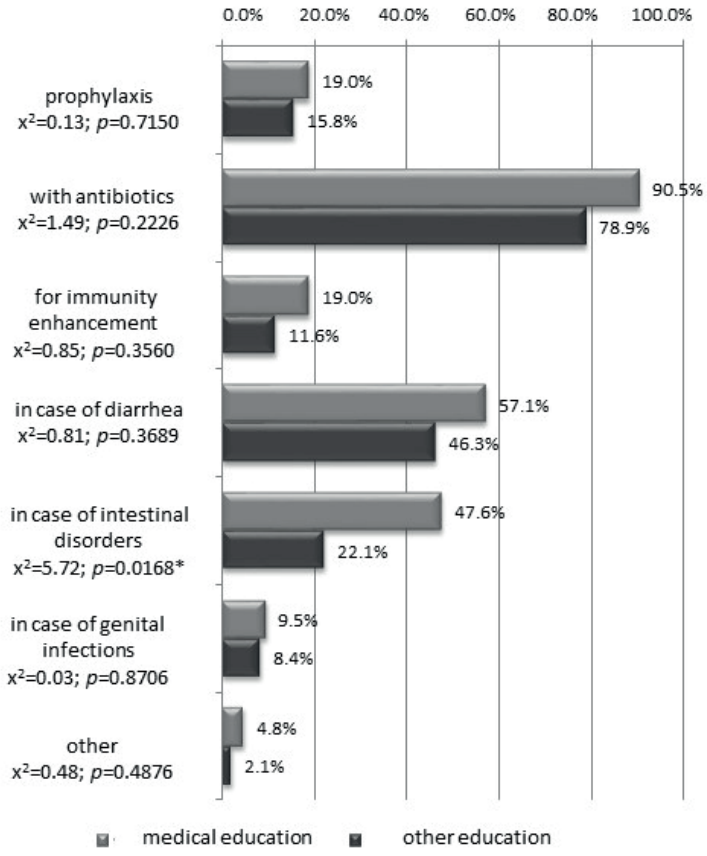

Figure 4. Reasons for probiotic use categorized by the educational background of the respondents

Notes: χ^2 – Pearson's Chi square test value; * – significant variation at p<0.05.

Among the many factors influencing the choice of probiotic preparations, the respondents reported: doctor's or pharmacist's recommendation (50.9%), health claims (38.8%), substances included in the preparation (27.6%), price (26.7%), taste value 8.6%, product advertising 6.0%, packaging appearance 0.9% and other features 3.5%. Almost half of the survey participants (49.1%) do not know what type of microorganisms are most commonly used in probiotic preparations. The remaining respondents mentioned *Lactobacillus acidophilus* (18.1%), *Saccharomyces boulardii* (8.6%) and *Lactobacillus casei* (8.6%) (Figure 5). More than half of the respondents (64.4%) declared that they always store probiotic preparations according to the manufacturer's recommendations.

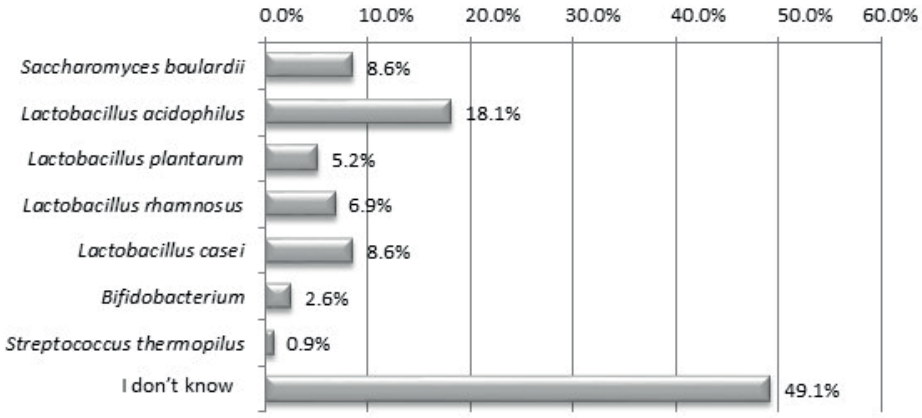

Figure 5. Microorganism genus most commonly used in probiotics, according to the respondents' opinion

An overwhelming majority of respondents (89.6%) believe that probiotic products have a positive effect on the human body. Few chose the "I don't know" (9.5%) or "no effect" (0.9%) answers. Among the many positive changes in health associated with probiotic use, the respondents reported: regulation of intestinal function (58.6%), reduction in the incidence of diarrhea (24.1%), improvement in immune function (19.0%), elimination of constipation (6.9%) and reduction of allergy symptoms (2.6%).

Discussion

Analysis of the collected data showed that more than 88% of the surveyed adult residents of the city of Biała Podlaska and Biała Podlaska County knew the definition of probiotics. Similar data were obtained in other studies, which showed that respectively 82.3% and 85% of the respondents knew the correct definition of probiotics [21,22]. This demonstrates that the public's knowledge in this area has increased significantly over recent years, as Mojka [23], citing a 2006 study by Połon and Rejman, reports that at that time 87% of the respondents had never heard the term "probiotic food" or "probiotic" [23]. Other studies have found a significant correlation between the level of knowledge about probiotics and the level of education [22] and the year of study [24]. Original research also found that women had a higher knowledge of probiotics compared to the men surveyed.

Natural sources of probiotics include dairy products, especially fermented products such as yoghurt, kefir, sour milk, buttermilk and unpasteurized cheeses, which contain mainly lactic acid bacteria. Probiotics are also found in pickled vegetables (cabbage, cucumbers, beetroot and others) [8,16,23,25]. The respondents correctly indicated food products containing the most probiotics as milk and dairy products, especially fermented ones (89.7%) and pickled fruit and vegetables (75.9%). According to a study by Zolotenka-Synowiec et al., 47% of the surveyed Poles and 50% of Czechs recognize dairy products as those containing probiotics [26]. Other studies conducted among elder people show that the vast majority of the respondents (85%) knew that fermented dairy products are the primary source of probiotics [22]. The highest percentage of the surveyed adult residents of the city of Biała Podlaska and Biala Podlaska County declared the use of probiotics in the form of dietary supplements (41.4%); however, the majority (49%) of the respondents had no knowledge of the type of microorganisms most commonly included in probiotic preparations.

Among the many factors influencing the choice of probiotic preparations, the highest percentage of the respondents take into account the recommendation of a doctor or pharmacist (50.9%). Karpińska-Tymoszuk et al. obtained different results in this respect – the respondents, when purchasing probiotic products, first chose those that suit their taste (35.3%) [24]. The analysis of the results of our study shows that taste values

were guided by only 8.1% of adults. The respondents declared using probiotics mainly during antibiotic therapy (81.0%), in case of diarrhea (48.3%) or intestinal diseases (26.7%). They most often reported their positive effect on bowel regulation (58.6%), a reduction in the incidence of diarrhea (24.1%) and improved immune function (19.0%). These results correlate with data obtained by Zolotenko-Synowiec et al. in which 80% of the surveyed Poles noted that their health improved after probiotic treatment [26], and 97% of the seniors surveyed knew that probiotics had a beneficial effect on the body [22]. Numerous data demonstrate the impact of probiotics on human health and the potential for their use in the prevention and treatment of many diseases [5,8,10,16,27-30]. Probiotic preparations are recognized as safe for health. In the European Union countries, they have been granted *Qualified Presumption of Safety* (QPS) status, with a counterpart in the USA being *Generally Recognized as Safe* (GRAS) status [8,31]. However, there is a potential for them to have adverse effects on the human body, especially in the case of immunodeficiency diseases, and they can also cause side effects such as bloating and abdominal discomfort [28,31]. In the conducted studies, none of the respondents indicated that probiotics could have negative health effects. Also in the study by Zolotenko-Synowiec et al. the respondents were not aware of possible harmful effects of probiotics [22]. This demonstrates the need for educational activities in this area and the awareness that the intake of various probiotic preparations, especially those that are medicinal products, is intended to improve health and should be done in accordance with medical indications [5].

Conclusions

The vast majority of the adults participating in the survey use probiotics and are familiar with their beneficial effects on the human body and natural dietary sources. Knowledge of the negative effects of probiotic supplementation and the use of prebiotics and synbiotics is less common, so it is important to strive to continuously raise public awareness of these issues by undertaking educational and informational activities.

A limitation of this study is the relatively small number of respondents. The obtained results, however, may suggest the need to extend the research in the undertaken thematic scope, employing a larger group of respondents, and paying attention to the eligibility characteristics of the study group.

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