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PARENTS' PERSPECTIVE ON PROBIOTICS IN PRESCHOOL CHILDREN: A CROSS-SECTIONAL SURVEY

POGLED STARŠEV NA UPORABO PROBIOTIKOV PRI PREDŠOLSKIH OTROCIH: PRESEČNA RAZISKAVA

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ABSTRACT

Introduction: The composition of the human gut microbiota, which can also be regulated by the consumption of probiotics, has a significant impact on host health. The main source of probiotics can be foods such as fermented foods, yogurts, fermented drinks and/or probiotic supplements. While parents play a critical role in ensuring the well-being of their children, this cross-sectional study is focused on parents' perspectives regarding the use of probiotics in the preschool period.

Methods: The self-administered online survey consisted of 24 questions arranged across two thematic sections. The final data analysis included 102 parents (96% F; 4% M), aged between 22 and 47. Their children were aged up to 6 years.

Results: The majority (52%) of the parents were familiar with the term 'probiotics' and 86.3% were including probiotics in their children's diet at the time of the survey. The main source was probiotic food (36.3%), of which yoghurt was the most commonly consumed (87.2%). The inclusion of probiotic supplements in a child's diet was positively correlated with parents' consumption and level of knowledge about the term 'probiotics'. Digestive tract-related disorders were the most frequently reported motive for the initial introduction of probiotics into children's diet.

Conclusions: Based on our study results, parents are familiar with probiotics and include them in their children's diet. However, an attempt should be made to close the gaps in parents' knowledge that our research identified. Further studies are needed to determine the recommended amount of probiotic foods, as well as strategies to educate parents about the benefits of including probiotic foods in their children's diet.

Keywords:
probiotics, preschool period, children's health, parents' perspective

IZVLEČEK

Uvod: *Sestavo črevesne mikrobiote lahko človek uravnava tudi z uživanjem probiotikov, kar pomembno vpliva na njegovo zdravje. Glavni vir probiotikov so lahko živila, kot so fermentirana živila, jogurti, fermentirane pijače in/ali probiotična prehranska dopolnila. Ta presečna študija je osredotočena na poglede staršev na uporabo probiotikov pri njihovih otrocih v predšolskem obdobju. Starši imajo namreč ključno vlogo pri izbiri hrane in prehranskih dopolnil.*

Metode: *Spletna anketa je bila sestavljena iz 24 vprašanj v dveh tematskih sklopih. V končno analizo podatkov sta bila vključena 102 starša (96 % Ž; 4 % M) otrok, starih do 6 let. Starost staršev je bila od 22 do 47 let.*

Rezultati: *Večina (52 %) staršev je poznala izraz probiotik, 86,3 % pa jih je v času raziskave tudi vključila v prehrano svojih otrok. Glavni vir so bila živila, ki vsebujejo žive mikroorganizme s potencialnim probiotičnim učinkom (36,3 %), od tega so najpogosteje zaužili jogurt (87,2 %). Vključitev probiotičnih prehranskih dopolnil v otrokovo prehrano je bila pozitivno povezana s porabo pri starših in nivojem znanja o pojmu probiotiki. Najpogosteje poročan razlog za začetno uvedbo probiotikov pri otrocih so bile motnje prebavnega trakta.*

Zaključki: *Rezultati naše študije kažejo, da so starši seznanjeni s probiotiki in jih vključujejo v prehrano svojih otrok. Kljub temu so vrzeli v znanju bile ugotovljene in treba bi jih bilo odpraviti. Zaključujemo, da je treba opraviti večje število kliničnih študij, na osnovi katerih bi lahko podali priporočila o dnevnem vnosu probiotičnih mikroorganizmov in oblikovali strategije za izobraževanje staršev o prednostih vključitve probiotičnih živil v prehrano otrok.*

Ključne besede:
probiotiki, predšolsko obdobje, zdravje otrok, pogled staršev

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1 INTRODUCTION

The human gastrointestinal (GI) tract is colonised by a complex population of microorganisms that are closely associated with the host in terms of health and disease (1). Importantly, the establishment of a stable microbial community within the GI tract early in life plays an important role in directing the development of the host's immune, GI and nervous systems (2). Although most studies focus on microbiota composition in the first 12 months of life (2, 3), the preschool period is a very important window during which children are exposed to many disturbances on a daily basis; in addition, children in day care settings are more likely to be exposed to infections that may often require antibiotic treatment (4). The latter can significantly upset GI microbiota and lead to common side-effects such as antibiotic-associated diarrhoea (5). Dysbiosis or disturbance in the gut microbiota homeostasis occurs as a result of the loss of beneficial members, the excessive growth of potentially harmful organisms or the loss of overall microbial diversity (6). Microbiota dysbiosis has also been associated with various gastrointestinal (7) and metabolic disorders (8), autoimmune and allergic diseases (9, 10), and neuropsychiatric disorders such as autism (11). Nevertheless, there is a growing number of studies that evaluate the benefits of probiotics in preventing or treating certain health conditions in children by modulating the microbiota, such as antibiotic-related diarrhoea (12), gastrointestinal and respiratory infections (13), chronic inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) (14), atopic eczema (15), mental health (16), autism spectrum disorders (17) and obesity-related disorders (18). These clinically based health benefits were used to design the false or true claims presented to survey participants in our study. Probiotics are 'live microorganisms that, when administered in adequate amounts, confer a health benefit on the host'. Live microorganisms refer to strains of a number of well-studied microbial species delivered at a functional dose for use as foods (fermented foods, yogurts, fermented drinks) or supplements (19). The first aim of our study was to investigate parental perspectives on probiotics use and the amount of fermented foods and/or probiotic supplements consumed by their preschool-aged children. The second aim was to find an association between variables such as knowledge, opinion, level of education, health conditions, and the consumption of probiotic foods and supplements.

2 METHODS

2.1 Survey subjects and design

A cross-sectional study was conducted to obtain information on parental perspectives regarding probiotics in preschool children. For the study, parents of children aged up to 6 years were invited to participate via internet sources. Each parent provided information on one of the children in their household. Only completed questionnaires were included in the survey data analysis. The study methods were performed in accordance with relevant guidelines and regulations. The survey was conducted and made available through the online 'EnKlikAnketa' portal using a free open-source application called 1KA (https://www.1ka.si/). The study protocol was approved by the Slovenian National Medical Ethics Committee (No 0120–631/2017/2). Written informed consent was obtained from all subjects participating in the survey. All of the participants were informed of the anonymity and confidentiality of the data obtained.

2.2 Survey

The self-administered online survey, which was based on previously published data with modifications (24–26), consisted of 24 questions arranged across two thematic sections. The questions in the first section asked for the parents' demographic information and their perspectives, as well as the amount of fermented foods and/or probiotic supplements consumed in the past month. Parents were also introduced to the nine claims derived from the literature review presented in the introduction. Parents were asked to mark whether they agreed or disagreed with the claims. The second section asked for the preschool child's demographic information, followed by details about the amount, frequency and purpose of consumption of probiotic foods and/or supplements. The survey subjects were asked to indicate the amount and frequency of selected fermented foods (raw sauerkraut, raw pickled turnip, cheese, yoghurt, kefir, buttermilk, acidophilic milk and whey) as potential sources of live microorganisms. The amount of food consumed was determined on the basis of the portion size material from the national survey (20). For data analysis, liquid fermented foods were considered regardless of age, and solid fermented foods were considered only after 12 months of age.

2.3 Data analysis

Quantitative data analysis was performed using statistical software (SPSS v26; IBM, Armonk, NY, USA). To test the statistical significance of the differences between the variables, a t-test for independent variables was used. Although the assumption of normal distribution of the observed variables was not justified, the nonparametric tests referred to as the Mann-Whitney U test or Kruskal-Wallis test were used. The level of statistical significance was set at $p<0.05$. The Spearman correlation test was used to assess the relationships between variables such as parents' level of education, their knowledge of the term 'probiotics', the source of probiotics in a child's diet, the amount of fermented foods consumed and any changes observed after the use of probiotics. A correlation was considered strong if rs approached 1, moderate if rs

was close to 0.5, and weak if rs was close to zero. The significance level for correlations was set at $p<0.05$ to indicate a statistically significant correlation.

3 RESULTS

3.1 Survey subjects

Of the 144 parents who followed the link to the survey, 102 (96% F; 4% M) were included in the final data analysis. They ranged in age from 22 to 47. Complete information about the parents and children who participated in the survey is presented in Table 1. The highest proportion (55.9%) of parents were from the 30–39 age group, had a Master's degree (36.3%) and lived in a three- or four-person household (84.3%). Parents provided information on one of their preschool children. Cumulatively, 56.9% were girls and 43.1% were boys. The age of the children ranged from two months to five years, with most between one and two years of age (32.3%). The majority of children were born vaginally (80.4%) and breastfed for the first months of life (65.7%).

3.2 Parental perspectives on and habits of consumption of probiotics

Parental perspectives and information on probiotics consumption are presented in Table 2. The majority of parents were familiar with the term (52%), and even knew how to explain it and to explain the benefits of probiotics consumption (44%). The most common sources of information about probiotics were books or magazines (18.4%) followed by online sources (18%). The latter was also the most frequently reported encouragement factor for probiotics consumption. Overall, 88.2% of parents confirmed that they included probiotic foods in their diet, while 41.2% of them also consumed probiotic supplements themselves. There was a statistically significant moderate positive correlation between knowledge of the correct definition of probiotics and variables such as level of education ($rs=0.371$; $p<0.001$), and parental consumption of probiotic supplements ($rs=0.393$; $p<0.001$). There was also a weak positive correlation between opinions about the influence of probiotics on host well-being and parental consumption of probiotics ($rs=0.344$; $p=0.02$). In addition, there was a statistically significant moderate positive correlation between parents' opinions about the health benefits of probiotics consumption and whether they considered them to be beneficial for their children ($rs=0.569$; $p<0.001$). Nevertheless, 88.2% of parents considered probiotics consumption to be beneficial for their children and the vast majority (86.3%) also included probiotics in their children's diet.

Table 1. Survey subjects' characteristics.

Characteristics	N (%)
Gender of parents	
Female	98 (96.1)
Male	4 (3.9)
Age group	
20–29	38 (37.2)
30–39	57 (55.9)
40–49	7 (6.9)
Level of education	
Primary school	1 (0.9)
Secondary school	30 (29.4)
College	33 (32.5)
Master's degree	37 (36.3)
Doctoral degree	1 (0.9)
Number of household members	
2	3 (2.9)
3	45 (44.1)
4	41 (40.2)
5	12 (11.8)
6	1 (1)
Gender of child	
Female	58 (56.9)
Male	44 (43.1)
Child age (years)	
0–1	7 (6.9)
1–2	33 (32.3)
2–3	12 (11.8)
3–4	12 (11.8)
4–5	14 (13.7)
5–6	24 (23.5)
Type of delivery	
Vaginal delivery	82 (80.4)
Caesarean section	20 (19.6)
Type of feeding in first months of life	
Exclusively breastfeeding	67 (65.7)
Combination of breastfeeding and milk formulas	30 (29.4)
Exclusively milk formulas	5 (4.9)

Table 2. Parental perspective and data on probiotics consumption.

Characteristics	N (%)
Parental knowledge of the term 'probiotic'	
Knows how to explain the term and the benefits of probiotics consumption	45 (44.1)
Familiar with the term and with the benefits of probiotics consumption	53 (52)
Has heard about the term 'probiotics', but is not familiar with the benefits of consumption	4 (3.9)
Unfamiliar with the term and with the benefits of consumption	0 (0)
Source of information on probiotics	
Family members	23 (7.8)
Friends or acquaintances	31 (10.6)
Medical doctor	28 (9.5)
Pharmacist	25 (8.5)
Media advertising	38 (12.9)
Through education	26 (8.8)
Workplace	14 (4.8)
Books or magazines	54 (18.4)
Online	53 (18)
Bioresonance therapy	2 (0.7)
Encouragement factor for probiotics consumption	
Family members	18 (14.4)
Friends or acquaintances	20 (16)
Medical doctor	16 (12.8)
Pharmacist	7 (5.6)
Media advertising	13 (10.4)
Books or magazines	9 (7.2)
Health food shop	8 (6.4)
Online sources	27 (21.6)
Other (by themselves, bio resonance therapy)	7 (6.8)
Source of parental consumption of probiotics	
Probiotic foods	90 (88.2)
Probiotic supplements	42 (41.2)
Do you consider probiotics consumption to be beneficial for your children?	
Yes	90 (88.2)
No	6 (5.9)
I don't have enough information	6 (5.9)
Are you currently including probiotics in your children's diet?	
Yes	88 (86.3)
No	14 (13.7)
Sources of probiotics consumption by children (N = 88)	
Probiotic foods	37 (36.3)
Probiotic supplements	13 (12.8)
Combinations of probiotic foods and supplements	29 (28.4)
Other (breastfeeding, milk formulas)	9 (8.8)
Children's first encounter with probiotic supplements (N = 92)	
During pregnancy	12 (11.8)
Breastfeeding, milk formulas	21 (20.6)
Introduction of solid food	25 (24.5)
Antibiotic treatment	26 (25.5)
Other (digestive disorders, colic, allergy)	8 (7.8)

Regarding the responses to the claims derived from the literature review (Table 3), the average percentage of agreement with true claims was 92.2±3.8% and disagreement with false claims was 77.8±8.6%. The largest proportion of parents (96.1%) agreed with the claims: 'The use of probiotics regulates digestion' and 'Nutrition has a significant impact on the composition of the gut microbiota'. Surprisingly, 29.4% of parents agreed with the false statement 'Probiotics are indigestible fibres in foods that have a beneficial effect on digestion', even though the correct definition of probiotics was provided in the questionnaire.

Table 3. Parents' agreement with the statements about probiotics derived from the literature review.

Statement	True (T) False (F)	Agree N (%)	Disagree N (%)
Probiotics work immediately after consumption.	F	24 (23.5)	78 (76.5)
It is recommended that probiotics be consumed during antibiotic treatment.	T	93 (91.2)	9 (8.8)
The use of probiotics regulates digestion.	T	98 (96.1)	4 (3.9)
The use of probiotics reduces the incidence and duration of diarrhoea.	T	91 (89.2)	11 (10.8)
Probiotics have positive benefits only on digestive tract health.	F	25 (24.5)	77 (75.5)
The composition of the gut microbiota is determined at birth and remains the same throughout life.	F	13 (12.7)	89 (87.3)
Consumption of probiotics strengthens the immune system.	T	90 (88.2)	12 (11.8)
Nutrition has a significant impact on the composition of the gut microbiota.	T	98 (96.1)	4 (3.9)
Probiotics are indigestible fibres in foods that have a beneficial effect on digestion.	F	30 (29.4)	72 (70.6)

Legend: T - true; F - false

3.3 Consumption of probiotics in the preschool period

For parents (86.3%) who were including probiotics in their children's diet at the time of the survey, the main source was probiotic food (36.3%), followed by a combination of probiotic food and supplements (28.4%). The lowest proportion was observed in relation to the consumption of probiotic supplements only (12.8%) (Table 2). However, the highest proportion of probiotics consumption was found among children aged between one and two (35.2%), followed by those aged between five and six (23.8%) and between four and five (13.6%). The most common reasons for introducing probiotics into children's diets in the form of fermented foods or supplements were to achieve better health outcomes, as follows: diarrhoea (44.1%), antibiotic treatment (42.1%), constipation (35.4%) and maintenance of gut health (32.3%). Since probiotic foods are the most common source of probiotics consumption among children, the amount of selected fermented foods consumed was investigated. The percentage of probiotic foods consumed shows the proportion of children who consumed individual probiotic foods in the past month. Cumulatively, children most frequently consumed plain or fruit yoghurt (87.2%; N=89), cheese (83.3%; N=85), and raw sauerkraut (43.1%; N=44) (Table 4). From the amount and frequency of consumption of probiotic foods in the last month, the mean amounts per day were calculated (161±212.5 mL and 19.06±29.8 g/day). The median amount of daily consumption was 71.4 mL for yoghurt, 21.4 mL for kefir, buttermilk and acidophilus milk, and 7.1 mL for whey. For solid fermented foods, the median amount was 8.6 g for cheese, 2.9 g for raw sauerkraut and 2.1 g for raw pickled turnip. There were 44 children who consumed at least 100 g/mL of fermented foods daily. There was a statistically significant moderate positive correlation between the consumption of probiotics (food or supplements) between parents and children (r_s=0.383; $p<0.001$) during the study period. As expected, there was also a statistically significant moderate positive correlation between the amount of liquid and solid fermented foods consumed by children (r_s=0.468; $p<0.001$). Interestingly, there was also a statistically significant moderate positive correlation between parents' knowledge of the term 'probiotics' and children's consumption of pickled turnip (r_s=0.461; $p=0.027$).

Table 4. Average amount of probiotic foods consumed by preschool children.

Consumption of liquid fermented products (N=90)	M±SD (mL/day)	N (%)
Yogurt	115.7±134.9	89 (87.2)
Kefir	51.5±73.8	33 (32.4)
Buttermilk	55.8±81.5	16 (15.7)
Acidophilus milk	48.0±70.0	23 (22.5)
Whey	36.9±83.7	12 (11.4)
Total:	161.0±212.5	90 (88.2)
Consumption of solid fermented products (N=85)	**M±SD (g/day)**	**N (%)**
Sauerkraut	8.7±20.5	44 (43.1)
Sour turnip	4.7±7.4	23 (22.5)
Cheese	12.6±13.4	82 (80.4)
Total:	19.1±29.8	85 (83.3)

4 DISCUSSION

Nutrition in the first years of life is one of the most important factors that affect a child's well-being, development and health. The first years of a child's life are also recognised as an important period in the development of healthy gut microbiota. While the composition of the gut microbiota is constantly and rapidly changing during this period, it is often exposed to stressors that can lead to dysbiosis (21, 22). While antibiotics are recognised as a key contributor to gut microbiota dysbiosis leading to various diseases, as reviewed by Vangay et al. (24), this is also the most commonly prescribed class of drugs in the child population (23, 24). Since it has been shown that consumption of probiotics can successfully reverse established microbial dysbiosis, they are commonly used as a strategy to modulate the gut microbiota (25). Probiotics are live microorganisms naturally present and/or added to food or dietary supplements. When administrated in adequate amounts, they have a favourable effect on host health (26, 27). As shown in our study, disorders associated with the digestive tract were the most frequently cited motive for the initial introduction of probiotics into children's diets, with antibiotic treatment (25.5%) in first place. Parents also indicated that probiotic supplementation in children's diet resulted as changed stool consistency, relief from constipation, reduction in gas and bloating, faster overcoming of colds, reduction in diarrhoea frequency, improvement in mood, and faster overcoming of allergies. Exposure to probiotics during pregnancy and early infancy could reduce the risk of developing various health problems, such as atopic dermatitis (28), necrotising enterocolitis (29) antibiotic-associated diarrhoea (30) and paediatric acute infectious diarrhoea (31, 32). As reviewed by Sestito et al., there is still a lack of evidence on the use of probiotic supplements to prevent allergic diseases. However, the World Allergy Organization (WAO), recommends probiotics during pregnancy and lactation for mothers at high risk of allergic disease in the case of atopic dermatitis (33). In our study, 8.8% of parents of children who suffered from food allergies and 6.9% of parents of children who suffered from skin allergies always used probiotics. While parents play a critical role in ensuring the well-being of their children, this cross-sectional study focused on parental perspectives regarding the use of probiotics in the preschool period. Our study results showed that parents were familiar with probiotics (all parents had heard the term before) and only 4% were unfamiliar with the benefits of probiotics consumption (Table 2). This was also evident in parents' perspectives on, and their agreement with the statement about, the benefits of probiotics for their children. In a previous study on maternal perspective (N=413), which included children aged up to two years, most mothers believed that probiotics were beneficial (73.1%), 9.7% of mothers had a neutral opinion and 15% reported not having enough information. However, the use of probiotics in children was lower compared to their mothers (50.8% vs. 89%), suggesting that mothers are more concerned about the use of probiotics in younger children (34). In addition, Andersen et al. (35) showed that parents were willing to take probiotics on the recommendation of a physician and other healthcare professionals, or when a child might benefit from taking probiotics, but were sceptical about preventive use (35). In our study, only a small proportion (12.8%) of parents were encouraged to consume probiotics by a physician (Table 2). However, there was no significant parental reluctance regarding the use of probiotics in their children's diet, while 88.2% of parents agreed that probiotics were beneficial for their children. Accordingly, 86.3% of parents reported that probiotics were a part of their children's diet, while almost all parents consumed fermented foods at least once a month (88.2%) and 41.2% also/or consumed probiotic supplements (Table 2). There was also a statistically significant positive correlation between parental views regarding their children's use of probiotics and parental educational level ($r_s=0.371$; $p<0.001$), parental use of probiotic supplements ($r_s=0.393$; $p<0.001$) and use by their children ($r_s=0.305$; $p=0.002$), and children's consumption of pickled turnip ($r_s=0.461$; $p=0.027$). Fermented dairy products such as yoghurt, fermented milk and cheese still remain the most common vehicle for the delivery of probiotics, although many non-dairy products have also been traditionally consumed for centuries (36). Although several epidemiological studies have reported health benefits from yoghurt and other fermented foods (37), it is important to distinguish between probiotic microorganisms and fermentation-associated microbes, the latter seldom being adequately defined. Unless isolated and defined, it is impossible to assess the potential probiotic properties of the relevant strain (38). In our study, fermented food was also the most common source of probiotics in children's diet (36.3%), followed by combined intake with probiotic supplements (28.4%) and solely by probiotic supplement (12.8%). However, the highest proportion of probiotics consumption was observed in children aged between one and two years (35.2%), followed by those between five and six (23.8%) and those aged between four and five (13.6%). The highest prevalence of consumption of probiotic supplements only (44.4%) was observed among children aged between one and two. There was a statistically significant positive correlation between the inclusion of probiotic supplements in the child's diet and their use in the parents' diet ($r_s=0.460$; $p<0.001$), as well as the parent's level of knowledge about the term 'probiotics' ($r_s=0.305$; $p=0.002$). It is generally accepted that probiotic products should have a minimum concentration of 106 CFU/mL or gram to confer health benefits to the host (39). Therefore, an adequate amount of probiotics to maintain

the balance of the gut microbiota can be achieved regularly with approximately 100 g/day, which delivers about 109 viable cells into the intestinal daily probiotic food intake (40). As shown before, increased dietary variety and the increased intake of probiotic and prebiotic food can be successfully achieved by microbiota modulation-focused dietary intervention in the perinatal period (41). Although the parents in our study noted an improvement in their children's well-being after the consumption of probiotics, no guidance or recommendations exist for this vulnerable age group. When making recommendations to parents as consumers, it is important to take into account their personal traits as well their taste predispositions (42). In our opinion, the preschool period should be considered to be an opportunity for more frequent and diverse inclusion of probiotic foods. This not only positively affects host well-being, but also introduces foods with different tastes and textures.

5 CONCLUSION

Further studies are needed to determine the recommended amount of probiotic foods, as well as strategies to educate parents about the benefits of including probiotic foods in children's daily diets.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

There is no financial interest or risk.

ETHICAL APROVAL

The study protocol was approved by the Slovenian National Medical Ethics Committee (No 0120–631/2017/2). Written informed consent was obtained from all subjects participating in the survey. The questionnaire was anonymous. The data collected was used solely for the purpose of the purpose.

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