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Can Traditional Fermented Food Products Protect Mothers Against Lactational Mastitis

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Abstract

Background/Objective: Various dietary factors, including the daily food intake during pregnancy and lactation can play a role in the development of lactational mastitis (LM). To investigate the effect of the most commonly consumed fermented foods (FF) during pregnancy and lactation in Turkey and other factors described in the literature regarding childbirth and breastfeeding on the development of LM.
Materials and Methods: The study included 607 volunteers in the lactational period, of whom 303 had LM and 304 had no mastitis event. The data on sociodemographics, childbirth, and breastfeeding, and the consumption frequency of six types of FF were collected through a face-to-face questionnaire.
Results: The variables significantly and independently associated with LM were birth week (odds ratio [OR] = 80.83, 95% confidence interval [CI]: 1.12–1.94), birth weight (OR = 0.63, CI: 1.24–1.79), time to breastfeeding after birth (OR = 0.79, CI: 1.62–2.31), breastfeeding length (OR = 0.12, CI: 2.25–2.78), breast preference (OR = 0.13, CI: 2.83–3.42), use of cream on nipples (OR = 0.81, CI: 1.31–1.97), use of oral probiotics (OR = 0.29, CI: 1.86–2.92), and receiving breastfeeding education from an expert (OR = 0.22, CI: 1.22–2.34). According to the multinominal logistic regression analysis, the daily consumption of kefir (OR = 0.69, CI: 1.18–2.22), homemade yogurt (OR = 0.78, CI: 1.14–1.87), conventional yogurt (OR = 0.81, CI: 1.24–2.46), boza (OR = 0.79, CI: 2.19–2.99), tarhana (OR = 0.52, CI: 2.47–2.81), and pickles (OR = 0.22, CI: 1.22–2.34) significantly reduced the risk of LM development. The diversity of consumed FF was also found to be protective against LM (OR = 0.34, CI: 1.34–2.35).
Conclusion: Kefir, homemade and conventional yogurt, boza, tarhana, and pickles can protect breastfeeding mothers and also reduce the risk of LM development.

Keywords: lactational mastitis, fermented food, probiotics

Introduction

Probiotics are living microorganisms useful for human health when used at an appropriate amount. Due to their immunomodulatory, anti-inflammatory, antitumoral and antiallergic properties, they have been investigated in terms of their protective and adjunct therapeutic effects in a wide spectrum of diseases.[1] In the inflammatory disease group, lactational (puerperal) mastitis (LM) is an appropriate clinical entity for probiotic use as an adjunct or alternative to existing treatment.

With the growing number of breastfeeding campaigns, the rate of breastfeeding has increased throughout the world, not only in rural areas but also in the urban population.[2] LM is seen in 3–33% of breastfeeding women. An abscess in the breast, reduced amount of dynamic milk, and unintended discontinuation of breastfeeding constitute an important health problem in LM patients.[3,4] Although it is commonly seen in the first 3 months after birth, recurrent mastitis may occur at any stage of breastfeeding. Local symptoms, such as sudden-onset severe pain, redness, and swelling in the affected breast may be observed, as well as systemic symptoms, including fever, headache, flu-like symptoms, nausea, and vomiting. Some epidemiological studies that have been conducted to determine potential risk factors of infectious LM report risk factors to be previous mastitis episodes, cracked nipple or nipple trauma, nipple cream application, and peripartum antibiotic use.[5] *Staphylococcus* spp. are the most commonly isolated pathogenic microorganisms in infectious mastitis, with the most prominent members being *Staphylococcus aureus* and increasingly *Staphylococcus epidermidis*. These are followed by *Streptococcus* strains

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(*Streptococcus mitis* and *Streptococcus salivarius*), and rarely *Corynebacterium* spp. In recent years, increasing pathogen resistance to antibiotics and treatment costs have also paved the way for probiotic use in LM as an adjunct or alternative to existing treatment.[6] In these studies, it has been suggested that different *Lactobacillus* strains isolated from human breast milk may be an alternative treatment for LM through their prevention of pathogen colonization by the host and bacteriotherapeutic effects on *Staphylococcus* strains.[7–9] In a short time, commercial preparations containing probiotics have begun to be produced and marketed worldwide.[10]

Fermentation has been used for ages for the long-term preservation of food. In recent years, ethnic fermented food (FF) has attracted the attention of the scientific community due to not only the probiotics, but also polyunsaturated fatty acids, oligosaccharides, antioxidants, folate, and other vitamins they contain. Biologically active peptides produced by the bacteria responsible for the fermentation process have been shown to exhibit antioxidant, antimicrobial, opioid antagonist, antiallergenic, anti-inflammatory, and blood pressure-lowering effects.[11] In the geography extending from Eastern Europe to Central Asia, there is a wide spectrum of FF easily prepared with dairy products and vegetables, making them suitable for daily consumption.[12] The most commonly isolated microorganisms from these foods are lactic acid bacteria (LAB) and yeasts, and strains vary depending on the region in which they are produced. However, chemical analyses have revealed the presence of the same substrains in the FF produced in Turkey.[11,12] These strains are in parallel to those that have been shown to be effective in the treatment of staphylococcal mastitis in the literature.[7,8,13] On the other hand, with their anti-inflammatory properties, they prevent the colonization of pathogens in intramammary lobules.[13]

There are studies examining the effects of FF consumption during pregnancy on maternal and infant health.[14,15] Turkey, with its rich and delicious varieties of FF, constitutes an appropriate commune for the investigation of the protective and therapeutic effects of diets during pregnancy and lactation on diseases.[14] The aim of this study was to investigate the risk factors of LM in breastfeeding women and determine the relationship between ethnic FF consumption and LM development.

Materials and Methods

Study design

This cross-sectional study was conducted with 607 women 18–45 years of age in the lactation period (0–24 months) who presented to the pediatric and general surgery outpatient clinics of Medipol University Faculty of Medicine between June 2019 and September 2019. The exclusion criteria of the study were history of cancer and non-LM, diseases requiring maternal immunosuppressive treatment, giving birth to infants with low birth weight according to the gestational week, separation of the mother and infant for more than 24 hours during breastfeeding, and exclusive breastfeeding for <4 months, which is the lower limit recommended by the World Health Organization (if the lactation period was <4 months at the time of the study, the lower limit was taken as the age of the infant). The study was carried out by dividing the mothers into two demographically similar groups as those who never had mastitis ($n=303$) and those that were undergoing mastitis. All volunteers were informed about the purpose of the study and signed the written informed consent form. The study was approved by the Ethics Committee of Medipol University (date: June 12, 2019; No. 10840098-604.01.01-E.18664).

Questionnaire

The questionnaire was completed by face-to-face interviews conducted by general surgery specialists conducting the study with patients and healthy volunteers. As a result of the literature review, the questionnaire was prepared taking into consideration the factors that were most investigated in various publications and found to increase the risk of LM. Thus, the forms contained questions to inquire about the mothers' age, educational status, average monthly income, number of pregnancies and live births, preconception and prenatal weight and body mass index (BMI), birth week and weight of the baby, method of delivery, time to start breastfeeding, month of breastfeeding, duration of breastfeeding, breast preference, cracked nipple, use of nipple cream, use of milk pump, use of oral probiotics, and receiving information or education on breastfeeding.

The questionnaire also aimed to retrospectively examine the most frequently used traditional FF consumption during pregnancy and lactation in Turkey. For this purpose, six types of FF, namely kefir, homemade yogurt, conventional yogurt, boza (fermented drink made from wheat and yeast), tarhana (dried food ingredient made from grain and yogurt), and pickles were examined in four groups according to mothers' frequency of consumption: (1) once or less than once a month, (2) once a week, (3) twice or thrice a week, and (4) daily.

Statistical analysis

In this study, the data collected by the face-to-face survey method were analyzed using SPSS statistical package program v. 25. All the data showed normal distribution. The chi-square and Shapiro/Wilk tests were used to check the normality assumption. The association of the sociodemographic information, data on birth and breastfeeding, and the consumption of six frequently consumed traditional FF products between the mothers with and without LM was undertaken using Student's t test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant. The possible factors identified by univariate analysis were further analyzed by multinominal logistic regression analysis to determine the independent predictors for the disease. The confidence interval (CI) was taken as 95%, and the variables with an odds ratio (OR) of <1 were considered to reduce the risk of LM development.

Results

The study groups consisted of 303 healthy women (Group 1) and 304 patients (Group 2) that were having LM episodes in the lactational period from 0 to 24 months. For the mothers in Group 2, the two general surgeons independently made an LM diagnosis based on the symptoms of swelling, pain or increased temperature on one or both breasts and fever (higher than 38°C) accompanied by chills, sweating, and widespread body ache (16). When the two surgeons did not agree on the diagnosis of mastitis, a breast ultrasound was performed as the most frequently used imaging method, and the patients with a definite diagnosis were included in the study group. The mothers in Group 1 were healthy individuals who did not have any complaints and applied to the general surgery or pediatric outpatient clinics for various other reasons. Their breast examinations were performed by the same physicians and it was observed and noted that they did not have LM. When the sociodemographic variables, namely age, educational level, monthly income, number of pregnancies and births, and preconception and prenatal body weight and BMI were compared between the two groups, no statistically significant difference was found (Table 1).

This study analyzed the most commonly identified variables that were considered to be associated with LM development.[5,16–18] These variables were the birth week and weight of the infant, method of delivery, time from delivery to breastfeeding, duration of breastfeeding for each breast, breastfeeding preference (one or two breasts), cracked nipple, use of nipple cream, and pump application. When the two groups were compared, there was no statistical difference regarding delivery method, cracked nipple, and pump use. Although this seems to contradict the literature data, especially in terms of nipple crack and pump use, this contradiction can be explained by the high rates of these variables in both patient groups.[16–18] In addition, there was a statistically significant difference between the two groups if the mothers that had a cracked nipple or used milk pump also used nipple cream ($p = 0.011$).

Table 1. Sociodemographic Data of the Mothers

	Control group, n = *301*	*LM group,* n = *304*	p
Mother's age	32 (±6.1)	29 (±5.6)	0.072
Education (%)			0.082
Illiterate	22 (7.4)	11 (3.6)	
Primary school	64 (21.2)	86 (28.2)	
Middle school	134 (44.5)	123 (40.5)	
University	81 (26.9)	84 (27.7)	
Monthly income, TL			0.487
<1,500 (%)	4 (1.3)	6 (1.9)	
1,501–4,500 (%)	116 (38.5)	124 (40.7)	
4,501–10,000 (%)	144 (47.8)	145 (47.6)	
>10,000 (%)	37 (12.2)	26 (8.5)	
Gravida (%)			0.391
1	54 (17.9)	65 (21.4)	
2	102 (33.9)	88 (28.9)	
≥3	210 (48.2)	151 (49.7)	
Parity (%)			0.486
1	91 (30.2)	107 (35.2)	
2	136 (45.3)	132 (43.5)	
≥3	74 (24.5)	65 (21.3)	
Preconception weight (kg)	65 (±6.2)	64 (±6.1)	0.107
Prenatal weight (kg)	81 (±6.9)	78 (±7.7)	0.010
Preconception BMI	25 (±2.0)	24 (±1.9)	0.312
Prenatal BMI	31 (±2.1)	30 (±2.6)	0.302

BMI, body mass index; LM, lactational mastitis.

Other variables found to be statistically associated with LM were the birth week and weight of the infant, time to breastfeeding, duration of breastfeeding, breast preference, oral probiotic use, and receiving breastfeeding education from an expert. These results are consistent with the literature data[5,16] (Table 2).

A multinominal logistic regression analysis (backward stepwise method) was performed on all variables that were found to be significant in univariate analysis. According to the results, the protective effect against LM development was 1.2 times greater for full-term delivery (OR: 0.83, 95% CI: 1.12–1.94), 1.5 times greater for birth weight (OR: 0.63, CI: 1.24–1.79), 1.2 times greater for starting breastfeeding within the first hour of delivery (OR: 0.79, CI: 1.62–2.31), 8.3 times greater for longer breastfeeding duration (OR: 0.12, CI: 2.25–2.78), 7.6 times greater for breastfeeding on both breasts (OR: 0.13, CI: 2.83–3.42), 1.2 times greater for cream application (OR: 0.81, CI: 1.31–1.97), 3.4 times greater for oral probiotic use (OR: 0.29, CI: 1.86–2.92), and 10 times greater for receiving breastfeeding education from an expert (OR: 0.01, CI: 2.11–2.63) (Table 3).

Considering the consumption of FF, kefir and homemade yoghurt were the most frequently daily consumed FF in both groups. All the six FF investigated were consumed at a higher rate in Group 1 compared with Group 2. The incidence of LM decreased with the increasing consumption of kefir, homemade yogurt, conventional yogurt, boza, tarhana, and pickle ($p = 0.038$, 0.001, 0.004, 0.026, 0.021, and 0.001, respectively) (Table 4). According to the results of the multinomial logistic regression analysis performed by dividing the FF products into four groups based on the frequency of consumption, the protective effect against LM development was 1.4 times greater for the daily consumption of kefir (OR: 0.69, CI: 1.18–2.22); 1.2 times greater for that of homemade yogurt (OR: 0.78, CI: 1.14–1.87), conventional yogurt (OR: 0.81, CI: 1.24–2.46), and boza (OR: 0.79, CI: 2.19–2.99); 1.9 times greater for that of tarhana (OR: 0.52, CI: 2.47–2.81); and 4.5 times greater for pickles (OR: 0.22, CI: 1.22–2.34) compared with the remaining consumption frequency groups (Table 5). The diversity of FF consumed was also examined. The mean number of FF consumed was found to be 3 (minimum to maximum: 1–4) for Group 1 and 2 (minimum to maximum: 0–5) for Group 2, which indicated a statistically significant difference between the two groups ($p < 0.001$). This suggests that FF products that have an important place in the daily diet of people living in Turkey and surrounding countries reduce the risk of LM development when consumed at an increased frequency and higher diversity during pregnancy and lactation.

Discussion

There are many articles in the literature about the risk factors, diagnosis, and treatment of LM.[18–21] Traditionally, the most common causative microorganism is *S. aureus*, but *S. epidermidis* has also been frequently isolated from dairy cultures in recent years.[22] Multidrug resistance is especially common in these two strains, which makes it difficult to treat mastitis and prevent recurrent episodes.[23,24] Although various studies have examined the potential curative effect of LAB isolated from human milk, rather than antibiotherapy, no study has been conducted to examine the relationship

Table 2. Birth and Breastfeeding Parameters of the Mothers and Infants

	Control group, n = *301*	*LM group,* n = *304*	p
Gestational week of birth			0.008
≤37%	26 (8.6)	7 (2.4)	
38–40%	267 (88.8)	295 (96.9)	
≥40%	8 (2.6)	2 (0.7)	
Birth weight of infant (g)	3,455 (±348.4)	3,354 (±342.4)	0.026
Delivery method			0.534
Vaginal %	139 (46.2)	151 (49.7)	
Cesarean section %	162 (53.8)	153 (50.3)	
Time to breastfeeding (hours)			0.036
First hour after birth	187 (62.1)	148 (48.7)	
After the first hour	114 (37.9)	156 (51.3)	
Breastfeeding duration			0.031
5 Minutes	27 (8.9)	38 (12.5)	
10 Minutes	143 (47.5)	156 (51.3)	
15 Minutes	117 (38.9)	106 (34.9)	
>20 Minutes	14 (4.7)	4 (1.3)	
Breast preference %			0.041
Single breast	94 (31.4)	119 (36.1)	
Both breasts	207 (68.6)	185 (60.9)	
Cracked nipple %			0.054
No	181 (60.1)	111 (36.6)	
Yes	120 (39.9)	193 (63.4)	
Nipple cream use %			0.011
No	195 (64.8)	173 (56.9)	
Yes	106 (35.2)	131 (43.1)	
Pump use %			0.463
No	194 (64.5)	118 (38.8)	
Yes	107 (35.5)	186 (61.1)	
Oral probiotic use %			0.002
No	241 (80.1)	273 (80.9)	
Yes	60 (19.9)	31 (10.1)	
Breastfeeding information/education %			0.004
None	10 (3.3)	4 (1.3)	
From family	61 (20.3)	45 (14.8)	
From health care personnel	204 (67.8)	238 (78.3)	
From an expert	26 (8.6)	17 (5.6)	

between LM development and previous daily consumption of FF containing a high level of LAB.[7,8,22]

LAB contained in FF have been described to have various benefits; for example, improving the intestinal tract health, enhancing the immune system, synthesizing and enhancing the bioavailability of nutrients, reducing the symptoms of lactose intolerance, decreasing the prevalence of allergy in susceptible individuals, and reducing the risk of certain cancers. It has been used in cases of antibiotic resistance and mucosal immune dysfunction and reported to prevent diseases

Table 3. Relationship Between Lactational Mastitis and Variables Related to Birth and Breastfeeding

	Raw		*Adjusted*	
	p	*OR (95% CI)*	p	*OR (95% CI)*
Birth week	0.012	0.92 (0.92–1.87)	0.002	0.83 (1.12–1.94)
Birth weight	0.027	0.79 (1.17–1.63)	0.016	0.63 (1.24–1.79)
Time to breastfeeding	0.034	0.45 (1.47–2.12)	0.021	0.79 (1.62–2.31)
Breastfeeding duration	0.025	0.96 (1.96–2.53)	0.017	0.12 (2.25–2.78)
Breast preference	0.019	0.91 (2.72–3.22)	0.003	0.13 (2.83–3.42)
Nipple cream use	0.015	0.63 (1.06–1.82)	0.004	0.81 (1.31–1.97)
Oral probiotic use	0.018	0.13 (1.42–2.83)	0.006	0.29 (1.86–2.92)
Breastfeeding education	0.014	0.68 (1.91–2.44)	0.009	0.01 (2.11–2.63)

CI, confidence interval; OR, odds ratio.

TABLE 4. CONSUMPTION FREQUENCY OF SIX TYPES OF TRADITIONAL FERMENTED FOOD DURING LACTATION

	Control group, n = *301*	*LM group,* n = *304*	p
Kefir %			0.038
Once a month or less	91 (30.2)	177 (58.3)	
Once a week	45 (14.9)	71 (23.3)	
Twice/thrice a week	49 (16.3)	32 (10.5)	
Daily	116 (38.6)	24 (7.9)	
Homemade yogurt %			0.001
Once a month or less	73 (24.2)	119 (39.1)	
Once a week	41 (13.6)	79 (26)	
Twice/thrice a week	61 (20.3)	53 (17.4)	
Daily	126 (41.9)	53 (17.4)	
Conventional yogurt %			0.004
Once a month or less	108 (35.9)	98 (32.2)	
Once a week	91 (30.2)	114 (37.5)	
Twice/thrice a week	44 (14.6)	65 (21.4)	
Daily	58 (19.3)	27 (8.9)	
Boza %			0.026
Once a month or less	141 (46.8)	217 (71.4)	
Once a week	115 (38.2)	86 (28.3)	
Twice/thrice a week	43 (14.3)	1 (0.3)	
Daily	2 (0.7)	0 (0)	
Tarhana %			0.021
Once a month or less	63 (20.9)	84 (27.6)	
Once a week	105 (34.9)	118 (38.8)	
Twice/thrice a week	115 (38.2)	96 (31.6)	
Daily	18 (6)	6 (2)	
Pickles %			0.001
Once a month or less	45 (15.0)	100 (32.9)	
Once a week	84 (27.9)	113 (37.2)	
Twice/thrice a week	96 (31.9)	66 (21.7)	
Daily	76 (25.2)	25 (8.2)	

and provide benefits.[25–27] In light of the data obtained from the literature review, our study is the first to evaluate both the most common risk factors of LM and the protective effect of FF in daily diet on LM development.

In recent years, several articles have been published to report the positive effects of the daily FF consumption on human health. Tu et al. stated that 6-month daily regular consumption of kefir led to a significant increase in hip bone mineral density in osteoporotic patients.[28] Chen et al. and Diaz-Lopez et al. emphasized the importance of fermented yogurt in the regulation of blood sugar in patients with type 2 diabetes mellitus.[29,30] Similarly, Lim et al. and Nagata et al. conducted studies demonstrating the positive effects of fermented dairy products on hypertension and hyperlipidemia.[31,32]

There are also studies investigating the efficacy of FF consumption in infection control and treatment. Hatakka et al. found that LAB-rich FF decreased the number and severity of pediatric respiratory infections.[33] In particular, this potent effect of LAB-containing probiotic agents on the immune system can be attributed to the fact that they are not affected by the gastrointestinal transit. Binding to the intestinal mucosa, these bacteria facilitate antigen transport and activate local and distant IgA responses. Newborns form their own idiosyncratic immune system through both genetic predisposition and microbiota obtained from breast milk and ready-made formulas, which prepare the basis of an individual's permanent immune system as a result of the changes in the gut microbiota through the interaction with environmental and internal factors over time.[32–34] LAB is considered to exhibit bactericidal effects through one or more of the following ways: the direct antagonistic effects of the metabolites or bacteriocins they produce, antimicrobial peptide induction, strengthening innate immunity by providing helper T cell balance, and systemic modulation over the endocrine and central nervous system. In this context, concrete evidence has been presented indicating that LAB-containing FF prevents and facilitates the treatment of urinary tract infections and bacterial vaginosis in women of childbearing age.[35,36] It has also been argued that the protective effect of probiotics is stronger when patients are selected from pregnant women or those that are susceptible to infection.[37,38]

The idea of using probiotics as an alternative or adjunct to antibiotherapy in LM emerged in the early 2000s as a solution to economic and welfare problems in the livestock industry. The use of LAB in the prevention and treatment of mastitis episodes in dairy farms has almost completely eliminated this problem and resulted in recovering the original quality and quantity of milk obtained from animals.[10,39] In the second decade of research on LAB, similar in vitro and in vivo studies were applied to investigate the effects of these bacteria isolated from human milk on the prevention and treatment of mastitis episodes in breastfeeding women. Arroyo et al. determined the counts of pathogenic *S. aureus*, *S. epidermidis*, and *S. mitis* in breast milk in randomized groups of mastitis cases and compared them with the data obtained from the patients that consecutively received antibiotherapy with oral capsules containing *Lactobacillus fermentum* or *Lactobacillus salivarius* for 21 days. The most significant reduction was observed in the bacterial counts of patients treated with *L. salivarius*.[7]

TABLE 5. RELATIONSHIP BETWEEN THE CONSUMPTION FREQUENCY OF TRADITIONAL FERMENTED FOOD AND LACTATIONAL MASTITIS

	Raw		*Adjusted*	
	p	*OR (95% CI)*	p	*OR (95% CI)*
Kefir	0.048	0.57 (1.11–2.14)	0.027	0.69 (1.18–2.22)
Homemade yogurt	0.029	0.67 (1.09–1.52)	0.013	0.78 (1.14–1.87)
Conventional yogurt	0.018	0.71 (1.14–2.25)	0.082	0.81 (1.24–2.46)
Boza	0.013	0.62 (1.82–2.24)	0.004	0.79 (2.19–2.99)
Tarhana	0.015	0.45 (2.21–2.79)	0.011	0.52 (2.47–2.81)
Pickles	0.016	0.12 (0.93–1. 62)	0.003	0.22 (1.22–2.34)

In similar studies by Fernández et al. and Jimenez et al., *L. salivarius*, *L. fermentum*, and *Lactobacillus gasseri* obtained from human milk decreased the number of pathogenic bacteria in the breast gland when orally administered in pregnant and lactating women. Based on these findings, the authors concluded that these agents might be an effective alternative to antibiotics in the prevention and treatment of LM.[8,22] It is suggested that most LAB, especially *L. salivarius* increase IgA and transforming growth factor b2 in breast milk, prevent bacteria from attaching to and damaging the mammary epithelium, and thus reduce virulence of *Staphylococcus* and *Streptococcus* spp.[7] All three studies reaching this conclusion were applied to women with clinical or subclinical mastitis, but due to the absence of a control group of healthy individuals, they were unable to investigate the potential protective effect of LAB on the development of LM. It is also suggested that specific probiotic supplementation during the perinatal period may alter breast milk microbiota by increasing beneficial bacteria and some functional components especially in vaginally delivering women.[40]

As an advantage of FF over oral probiotic supplements, various studies have shown the presence of short-chain fatty acids (SCFAs) produced by the intestinal microbiota at a high concentration in the plasma and feces after the consumption of FF. SCFAs are metabolites with proven anti-inflammatory and bacteriostatic properties; thus, they play a preventive and therapeutic role against infections through their effects on the immune system.[14]

As mentioned earlier in the text, no study was found that examined the relationship between ethnic FF consumption and LM development during pregnancy and breastfeeding in lactating women. The protective effects of FF during pregnancy on preterm birth and the development of atopic dermatitis,[14] as well as its use in the treatment of bacterial vaginosis in pregnancy[37] have been explored in terms of consumption generally in the last weeks of gestation. In the current study, we investigated selected FF consumption throughout pregnancy until the time of the study; therefore, the content and methodology of our study differed from previous research.

The common characteristic of the six FF products, the consumption of which was investigated in this study, was the similarity of their LAB content. Although the dairy products and vegetables used to produce FF and the number of bacterial colonies contained vary, the most frequently seen substrains can be listed as *L. salivarius*, *Lactobacillus delbrueckii*, *Lactococcus lactis*, *Lactobacillus plantarum*, and *Streptococcus thermophile*.[11,12] Detailed prospective randomized studies are needed to isolate these strains and determine their anti-inflammatory and immune modulator effects.

There are some limitations to our study. Although we investigated the consumption of FF during the entire pregnancy and lactation period, we only collected data on the frequency of consumption, not the amount consumed. However, similar studies on FF were also based on the frequency of consumption.[14,15,30] In addition, since the study had single-center design and was conducted in a region where FF consumption is generally high, the results may not be valid for or consistent with the whole of Turkey. Despite these limitations, the significance of the study was that the LM episodes were recorded through not only verbal communication with the patients but also examination by two physicians, and imaging methods were utilized to confirm the diagnosis in cases where the two physicians could not reach an agreement.

Conclusion

The results of our study were similar to the in vitro studies published in the literature on the use of probiotic agents in the treatment of LM. Although there is a need for detailed studies on the preventive and therapeutic effects of ethnic FF on inflammatory and infectious diseases, it is worth mentioning that their daily consumption has positive effects on the mother's health.

Ethics Committee Approval

Ethics Committee approval was received for this study from the Research Ethics Committee of Medipol University (decision No. 10840098-604.01.01-E.18664).

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Author Contributions

Concept: P.B.; design: P.B.; supervision: P.B.; resources: P.B., Y.Ö.; data collection and/or processing: P.B., Y.Ö.; physical examination: P.B., Y.Ö.; analysis and/or interpretation: P.B.; literature search: P.B.; writing article: P.B.; critical review: P.B.

Disclosure Statement

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