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Original Research

Breastfeeding and Complementary Feeding Practices Among Women with Infants Aged 0-24 Months: A Comparative Study of Pre-Pandemic and Pandemic Deliveries

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Abstract

Objectives: It is important to understand the impact of the pandemic on breastfeeding and complementary feeding practices. This study was conducted to examine the impact of COVID-19 restrictions on the complementary feeding and breastfeeding practices of mothers with 0-24-month-old infants who gave birth before and during the pandemic.
Materials and Methods: This study used a cross-sectional, descriptive study design. An online survey including demographic variables, questions about breastfeeding, and complementary feeding practices was sent through the online data collection platform.
Results: A total of 814 mothers [489 delivered before the pandemic (BP), 325 delivered during the pandemic (DP)] with infants infant 0-24 months old completed the survey. Mothers reported that 31.4% of DP infants were exclusively breastfed, while 67.5% of BP infants were breastfed+complementary fed. A perception of insufficient milk production was higher in DP mothers (27.0%, n = 80) than BP mothers (10.8%, n = 42) ($p<0.001$). The proportion of early initiation to infant formula was higher in DP mothers (2.3±2.64 months) than BP mothers (3.4±3.62 months) ($p = 0.034$). The rate of mothers who stated that they would not make any changes in the feeding practices of infants in case of being infected with COVID-19 was higher in DP mothers (83.1%) than BP mothers (75.9%) ($p = 0.040$).
Conclusion: The results of this study suggest that the COVID-19 pandemic may affect the method of breastfeeding and complementary feeding practices. These results emphasize the need to receive professional support for breastfeeding and complementary feeding during the outbreak.

Keywords: *COVID-19, breastfeeding, complementary feeding, infant*

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Introduction

The discovery of the first COVID-19 cases in Wuhan, China, in December 2019 led the World Health Organization (WHO) to declare a global health emergency and subsequently a pandemic (Zhu et al., 2020; World Health Organization (WHO, 2020a). The global outbreak of COVID-19 has profoundly affected every aspect of life worldwide (Zhu et al., 2020). In Türkiye, the first case of COVID-19 was detected on March 11, 2020. Due to the rapid and exponential increase in the number of people affected, hospitalizations, and deaths, the Turkish government took decisive action and introduced strict containment and social isolation measures from March 11, 2020. The quarantine measures have a particularly negative impact on mothers who are breastfeeding. While changing and uncertain conditions, many people faced the challenge of adapting quickly, dealing with scarce information, and understanding the sometimes contradictory messages from key health authorities (Renfrew et al., 2020).

At the beginning of the pandemic, the American Academy of Pediatrics (AAP) and the Centers for Disease Control and Prevention (CDC) advised temporary separation of mother and child as a precautionary measure to address potential concerns about transmission of infection from mother to child. However, the revised guidelines advocate both direct breastfeeding and the use of expressed breast milk (Cheema et al., 2023). The WHO also advocated direct breastfeeding while emphasizing the importance of preventive hygiene measures. They advised that mother and child should only be separated if the mother's state of health was poor or if therapeutic measures were necessary for the child (WHO, 2020c). The confusing, contradictory, and frequently updated recommendations on breastfeeding may have led to changes in breastfeeding trends and probably influenced mothers' decisions to breastfeed (Tigka et al., 2022). The economic challenges such as low income, limited financial opportunities, limited access to safe and fresh food, and limited availability of medical care during COVID-19 restrictions may impact maternal and infant feeding, including complementary feeding and breastfeeding (Akseer et al., 2020). This cross-sectional study was conducted to investigate the impact of COVID-19 restrictions on complementary feeding and breastfeeding practices of mothers with 0–24-month-old infants who gave birth before and during the pandemic.

Materials and Methods

Mothers who had an infant under 24 months of age at the time of recruitment took part in the online cross-sectional study. This study was conducted in accordance with the guidelines of the Declaration of Helsinki, and all procedures concerning study participants were approved by the İzmir Katip Çelebi University Clinical Research Ethics Committee (decision

date/number: 19/11/2020/1066) and the study authorization of the Scientific Research Platform of the Turkish Ministry of Health. As this was a web-based study, the online questionnaire included an 'I agree to participate in the study' tab to obtain written informed consent from the participants. From December 2020 to April 2021, the self-report survey was conducted using an online questionnaire created with Google Forms web survey software. The survey used a snowball technique. The link to the online survey was distributed via websites and social media groups used by mothers, such as Facebook, Twitter, and Instagram. The survey invitations were systematically shared on Facebook and Instagram at different times of the day and days of the week. Participants were also encouraged to share the survey with others.

The inclusion criteria were 1) residency in Türkiye, 2) using social media, and 3) being ≥18 years of age. Mothers were excluded from the study if they 1) had given birth to twins, 2) had an infant with conditions that might interfere with breastfeeding (such as genetic or metabolic disease, long-term hospitalization), 3) had a preterm birth (born <37 weeks gestation), 4) were infected with COVID-19 at the time of the study, 5) did not report their current breastfeeding status or the age of their infant, and 6) did not complete the survey. The responses of the mothers who duly completed the questionnaire were analyzed. Participants were asked to provide their e-mail addresses to avoid duplicate submissions. Subsequently, all duplicate submissions with the same e-mail address were excluded from the analysis.

The literature-based, non-validated questionnaire was developed by the researchers and consists of five sections. The first section contained questions on socio-demographic characteristics such as mother's age, child's age, mother's education (literate, primary, secondary, high school, university, postgraduate), marital status (married and single), number of children and occupation (unemployed, officer, housewife, private sector). The second and third parts contained questions on the attitudes and behaviors of mothers before the pandemic (BP) and during the pandemic (DP) regarding breastfeeding, the use of infant formula and complementary feeding. The last part of the questionnaire contained questions about changes in mothers' feeding habits during the COVID-19 pandemic.

The data were analyzed using the statistical program SPSS 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were calculated for the categorical variables, including frequencies (n) and percentages (%). Means and standard deviations (SD) were calculated for continuous variables. Normal distribution was tested using the Kolmogorov-Smirnov test. To analyze significant differences in categorical variables, a statistical chi-square ($\chi 2$) test was performed. The accepted level of statistical significance was set at $p<0.05$, and all p-values were two-sided.

Results

Table 1 shows the socio-demographic characteristics of the mothers and their infants who participated in the study. A total of 836 women took part in the study. Several participants were excluded from this sample for various reasons. Those who did not provide information on their current breastfeeding status or the age of their infants (n = 12), had a preterm birth (n = 1), came from other countries (n = 2), were under 18 years old (n = 4), and had twins (n = 3) were excluded from the analysis. The remaining 814 participants were involved in the study. The majority of the mothers (72.0%) were between the ages of 25 and 34, and the mean age was 30.5±4.63 years. More than half of the mothers (59.9%) had a university degree.

The attitudes and behaviors of BP and DP mothers regarding breastfeeding and formula use are shown in Table 2. At the time of survey completion, 464 (57.0%) participants were breastfeeding and complementary feeding, 122 (15.0%) were exclusively breastfeeding, and 78 (9.6%) were giving complementary feeding and formula. Of the mothers who breastfed, 81.4% (n = 557) reported no change in feeding practices, 10.4% (n = 71) reported an increase, and 1.3% (n = 9) reported a decrease in feeding frequency due to concerns about COVID-19, while 5.6% (n = 38) reported an increase in the duration and frequency of feedings. A perception of insufficient milk production was higher among DP mothers (27.0%, n = 80) than BP mothers (10.8%, n = 42) ($p<0.001$). DP mothers (2.3±2.64 months) started formula earlier than BP mothers (3.4±3.62 months) ($p=0.034$).

The attitudes and behaviors of BP and DP mothers regarding complementary feeding are shown in Table 3. The rate of early initiation to complementary feeding was higher among DP mothers (36.2%, n = 47) than BP mothers (20.7%, n = 81) ($p<0.001$). The main reason reported by mothers for starting complementary feeding earlier was to introduce their infants to solid foods (42.2%, n = 54). 31.1% (n = 162) of mothers who gave complementary foods reported that they paid more attention to the hygiene of the materials they used, while 68.9% (n = 359) reported that COVID-19 had not changed their attitudes and behaviors. The percent of mothers who stated that they would not make any changes in the feeding practices of infants in case of being infected with COVID-19 was higher among DP mothers (83.1%) than among BP mothers (75.9%).

Table 1: *Socio-demographic Characteristics of the Mothers and Infants*

Variable		n	%
Mothers characteristics			
Age (years)			
	18-24	78	9.6
	25-34	586	72.0
	>35	150	18.4
Educational level			
	Literate	6	0.7
	Primary	22	2.7
	Secondary	63	7.7
	High school	134	16.5
	University	487	59.9
	Postgraduate	102	12.5
Occupation			
	Unemployed	23	2.8
	Officer	259	31.8
	Housewife	230	28.3
	Private sector	302	37.1
Marital status	Married	659	81.0
	Single	155	19.0
Number of children			
	1	538	66.1
	2	203	24.9
	≥3	73	9.0
Infants characteristics			
Age of infants (months)	0-≤6	197	24.2
	>6-≤12	312	38.3
	>12-24	305	37.5
BP infants (months)	0-≤6	36	7.4
	>6-≤12	161	32.9
	>12-24	292	59.7
DP infants (months)	0-≤6	161	49.5
	>6-≤12	151	46.5
	>12-24	13	4.0
Age of infants (months) (Mean ± SD)		11.22±6.05	

Table 2: *Breastfeeding and Formula Use Attitudes and Behaviors of Mothers*

	Total		Delivered BP (n=489)		Delivered DP (n=325)		p value
	n	**%**	**n**	**%**	**n**	**%**	
Current infant feeding (n=814)							
Exclusive breastfeeding	122	15.0	20	4.1	102	31.4	
Breastfeeding+formula	67	8.2	21	4.3	46	14.2	
Formula	5	0.6	2	0.4	3	0.9	
Breastfeeding+complementary feeding	464	57.0	330	67.5	134	41.2	x^2=172.28
Complementary feeding+formula	78	9.6	61	12.5	17	5.2	**p<0.001**
Cow's milk+formula	2	0.2	1	0.2	1	0.3	
Formula+complementary feeding+breastfeeding	39	4.8	20	4.1	19	5.8	
Complementary feeding	17	2.1	16	3.3	1	0.3	
Complementary feeding+cow's milk	20	2.5	18	3.7	2	0.6	
Have you changed your breastfeeding practices due to concerns about COVID-19? (n=684)							
No, I have not change	557	81.4	318	82.0	239	80.7	
Yes, I have increased the frequency of breastfeeding	71	10.4	38	9.8	33	11.1	
Yes, I have increased the duration of breastfeeding	6	0.9	3	0.8	3	1.0	
Yes, I have increased the duration and frequency of breastfeeding	38	5.6	21	5.4	17	5.7	x^2=3.44
Yes, I have reduced the frequency of breastfeeding	9	1.3	7	1.8	2	0.7	p=0.751
Yes, I have shortened the duration of breastfeeding	1	0.1	-	-	1	0.3	
Yes, I have reduced the frequency and duration of breastfeeding	2	0.3	1	0.3	1	0.3	
Have you ever thought that your breast milk was not enough during COVID-19? (n=684)							
Yes	122	17.8	42	10.8	80	27.0	x^2=30.07
No	562	82.2	346	89.2	216	73.0	**p<0.001**
Has the COVID-19 pandemic affected the amount of formula you give to your baby? (n=166)							
Yes, I have used more scoops than ever before.	3	1.8	2	2.3	1	1.3	x^2=0.23
Yes, I have used fewer scoops than ever before.	2	1.2	1	1.1	1	1.3	p=0.889
No, I have not changed the amount of formula I give.	161	97.0	85	96.6	76	97.4	
Have you worried about buying formula because of the COVID-19? (n=166)							
Yes	53	31.9	26	29.5	27	34.6	x^2=0.48
No	113	68.1	62	70.5	51	65.4	p=0.509
	$\bar{X}$±SD		**$\bar{X}$±SD**		**$\bar{X}$±SD**		
How old was your baby when you started giving formula? [Age of infants (months) (Mean ± SD)] (n=166)	2.9±3.23		3.4±3.62		2.3±2.64		**p=0.034**

BP: Before Pandemic DP: During Pandemic

Table 3 :*Complementary Feeding Attitudes and Behaviors of Mothers*

	Total		Delivered BP (n=489)		Delivered DP (n=325)		p value
	n	%	n	%	n	%	
Starting complementary feeding before 6th months (n=521)							
Yes	128	24.6	81	20.7	47	36.2	x^2=12.546
No	393	75.4	310	79.3	83	63.8	**p<0.001**
Reasons to start complementary feeding early (n=128)							
The belief that the baby is hungry	15	11.7	14	17.3	1	2.1	
Use of formula	15	11.7	4	4.9	11	23.4	
Insufficient weight gain of the baby	11	8.6	5	6.2	6	12.8	
To introduce their infants to solid foods	54	42.2	32	39.5	22	46.8	x^2=24.340
Mother's starting work	6	4.7	4	4.9	2	4.3	**p=0.002**
Cessation of breast milk	6	4.7	6	7.4	-	-	
Insufficient breast milk	10	7.8	9	11.1	1	2.1	
Illness of mother	2	1.6	2	2.5	-	-	
Doctor's advice	9	7.0	5	6.2	4	8.5	
First complementary food for the infant (n=521)							
Soups	34	6.5	26	6.6	8	6.2	
Eggs	11	2.1	7	1.8	4	3.1	
Yogurt	247	47.4	190	48.6	57	43.8	x^2=6.361
Fruit juice	8	1.5	4	1.0	4	3.1	p=0.498
Fruit puree	90	17.3	64	16.4	26	20.0	
Cow milk	3	0.6	3	0.8	-	-	
Vegetable puree	126	24.2	95	24.3	31	23.8	
Baby's biscuit	2	0.4	2	0.5	-	-	
How has the COVID-19 affected the time you started complementary feeding? (n=521)							
I have started complementary feeding earlier	24	4.6	15	3.8	9	6.9	x^2=5.544
I have delayed to start complementary feeding	5	1.0	2	0.5	3	2.3	p=0.063
I have not changed the time to start complementary feeding	492	94.4	374	95.7	118	90.8	
Have your attitudes and behaviors about complementary feeding changed due to COVID-19? (n=521)							
Yes	162	31.1	113	28.9	49	37.7	x^2=3.520
No	359	68.9	278	71.1	81	62.3	p=0.064
How would you feed your infant if you have symptoms of COVID-19? (n=814)							
I would not change my infant feeding.	641	78.7	371	75.9	270	83.1	
I would stop breastfeeding and initiate formula feeding.	33	4.1	19	3.9	14	4.3	x^2=11.642
I would stop breastfeeding and feed complementary foods.	43	5.3	35	7.5	8	2.5	**p=0.040**
I would stop breastfeeding and start formula and complementary foods.	76	9.3	51	10.4	25	7.7	
I would consult my doctor.	11	1.4	6	1.2	5	1.5	
I would change the variety of complementary foods.	10	1.2	7	1.4	3	0.9	

BP: Before Pandemic DP: During Pandemic

Changes in mother's dietary habits during COVID-19 are shown in Figure 1. 28.0% of mothers reported paying more attention to a healthy diet, 24.2% reported consuming more foods that boost the immune system, and 34.4% reported making no changes to their diet during the COVID 19 pandemic (Figure 1).

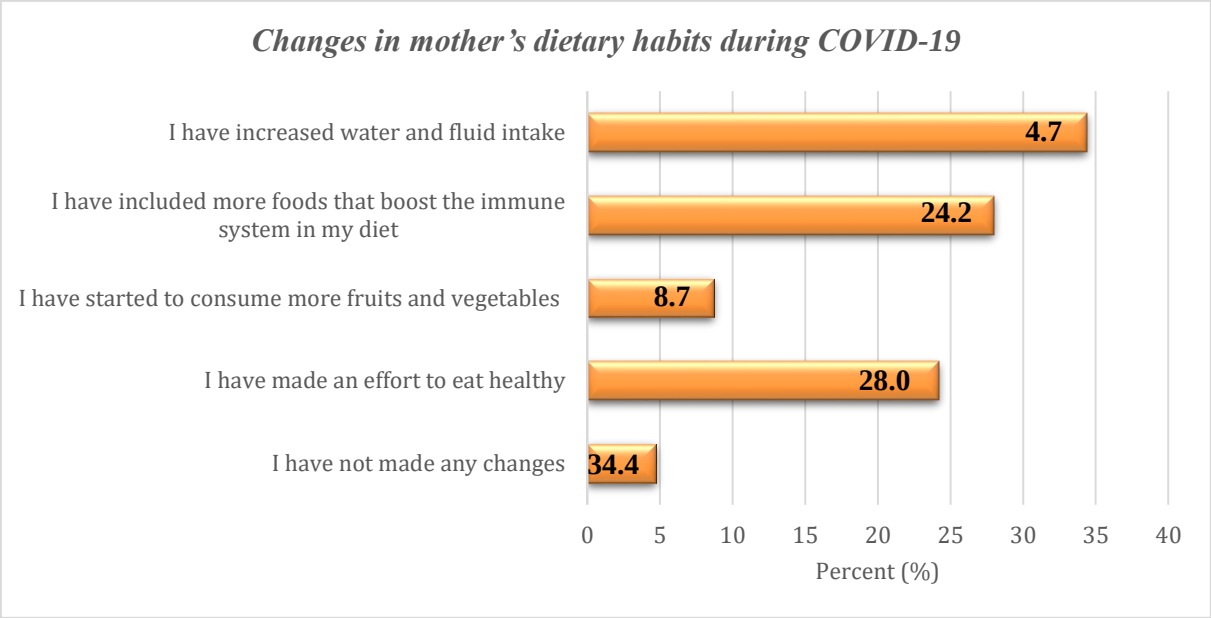

Figure 1: *Changes in Mother's Dietary Habits During COVID-19 (%)*

Discussion

This cross-sectional study was conducted to ensure a better understanding of the issues related to complementary feeding and breastfeeding practices among mothers with 0-24-month-old infants who gave birth before and during the COVID-19 pandemic. To our knowledge, no studies on this topic have been conducted in Türkiye. The results of this study indicate that the COVID-19 pandemic may affect breastfeeding and complementary feeding practices. However, the perception of insufficient milk production was higher among women who had given birth during the pandemic. In addition, mothers in this group started formula and complementary feeding earlier than mothers in the other group. The proportion of mothers who stated that they would not make any changes to their feeding practices if they were infected with COVID-19 was higher among women who had given birth during the pandemic.

Breastfeeding provides essential nutritional components and a wealth of biologically active molecules that play an important role in the infant's growth, development, and the immune system (Mosca & Giannì, 2017). Breastfeeding is the best protective method for healthy and vulnerable infants and their mothers during the COVID-19 pandemic (Lubbe et al., 2020). The Association of Women's Health, Obstetric, and Neonatal Nursing, the WHO, and the AAP recommend exclusive breastfeeding for the first 6 months of life as the gold standard for infant feeding. (Spatz, 2012). According to the available findings, the virus does not appear to be transmitted via breast milk (Royal College of Obstetricians and Gynecologists, 2022). Therefore, breastfeeding should not be interrupted, mother and newborn should not be

separated, and skin-to-skin contact should not be stopped. Whilst maintaining as much normality as possible, general infection control measures should be taken and followed very strictly (Lubbe et al., 2020). However, the measures taken during the pandemic led to the separation of mothers and infants after birth and prevented close mother-infant practices, including breastfeeding, especially in mothers suspected or confirmed to be COVID-19 positive (Stuebe, 2020).

A number of reports suggest that exclusive breastfeeding declined in the first six months during the COVID-19 pandemic (Al Shahrani, 2022; Latorre et al., 2021; Zanardo et al., 2021). During the peak of the outbreak, the initiation of breastfeeding and the prevalence of exclusive breastfeeding in the first six months were low among Saudi mothers (Al Shahrani, 2022). Similarly, an Italian study observed a decline in the rate of exclusively breastfed infants during the pandemic (Latorre et al., 2021). Women who had given birth during the COVID-19 lockdown had a lower rate of exclusive breastfeeding compared to the control group, which consisted of women who had given birth in the year before (Zanardo et al., 2021). Various reasons, such as emotional, social, and psychological, can cause the early introduction of complementary foods (Pacheco et al., 2021). The aim of the study was to investigate the relationship between breastfeeding, exclusive breastfeeding at six months, and the introduction of complementary foods both before the pandemic and during the pandemic. The results indicated that the pandemic was a risk factor for early cessation of exclusive breastfeeding and early initiation of complementary foods (Holand et al., 2022). A similar result was observed in a study conducted in Italy, the results of which indicated a 20% higher likelihood of early initiation of complementary feeding before sixth months of age during the pandemic period (Zanardo et al., 2021). In the present study, the rate of exclusive breastfeeding among DP mothers was 31.4%. Similar to the results of this study, the Türkiye Health Statistics 2019 report indicates that 28.7% of infants were exclusively breastfed in the first six months before the COVID-19 pandemic (Republic of Türkiye Ministry of Health The General Directorate of Health Information Systems, 2019). In addition, DP mothers started infant formula earlier, and introduced complementary foods. According to results of the present study, the rate of exclusive breastfeeding in the first 6 months was not at the recommended level. Promoting exclusive breastfeeding in the first 6 months should be a priority. Healthcare professionals, including dietitians, play a crucial role in raising awareness among mothers about the benefits of breastfeeding and proper complementary feeding practices. Their efforts can contribute significantly to improving infant nutrition and overall child health.

A study conducted in Belgium found that 91% of breastfeeding mothers reported that their infants' diet had not changed as a result of the pandemic. In addition, 88% of mothers stated that the interruption of breastfeeding was not caused by the pandemic (Ceulemans et al., 2020). In the New Mum Study, only 13% of mothers stated that they had changed their child's diet in connection with the onset of the outbreak (Vazquez-Vazquez et al., 2021). The results of present study are consistent with findings from previous studies (Ceulemans et al., 2020; Vazquez-Vazquez, 2021). 81.4% of mothers reported that the infant's diet had not changed due to COVID-19. In addition, almost all mothers (94.4%) stated that COVID-19 had no influence on the timing of the start of complementary feeding. More than half of the mothers (78.7%) stated that they would not change the feeding methods for their infants if they were infected with COVID-19.

The COVID-19 pandemic could affect mothers' breastfeeding decisions differently (Ceulemans et al., 2020; Motrico et al., 2020; Busch-Hallen et al., 2020). There could be an increase in breastfeeding practices as mothers who previously did not plan to breastfeed change their plans due to the pandemic. Other reasons for this increase were staying at home with the infant and the mother's desire to protect her infant from COVID-19 by breastfeeding. On the contrary, mothers may face clinical barriers to breastfeeding. Due to social distancing measures during the pandemic, there is limited professional support to help mothers cope with negative experiences in the first days after delivery (Motrico et al., 2020; Busch-Hallen et al., 2020). The other explanations for a decline in breastfeeding were indeed a reduction in milk production due to concerns about the virus and the combination with other childcare tasks (Ceulemans et al., 2020). In a study conducted by Brown and Shenker (2021) in the United Kingdom, 41.8% of women reported positive breastfeeding experiences during the COVID-19 pandemic. Vazquez-Vazquez et al. (2021) also showed positive breastfeeding behaviors such as an increase in the frequency and duration of breastfeeding (30% and 17%, respectively) during the lockdown in the United Kingdom. In a study conducted by Ceulemans et al. (2020), half of the women reported that they had breastfed for longer due to COVID-19. On the other hand, the researchers found that home confinement during the quarantine can have different effects on breastfeeding practices. Being at home more often made breastfeeding easier for some mothers, while others reported anxiety and stress due to childcare responsibilities (Ceulemans et al., 2020). Consistent with the literature, 11.1% of DP mothers in the present study stated that they increased the frequency of breastfeeding.

Ongoing community support is critical to the success of breastfeeding (Pérez-Escamilla et al., 2016). In an Australian study examining the challenges of breastfeeding after childbirth,

approximately 44% of mothers reported low milk supply. However, after seeking advice and support from a lactation consultant, most mothers showed positive changes in their perceptions and experiences related to breastfeeding (Kent et al., 2021). In this study, around a quarter of DP mothers (27%) stated that their milk was insufficient. The results of this study underpin the need for accessible professional breastfeeding support and family support during the outbreak.

As it is assumed that the COVID-19 pandemic could have an impact on mothers' eating habits and attitudes, the mothers in this study were also asked whether they had changed their eating habits during the pandemic. 34.4% stated that they had not made any changes, 28% reported that they paid attention to a healthy diet, and 24.2% increased their consumption of foods that would strengthen the immune system. According to current data, no single food or supplement is known to prevent or treat COVID-19. However, it is recommended to support the immune system during this time, and the general recommendation is to eat a healthy diet and consume a wide range of foods within each food group, including fresh foods such as fruits, vegetables, fish, lean meats, dairy products, water and other non-sugary beverages, and healthy fats (de Faria Coelho-Ravagnani et al., 2021; WHO, 2020b; Turkish Dietetic Association, 2021; Food and Agriculture Organization of the United Nations, 2020).

The current study has several limitations. First, the cross-sectional design of the study and the lack of longitudinal follow-up are limitations. The data was collected via an online questionnaire. Despite our efforts to include more DP mothers, the distribution of participants across the groups was not balanced. In addition, the age distribution of the infants was different. in both groups. Therefore, this difference should be taken into account when interpreting the results. It is important to recognize several inherent biases in our study, including self-report bias, self-selection bias, and sample bias due to the use of a snowball sampling technique. Given that Türkiye is a large country with limited internet access in certain regions, it is important to recognize that this study findings may not be representative of the entire population in Türkiye and should be interpreted with caution.

Despite these limitations, the results of the present study indicate some possible directions for future research. Future, studies with larger samples from different countries and cultures could investigate whether there are differences in breastfeeding and complementary feeding practices due to the COVID-19 outbreak. This study findings provide valuable insights into the impact of the pandemic on women's breastfeeding and complementary feeding practices, and thus contribute significantly to our understanding of this important aspect.

Conclusion

The results of this study suggest that the COVID-19 pandemic may affect breastfeeding and complementary feeding practices. However, Türkiye is still far from the WHO's goal of achieving an exclusive breastfeeding rate in the first six months of life. It is strongly recommended to encourage mothers to breastfeed exclusively in the first 6 months. These results emphasize the need to receive professional support for breastfeeding and complementary feeding during the onset of the outbreak.

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Conflict of Interest

The authors declare that they have no conflict of interest.

CRediT authorship contribution statement

Study conception and design; G.K., G.Y.D., Data collection; G.K., B.K., G.Y.D., G.Ç., Data analysis and interpretation; G.Y.D., Drafting of the article; G.K., G.Y.D., T.Y., G.Ç. Critical revision of the article; G.K.; G.Y.D., T.Y., G.Ç.

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