



Impact of COVID-19 on breastfeeding intention and behaviour among postpartum women in five countries

Li-Yin Chien^a, Eun Young Lee^b, Kelly Pereira Coca^c, Seung Chun Paek^d, Seo Ah Hong^{e,f,*}, Yan-Shing Chang^g

^a Institute of Community Health Care, College of Nursing, National Yang Ming Chiao Tung University, Yang-Ming Campus, Taipei, Taiwan

^b Department of Nursing, Catholic Kkottongnae University, Cheongju, Republic of Korea

^c Women's Health Nursing Department, Escola Paulista de Enfermagem, Universidade Federal de São Paulo, São Paulo, Brazil

^d Department of Society and Health, Mahidol University, Nakhon Pathom, Thailand

^e ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, Thailand

^f Institute for Health and Society, Hanyang University, Seoul, Republic of Korea

^g Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care, King's College London, London, United Kingdom

ARTICLE INFO

Keywords:

Breastfeeding
Postpartum
COVID-19
Infant feeding
Intention to breastfeed

ABSTRACT

Background: Studies regarding the impact of COVID-19 on breastfeeding have mostly used single-country samples or a qualitative design.

Aim: The objective of this study was to examine breastfeeding intention during pregnancy and breastfeeding behaviour among postpartum women in five countries during the COVID-19 pandemic and the associated factors. **Methods:** An online questionnaire survey was conducted in Thailand, the United Kingdom, South Korea, Taiwan, and Brazil from July through November 2021. The study participants included 3253 mothers within six months of birth.

Findings: About 90% of participants intended to breastfeed during pregnancy and 85.7% reported breastfeeding in the past 24 h. More than half reported their breastfeeding duration being as planned or longer despite COVID-19. Multivariate logistic regression models showed that being multiparous, ever tested COVID-19 positive, and having positive breastfeeding beliefs were associated with increased odds for intention to breastfeed during pregnancy. Lower maternal educational level, being primiparous, ever tested COVID-19 positive, and experiencing food insecurity were associated with decreased odds for breastfeeding duration being as planned or longer. Vaginal birth, currently working or on maternity leave, breastfeeding beliefs, breastfeeding support from spouse/partner/friend/relative, online support groups, and in-person or telephone contact with healthcare professionals were associated with increased odds for breastfeeding duration being as planned or longer.

Conclusion: Breastfeeding intention and behaviour remained high during the COVID-19 pandemic. Online support groups and telephone contact with health professionals were effective during the pandemic.

Statement of significance

Problem

The global COVID-19 pandemic has greatly affected health care practices in that many health care services have been shut down or down-scaled. Breastfeeding intention and behaviour may have been influenced.

What is already known

Breastfeeding mothers felt that breastfeeding support was negatively impacted by the COVID-19 pandemic due to the lack of social contacts to engage with individuals in person and access to childcare.

* Correspondence to: ASEAN Institute for Health Development, Mahidol University, 999 Salaya, Phutthamonthon, Nakhon Pathom 73170, Thailand.
E-mail address: seoah.hon@mahidol.ac.th (S.A. Hong).

What this paper adds

During pregnancy, about 90 % of mothers intended to breastfeed and more than half of them reported that their breastfeeding duration was as planned or longer despite the impact of COVID-19. Ever tested COVID-19 positive women were more likely to intend to breastfeed during pregnancy and less likely to breastfeed as planned or longer. Online support groups and telephone contact with health professionals were associated with breastfeeding duration being as planned or longer during the pandemic.

1. Introduction

Breastfeeding is one of the most effective ways to ensure child health and survival [1]. Numerous studies have demonstrated the health benefits of breastfeeding for both mothers and children [2–5]. The World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF) recommend that babies be fed only with human milk for the first six months of life [6]. However, nearly two-thirds of infants are not exclusively breastfed for the recommended six months [1] and breastfeeding rates vary widely across cultures and countries [7].

The COVID-19 outbreak, caused by coronavirus 2 (SARS-CoV-2) and started in Wuhan, China at the end of 2019, has been affecting countries across the world. Current evidence suggests that it is unlikely that the virus can be spread from mother to baby through breast milk [8,9]. Breastfeeding is protective against infectious diseases, due to the direct transfer of antibodies as well as anti-infective factors and the long-lasting transfer of immunological competence and memory [9]. The benefits of breastfeeding in nurturing mother-infant interaction to prevent infection and promote health and development are especially important when health and other community services are themselves disrupted or limited [9]. The WHO and UNICEF recommend the initiation and continuance of breastfeeding for infants and young children during the pandemic and this recommendation also applies to mothers with suspected or confirmed COVID-19 infection [10,11].

The pandemic has greatly affected health care practices in that many health care services have been shut down or down-scaled. Breastfeeding mothers felt that breastfeeding support was negatively impacted by the pandemic due to the lack of social contacts to engage with individuals in person and the lack of access to childcare [12]. A study reported exacerbated loneliness due to diminished accessibility to support as well as confusion, alienation, and anxiety regarding disrupted face-to-face healthcare checks and professional support among postpartum women in the United Kingdom (UK) [13]. In addition, concerns about transmitting infectious diseases to infants through breastfeeding or close contact may prevent mothers from breastfeeding.

A review reported that both positive and negative breastfeeding experiences were reported during the COVID-19 pandemic [14]. Positive breastfeeding experiences were observed when mothers perceived that they had more time for motherhood while negative breastfeeding experiences were observed when mothers were separated from their new-borns, struggled with breastfeeding, or perceived decreased family and professional support [14]. A study in Taiwan compared rooming-in and exclusive breastfeeding rates before (2019) and during the COVID-19 period (January to June 2020). It was found that the rate of rooming-in and exclusive breastfeeding was 7.7 % and 44.8 %, respectively. These rates did not differ significantly before and during the COVID-19 period, suggesting that rooming-in and breastfeeding were not affected by the COVID-19-related preventive measures in hospitals [15].

To the best of our knowledge, no empirical quantitative study using multi-country samples has been conducted to examine how COVID-19 has affected breastfeeding intention and behaviour. The objectives of this study were to examine breastfeeding intention during pregnancy

and breastfeeding behaviour among postpartum women in five countries during the COVID-19 pandemic as well as associated factors including socio-demographics, obstetric characteristics, COVID-19 positive and vaccination experience, COVID-19 impact on food security, breastfeeding beliefs, and postpartum breastfeeding support (only for breastfeeding behaviour for logistical reasons).

2. Methods

2.1. Design and participants

This study was part of an international collaborative project on postpartum women’s breastfeeding behaviour and COVID-19-related knowledge, attitudes, and practices. A cross-sectional and online questionnaire survey was conducted in five countries, namely Thailand, the UK, South Korea, Taiwan, and Brazil. Investigators in each of the five countries were responsible for the recruitment of study participants and data collection in their country. The inclusion criteria were postpartum mothers within six months of birth who had reached adult age as defined by their country (20 years of age in Taiwan and 18 in other countries), who were able to access an online survey, who could use the local language to complete the survey, and who were residents in the designated country during the survey period. Data were collected from July to November 2021.

2.2. Data collection

The study questionnaire was first developed in English. All investigators reviewed, assessed, and revised the questionnaire. Then, the questionnaire was translated into the local languages for the countries other than the UK. The local language version of the questionnaire was each assessed by 2–3 nursing or midwifery professionals in 4 out of the 5 countries, then pre-tested with 3–10 postpartum mothers in each respective country and revised to increase clarity. Investigators in each country developed their own Google form in the local language and distributed the questionnaire link through social media (such as Facebook, Line, and WhatsApp), personal social networks, websites, or posters in hospitals/clinics. A total of 3253 participants who met the inclusion criteria completed the online survey (Brazil: 560, Taiwan: 614, Thailand: 840, South Korea: 381, UK: 858). The study protocol was approved by relevant ethical review committees in all participating countries. The study was conducted in accordance with relevant institutional guidelines and the declaration of Helsinki. All participants completed an online informed consent prior to the beginning of data collection. The informed consent explained the study purpose, assured confidentiality of their identity and their right to refuse to participate. Incentives worth less than 4 US dollars in the form of coffee coupon, convenience store voucher, or cash were provided in South Korea, Taiwan, and Thailand, respectively. No incentive was provided in Brazil and the UK.

2.3. Measures

The dependent variables in this study were breastfeeding intention during pregnancy and breastfeeding behaviour. The other study variables included socio-demographics (maternal age, work status, and educational level), obstetric characteristics (parity, birth mode, birthweight, and preterm birth), COVID-19 positive and vaccination experience, COVID-19 impact on food security, breastfeeding beliefs, and postpartum breastfeeding support.

Breastfeeding intention during pregnancy was measured by the question, “During your pregnancy, did you intend to breastfeed (feed your baby your breast milk directly from your breast or your expressed breast milk)?” The alternative answers were “yes,” “no,” or “don’t know.” Current breastfeeding status was assessed by asking “How was your youngest baby fed in the last 24 h? Mark all that apply.” The

alternatives included “breastfeeding directly on breast” and “expressed breast milk,” more than one choice was allowed. A woman can tick “breastfeeding directly on breast” and “expressed breast milk” if both were used in the last 24 h. An answer of “yes” to the two alternatives was regarded as breastfeeding in the last 24 h. The impact of COVID-19 on breastfeeding behaviours was assessed by asking “Did COVID-19 affect your infant feeding behaviour?” This question was asked for “directly on breast” and “expressed breast milk” separately. The alternatives were “did/do not intend to feed,” “shorter than I intended,” “the same duration as I intended,” and “longer than I intended.” We separated “directly on breast” and “expressed breast milk” since “expressed breast milk” may have been suggested to those mothers who were at risk of or showed signs of suspected infection.

Since the participants were within six months postpartum, current work status was assessed with four alternatives (“yes,” “no,” “on paid maternity leave,” and “on unpaid maternity leave”). COVID-19 positive status and vaccination were each assessed using one question, “Have you ever been diagnosed as COVID-19 positive?” and “Have you had a COVID-19 vaccine?” respectively. The impact of COVID-19 on food security was determined by asking two questions, “Did you ever run out of food before the end of the month or cut down on the amount you ate to feed others in 2019 BEFORE COVID-19?” and “Did you ever run out of food before the end of the month or cut down on the amount you ate to feed others DURING COVID-19 in 2020–2021?” The answers to the two questions were combined and categorised into four groups: insecure to insecure, worse (secure to insecure), better (insecure to secure), and secure to secure.

Breastfeeding beliefs in the context of the COVID-19 pandemic was measured by a scale developed specifically for this study. The scale included six questions rated on a scale of 0–2 including “disagree,” “uncertain,” and “agree.” The first of the six questions related to beliefs regarding passing on COVID-19 to the baby through breastfeeding. The remaining five questions assumed that the mother was confirmed or suspected to have COVID-19 and assessed her beliefs as to whether she should (2) breastfeed, (3) have skin-to-skin contact and breastfeed

following birth, (4) give the baby infant formula milk, (5) always wear a face mask when breastfeeding, and 6) touch and hold her new born baby without wearing a face mask. Item scores were coded so that higher scores indicating a more positive breastfeeding belief.

Information regarding to whom and how postpartum breastfeeding support was provided was obtained by asking two respective questions: “Who do you receive support for postnatal infant feeding from (mark all that apply)?” Alternatives were “no support,” “healthcare professionals,” “spouse/partner and friend/relative,” “online support group (e.g., Facebook),” and “others”; and “How do you make contact with healthcare professionals for postnatal breastfeeding support? (mark all that apply)” Alternatives were “none,” “in person,” “by phone,” “video contact,” and “others.”

2.4. Data analysis

The data analyses were performed using the SAS 9.3 (SAS Institute Inc., Cary, NC, USA). Regarding descriptive statistics, the continuous variables were presented as means with their standard deviations (SDs), and the categorical variables were presented as numbers and percentages. Pearson’s chi-squared test was used to compare the proportions in the bi-variate analysis. Analyses of variance or Student’s t-test was used to compare the means. Binary multivariate logistic regression models were used to examine associated factors for breastfeeding intention and breastfeeding behaviour. The level of significance was set at 0.05.

3. Results

The characteristics of the study participants are presented in Table 1. Of the 3253 postpartum women who participated in this study, 75.8 % had an educational level of college/university or postgraduate degree. The mean age of the study participants was 31.26 (SD = 5.21) years. Close to half of the participants (48.7 %) were on paid maternity leave, while 10.6 % were on unpaid maternity leave. About 57.0 % were primiparous women and 39 % had a caesarean birth. About 10 % (12.3 %)

Table 1
Characteristics of the study participants.

	All N = 3253 n (%)	Brazil n = 560	Taiwan n = 614	Thailand n = 840	South Korea n = 381	UK n = 858	p
Maternal age (years)							<.0001
18–29	1094 (33.6)	164 (29.3)	204 (33.2)	489 (58.2)	51 (13.4)	186 (21.7)	
30–39	2005 (61.6)	360 (64.3)	397 (64.7)	318 (37.9)	311 (81.6)	619 (72.1)	
>=40	154 (4.7)	36 (6.4)	13 (2.1)	33 (3.9)	19 (5.0)	53 (6.2)	
Work status							<.0001
Yes	564 (17.3)	87 (15.6)	28 (4.6)	357 (42.5)	61 (16.0)	31 (3.6)	
No	762 (23.4)	104 (18.6)	99 (16.1)	312 (37.1)	197 (51.7)	50 (5.8)	
On paid maternity leave	1583(48.7)	335(59.9)	312(50.8)	121(14.4)	84(22.1)	731(85.2)	
On unpaid maternity leave	343(10.6)	33(5.9)	175(28.5)	50(6.0)	39(10.2)	46(5.4)	
Educational level							<.0001
Secondary school or lower	787 (24.2)	85 (15.2)	35 (5.7)	458 (54.5)	34 (8.9)	175 (20.4)	
College/University or higher	2465 (75.8)	475 (84.8)	579 (94.3)	382 (45.5)	347 (91.1)	682 (79.6)	
Parity							<.0001
1	1853 (57)	393 (70.2)	424 (69.1)	436 (51.9)	207 (54.6)	393 (45.8)	
>1	1398 (43)	167 (29.8)	190 (30.9)	404 (48.1)	172 (45.4)	465 (54.2)	
Birth mode							<.0001
Vaginal	1985 (61.0)	272 (48.6)	417 (67.9)	489 (58.2)	251 (65.9)	556 (64.8)	
Caesarean	1268 (39.0)	288 (51.4)	197 (32.1)	351 (41.8)	130 (34.1)	302 (35.2)	
Birthweight (grams)							0.0045
<2500	250 (7.7)	43 (7.7)	57 (9.3)	81 (9.6)	18 (4.7)	51 (5.9)	
>=2500	3002 (92.3)	516 (92.3)	557 (90.7)	759 (90.4)	363 (95.3)	807 (94.1)	
Preterm birth	399 (12.3)	52 (9.3)	60 (9.8)	173 (20.6)	48 (12.6)	66 (7.7)	< .0001
Ever tested COVID-19 positive	417 (12.8)	140 (25.0)	1 (0.2)	143 (17.0)	6 (1.6)	127 (14.8)	< .0001
Has received COVID-19 vaccine	2348 (72.2)	543 (97.0)	484 (78.8)	469 (55.8)	96 (25.2)	756 (88.1)	< .0001
Impact of COVID-19 on food insecurity							<.0001
Insecure to insecure	298 (9.2)	19 (3.4)	–	236 (28.1)	21 (5.5)	22 (2.6)	
Worse	340 (10.5)	75 (13.5)	–	180 (21.4)	13 (3.4)	72 (8.4)	
Better	27 (0.8)	5 (0.9)	–	13 (1.6)	5 (1.3)	4 (0.5)	
Secure to secure	2584 (79.5)	457 (82.2)	614 (100)	411 (48.9)	342 (89.8)	760 (88.6)	

of the infants were born preterm. About 13 % (12.8 %) of the participants had ever been tested as COVID-19 positive and the majority (72.2 %) had received a COVID-19 vaccine. As for the impact of COVID-19 on food insecurity, 10.5 % of participants reported becoming food insecure during the pandemic and another 9.2 % reported continuous insecurity.

The characteristics of the participants differed significantly by country (Table 1). In terms of ever being tested COVID-19 positive, the proportion was highest in Brazil (25.0 %), followed by Thailand (17.3 %), the UK (14.8 %), South Korea (1.6 %), and Taiwan (0.2 %). Regarding ever having received a vaccine, the proportion from highest to lowest was Brazil (97 %), the UK (88.1 %), Taiwan (78.8 %), Thailand (55.8 %), and South Korea (25.2 %). The impact of COVID-19 on food insecurity was highest in Thailand with 49.5 % (secure to insecure 21.4 %, insecure to insecure 28.1 %) of participants reporting food insecurity, followed by Brazil (secure to insecure 13.5 %, insecure to insecure 3.4 %), the UK (secure to insecure 8.4 %, insecure to insecure 2.6 %), and South Korea (secure to insecure 3.4 %, insecure to insecure 5.5 %). None of the participants in Taiwan reported food insecurity.

The majority of participants (85.7%) reported breastfeeding in the past 24 h, with the majority feeding directly on the breast (73.5 %) and 38.3 % using expressed milk (Table 2). The proportion of breastfeeding was higher in Brazil (94.5 %), Thailand (89.3 %), and the UK (88.6 %) than in South Korea (77.4%) and Taiwan (74.1%). Expressed breast milk was more commonly used in Thailand, Taiwan, and South Korea (>50%) than in Brazil (13.8 %) and the UK (17.6 %). About 90 % of participants expressed an intention to breastfeed during pregnancy. Taiwan (82.4 %) and South Korea (74.5 %) had an intention rate of less than 90%, while the other three countries had an intention rate of higher than 90 %. As for COVID-19 affecting infant feeding behaviour, 66.4 % of participants who breastfed directly from the breast breastfed for as long as planned or longer, higher than that of mothers who used expressed breast milk (52.3 %). For mothers breastfeeding directly from the breast, the UK (85.1 %) and Brazil (74.8 %) had a higher proportion of mothers who breastfed for as long as planned or longer during the COVID-19 pandemic than those in the other countries (48.7–67.8 %).

Factors associated with intention to breastfeed during pregnancy are presented in Tables 3 and 4. Bi-variate analysis (Table 3) showed that those who intended to breastfeed during pregnancy were more likely to be older, on paid maternity leave, were multiparous, tested COVID-19 positive, received a COVID-19 vaccine, experienced food security from secure to insecure from pre-COVID-19 to the COVID-19 period, and had higher scores for breastfeeding beliefs. In multivariate analysis (Table 4), being multiparous, ever tested COVID-19 positive, and having positive breastfeeding beliefs were associated with increased odds for intention to breastfeed during pregnancy after country differences were controlled.

Bi-variate analysis on factors associated with the impact of COVID-

Table 2
Breastfeeding intention during pregnancy and impact of COVID-19 on breastfeeding behaviour.

	All N = 3253	Brazil n = 560	Taiwan n = 614	Thailand n = 840	South Korea n = 381	UK n = 858	p
Intention to breastfeed during pregnancy	2931 (90.1)	554 (98.9)	506 (82.4)	758 (90.2)	284 (74.5)	829 (96.6)	< .0001
Breastfeeding in the last 24 h [£]	2789 (85.7)	529 (94.5)	455 (74.1)	750 (89.3)	295 (77.4)	760 (88.6)	< .0001
Directly on breast	2392 (73.5)	508 (90.7)	333 (54.2)	544 (64.8)	274 (71.9)	733 (85.4)	< .0001
Expressed breast milk	1246 (38.3)	77 (13.8)	323 (52.6)	503 (59.9)	192 (50.4)	151 (17.6)	< .0001
Breastfeeding directly from breast	489(15.1)	80 (14.4)	73(11.9)	265 (31.6)	29(7.6)	42 (4.9)	< .0001
Did/do not intend to feed	603(18.6)	60 (10.8)	197(32.1)	166 (19.8)	94(24.7)	86 (10.0)	
Shorter than I intended	1746 (53.7)	352 (63.3)	277(45.1)	251 (29.9)	190(49.9)	676 (78.8)	
The same duration as I intended	411(12.7)	64 (11.5)	67(10.9)	158 (18.8)	68(17.9)	54 (6.3)	
Longer than I intended							
Breastfeeding from expressed breast milk	895(27.6)	206 (37.1)	51(8.3)	235 (28.0)	67(17.6)	336 (39.2)	< .0001
Did/do not intend to feed	654(20.1)	95 (17.1)	192(31.3)	180 (21.4)	101(26.5)	86 (10.0)	
Shorter than I intended	1325 (40.8)	211 (38.0)	283(46.1)	281 (33.5)	164(43.0)	386 (45.0)	
The same duration as I intended	375(11.5)	44 (7.9)	88(14.3)	144 (17.1)	49(12.9)	50 (5.8)	
Longer than I intended							

Note: [£] The participant can choose either “directly on breast” or “expressed breast milk” or both. Directly from breast and expressed breast milk were non-exclusive categories.

Table 3
Factors associated with intention to breastfeed during pregnancy.

	Intention 2931 (90.10%)	No intention 592 (9.90%)	p
Maternal age (years)			0.04
18–29	33.4	v5.4	
30–39	61.5	62.7	
>=40	5.1	1.9	
Work status			<.0001
Yes	17.1	19.9	
No	22.6	31.1	
On paid maternity leave	50.7	30.8	
On unpaid maternity leave	9.7	18.3	
Educational level			0.899
Secondary school or lower	24.2	23.9	
College/University or higher	75.8	76.1	
Primiparous	56.2	64.6	0.004
Birth mode			0.51
Vaginal	60.8	62.7	
Caesarean	39.2	37.3	
Birthweight <2500 g	7.7	7.8	0.96
Preterm birth	11.9	15.2	0.09
Ever tested COVID-19 positive	13.8	4	<.0001
Has received COVID-19 vaccine	73.4	61.2	<.0001
Impact of COVID-19 on food insecurity			0.01
Insecure to insecure	9.1	9.6	
Worse	11	5.3	
Better	0.8	1.2	
Secure to secure	79.1	83.9	
Breastfeeding belief; M(SD)	13.5 (2.7)	11.8 (2.1)	< .0001

Table 4
Multivariate logistic regression results on factors associated with intention to breastfeed during pregnancy.

	Adjusted OR	95% CI
Country		
Taiwan	1	
Brazil	10.81	4.56, 25.60
Thailand	1.96	1.35, 2.87
South Korea	0.70	0.49, 0.996
UK	3.65	2.30, 5.79
Parity		
1	0.75	0.58, 0.97
> 1	1	
Ever tested COVID-19 positive	1.87	1.03, 3.37
Breastfeeding belief; M(SD)	1.13	1.07, 1.20

Table 5
Factors associated with impact of COVID-19 on breastfeeding behaviour.

	Impact of COVID-19 on feeding directly from breast					Impact of COVID-19 on feeding with expressed breast milk				
	No intention n =	Shorter n =	Planned n =	Longer n =	p	No intention n =	Shorter n =	Planned n =	Longer n =	p
	489;15.05%	603;18.56%	1746;53.74%	411;12.65%		895;27.55%	654;20.13%	1325;40.78%	375;11.54%	
Maternal age (years)					< .0001					0.004
18–29	50.1	39	27	34.6		35.9	39	30	31.7	
30–39	46	57.4	67.5	61.6		59.4	57.2	64.8	63.5	
> =40	3.9	3.7	5.6	3.9		4.7	3.8	5.2	4.8	
Work status					< .0001					< .0001
Yes	27.2	18.2	13	22.6		15.5	18.7	16.5	22.1	
No	59.7	65.7	54.6	51.2		49.5	62.3	59.9	55.2	
On paid maternity leave	10	14.8	9	11.7		6.4	13.5	11.1	13.6	
On unpaid maternity leave	31.7	23.6	20	28.2		27.4	26.5	19.3	23.5	
Educational level					< .0001					< .0001
Secondary school or lower	46.4	21.4	18.9	24.6		33.9	24.5	18.4	21.3	
College/University or higher	53.6	78.6	81.1	75.4		66.1	75.5	81.6	78.7	
Primiparous	59.7	65.7	54.6	51.2	< .0001	49.5	62.3	59.9	55.2	< .0001
Birth mode					0.05					0.66
Vaginal	60.3	56.6	61.9	64.5		60.9	59	61.7	62.1	
Caesarean	39.7	43.5	38.1	35.5		39.1	41	38.3	37.9	
Birthweight < 2500 g	7.6	11.1	6.8	6.8	0.0058	5.6	9.3	7.2	11.8	0.0006
Preterm birth	12.9	15.6	9.9	16.6	< .0001	10.4	13	11	19.7	< .0001
Ever tested COVID-19 positive	16.6	11.3	12.9	10.5	0.02	15.9	12.1	11.9	10.1	0.01
Has received COVID-19 vaccine	63.8	70.7	77.2	63	< .0001	74.2	69.4	72.5	70.9	0.2
Impact of COVID-19 on food insecurity					< .0001					< .0001
Insecure to insecure	18.4	9.8	6.1	10.2		11.6	10.7	6.6	9.6	
Worse	15	11.1	7.8	15.6		14.1	11.5	7	12.3	
Better	1.6	0.5	0.7	1		1	1.1	0.5	1.1	
Secure to secure	65	78.6	85.4	73.2		73.3	76.7	85.8	77	
Breastfeeding belief; M(SD)	12.5 (2.4)	12.6 (2.5)	14.0 (2.6)	13.1 (2.7)	< .0001	13.8 (2.6)	12.7 (2.5)	13.5 (2.7)	13.1 (2.6)	< .0001
Support provider for postnatal infant feeding (Mark all that apply)										
No support	15.5	13.4	16.2	15.8	0.45	20.3	17	12.9	10.9	< .0001
Healthcare professionals	69.9	67.7	65.3	70.3	0.09	60.7	65.6	70.5	72.8	< .0001
Spouse/partner, friend, or relative	38.5	53.7	55.3	47.9	< .0001	45.1	48.3	56.2	55.7	< .0001
Online support group (e.g., Facebook)	22.7	25	34.7	31.9	< .0001	30.8	23.6	33.7	32.5	< .0001
Others	3.9	9.1	7.8	6.1	0.005	5.5	8.7	7.2	9.1	0.04
How contact is/was made with healthcare professionals for postnatal breastfeeding support (Mark all that apply)										
Never	25.8	27.2	26.9	26.3	0.95	34.2	27.8	22.7	21.1	< .0001
In person	51.5	56.1	56.1	58.2	0.21	47.7	54.6	59.8	61.9	< .0001
By phone	34.8	28.7	33.1	35.3	0.08	30.5	28.4	35.2	37.6	0.002
Video	7.8	5	10	10.2	0.001	10.1	6.7	9.1	8.3	0.14
Others	0.4	1	2.8	0.7	0.0003	2.4	1.1	2	1.3	0.25

19 on direct breastfeeding or expressed breast milk are presented in Table 5. Maternal age, work status, educational level, parity, birthweight, preterm birth, ever tested COVID-19 positive, food security, breastfeeding beliefs, and postnatal breastfeeding support were significantly related to breastfeeding behaviour. To show the association more clearly, we combined the breastfeeding behaviour responses into a binary variable (breastfeeding duration as planned or longer versus shorter or no intention). Multivariate logistic regression results (Table 6)

showed that factors associated with breastfeeding duration being as planned or longer were somewhat different between direct breastfeeding and using expressed breast milk. For direct breastfeeding, lower education, primiparous, and ever tested COVID-19 positive were associated with decreased odds for breastfeeding duration being as planned or longer. Vaginal birth, breastfeeding beliefs, breastfeeding support from a spouse/partner/friend/relative, breastfeeding support from online support groups, and in-person contact with healthcare professionals

Table 6

Multivariate logistic regression results on factors associated with the impact of COVID-19 on breastfeeding duration being as planned or longer than planned.

	Impact of COVID-19 on feeding directly from breast		Impact of COVID-19 on feeding with expressed breast milk	
	Adjusted OR	95 % CI	Adjusted OR	95 % CI
Country	1	1.53,	1	0.48,
Taiwan	2.05	2.75	0.62	0.79
Brazil	0.98	0.76,	1.10	0.83,
Thailand	2.12	1.27	1.22	1.46
South Korea	4.03	1.58,	0.78	0.92,
UK		2.84		1.63
		3.05,		0.61,
		5.33		0.98
Work status	NS		1	1.06,
No			1.34	1.69
Yes			1.35	1.09,
On paid maternity leave			1.34	1.67
On unpaid maternity leave				1.01,
				1.77
Educational level	0.70	0.57,	0.67	0.55,
Secondary school or lower	1	0.86	1	0.81
College/University or higher				
Parity	0.70	0.59,	NS	
1	1	0.82		
> 1				
Birth mode	1.30	1.10,	NS	
Vaginal	1	1.52		
Caesarean				
Ever tested COVID-19 positive	0.77	0.60,	NS	
		0.99		
Impact of COVID-19 on food insecurity	NS		0.66	0.50,
Insecure to insecure			0.64	0.88
Worse			0.61	0.50,
Better			1	0.83
Secure to secure				0.27,
Breastfeeding belief	1.11	1.06,	NS	1.35
		1.15		
Spouse/partner, friend, or relative support	1.21	1.02,	1.33	1.14,
Online support group (e.g., Facebook)	1.30	1.43		1.55
How contact is/was made with healthcare professionals for postnatal breastfeeding support	1.25	1.06,	1.38	1.19,
In person		1.47	1.40	1.60
By phone				1.19,
				1.65

NS: not significant and was not included in the model

for postnatal breastfeeding support were associated with increased odds for breastfeeding duration being as planned or longer.

For expressed breast milk, work status, educational level, food security, and postnatal breastfeeding support were significantly related to breastfeeding duration being as planned or longer (Table 5). Lower educational level (secondary school, or lower) was associated with decreased odds for breastfeeding duration being as planned or longer. Currently working or being on maternity leave, regardless of whether it was paid or unpaid, were positively associated with breastfeeding duration being as planned or longer. Food security problems, i.e., food insecurity become worse or continuous insecurity before or during the COVID-19 period, were associated with decreased odds for breastfeeding duration being as planned or longer. Breastfeeding support from a spouse/partner/friend/relative and in-person as well as telephone contact with healthcare professionals for postnatal breastfeeding support were associated with increased odds for breastfeeding duration being as planned or longer (Table 6).

4. Discussion

This study found that about 90 % of the participants intended to breastfeed during pregnancy and did breastfeed during the COVID-19 pandemic. Although there was a lack of pre-COVID comparative data, the results suggested that the vast majority of mothers managed to initiate and continue breastfeeding during the pandemic. These findings are consistent with a previous study that the reported rate of rooming-in and exclusive breastfeeding during hospitalisation were similar before and during the COVID-19 pandemic [15]. Our results extend the previous findings and show that breastfeeding continued after hospital discharge during the first six months postpartum.

More than half of the participants in this study reported their breastfeeding duration being as planned or longer. The finding that about half of participants were not able to continue breastfeeding to the extent they wished after hospital discharge is consistent with previous study findings [16,17]. More studies are needed to examine the reasons behind an intention not to breastfeed and breastfeeding duration being shorter than planned in order to encourage breastfeeding and longer breastfeeding duration. During the COVID-19 pandemic, social support such as health care and professional support, as well as social network support, was restricted [12,13]. Despite this, more than half of the participants could still adhere to their planned breastfeeding duration or breastfeed for longer. Previous studies showed that lactation support, social support, and consultation and hand-on assistance to deal with breastfeeding problems and concerns are key to the promotion of long-term breastfeeding [18,19]. Since the threat of COVID-19 has become part of ordinary life, like many other infectious diseases, continued support and services should be offered to breastfeeding mothers and should integrate preventive measures relating to infectious disease such as wearing a mask during feeding, washing hands with soap before and after touching the baby, and wiping and disinfecting surfaces regularly in order to help breastfeeding mothers and their infants [20].

The percentage of participants with a breastfeeding duration as planned or longer was 15 % greater among those feeding directly from the breast (66.4%) than those using expressed breast milk (52.3 %). It was noted that mothers could use both to breastfeed in our study and the proportions were not exclusive. Nonetheless, Brazil (91 %) and the UK (85 %) had a higher rate of breastfeeding directly from the breast and a lower rate of using expressed breast milk (Brazil: 13.8 %; UK: 17.6 %) compared to the other three countries (direct: 54.2–71.9 %; expressed: 50.4–59.9 %). Brazil and the UK also had the highest proportion of breastfeeding duration as planned or longer. Those results may suggest that breastfeeding directly from the breast is better than using expressed breast milk for breastfeeding duration being as planned or longer although further study may be needed to examine this issue.

We found that participants who had ever tested COVID-19 positive were more likely to report intention to breastfeed during pregnancy, but they were less likely to breastfeed as planned or longer. The results need to be explained with caution because the COVID-19 positive status in this study may not concur with the time frame when women recalled their breastfeeding intention during pregnancy and reported their breastfeeding behaviour. Nevertheless, during the COVID-19 pandemic, practice of maternal-baby dyad separation and limiting breastfeeding were common among women who had suspected or confirmed COVID-19 due to the concerns for transmission of infection from maternal respiratory secretions to the infant [20]. Those could be the reasons why women ever tested COVID-19 positive were less likely to breastfeed as planned. Regardless of whether mothers or their infants have suspected or confirmed COVID-19 or not, UNICEF recommends that mothers should be encouraged to breastfeed and practice skin-to-skin contact immediately after birth and during the establishment of breastfeeding [11,21]. Since COVID-19 is not likely to spread through breastfeeding, mothers could be advised to continue breastfeeding with the implementation of precautionary and hygiene practices [11,21]. Advocacy of breastfeeding and pro-breastfeeding practices for COVID-19 positive

women following childbirth are needed. Postpartum breastfeeding support services could use those information to educate COVID-19 positive mothers and their families, and improve support for those mothers.

Breastfeeding support from a spouse/partner/friend/relative, online support groups, and in-person or telephone contact with healthcare professionals for postnatal breastfeeding support were all helpful in increasing the likelihood of breastfeeding duration being as planned or longer. Multiple media channels were effective in the pandemic and could be used to support mothers to achieve their breastfeeding goals.

Breastfeeding beliefs and maternity leave were positively associated with breastfeeding intention and behaviour while being primiparous and experiencing food insecurity were negatively associated with breastfeeding intention and behaviour. Those results concurred with previous study findings [16,17,19,22,23]. Maternity leave policies and food security for families with young infants should be emphasised to promote maternal and child health. Health education programmes could emphasise the benefits of breastfeeding in the COVID-19 context.

5. Limitations

This study was limited by the use of a cross-sectional design. Causal relationships cannot be inferred and there was a lack of a comparison group (not exposed to COVID-19) in this study. A convenience sample and an online survey were conducted; therefore, the study participants may not represent women within six months postpartum in each of the participating countries. For example, the participants attained a high educational level, which was different from the general postpartum population. We included mothers of infants within six months of age and did not include age of the infant in the study. However, younger infants may be more likely to be exclusively breastfed than older infants. Nonetheless, the inclusion of women from five different countries increases the heterogeneity of the study sample. As the data relied on self-reports, social desirability bias may be a threat. We are not able to tell the timing of COVID-19 positive status being before pregnancy, during pregnancy, or after birth. Nonetheless, since world COVID-19 pandemic started around March 2020, the status in the study deemed to be recent (within 2 years).

6. Conclusions

This multi-country survey of women within six months postpartum during the COVID-19 pandemic found that about 90% of participants intended to breastfeed during pregnancy and were breastfeeding at the time of the survey. More than half of the participants reported their breastfeeding duration being as planned or longer, suggesting that breastfeeding intention and behaviour remained high during the COVID-19 pandemic. Participants that had ever tested COVID-19 positive were more likely to report intention to breastfeed during pregnancy, but were less likely to breastfeed for as long as planned or longer. Online support groups and in-person as well as telephone contact with health professionals are all associated with breastfeeding duration being as planned or longer during the pandemic period, suggesting that multiple media channels were effective during the pandemic.

Acknowledgements

This project is supported by Mahidol University (MU-GPI 02/2564). The Taiwan survey was partially supported by the One Health Research Center of the National Yang Ming Chiao Tung University within the

framework of the Higher Education Sprout Project by the Ministry of Education in Taiwan.

References

- [1] World Health Organization [Internet]. Breastfeeding. WHO 2022 [cited 2022 March 7]. Available from: (https://www.who.int/health-topics/breastfeeding#tab=tab_1).
- [2] C.G. Victora, R. Bahl, A.J. Barros, G.V.A. França, S. Horton, J. Krasevec, et al., Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect, *Lancet* 387 (2016) 475–490.
- [3] M.J. Sankar, B. Sinha, R. Chowdhury, N. Bhandari, S. Taneja, J. Martines, et al., Optimal breastfeeding practices and infant and child mortality: a systematic review and meta-analysis, *Acta Paediatr.* 104 (2015) 3–13.
- [4] Horta B., Victora C. A systematic review on the benefits of breastfeeding on diarrhoea and pneumonia mortality. Geneva: World Health Organization; 2013.
- [5] M.S. Kramer, R. Kakuma, Optimal duration of exclusive breastfeeding, *Cochrane Lib.* 15 (2012), CD003517.
- [6] World Health Organization [Internet]. Joint statement by UNICEF Executive Director Henrietta Fore and WHO Director-General Dr. Tedros Adhanom Ghebreyesus on the occasion of World Breastfeeding Week (1 August 2021) [cited 2022 March 7]. Available from: (<https://www.who.int/news/item/01-08-2021-joint-statement-by-unicef-executive-director-henrietta-fore-and-who-director-general-dr.-tedros-adhanom-ghebreyesus-on-the-occasion-of-world-breastfeeding-week>).
- [7] P.A.R. Neves, J.S. Vaz, F.S. Maia, P. Baker, G. Gatica-Domínguez, E. Piwoz, et al., Rates and time trends in the consumption of breastmilk, formula, and animal milk by children younger than 2 years from 2000 to 2019: analysis of 113 countries, *Lancet Child Adolesc. Health* 5 (9) (2021) 619–630.
- [8] World Health Organization. Breastfeeding and COVID-19: scientific brief. 2020 Jun [cited 2022 March 7]. Available from: (https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci_Brief-Breastfeeding-2020.1).
- [9] W. Lubbe, E. Botha, H. Niela-Vilen, P. Reimers, Breastfeeding during the COVID-19 pandemic a literature review for clinical practice, *Int. Breast J.* 15 (2020) 82.
- [10] World Health Organization. Breastfeeding advice during the COVID-19 outbreak. 2020 May [cited 2022 March 7]. Available from: (http://www.emro.who.int/image/stories/ncds/documents/en_flyer_breastfeeding_covid_19.pdf?ua=1).
- [11] UNICEF. Breastfeeding safely during the COVID-19 pandemic: how to nourish your child following the latest expert guidance. 2021 July [cited 2022 March 7]. Available from: (<https://www.unicef.org/coronavirus/breastfeeding-safely-during-covid-19-pandemic>).
- [12] K. Snyder, G. Worlton, Social support during COVID-19: perspectives of breastfeeding mothers, *Breast Med.* 16 (1) (2021) 39–45.
- [13] L. Jackson, L.D. Pascalis, J.A. Harrold, V. Fallon, S.A. Silverio, Postpartum women's experiences of social and healthcare professional support during the COVID-19 pandemic: a recurrent cross-sectional thematic analysis, *Women Birth* S1871–5192 (21) (2021 11) 00174–00178.
- [14] F. Pacheco, M. Sobral, R. Guiomar, A. Torre-Luque, R.A. Caparros-Gonzalez, A. Ganho-Ávila, Breastfeeding during COVID-19: a narrative review of the psychological impact on mothers, *Rev. Behav. Sci.* 11 (2021) 34.
- [15] S.C. Liao, L.Y. Chien, COVID-19 control measures and their effectiveness in the department of obstetrics and gynecology, Taipei veterans general hospital, *Taiwan J. Public Health* 40 (4) (2021) 453–458.
- [16] S.T. Chiou, L.C. Chen, H. Yeh, S.R. Wu, L.Y. Chien, Early skin-to-skin contact, rooming-in, and breastfeeding: a comparison of the 2004 and 2011 National Surveys in Taiwan, *Birth* 41 (1) (2014) 33–38.
- [17] C.C. Lee, S.T. Chiou, L.C. Chen, L.Y. Chien, Breastfeeding-friendly environmental factors and continuing breastfeeding until 6 months postpartum: 2008-2011 National Surveys in Taiwan, *Birth* 42 (3) (2015) 242–248.
- [18] M. Almeida, A.D. Shrestha, D. Stojanac, L.J. Miller, The impact of the COVID-19 pandemic on women's mental health, *Rev. Arch. Women's. Ment. Health* 23 (6) (2020) 741–748.
- [19] S.S. Cohen, D.D. Alexander, N.F. Krebs, B.E. Young, M.D. Cabana, P. Erdmann, et al., Factors associated with breastfeeding initiation and continuation: a meta-analysis, *J. Pediatr.* 203 (2018) 190–196.
- [20] R. Cheema, E. Partridge, L.R. Kair, K.M. Kuhn-Riordon, A.I. Silva, M.E. Bettinelli, D. Blumberg, Protecting breastfeeding during the COVID-19 Pandemic, *Am. J. Perinatol.* (2020), <https://doi.org/10.1055/s-0040-1714277>.
- [21] UNICEF. Breastfeeding during the COVID-19 pandemic: tips on keeping your baby healthy and safe. ND [cited 2022 March 7]. Available from: (<https://www.unicef.org/eap/breastfeeding-during-covid-19>).
- [22] A. Waits, C.Y. Guo, L.Y. Chien, Evaluation of factors contributing to the decline in exclusive breastfeeding at 6 months postpartum: the 2011-2016 National Surveys in Taiwan, *Birth* 45 (2) (2018) 184–192.
- [23] A.O. Odeniyi, N. Embleton, L. Ngongalah, W. Akor, J. Rankin, Breastfeeding beliefs and experiences of African immigrant mothers in high-income countries: a systematic review, *Matern. Child Nutr.* 16 (3) (2020), e12970.