

# Associations of Breastfeeding Knowledge, Attitude and Interest with Breastfeeding Duration: A Cross-sectional Web-based Study

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**Purpose:** Maternal knowledge, positive attitudes and interest toward breastfeeding may improve the sustainability of breastfeeding. This study examined the associations of knowledge, attitudes, and interest toward breastfeeding with the duration of breastfeeding in Korean mothers who used the internet. **Methods:** We conducted a cross-sectional study of 604 Korean mothers who breastfed their babies. Mothers were recruited through the internet and their knowledge, attitudes and interest toward breastfeeding were assessed using a web-based self-administered questionnaire. Geometric means and odds ratio (OR) with 95% confidence intervals were calculated. **Results:** Higher knowledge, attitudes, and interest toward breastfeeding were associated with longer duration of breastfeeding in Korean mothers. In particular, mothers who had optimal breastfeeding duration were more likely to be aware of the easiness of breast milk stimulation and breastfeeding, the development of attachment between mother and child, and pleasure from breastfeeding compared to those mothers with shorter duration. The association with optimal breastfeeding duration was more pronounced among mothers who graduated from high school for total attitude scores and total interest scores, compared to mothers who graduated from college or above. **Conclusion:** The results of this study suggest that it is important to improve maternal knowledge, attitudes, and interest toward breastfeeding in Korean mothers who use the internet as a source of knowledge. Also, the study results imply that the development of strategies to target mothers with relatively low education levels may improve breastfeeding rates.

**Key words:** Breastfeeding, Health knowledge, Attitudes, Practice, Internet

## INTRODUCTION

Breast milk is the best source of nutrition for infants, and it is important for their growth and the development of their brain and nervous system[1]. Breastfeeding has been shown to be related to a decreased risk of Sudden Infant Death Syndrome (SIDS), otitis media, respiratory tract infections, gastroenteritis, asthma,

atopic dermatitis, type 2 diabetes, and obesity[2]. Furthermore, breastfeeding enhances the intellectual and psycho-emotional comfort of infants and the mother-infant relationships[3]. Moreover, breastfeeding mothers may have a lower risk of postpartum bleeding and have a faster recovery to pre-pregnancy body conditions as compared to those who bottle feed[2,4].

The World Health Organization (WHO)[4] recommends exclu-

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sive breastfeeding for the first 6 months of life. The 2012 National Survey on Fertility, Family Health and Welfare in Korea reported that rates of exclusive breastfeeding were 56.7% at 1~2 months, 50.0% at 3~4 months, 32.3% at 5~6 months, and 11.4% at 6~7 months[5], which was still below government's goal of 70% during the first month and 60% for six months[6]. The 2012 National Survey indicated that the most common reasons for stopping breastfeeding were a lack of breast milk (40.2%), reaching the right time to stop breastfeeding (26.0%), and returning to work (11.8%). Breastfeeding rates in 2012 in Korea have decreased compared to 2009, for example, from 51.0 to 44.5% of combined rate of exclusive breastfeeding and mixed feeding for 5~6 months[5]. Although several efforts, including breastfeeding education and implementing a baby-friendly hospital campaign, have been made by local communities and by UNICEF Korea, such a decrease in the breastfeeding rate in Korea suggests that both social support and individual effort are strongly needed to encourage breastfeeding.

A recent intervention study found that a 2-hour breastfeeding education session improved breastfeeding technique, the mother's breastfeeding perception, and spousal support[7]. Also, previous studies have shown that maternal knowledge and attitudes toward breastfeeding may influence the personal decision and intention to breastfeed as well as the duration of breastfeeding[8,9]. Another study showed independent association between maternal perception of the acceptability of breastfeeding in public and breastfeeding practices[10]. A few studies have suggested that maternal attitude is a better predictor of infant feeding method than socio-demographic factors[11,12].

The development of positive maternal attitudes and practice toward breastfeeding may be facilitated through web-based breastfeeding education and the provision of breastfeeding information through the internet[13]. A recent US study reported that mothers had difficulty accessing and understanding maternal and infant health information although educational materials already exist[14]. The internet may be and will be, more critically, an important resource to provide parents and health professionals with essential information including breastfeeding techniques, benefits of breastfeeding and self or peer-care tools such as self-monitoring modules and peer supporting network programs[15]. Thomas and Shaikh[16] conducted an email-survey and found

that many breastfeeding mothers reached out to breastfeeding experts over the internet. Because the internet is commonly used in Korea and a useful tool to provide health information, a web-based breastfeeding health-care protocols needs to be properly developed to satisfy user's knowledge, attitude, and interest. Given a need of strategies that promote breastfeeding rate and duration in Korea, increasing knowledge through the internet may be the first step in improving clinical practice[17]. Especially obtaining health information through internet comes into the spotlight because of its good accessibility and effectiveness. However, studies on web-based breastfeeding educational program are rarely found in Korea, and, therefore, there is a need to test the feasibility of web-based monitoring among breastfeeding mothers in Korea. To develop an interactive web-based breastfeeding monitoring system and examine its feasibility, usability, and acceptability among breastfeeding mothers[18], we conducted a base study regarding the web-based knowledge, attitude and interest toward the breastfeeding for a tailored web-based breastfeeding educational information system.

To develop a web-based tailored breastfeeding promotion program, it is essential to examine whether knowledge, attitudes, and interest toward breastfeeding were associated with the duration of breastfeeding in Korean women who used the internet to search for child-related information. A better understanding of determinants of breastfeeding duration, including knowledge, attitudes, and interest toward breastfeeding and education tools, may support the development of better targeted, more effective programs designed to promote breastfeeding. Therefore, we examined whether duration of breastfeeding was associated with knowledge, attitudes, and interest toward breastfeeding in a large cross-sectional study of Korean women who used the internet as a source of knowledge and communication. We also examined whether these associations differed by education levels of the mothers.

The specific aims of this study were as follows: a) To identify the associations of maternal breastfeeding knowledge, attitudes, and interest score with breastfeeding duration; b) to examine the associations for optimal breastfeeding practice (6 or more month of breastfeeding) with breastfeeding knowledge, attitudes and interest toward breastfeeding; and c) to investigate whether the relationships vary by age and education.

## METHODS

### 1. Study design and study population

This study is a cross-sectional study of women who had children of 24 months or less – and were recruited based on convenience sampling. Women who had children of 24 months of age or younger were invited to participate in this study via email through an online system of a dairy company (Maeil Dairies Co., Ltd., Seoul, Korea). The company sent an invitation email to those who voluntarily registered on their website. A total of 1,508 individuals agreed to participate in this study and provided informed written consent forms. The surveys were completed between October and November, 2009. Of the respondents, we excluded men or individuals of unknown gender ( $n=35$ ), unmarried women ( $n=14$ ), women without children ( $n=289$ ), women whose last child was younger than 6 months old ( $n=564$ ), and women who did not answer the question on the duration of breastfeeding ( $n=2$ ). As a result, a total of 604 mothers who breastfed their children were included in our study. Participants voluntarily answered the questionnaires after they were informed about the purpose of the study. Responses to the questions on our web-based questionnaire were not related to accessibility to the online system of the company. All information was handled with confidentiality. Voluntary withdrawal was guaranteed for all participants without any adverse effect for the mother or the baby. This study was approved by the Institutional Review Board of K University Hospital (KUB1040024).

### 2. Theoretical frameworks

Theoretical triangulation was used to combine the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), Concerns Based Adoption Model (CBAM), and the major concepts based on a review of the literature on breastfeeding knowledge, attitudes, and interest. In the study, three models (TRA, TPB and CBAM) were integrated and used to guide the research questions, the data collection process, and interpretation of the findings. Major concepts/variables related to breastfeeding were drawn from existing literature from 1997 to the present. Based on these theoretical bases, the concepts were defined as follows:

breastfeeding knowledge indicates the understanding gained by experience and range of information toward breastfeeding; breastfeeding attitude indicates the conditions of readiness to a certain breastfeeding behavior—like or dislike, the belief of breastfeeding's usefulness, its value, and the benefit of internet breastfeeding information; and interest toward breastfeeding indicates the feeling of a mother whose attention, concern, or curiosity particularly engaged by breastfeeding educational information on the internet.

### 3. Measurements and data collection

The web-based questionnaire was designed to evaluate a mother's knowledge, attitude, and interest toward breastfeeding based on our previous research and literature review[19–21]. We asked each participant about the duration of breastfeeding of their last child. Breastfeeding duration was defined as the duration that last child was exclusively breastfed or mixed-fed. Participants were asked about their gender, age, education, occupation, marital status, and feeding method. With regard to knowledge of breastfeeding practices, each participant responded to 15 sub-questions using a 5-point Likert scale, including “Milk-making is easy”, “Breastfeeding protects mom and baby”, and “Baby and mom belong together”. We asked participants about their attitudes toward breastfeeding using 8 sub-questions, including “breastfeeding is pleasant” and “breastfeeding is fun and easy”. Knowledge and attitudes toward breastfeeding practices were scored using a 5-point Likert scale that included responses of strongly agree, agree, neutral, disagree, and strongly disagree. The responses were assigned ascending values from 1 to 5 from strongly disagree to strongly agree. Cronbach's alpha was 0.88 for questions on knowledge and attitudes toward breastfeeding.

The breastfeeding interest questions consisted of 25 items. These included mother's interest in breastfeeding education, breast care, weight management, maternal diet, medication, maternal health, physiology and changes in the breasts, breastfeeding discomfort, breastfeeding skills, breast milk storage, depression, exercise, and attachment with baby. With respect to questions on the interest toward breastfeeding, we also used a 5-point Likert scale that included responses of very interested, somewhat interested, neutral, not very interested, and not at all interested, and then scored these participant responses from 1

to 5. Cronbach's alpha was 0.97 for questions on interest in breastfeeding, suggesting a good reliability of the survey.

Our group previously developed a questionnaire about use of web-based information based on literature review and panel interview of breastfeeding experts in a pilot study. A total of 269 participants in the pilot study were asked to fill out the questionnaire, and their answers were reviewed by the expert panels. These questionnaires were developed and evaluated as follows: 1) a content validity study through an expert panel discussion with the expert panel including a measurement expert, content expert, and sampling expert who reviewed and developed the questions; 2) a factor analysis to categorize the items; and 3) the expert panels' content analysis and usability evaluation in the pilot study. Regarding the factor analysis for validity of interest measurement tools, we derived 6 factors based on a scree plot and eigenvalues exceeding 1.0. The explanation level for the derived factors was 85.3%, indicating the total proportion of variance explained by the 6 factors. Factors derived were as follows; breastfeeding education target, education during pregnancy, things to avoid for breastfeeding, education for working mom, education during postpartum period, and attachment and successful breastfeeding. The content validity of this

tool was rigorously checked and assessed prior to the study with the advice of a panel of experts and population representatives in this field including two breastfeeding researchers, four nurse faculty, and two nutrition faculty. The Cronbach's alpha coefficients for the Korean version of the breastfeeding knowledge, attitudes and interest tools were calculated in a pre-test. Based on the results from the pilot study, the questionnaire was modified for the main study. To pre-test and refine the questionnaire, a pilot survey was conducted among 269 mothers in Seoul City. The response rate of the pilot study was 82%.

#### 4. Data analysis

We used a Generalized Linear Model (GLM) to examine whether knowledge, attitudes and interest toward breastfeeding practices differed with respect to breastfeeding duration. We also used logistic regression models to evaluate whether knowledge, attitudes, and interest toward breastfeeding were associated with optimal breastfeeding duration (yes,  $\geq 6$  months; no,  $< 6$  months). We selected six or more months because six months of exclusive breastfeeding has been considered to be the optimal duration[22], and our analysis showed an apparent increase, to

**Table 1.** Characteristics of Mothers

(N=604)

Characteristics	Categories	n (%)	M $\pm$ SD	Range
Age (yr)		604 (100.0)	30.87 $\pm$ 3.72	18.00~43.00
Number of breastfed children		604 (100.0)	1.19 $\pm$ 0.46	1.00~4.00
Education	High school graduate or below College graduate or above	185 (30.6) 419 (69.4)		
Occupation	Housewife Office job Sales work Service work Production work Specialized job Part time job or none	452 (74.8) 81 (13.4) 7 (1.2) 9 (1.5) 3 (0.5) 47 (7.8) 5 (0.8)		
Type of current feeding	Bottle feeding Bottle and breastfeeding Breastfeeding only	80 (13.2) 166 (27.5) 358 (59.3)		
Duration of breastfeeding	1 month 2 months 3 months 6 months 12 months 18 months or more	56 (9.3) 18 (3.0) 42 (6.9) 184 (30.5) 240 (39.7) 64 (10.6)		
Total knowledge score		604 (100.0)	67.93 $\pm$ 5.77	39.00~82.00
Total attitude score		604 (100.0)	37.25 $\pm$ 5.10	14.00~49.00
Total interest score		604 (100.0)	98.09 $\pm$ 18.79	25.00~125.00

some degree, in knowledge scores from those that breastfed for 6 months. In the multivariate GLM and logistic regression models, we adjusted for maternal age (years, continuous), education (high school graduate or below, college graduate or above), and occupation (housewife, working/others). When we further adjusted for the total number of breastfed children, the results did not markedly change, and therefore this variable was not included in the final model. We also evaluated whether knowledge, attitudes, and interest toward breastfeeding were associated with breastfeeding duration according to maternal age ( $\leq 30$ ,  $>30$  years; median), and education (high school graduate or below, college graduate or above). The heterogeneity of each interaction was tested by including a cross-product term of the main exposure and an interaction term using the likelihood ratio test. All  $p$  values were two-sided, and  $p < .05$  was considered to be statistically significant. All analyses were performed using SAS 9.3 (SAS Institute Inc., Cary, North Carolina).

## RESULTS

### 1. Characteristics of the participants

The characteristics of the mothers are described in Table 1. The mean age of the mothers was  $30.87 \pm 3.72$  SD years. The mean number of breastfed children was 1.19 children. The proportion of mothers who graduated from college or above was 69.4%. 74.8% of mothers were housewives, and 13.4% of the mothers were office workers. The proportion of the current feeding types was as follows: 27.5% used a combination of bottle and breastfeeding, and 59.3% exclusively breastfed their children. Total mean scores of breastfeeding knowledge, attitude, and interest were 67.93 (SD=5.77, range=39~82), 37.25 (SD=5.10, range

=12~49), and 98.09 (SD=18.79, range: 25~125), respectively.

### 2. Breastfeeding knowledge, attitude and interest according to breastfeeding duration

When we estimated the breastfeeding knowledge score according to breastfeeding duration (Table 2), mothers who had longer breastfeeding duration obtained a higher score compared to mothers with shorter breastfeeding duration. The geometric mean values of the total knowledge scores were 65.77 (64.69~66.85) for 1~3 months, 67.73 (66.84~68.62) for 6 months and 68.87 (68.14~69.61) for 12 or more months ( $p$  for trend  $< .001$ ). Also, mothers who had longer breastfeeding duration obtained a higher total attitude score compared to mothers with shorter breastfeeding duration. The geometric mean values of the total attitude score were 35.32 (34.36~36.28) for 1~3 months, 37.30 (36.51~38.08) for 6 months, and 37.41 (36.75~38.06) for 12 or more months ( $p$  for trend=0.003). We did not find a significant trend regarding the total interest score ( $p$  for trend=0.80).

### 3. Association of breastfeeding knowledge, attitudes, and interest with optimal breastfeeding practices

We used multivariate logistic models to examine the association of knowledge, attitudes, and interest toward breastfeeding with optimal breastfeeding practices of 6 or more months in duration (Table 3). Mothers who had optimal breastfeeding duration were more likely to experience ease of breastmilk stimulation (OR=1.21; 95% CI: 1.11~1.32 for a one unit-score increase) and build-up of emotional attachment (OR=1.17; 95% CI: 1.10~1.25 for a one unit-score increase). A one-unit increase in the score for total knowledge was associated with a 1.08-fold in-

**Table 2.** Geometric Mean and 95% Confidence Interval (CI) of Knowledge, Attitudes, and Interest Score according to Breastfeeding Duration (n/N<sup>a</sup>=488/604)

Variables	$\leq 3$ months (n=116)	6 months (n=184)	$\geq 12$ months (n=304)	$p$ for trend
	Mean* (95% CI)	Mean* (95% CI)	Mean* (95% CI)	
Total knowledge score	65.77 (64.69~66.85)	67.73 (66.84~68.62)	68.87 (68.14~69.61)	< .001
Total attitude score	35.32 (34.36~36.28)	37.30 (36.51~38.08)	37.41 (36.75~38.06)	.003
Total interest score	95.64 (92.09~99.18)	100.64 (97.72~103.56)	97.31 (94.90~99.72)	.800

\*Adjusted for maternal age (continuous, years), education (high school graduate or below, college graduate or above), and occupation (housewife, others);

<sup>a</sup>No. of mothers with optimal breastfeeding duration/ total no. of mothers; <sup>b</sup>Maximum scores were 90 for total knowledge score, 50 for total attitude score, and 125 for total interest score.

**Table 3.** Odds Ratios (OR) and 95% Confidence Intervals (95% CI) for Optimal Breastfeeding Practice (6 or More Months of Breastfeeding) according to Knowledge, Attitudes and Interest Score (n/N<sup>i</sup> = 488/604)

Variables	OR*	95% CI
Total knowledge score	1.08	1.04~1.12
Milk-making is easy	1.21	1.11~1.32
Breastfeed soon after birth	1.14	0.91~1.43
Stay together 24-hrs, no separation	0.85	0.70~1.03
Follow baby's cues, let baby end	1.18	0.97~1.43
Exclusive human milk feedings	1.51	1.27~1.81
Reassuring signs of intake-stools, urine, satiation, weight gain	0.71	0.55~0.91
Breastfeeding protects mom and baby	1.01	0.94~1.08
Mom's diet fairly unimportant	1.07	0.90~1.27
Lactation good for mother	1.07	0.86~1.32
Specific protection from disease	1.11	0.88~1.40
Reduction in fertility	0.81	0.69~0.97
Milk supports brain functioning	0.92	0.71~1.20
Baby and mom belong together	1.17	1.10~1.25
Baby can trust mother to meet needs	1.58	1.14~2.18
Mother can trust baby for cues	1.59	1.26~2.01
Mom's relationship with baby unique	1.49	1.06~2.09
Exclusive breast feeding 4~6 months	2.00	1.57~2.55
Breastfeeding continue 2+ years	1.21	1.02~1.45
Total attitude score	1.09	1.04~1.13
Breastfeeding is pleasant	1.23	1.09~1.39
Correct latch-on and positioning	1.39	1.03~1.89
Early intervention if painful	0.93	0.75~1.16
Diagrams, photos correct and clear	0.92	0.75~1.14
Breastfeeding is fun and easy	1.08	1.03~1.14
Visual and auditory congruence	1.16	0.95~1.42
Accurate, positive images at breast	1.34	1.08~1.67
Comfortable pace and amount of information	1.22	0.99~1.49
Appropriate language, scenes	1.16	0.91~1.48
Narration positive, clear and direct	1.22	0.95~1.57
Total interest score	1.01	1.00~1.02
Breastfeeding education targeted to mother	1.09	0.88~1.35
Breastfeeding education targeted to father	1.24	1.03~1.51
Health care education for bottlefeeding	0.71	0.58~0.86
Breast care during pregnancy	1.13	0.92~1.37
Weight management during pregnancy	1.02	0.84~1.23
Diet during breastfeeding	1.19	0.96~1.46
Breastfeeding and maternal health	1.32	1.07~1.62
Physiology and change of breast during pregnancy	1.39	1.12~1.72
Maternal health during pregnancy for healthy breastfeeding	1.11	0.91~1.35
Food avoidance, medication, and preferred food	1.29	1.06~1.58
How to reduce breastfeeding discomfort	1.13	0.92~1.39
Things to avoid during breastfeeding	1.19	0.97~1.45
Breastfeeding skills for working mom	1.01	0.84~1.21
How does working mother store breast milk	0.99	0.83~1.19
How does working mother use breastfeeding facilities	1.04	0.87~1.24
How to store breast milk at home	1.07	0.89~1.30
Maternal health care during breastfeeding	1.25	1.03~1.52
Postpartum depression	1.12	0.93~1.34
Postpartum exercise	1.03	0.85~1.25
How to increase breast milk supply	1.20	0.99~1.46
Postpartum weight management	0.99	0.81~1.20
Maternal role in development of attachment with baby	1.09	0.89~1.34
Paternal role in development of attachment with baby	1.23	1.01~1.50
How to prolong breastfeeding	1.43	1.18~1.73
10 steps for successful breastfeeding	1.08	0.89~1.31

\*Adjusted for maternal age (continuous, years), education (high school graduate or below, college graduate or above), and occupation (housewife, others)

<sup>i</sup>No. of mothers with optimal breastfeeding duration/ total no. of mothers.

crease in the odds of engaging in an optimal breastfeeding practice. When we examined each item for knowledge, mothers engaged in optimal breastfeeding duration tended to have better knowledge on exclusive breastfeeding and attachment with the baby than mothers with less than 6 months of breastfeeding. Also, mothers with optimal breastfeeding duration were more likely to have positive attitudes toward correct positioning and breast image than mothers with less than 6 months of breastfeeding. Regarding the total attitude score, the OR (95% CI) for a one unit-score increase was 1.09 (1.04~1.13). Mothers who had optimal breastfeeding duration had a more positive attitude and more frequently claimed that "breastfeeding is pleasant" and "breastfeeding is fun and easy" compared to mothers who breastfed their children for less than 6 months. ORs (95% CIs) for a one unit-score increase in these two questions were 1.23 (1.09~1.39) and 1.08 (1.03~1.14), respectively. Mothers engaged in an optimal breastfeeding duration were more interested in the following topics as compared to mothers with less than 6 months of breastfeeding: "breastfeeding education targeting fathers", "breastfeeding and maternal health", "physiology and change in the breasts during pregnancy", "food avoidance, medication, and preferred foods", "maternal healthcare during breastfeeding", "paternal role in the development of emotional attachment with the baby", and "how to prolong breastfeeding". The association between the total interest score and an optimal breastfeeding practice was weak and only borderline significant (OR=1.01; 95% CI: 1.00~1.02 for a one unit-score increase).

#### 4. Association between optimal breastfeeding practice and total knowledge, attitude and interest by age or education

We examined whether the association between optimal breastfeeding practice and total knowledge, attitude, and interest scores varied according to age or education. Notably, the associations of optimal breastfeeding practice with total attitude score ( $p$  for heterogeneity=.002) and total interest score ( $p$  for heterogeneity=.04) were more pronounced among mothers who had graduated from high school or had lower educational level as compared to those who graduated from college or above (Table 4).

**Table 4.** Odds Ratio (OR) and Confidence Interval (95% CI) for Optimal Breastfeeding Practice (6 or More Months of Breastfeeding) according to Knowledge, Attitudes, and Interest Score by Age and Education (n/N<sup>r</sup> = 488/604)

Scores	Variables	Categories	OR* (95% CI)		<i>p</i> for heterogeneity
			<Median <sup>†</sup>	≥ Median <sup>†</sup>	
Total knowledge score	Age (yr)	≤ 31	1.00	2.24 (1.22~4.10)	.479
		> 31	0.64 (0.39~1.05)	1.99 (1.00~3.94)	
	Education	High school graduate or below	1.00	3.79 (1.55~9.25)	.325
		College graduate or above	1.13 (0.66~1.94)	2.58 (1.39~4.80)	
Total attitude score	Age (yr)	≤ 31	1.00	1.81 (1.01~3.24)	.577
		> 31	0.77 (0.45~1.30)	1.09 (0.59~1.99)	
	Education	High school graduate or below	1.00	5.65 (2.07~15.40)	.002
		College graduate or above	1.58 (0.92~2.73)	1.74 (0.99~3.03)	
Total interest score	Age (yr)	≤ 31	1.00	1.19 (0.67~2.11)	.786
		> 31	0.71 (0.40~1.25)	0.76 (0.42~1.36)	
	Education	High school graduate or below	1.00	2.27 (1.02~5.09)	.041
		College graduate or above	1.47 (0.82~2.64)	1.28 (0.72~2.26)	

\*Adjusted for maternal age (continuous, years), education (high school graduate or below, college graduate or above), and occupation (housewife, others);

<sup>†</sup>No. of mothers with optimal breastfeeding duration/ total no. of mothers: <sup>†</sup>Median for knowledge score was 69, median for attitude score was 37 and median for interest score was 100.

## DISCUSSION

We conducted a cross-sectional study of 604 Korean mothers who breastfed their babies and used the internet as a source of knowledge and communication. Of the participants included in this study, 69.4% graduated from college and 74.8% were housewives. About one-third of the mothers (30.5%) breastfed their last child for 6 months while 39.7% breastfed for 12 months. We found that higher scores of breastfeeding knowledge, attitudes, and interest were associated with higher odds of optimal breastfeeding practices (6 or more months of breastfeeding). In particular, mothers who had an optimal duration of breastfeeding were more likely to be aware of the ease of breastmilk stimulation and breastfeeding, of the development of emotional attachment between the mother and the child, and of the pleasure obtained from breastfeeding as compared to mothers who had a shorter duration. The association with an optimal breastfeeding practice was more pronounced among mothers who graduated from high school or below for total attitude score or total interest score, compared to mothers who graduated from college or above. The results of this study suggest that improving maternal knowledge, attitudes, and interest toward breastfeeding could be an effective strategy to encourage successful breastfeeding practices, especially for mothers who have relatively low education levels and actively seek the web-based information. Interestingly, we found that the paternal role, foods

to avoid, body change in mothers, mothers' health and methods to prolong breastfeeding would be important elements for the development of web-based educational information program. These findings agree with those of previous studies on the association between knowledge and attitudes toward breastfeeding[8,9,23]. Maternal knowledge on the benefits of breastfeeding in order to improve child health and comfort was directly associated with an intention to exclusively breastfeed[9]. Also, intention of breastfeeding was associated with positive breastfeeding attitudes[23]. Higher scores of knowledge and attitudes were significantly associated with higher odds of exclusive breastfeeding for 6 months postpartum (OR=1.08, 95% CI: 1.03~1.14)[8]. However one study showed that knowledge and awareness did not translate into the practice of breastfeeding[24]. Health workers and policy makers should direct their efforts to encouraging mothers to continue exclusive breastfeeding.

The association between total attitude score or total interest score and an optimum breastfeeding practice among mothers with higher education levels was weak in our study. This may be partly due to the fact that mothers with higher education levels or with jobs discontinue their breastfeeding due to certain social barriers, such as having to return to work[25], in spite of their good attitudes or interests towards breastfeeding. This result supports findings that perceived social norms may exert a stronger influence on breastfeeding outcomes than a woman's breastfeeding attitudes and knowledge[10].

We included mothers who used the internet to seek child-related information to take into account the development of web-based education because use of internet breastfeeding information is a good strategy to promote breastfeeding due to its easy accessibility and easy implementation of surveys and evaluation tools, social network system, automatic feedback and customization to individual needs[26]. Interventions to increase maternal knowledge of breastfeeding benefits and family and clinician's support of breastfeeding in the prenatal period may help to increase breastfeeding rates. The encouragement of breastfeeding needs to be prioritized by the health care providers to improve both the mother's and infant's health[27]. This research showed an important finding that constructing the contents of the website on breastfeeding educational information should provide information not only to mothers, but also to fathers. The educational information should include paternal role, maternal health, physical change, and diet information in order to increase the duration of breastfeeding. Hence, maternity health professionals including nurses and nutritionist should take such these results into account while planning their approaches.

However, studies that examined the effect of internet use on breastfeeding success are few[26]. In our study, we found that, among mothers who often used the internet to search for feeding information, higher scores of knowledge, attitudes and interest toward breastfeeding were associated with longer duration of breastfeeding. Given the deep penetration of high-speed internet in Korea, effective web-based instruments for breastfeeding education developed by health professionals are needed.

According to the 2012 National Survey on Fertility, Family Health and Welfare in Korea, the proportion of mothers that performed exclusive breastfeeding at 1 month decreased from 65.6% in 2009 to 56.7% in 2012 whereas the combined proportion of bottle- and breast-feeding at 1 month increased from 19.0% in 2009 to 29.8% in 2012[5]. Although the Mother and Child Health Law recommends having breastfeeding facilities, breastfeeding surveys, promotion and education, and provision of breastfeeding information, data on infant feeding practices are limited[28]. Therefore, further studies on the cost effectiveness of programs, determinants of breastfeeding, and the effects of recommendations and evaluation are needed.

In recent years, researchers and health-care professionals

have shown a growing interest in the health benefits associated with breastfeeding. However, little research has been undertaken with respect to the marketing of breastfeeding. Thus, our society may need tools that enhance health promotion programs, specifically the programs that encourage the adoption of breastfeeding and increase its rate. Because of a high discontinuation rate of breastfeeding and a lack of sociocultural support in Korea, identifying factors showing significant associations in our study may contribute to encourage successful breastfeeding practices in Korea.

The strengths of our study include having a large sample size. Although a potential bias due to the unmeasured and residual confounding factors may be present, we still found significant associations after adjusting for potential related factors. We found that mothers with relatively low education levels could benefit from improvement of knowledge, attitudes and interest toward breastfeeding. Although our study population may not be generalizable to all Korean women, we were able to include mothers who had good willingness to support their child health through active internet usage. Recruitment of participants through the internet is one of the strengths of our study. To use the internet as a venue for education program, it is important to evaluate its benefit among mothers who actively use the internet as an important source of child-related information and communication.

There are several limitations in our study. First, the responses were self-reported. Therefore, we cannot rule out the possibility of misclassification of breastfeeding duration. However, maternal recall was reported to provide accurate information on the initiation and duration of breastfeeding when the duration was of less than 3 years[29]. Secondly, we included mothers engaged in both mixed feeding (combination of bottle- and breast-feeding) and exclusive breastfeeding. Although the WHO recommends 6-months of exclusive breastfeeding[4], we believe that the optimal breastfeeding duration with and without bottle feeding could be considered to be a good efforts toward successful breastfeeding given that there is lower social or hospital support in Korean society than in Western societies. Third, as this is a cross-sectional study, we cannot disentangle the causal relationships of knowledge, attitudes, or interest with the rates of breastfeeding. Fourth, our study population may not be representative of all Korean women as there is a higher

proportion of women who are college graduates or have a higher educational level in our study as compared to the national average[30]. However, the inclusion of a homogenous and highly educated population may enable our study to have relatively good accuracy, control for potential confounding factors, and detect meaningful associations. This is the first large study that has examined the potential factors associated with the knowledge, attitude, and interest in web-based breastfeeding information in Korean mothers for 3, 6 and 12 months postpartum in relation to the duration of breastfeeding. In order to increase breastfeeding duration of Korean women, tailored web-based breastfeeding educational information contents and policies should be developed to practically support the childbearing family and promote breastfeeding in family-centered and evidence-based care. The web-based survey by collaborating with dairy company, where mothers actively obtained the web-based knowledge, may enable our findings to be implemented directly into the web system. Our study merits further researches on new strategies to encourage successful breastfeeding.

## CONCLUSION

The results of this study showed that increases in the levels of knowledge, attitudes, and interest toward breastfeeding are associated with a longer duration of breastfeeding among mothers who used the internet as a source of child-related information and communication. Also, these findings suggest that targeting mothers with relatively low education levels can be an effective strategy to encourage successful breastfeeding practices in Korea.

Our findings support the evidence that favorable knowledge, attitudes, and interest toward web-based breastfeeding information may enable women to plan for an extended duration of breastfeeding. In particular, healthcare professionals should play prominent roles in educating mothers on the benefits of breastfeeding, on how to stimulate milk supply, and on improving the emotional attachment between the mother and the child, and on how to make effective use of web-based information. Also, we found that interest in paternal role, maternal health, physical change, and food and medication information were associated with optimal breastfeeding, suggesting that these items are important elements for development of web-based education

programs. Our study also merits further longitudinal prospective studies that examine the associations of knowledge and attitudes toward breastfeeding before and during pregnancy with the subsequent success of breastfeeding.

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