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Social and Bio-Medical Predictors of Exclusive Breastfeeding Among Nursing Mothers in Lagos and Taraba States, Nigeria

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ABSTRACT

Purpose: Although exclusive breastfeeding (EBF) is known to have positive consequences for mothers and infants, EBF rate in Nigeria is <25%. This study investigated if social factors were stronger predictors of EBF than bio-medical factors in the metropolitan areas of Lagos and Taraba States. Social factors included mother's education, infant sex, place of birth, and nature of mother's employment, while bio-medical factors included nature of birth (whether vaginal or caesarean section), problems with breast/nipple, breast milk insufficiency, and mother's age.
Design and methods: The study adopted a cross-sectional survey design and mixed method of data collection. From the two states, 500 mothers with babies between 7 and 12 months of age completed a structured questionnaire. Twenty respondents from each state were interviewed using an in-depth interview guide.
Results: Education ($\beta = 1.743$; $p < 0.001$), infant sex ($\beta = -0.454$; $p < 0.05$), and place of delivery ($\beta = -1.552$; $p < 0.001$) were significant social predictors. Breast milk insufficiency ($\beta = -1.851$; $p < 0.001$) and mother's age ($\beta = 0.064$; $p < 0.001$) were significant bio-medical predictors. When all the eight factors were considered, only two of the three social factors, namely, education and infants' sex, remained significant, while three bio-medical factors, namely, breast milk insufficiency, mother's age, and nature of delivery, were significant.
Conclusions: Social and bio-medical factors co-determine the practice of EBF and must not be considered dichotomous.
Practical implications: Interventions to encourage EBF among Nigerian mothers must focus on education regarding its benefits and correction of misconceptions that breast milk alone is insufficient as an infant's diet.

Background

The practice of exclusive breastfeeding (EBF) requires that mothers feed their infants with only breast milk without additional food or drink, including a drop of water during the first 6 months of birth (Alzaheb, 2017; Chhetri, Rao, & Guddattu, 2018; Zhang, Zhu, Zhang, & Wan, 2018). Practising EBF has many benefits for the infants and their mothers (Brahma & Valdés, 2017). For the infants, EBF improves growth (Binns, Lee, & Low, 2016); provides immunity against infections (World Health Organization, 2015); lowers the occurrence of diabetes, early childhood obesity, and pneumonia (Brahma & Valdés, 2017; Okafor, Agwu, Okoye, Uche, & Oyeoku, 2018; Victora et al., 2016); and improves survival and development (Rollins et al., 2016). For the mothers, EBF prevents breast cancer and diabetes and helps in child-spacing (Susiloretni, Hamam, Blakstad, Smith, & Shankar, 2018; World Health Organization, 2019).

Given these benefits of breastfeeding, World Health Organization and United Nations International Children's Emergency Fund (2014) set a target to 'increase the rate of exclusive breastfeeding in the first 6 months up to at least 50%' for member countries (World Health Organization & United Nations International Children's Emergency Fund, 2014, p. 1). However, according to the WHO's Global Health Observatory data repository (2018) and Continental Nutrition Accountability Scorecard of the African Development Bank (2019), less than a quarter of infants (aged 0–6 months) are exclusively breastfed in Nigeria; however, the rate of any breastfeeding in general was high (Adewuyi & Adefemi, 2016). This shows that the rate of EBF in the country is still low and the WHO's target of 50% EBF rate is yet to be met. Attempts to unravel the factors associated with such low rates of EBF are not new in the country. In the last 5 years, studies in the country have investigated different possible factors associated with EBF. For instance, seeking antenatal care in private hospitals, religion, education, delivery via caesarean section, place of delivery, mother's age at birth, number of previous births, frequency of antenatal care attendance, income, knowledge of EBF, and occupation have been found to influence the practice of

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EBF in the country (Gayawan, Adebayo, & Chitekwe, 2014; Ogbo, Agho, & Page, 2015; Okafor, Olatona, & Olufemi, 2014; Olayemi et al., 2014; Onah et al., 2014; Senbanjo, Oshikoya, Ogbera, Wright, & Anga, 2014). However, many of these studies used only quantitative methods, and none attempted to understand if a combination of social factors will be stronger predictors of EBF than biological and medical related factors.

This study sought to investigate which of the factors, social or bio-medical, are stronger predictors of EBF. The study aimed to answer the question 'Are social factors (education, infant's sex, place of birth, and mother's employment status during the first 6 months of delivery) stronger predictors of EBF than bio-medical factors [nature of birth (vaginal or Caesarean)], experience of breast/nipple problem, breast milk insufficiency, and mother's age'? A better understanding of which factors are more important will help policy makers develop proper intervention programmes.

Methods

Design and study setting

The study adopted a cross-sectional survey design, and mixed method of data collection. The study was conducted in the Somolu local government area of Lagos State in the south-western part of Nigeria, and the Jalingo local government area of Taraba in the north-eastern part of the country.

The study population was comprised of nursing mothers with babies within 7–12 months. This age bracket was based on the WHO definition of EBF, which means that the infant receives only breast milk for the first 6 months; no other liquids or solids are given, not even water, 'with the exception of oral rehydration solution, or drops/syrups of vitamins, minerals, or medicines' (World Health Organization, 2009, p. 4). Hence, only mothers in this category were expected to have experienced and practised EBF since their children were older than 6 months, and the experience would still be fresh in their memory. Respondents were screened verbally to know if they had an infant aged 7–12 months before they participated in the study.

Sampling and research instruments

A total of 300 respondents were selected from each state for the quantitative method. Of the 600 questionnaires taken to field, 538 copies were returned. During post-field screening, 26 questionnaires were disqualified from Taraba State, and 12 were cancelled from Lagos State owing to lack of response to core questions. Thus, the total number of qualified questionnaires was 500, i.e. 254 from Taraba and 246 from Lagos. Twenty respondents from each state were selected using snowball and random sampling techniques for the qualitative aspect of the study.

Semi-structured questionnaire and in-depth interview guide were used to collect data from the respondents. The questionnaire contained 8 sections and 43 questions. Each of the independent variables had its own section, except age, which was included in the socio-demographic questions and place of delivery, which was included in the section on breastfeeding practices. All questions, except the question on age, were categorical.

The instruments were designed by the authors (two each from Social Sciences and Medicine/Nursing) after review of existing tools such as Emmanuel and Clow's (2017) questionnaire for assessing breastfeeding practices in Nigeria. The initial drafts were reviewed by two experts in Population Studies and Health, and their comments were taken into consideration when the instruments were revised.

Measurement

The dependent variable was operationalised by whether or not the respondents breastfed their infants with only breast milk during the first 6 months of birth. We asked, 'What did you feed your child with when he/she was between ages 0 and 6 months?' with options, 'breast milk only', 'complementary breastfeeding', 'infant formula only', 'pap only', and 'solid foods'. Those who chose only the first option were regarded to have practised EBF. For social factors, we asked questions about the highest level of education, infant sex, place of delivery, and employment status during the first 6 months after delivery. With regard to bio-medical factors, we asked respondents how they gave birth to their child, with two options: 'through vaginal delivery' and 'through caesarean section'. We also asked whether they experienced breast/nipple problems during the first 6 months after delivery. Regarding breast milk insufficiency, we asked 'Did you at any point when your child was between ages 0 and 6 months feel that your breast milk was not sufficient for him/her?' to measure breast milk insufficiency.

Data analysis

Statistical Package for the Social Sciences (version 22) was used to analyse quantitative data. Simple frequencies and percentages were used for descriptive analysis. We used the Pearson's chi-square test to determine which of the eight independent variables was individually related to EBF practice. Binary logistic regression was used to analyse three different models. The first and second models included the social and bio-medical factors, respectively. This allowed us to see the overall predictive ability of the factors when they occurred separately. The third model contained all the 8 factors and allowed us to check the influence of the co-existence of the social and bio-medical factors. To determine which of social or bio-medical factors were the most important, we compared the summation of coefficients (B) for each of the broad factors. We also compared the addition of the odds ratio in positive form for both factors.

The interviews were transcribed into Microsoft Office Word (Version 2010) and analysed thematically using manual content analysis.

Ethical consideration

Permission to conduct the study was sought from the Department of Sociology, University of Lagos, and the Department of Public Health, Taraba State University. All respondents were briefed about the rationale for the study before they participated. Participation was voluntary, and verbal informed consent was obtained from each participant.

Table 1
Socio-demographic characteristics.

Variables	Lagos (N = 246)	Taraba (N = 254)
Ethnic group	n (valid%)	n (valid%)
Yoruba	179 (72.8)	15 (5.9)
Igbo	44 (17.9)	15 (5.9)
Hausa	18 (7.3)	69 (27.2)
Others	5 (2.0)	155 (61.0)
Total	246 (100.0)	254 (100.0)
Mean age (standard deviation) in years	26.7 (4.98)	30.1 (6.55)
Current employment status		
Unemployed	82 (34.5)	107 (43.7)
Employed	156 (65.5)	137 (56.3)
Total	238 (100.0)	245 (100.0)
Highest level of education		
No formal education	15 (6.3)	40 (16.2)
Primary education	55 (22.9)	33 (13.4)
Secondary education	112 (46.7)	68 (27.5)
Tertiary education	58 (24.2)	106 (42.9)
Total	240 (100.0)	247 (100.0)

Results

Socio-demographic characteristics

Table 1 shows that in Lagos, the majority (72.8%) of the respondents were Yoruba, while in Taraba, more than half (61%) of the respondents belonged to ethnic groups (Tiv, Jukun, Fulani, etc.) other than the three largest ones (Hausa, Yoruba, and Igbo). More than a quarter of the respondents in Taraba were Hausa. The mean ages were approximately 27 in Lagos and 30 in Taraba. Close to two-thirds (65.5%) of the respondents in Lagos were employed compared with 56.3% in Taraba. More than one-tenth of the respondents in Taraba had no formal education while 42.9% of them had tertiary education. In Lagos, the majority (46.7%) of the respondents did not receive beyond secondary education, while 24.2% of them had tertiary education.

Association between social factors and EBF

In Table 2, we found that when treated individually, education was significantly associated with practice of EBF as more than two-thirds (69.5%) of the mothers with tertiary education breastfed exclusively, as opposed to less than half of those with secondary education and less than one-third of those with lower education in each of the groups. More than half (51.6%) of mothers who had a male child practised EBF compared with 44.5% of those who had a female child. A higher proportion of mothers (53.8%) who gave birth in the hospital practised EBF compared with 42.9% who underwent home delivery and 13.7% who underwent trado-medical centre delivery. In summary, when cross-tabulated individually, two social factors – education and place of birth – were significantly related to EBF practice.

Association between bio-medical factors and EBF

In Table 3, only two bio-medical factors, breast milk insufficiency and mother's age, were significantly associated with EBF when cross-tabulated individually. Close to half (49.3%) of the mothers who had vaginal delivery practised EBF, unlike 39.7% of those who delivered by caesarean section. Less than one-third (26%) of the mothers who felt breast milk insufficiency breastfed exclusively, while 74% of those who did not have such feeling breastfed exclusively. Mothers aged 36 years and above practised EBF the most (62.1%), while those below 20 years had the least (25.4%).

Table 4 shows that when all four social factors are put in a single model, three factors (education, place of birth, and infant sex) were significant predictors. Mothers who had secondary education and tertiary education were 2.5 and 5.7 times, respectively, more likely to practise EBF than mothers with no formal education. Mothers who had male infants were 1.6 times more likely to practise EBF than those who had female infants. Mother who gave birth at the hospital were 4.7 times more likely to practise EBF than those who gave birth at a trado-medical centre.

When all bio-medical factors were put together in a single model, breast milk insufficiency and mothers' age remained significant predictors. Mothers who had feelings of milk insufficiency were less likely to practise EBF (OR = 0.157). Older mothers tended to practise EBF more often than younger mothers. Even though three social factors were significant predictors as opposed to two bio-medical factors, these data were not sufficient for us to make any conclusion as to which factor is more important since the two broad factors were not included in the same model.

In Table 5, we found that when all eight variables were considered in the same model, two social factors (education and infant sex) and three bio-medical factors (nature of birth, breast milk insufficiency, and maternal age) contributed significantly to the model, suggesting that the

Table 2
Cross-tabulation of social factors and exclusive breastfeeding.*

Level of education	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
No formal education	38 (69.1)	17 (30.9)	55 (100.0)
Primary education	68 (77.3)	20 (22.7)	88 (100.0)
Secondary education	96 (53.3)	84 (46.7)	180 (100.0)
Tertiary education	50 (30.5)	114 (69.5)	164 (100.0)
Total	252 (51.7)	235 (48.3)	487 (100.0)
X^2: 59.455; df: 3; P: 0.000			

Infant sex	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
Male	118 (48.4)	126 (51.6)	244 (100.0)
Female	137 (55.5)	110 (44.5)	247 (100.0)
Total	255 (51.9)	236 (48.1)	491 (100.0)
X^2: 2.482; df: 1; P: 0.115			

Place of birth	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
Hospital	180 (46.2)	210 (53.8)	390 (100.0)
Trado-medical centre	44 (86.3)	7 (13.7)	51 (100.0)
Home	32 (57.1)	24 (42.9)	56 (100.0)
Total	256 (51.5)	241 (48.51)	497 (100.0)
X^2: 29.868; df: 2; P: 0.000			

Employment status when the baby was 0–6 months	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
Unemployed	117 (55.2%)	95 (44.8%)	212 (100.0%)
Employed	131 (48.5%)	139 (51.5%)	270 (100.0%)
Total	248 (51.5%)	234 (48.5%)	482 (100.0%)
X^2: 2.115; df: 1; P: 0.146			

* p value < 0.05 indicates statistical significance.

Table 3
Cross-tabulation of bio-medical factors with exclusive breastfeeding.*

Type of delivery	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
Vaginal delivery	217 (50.7)	211 (49.3)	428 (100.0)
Caesarean section	41 (60.3)	27 (39.7)	68 (100.0)
Total	258 (52.0)	238 (48.0)	496 (100.0)
X^2: 2.164; df: 1; P: 0.141			

Experience of breast/nipple problem	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
No	218 (51.8)	203 (48.2)	421 (100.0)
Yes	31 (56.4)	24 (43.6)	55 (100.0)
Total	249 (52.3)	227(47.7)	476 (100.0)
X^2: 0.409; df: 1; P: 0.522			

Breast milk insufficiency	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
No	98 (34.9)	183 (65.1)	281 (100.0)
Yes	159 (74.0)	56 (26.0)	215 (100.0)
Total	257 (51.8)	239 (48.2)	496 (100.0)
X^2: 74.501; df: 1; P: 0.000			

Mother's age	Exclusive breastfeeding		Total (%)
	No (%)	Yes (%)	
20 or less (years)	47 (74.6)	16 (25.4)	63 (100.0)
21–25 (years)	54 (50.5)	53 (49.5)	107 (100.0)
26–30 (years)	85 (49.7)	86 (50.3)	171 (100.0)
31–35 (years)	48 (51.6)	45 (48.4)	93 (100.0)
36 and above (years)	25 (37.9)	41 (62.1)	66 (100.0)
Total	259 (51.8)	241 (48.2)	500 (100.0)
X^2: 18.621; df: 4; P: 0.001			

* p value < 0.05 indicates statistical significance.

Table 4
Logistic regression model for social and bio-medical factors influencing exclusive breastfeeding.

	B	S.E.	Exp(B)	95% C.I. for Exp (B)	
				Lower	Upper
Model 1 (social predictors)					
Level of education					
No education (reference category)					
Primary education	−0.011	0.433	0.989	0.424	2.310
Secondary education	0.897	0.377	2.453*	1.172	5.137
Tertiary education	1.743	0.396	5.716***	2.629	12.430
Infant sex					
Male (reference category)					
Female	−0.454	0.206	0.635*	0.424	0.950
Place of delivery					
Hospital (reference category)					
Trado-medical centre	−1.552	0.467	0.212***	0.085	0.529
Home	0.094	0.334	1.098	0.571	2.114
Employment during breastfeeding					
Unemployed (reference category)					
Employed	−0.065	0.216	0.937	0.614	1.430
Constant	−0.617	0.373	0.540		
Model X^2 (p) 77.925 (0.000)					
Hosmer and Lemeshow's test (p) 5.998 (0.647)					
Model 2 (bio-medical factors)					
Nature of delivery					
Vaginal delivery (Ref. Cat.)					
Caesarean section	−0.501	0.302	0.606	0.335	1.096
Breast/nipple problem					
No (reference category)					
Yes	0.159	0.333	1.173	0.611	2.251
Breast milk insufficiency					
No (reference category)					
Yes	−1.851	0.217	0.157***	0.103**	0.240
Age	0.064	0.017	1.066***	1.030	1.103
Constant	−1.110	0.497	0.330*		
Model X^2 (p) 95.523 (0.000)					
Hosmer and Lemeshow's test (p) 17.414 (0.026)					

* $p \le 0.05$.
** $p \le 0.01$.
*** $p \le 0.001$.

latter is more crucial. The most important single factor was breast milk insufficiency ($\beta = -1.966$; OR = 7.1) which is a bio-medical factor, followed by education, a social factor ($\beta = 0.728$; OR = 2.1). When the overall contribution of variables in each model was summed, the social factors showed β value of 1.65 (OR = 6.3), while the bio-medical factors showed β value of 3.24 (OR = 11.858), suggesting that when all variables were considered together, the bio-medical factors were more important.

In the interview, participants' responses showed that both social and bio-medical factors were important. With regard to social factors, for instance, a respondent who was asked about the role of education on EBF stated, '*Education has positive effects, I was able to read on paper and TV, the benefits and risks involved if I do not breastfeed exclusively*' (IDI, P. 19, 34 years).

Considering the place of delivery, most of the respondents who knew about breastfeeding said that they heard about it in the hospital. Some usually had sessions where they were informed about EBF during the antenatal period and after birth. With regard to infant sex, some mothers believed that male infants needed more milk and enjoyed breastfeeding more than female infants. Despite their importance, some social factors appear to be within the control of the mothers, and providing education about EBF will be beneficial. For instance, one nursing mother said that: *I only breastfed him exclusively for the first three months, I began to feed him with breastmilk and baby food when I noticed that he was not growing fast* (IDI, P. 7, 25 years old). With adequate education about EBF and its benefits, mothers may begin to understand that breast milk alone is sufficient for the first 6 months after birth regardless of the baby's sex.

Another participant who gave birth to her baby at a trado-medical centre stated that:

> *I did not practice exclusive breastfeeding between 0-6 months because in the hospital where I gave birth to my baby, the norm there is that the first food the baby takes is water so that it can make her body system settle before you can now give the baby breast milk.* (IDI, P. 24, 36 years old)

Adequate education for traditional birth attendants, especially in rural areas, and encouraging mothers to give birth in government-approved hospitals may yield positive result. A 33-year-old banker lamented that the nature of her employment had negative effects on her practice of EBF as her boss did not allow her to bring her baby to the office, so she only breastfed her baby for only the 3 months of her maternity leave. Concerted efforts of the government and policy makers toward work environment that encourages EBF may be apposite.

However, some bio-medical factors appeared to be beyond the control of some mothers. Hence, they had no choice but to adopt supplementary feeding. With regard to the nature of birth, a mother who delivered by caesarean section narrated her experience: '*Generally, it is not easy to breastfeed after caesarean section…*' (IDI, P. 15, 25 years old). Another respondent said, '*I was very weak after the operation that I was unconscious for three days, by the time I woke up back to life, my baby was already given baby food and water, and this make her not to really like breast milk.*' (IDI, P. 35, 34 years old).

Another respondent who underwent caesarean section said:

> *I was very weak and could not breastfeed my baby on time after the operation. Because my baby was crying too much, the nurses gave her water and baby food before I started giving her breast milk from the next*

Table 5
Logistic regression model for social and bio-medical factors influencing exclusive breastfeeding.

Predictors	B	S.E.	Exp(B)	95% C.I. for Exp(B)	
				Lower	Upper
Education	0.728	0.139	2.071***	1.577	2.719
Infant sex	−0.679	0.231	0.507**	0.322	0.798
Place of delivery	−0.158	0.188	0.853	0.590	1.234
Employment	−0.087	0.247	0.916	0.565	1.486
Nature of delivery	−0.715	0.329	0.489*	0.257	0.931
Breast/nipple problem	0.508	0.370	1.662	0.805	3.434
Breast milk insufficiency	−1.966	0.244	0.140***	0.087	0.226
Age	0.051	0.021	1.052*	1.010	1.096
Constant	−0.858	0.831	0.424		
Model X^2 (p) 138.447 (0.000)					
Hosmer and Lemeshow's test (p) 6.241 (0.620)					

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.

Comparison of coefficients, odds ratios, and p-values

	B	Exp(B)	Mean p-value
Social factors	1.65	6.307	1.126
Bio-medical factors	3.24	11.858	0.215

day after operation. (IDI, P. 8, 24 years old)

Another mother shared her experience:

After the operation, I became unconscious and I did not wake up until the next day. Within this period, my baby cried so much that the nurses had to give her baby food and water. As a result of other foods she has tasted, my baby refused breast milk but I managed to give her the yellowish first milk from my breast (colostrum), and I sometimes force her to take breast milk. (IDI, P. 36, 22 years old)

With respect to breast/nipple problem, mothers believed that it depended on the nature of disease; some respondents were aware that some breast diseases are contagious and could infect the baby if the mother decides to manageably breastfeed the baby with the affected breast (s). As one mother noted, '*The mother will not be able to breastfeed until the breast is healed so that she will not infect the baby with any disease*' (IDI, P. 39, 32 years). Another said that: '*The mother will fear to give the baby disease so she would not breastfeed the baby*' (IDI, P. 14, 28 years).

As regards breast milk insufficiency, some mothers usually resorted to the addition of other foods for the baby. A 35-year-old mother clarified: '*I naturally do not lactate well so I was unable to breastfeed my baby exclusively. I therefore gave him baby food and water*' (IDI, P. 14, 28 years old). Another 25-year-old mother reported that she experienced insufficient breast milk and was advised to give the baby hot pap, hot tea, vegetables, and fruits. Her baby cried even after she had taken all those foods; she had no option other than to give the baby other foods.

Discussion

This study showed that both social and bio-medical factors were important predictors of the practice of EBF by mothers. The most important social factor was mother's education, while breast milk insufficiency was the most important bio-medical factor.

This study found that 75.9% of the respondents had heard about EBF and 48.2% of the study sample practised the same. This is less than the WHO and UNICEF's target of 50%; however, it was more than the 23% figure of the African Development Bank (2019). The results from our study do not cast any doubt on the ADB's figure; however, this difference could be attributed to the smaller sample in our study, drawn from two metropolitan areas in the country, which are not representative of the entire country. According to Onah et al. (2014), high awareness and knowledge of EBF was seen among people in Nigeria: 95.3% of mothers in their study had heard about EBF, and 82.0% of them had correctly defined EBF. However, Onah et al. (2014) observed that high knowledge of EBF did not necessarily translate to practice: only 66.0% of infants in the same sample were exclusively breastfed. A number of factors could be attributed to this discrepancy between knowledge of a mother and her practice of EBF, including mothers not fully appreciating the benefits of EBF, mothers falsely believing that breast milk alone is insufficient, or social and medical constraints that prevent mothers from practising EBF.

The findings from our study indicate that mother's education was significantly associated with the practice of EBF; mothers with at least a college degree were more likely to practise EBF compared to those with secondary school education or lower. This finding is consistent with that of Asemahagn (2016) and Maonga, Mahande, Damian, and Msuya (2016) who also found that educated women were more likely to practise EBF than their less educated counterparts. A plausible explanation for this is that women who have a college education are generally more informed and therefore more knowledgeable about the benefits of EBF. However, some studies have contradictory findings. Asare, Preko, Baafi, and Dwumfour-Asare (2018) found that 'mothers who had tertiary education were less likely to practise EBF than those with no education'. Kimani-Murage et al. (2014) attribute this to the phenomenon of 'dotcom mothers' – young girls born in the era of the internet – or older women who attained sexual maturity in the era of the internet, who do not like to breastfeed because 'the breasts will sag' (p. 9). Given this (excessive) concern for their body image, such women avoid breastfeeding to maintain their breast size and beauty (Asemahagn, 2016), even though they may have a college education.

Our study showed that male infants were more likely to be exclusively breastfed compared to female infants, apparently because some mothers believed that male infants needed more milk and enjoyed breastfeeding more than female infants. Although Chhetri et al. (2018) also found infant sex to be a significant predictor of EBF, in their study, however, female infants were more likely to receive EBF compared to male infants. There are no obvious reasons, and further research will be needed to investigate the reason for this finding. Results from other studies also suggested that infant age may be important as well. Diji et al. (2017) found that mothers were more likely to discontinue EBF with increase in infant age. Therefore, 'an infant who is 0-1-month-old was four times more likely to be exclusively breastfed than an infant aged 4-5 months' (Tewabe et al., 2017).

Mothers who gave birth in a hospital were more likely to practise EBF compared to those who gave birth at home or in non-medical,

traditional homes. This finding is consistent with studies by Hunegnaw, Gezie, and Teferra (2017) and Ogbo et al. (2015) who observed that mothers who gave birth in formal health institutions were more likely to practise EBF. The authors reported that this could be attributed to proper education and information about the importance of optimal breastfeeding practices provided to the mothers. This is in accordance with the qualitative finding of our study and that of Ogbo et al. (2015). We suggest that maternity-related counselling dispensed at the healthcare facilities is an important means of promoting EBF practice among women.

Our quantitative study did not find a significant association between mothers' employment status and practice of EBF; however, the qualitative study emphasised the role of the nature of mother's employment. Diji et al. (2017) found that mothers who were self-employed were more likely to practise EBF compared to those who were unemployed. The WHO (2009) attributes this to the financial constraints that unemployed mothers face, which might lead them to conclude that their own nutritional levels are inadequate to meet their babies' nutritional needs. However, some studies have found that unemployed mothers were more likely to practise EBF compared to their employed counterparts as they typically did not have the financial latitude to buy other foods (particularly baby milk, which is often expensive in developing countries), whereas employed mothers were short on time and did not have the luxury of staying at home beyond the legally mandated maternity leave (Tewabe et al., 2017). This explanation was valid considering the observation that being unemployed significantly increased the likelihood of breastfeeding in Lagos State (X^2: 6.062; p: 0.014) but not in Taraba State and overall. The rate of formal and informal employment among women was higher in Lagos State, which is considered the economic hub of West Africa, unlike Taraba State where the 'house wife' phenomenon is considerably high. It is also possible that the nature of employment rather than employment status itself is the predictor. As the finding from the qualitative study suggests, informal employment may allow flexibility and increase the likelihood of EBF compared with employment in the private and formal sector. Further studies are needed to investigate this explanation.

Two bio-medical factors were found to be significantly associated with EBF when the models are separated: breast milk insufficiency and mother's age. The practice of EBF increased steadily with mothers' age: women ≤20 years were least likely to practise EBF, while older women were more likely to practise EBF. This is consistent with the findings from a study by (Maonga et al., 2016) who also found that maternal age was significantly associated with EBF and that younger mothers were less likely to practise EBF than their older counterparts. Diji et al. (2017) attributed the relationship between mother's age and practice of EBF to older women having acquired more 'infant care experiences and education' over the life course than did younger women. Women who experienced breast milk insufficiency were also less likely to practise EBF than those who had no such experience. When bio-medical factors were separated from social factors, no significant association was found between the nature of birth and practice of EBF. No significant association was found between breast/nipple problem and practice of EBF as well. The bio-medical factor most strongly associated with EBF was breast milk insufficiency, followed by mother's age.

The results of this study suggested that bio-medical factors were more important than social factors in predicting EBF. Specifically, this study found that breast milk insufficiency (a bio-medical factor) was the most important single factor in predicting EBF, followed closely by mother's education (a social factor). However, some divergence in the literature exists about which of these factors is more important. Kimani-Murage et al. (2014) discussed that social factors were more important in predicting EBF, particularly among working women who have to resume work shortly after delivery and among those who work long hours, making it difficult for them to practise EBF. Similarly, Babakazo, Donnen, Akilimali, Ali, and Okitolonda (2015) found that 'psycho-social factors' were the most important in predicting EBF – the most important of which they termed as 'breastfeeding self-efficacy' – that is, a mother's confidence (or lack of it) in her ability to breastfeed, followed by breastfeeding problems in the post-partum period.

It may be better to think of social and bio-medical factors as dynamic, interacting variables that co-determine the practice of EBF. This is because even bio-medical factors often have important social manifestations. For instance, many mothers believe that 'breast milk alone is not sufficient to meet the babies' nutritional needs' (Goosen, McLachlan, & Schübl, 2014); hence, they introduce other foods (especially water) into the infants' diets (Issaka et al., 2014). The literature is replete with such findings. Tewabe et al. (2017) observed that the most common reason among mothers who did not exclusively breastfeed their infant was the perception that breast milk alone was insufficient. Consequently, while breast milk insufficiency is a bio-medical factor, it can prevent mothers from practising EBF. Further, ignorance about the sufficiency of breast milk alone to nourish the infant can also prevent many women from practising EBF. This shows the interaction between bio-medical and social factors in predicting EBF. Hence, the breastfeeding knowledge of mothers and their attitudes toward breastfeeding, subjective social norms related to breastfeeding, as well as their perceived control over breastfeeding are important social factors in the practice of EBF (Wan, Tiansawad, Yimyam, & Sriaporn, 2015).

Limitations

Our study has few limitations. First, the study was conducted in one metropolitan area in each of the two states. We did not sample any rural area where the characteristics of mothers in terms of education, place of delivery, and employment status might differ from their counterparts in the urban centres; hence, the findings of the study cannot be extrapolated to the entire country. Second, we relied on self-reported account of nursing mothers about their breastfeeding practices, which may not be solely reliable. Third, this study does not claim to have investigated all possible social and bio-medical factors; further studies should include more factors in each category to see if there will be changes in the results.

Implication for practice

This study has two major implications for practice. First, while it is imperative to encourage EBF for the first six months after birth, it is equally important for both health professionals and nursing mothers to be educated on how to identify when the breast milk from nursing mothers is insufficient to exclusively feed the baby in the first six months. Breast milk insufficiency is a bio-medical condition that should be addressed by healthcare professionals. Alternative(s) should be provided for nursing mothers with such conditions and should be strictly supervised by healthcare professionals. Second, health professionals should be encouraged to identify expectant mothers who have lower education for special attention as our findings suggest that this set of women do not engage in exclusive breastfeeding. Healthcare professionals should equally identify and adequately educate young mothers who do not like to breastfeed for the fear of having physical changes of their breasts. The education should include reorientation of mothers about the misconception that male infants should be breastfed more because they need more milk than female infants.

Conclusion

Bio-medical factors appeared to be more important than social factors as some of the former were rigid and beyond the control of the nursing mothers. Importantly, however, this study suggests that it is misleading to think of the influence of the social and bio-medical factors in dichotomous terms, as though one were more important than the other. Rather, it would be more pertinent to consider both social and

bio-medical factors as dynamic, interacting variables that co-determine the practice of EBF, as bio-medical factors have important socially subjective implications. Thus, interventions to increase the practice of EBF among Nigerian mothers are likely to be more effective if they focus on educating prospective and nursing mothers about the benefits of EBF. More importantly, such education should devote significant attention to correcting mothers' misconceptions about the insufficiency of breast milk alone as an infant's diet. Nursing mothers who have lactation problems must be encouraged to seek medical attention rather than quit EBF.

CRediT authorship contribution statement

Tunde A. Alabi: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing - original draft.**Samuel O. Adejoh:** Conceptualization, Writing - review & editing, Supervision, Project administration.**Sonnen Atinge:**Conceptualization, Investigation, Methodology, Writing - review & editing.**Esther Umahi:**Conceptualization, Investigation, Writing - review & editing.

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