Determinants of Exclusive Breastfeeding and Patterns of Complementary Feeding Practices in Mecca City, Saudi Arabia

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Abstract: Background: The World Health Organization (WHO) recommends optimal feeding practices during infancy and early childhood for better health and growth of children.

Objective: To determine the factors affecting exclusive breastfeeding (EBF) duration and the time of introducing complementary feeding (CF) in Mecca City, Saudi Arabia.

Methods: This cross-sectional study recruited 814 Saudi mothers. All mothers filled out a closed questionnaire on family sociodemographics, health status of mothers and infants, and postpartum breastfeeding habits and patterns. The patterns of CF and bottle-feeding were examined, and binary logistic regression was performed.

Results: The mean ± standard deviation EBF duration was 4.6 ± 2.5 months. The EBF rate showed a sharp decrease from 50.6% at birth to 14.4% at 6 months among children. Employment of mothers, weight at childbirth ≤2.5 kg, weight of 2.6–3 kg at child birth, postnatal disease in infants, and pacifier use for infants were associated with a low EBF rate. Intermediate education of the mother was found to increase EBF duration as compared to mothers with higher levels of education. Most mothers introduced plant-based CFs to infants at 4 months of age (median), but animal-based CFs were introduced only after 8 months (median). The median age of starting milk formula was 3 months.

Conclusion and Recommendation: The reported rate of EBF is far below the current international recommendations. The patterns of CF practices and bottle-feeding differ widely from the WHO recommendations in Mecca City. National campaigns should be implemented to promote EBF in Saudi Arabia.

Keywords: Bottle-feeding, Complementary feeding, Exclusive breastfeeding, Mecca, Saudi Arabia.

INTRODUCTION

For normal growth and good health, optimum feeding practices should be followed for infants and young children during the first 2 years of life. The World Health Organization (WHO) describes optimal feeding practices during infancy and early childhood as 6 months of exclusive breastfeeding (EBF), introduction of complementary foods after completing 6 months of age, and continued breastfeeding (BF) for ≥24 months of life [1]. However, many mothers do not follow these practices precisely, due to which their children's health and development may be adversely affected [2]. Suboptimal feeding practices during the first 2 years of life may cause malnutrition, resulting in immense health problems with age such as stunting, micronutrient deficiencies (mainly iron, zinc, and vitamin A), muscle wasting [3], impaired intellectual performance [4], and high risk of illnesses [5]. Previous under nutrition problems have resulted in an annual aggregate of 45%, or 3.1 million, child deaths globally [6]. In addition, inappropriate overfeeding practices may result in an increase in the overweight and obesity rates among preschool children; consequently, they may develop diabetes and other chronic diseases as they grow [1]. Practicing optimal feeding by BF and complementary foods could avoid 19% of deaths worldwide in children aged ≤5 years [7]. To implement such practices and enhance the health and development of children, health professionals should have basic knowledge and counseling skills to educate mothers and families about the importance of proper BF and complementary feeding (CF) practices.

A previous systematic review [8] reported that 0.8%–43.9% of the mothers in different cities in Saudi Arabia performed EBF for 6 months. The most common determinants of EBF were related to young maternal age, high education level, high income, residency in urban areas, employment, contraceptive usage, multiparity, and chronic illness in mothers. Furthermore, early introduction of bottle-feeding and/or solid foods is another factor affecting EBF in Saudi Arabia [9-11]. In 2009, a national survey [12] of 5339 Saudi mothers was conducted to determine the compliance of infants' nutrition to the WHO recommendations. Solid foods were introduced for 80.8% of infants between the age of 4–6 months, whereas bottle-feeding was introduced for 51.4% of infants at the age of 1 month and 90% of infants at the age of 6 months. The study concluded that the feeding practices for a majority of infants vary widely from the WHO recommendations for EBF and CF practices.

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The factors associated with EBF and CF practices may have changed over time, as these practices are influenced by sociodemographic factors, health status of the mother or infant, common BF practices and patterns, and mother's knowledge about BF [13]. To the best of our knowledge, no recent studies have thus far determined the novel factors associated with EBF and practices of CF in many cities in Saudi Arabia. Therefore, this study aimed to identify the determinants of EBF and the practices of CF in Mecca City in Saudi Arabia.

SUBJECTS AND METHODS

Subjects and Setting

This cross-sectional, descriptive study was conducted in Mecca City in the Western Province of Saudi Arabia. Mothers and their infants (age 24–36 months) who visited the Maternity and Children Hospital or primary healthcare centers for vaccination or routine follow-up of the infant were recruited by random sampling. A total of 814 Saudi mothers were recruited between June 2014 and November 2015. Mothers of infants with congenital anomalies, disabilities, Down's syndrome, cerebral palsy, and any genetic metabolic disorder such as phenylketonuria, galactosemia, glycogen storage diseases, organic aciduria, urea cycle disorder, and disorders of fatty acid oxidation were excluded from the study. Ethical approval was obtained from the College of Applied Medical Sciences, Umm Al-Qura University. Before the face-to-face interview, signed informed consent was obtained from each mother who agreed to participate in the study.

Questionnaire

Eligible respondents were invited for interviews. Trained female dietitians conducted the interviews using a pretested questionnaire with closed-ended questions, which was designed on the basis of previous studies [13, 14]. The questionnaire was tested on a pilot sample of 60 subjects prior to data collection and showed a reliable Cronbach's alpha value of 0.78. The questionnaire consisted of 4 sections: family sociodemographics, health status of the mother and infant, postpartum BF habits and patterns, and the time of introduction of CF and milk formula for infants. Before data collection, the female investigators informed the mothers about the definitions of BF and optimal feeding practices during infancy and early childhood according to the WHO definitions [1]. In addition, feeding patterns were defined according to the WHO criteria [1] as follows:

- EBF: infants who received only breast milk without any additional food, formula, liquids, or water.
- Predominant BF: infants who received breast milk with water or drops of vitamins, minerals, and medicines.
- Partial BF: infants who received breast milk with foods, liquids, or milk formula.
- Bottle-feeding: infants who did not breastfeed and received only milk formula since birth.
- CF: supplementary solid and semisolid foods or liquids that were added to the infants' diet because breast milk alone was not sufficient to meet their nutritional requirements.

The interview lasted for approximately 20–25 min for each participant. The weight, height, and body mass index (BMI) of mothers were measured according to the WHO standard methods and reference ranges [1].

Statistical Analysis

Statistical analyses were performed using SPSS software version 20 (IBM Corp., Armonk, NY, USA). P-values $\leq$ 0.05 were considered to be statistically significant. Continuous data are presented as means± standard deviations (SDs), and categorical data are expressed as numbers and percentages. The chi-square test (χ^2) was used to detect significant differences among categorical data. The odds ratio (OR) and 95% confidence interval (CI) were measured by binary logistic regression to identify which independent variables could be predictors for EBF of <6 months. Mothers who started bottle-feeding and did not exclusively breastfeed their children at any time (n= 156) or mothers who partially breastfed their children (n= 246) were not included in the bivariate analyses. Accordingly, logistic regression categorized the participants into two groups: mothers who exclusively breastfed their children for $\geq$6 months (n= 114; the reference group) and mothers who exclusively breastfed their children for <6 months (n= 298).

RESULTS

The mean age of the mothers was 29.8±6.2 years (range, 17–44 years); the mean BMI was 25.5±5.3

Table 1: Duration and Initiation of Breastfeeding and Exclusive Breastfeeding in the Studied Sample (n = 814)

Parameter	Frequency (%)[a] or mean ± SD
Duration of BF (months) (n = 814)	8.2±7.3 (min:1, max:24)
0	156 (19.2)
≤6 months	404 (49.6)
7–12 months	133 (16.3)
≥13–24 months	121 (14.9)
Initiation of BFduring the first 24 h of infant's life (n = 658)	
Exclusively (or predominantly)	412 (50.6)
Partially	246 (30.2)
Duration of EBF (months)	
(n = 412)	4.6±2.5 (min:1, max:12)
<6 months (n = 298)	2.3±1.3
≥6 months (n =114)	6.9±1.9

[a]Percentages are determined from the total number (n=814).
SD, standard deviation; BF, breastfeeding, EBF, exclusive breastfeeding.

kg/m^2; and the family size ranged from 3 to 13 members, with a mean of 4.8±1.7 persons. Among the infants, 48.4% (n=394) were male and 51.6% (n=420) were female, and the weight at childbirth was 2.9±0.5 kg. Durations, proportions, and initiation of BF and EBF are presented in Table **1**. The average duration of any type of BF for the whole sample was 8.2±7.3 months (minimum, 1 month; maximum, 24 months). Overall, 19.2% of mothers did not breastfeed, 49.6% breastfed for ≤6 months, 16.3% breastfed for 7–12 months, and 14.9% breastfed for 13–24 months. Within 24 h of the infant's birth, BF was initiated exclusively or predominantly in 412 mothers (50.6%) and partially in 246 mothers (30.2%). The average duration of EBF was 4.6±2.5 months (minimum, 1 month; maximum, 12 months). The average duration of EBF was 6.9±1.9 months for mothers who breastfed for ≥6 months (n = 114; 14%) and 2.3±1.3 months for mothers who breastfed for <6 months (n = 298; 36.6%).

Results of the binary logistic regression for sociodemographic characteristics predicting EBF of <6 months are presented in Table **2**. No significant differences were observed in age, BMI, family size, and income between the two study groups: mothers who exclusively breastfed their children for ≥6 months (n = 114) and mothers who exclusively breastfed their children for <6 months (n = 298). Intermediate education of the mother (OR: 0.5; 95% CI: 0.3–0.82), intermediate education of the father (OR: 0.52; 95% CI: 0.32–0.85), and employment of mothers (OR: 2.22; 95% CI: 1.32–3.71) were significant sociodemographic variables.

Table **3** demonstrates the health-related characteristics of mothers and infants predicting EBF of <6 months. EBF was not affected by current birth, type of the delivery, sex, and infant's age, chronic diseases of the mother, contraceptive use, mother's smoking status, and second-hand smoking status. On the other hand, EBF was significantly associated ($P < 0.05$) with infant's birth weight and postnatal disease. The ORs were 2.63 (95% CI: 1.53–4.51) for childbirth weight ≤ 2.5 kg and 2 (95% CI: 1.04–3.85) for childbirth weight of 2.6–3 kg compared to infants with normal birth weight. The OR for children with postnatal disease(s) was 2.96 (95% CI: 1.01–8.63) as compared to children who were born healthy.

Results of bivariate analysis of the factors related to the habits and patterns of BF predicting EBF of <6 months are presented in Table **4**. Rooming-in, frequency of BF, number of breastfeeds at night, and provision of information about the importance of BF to mothers showed no effect on EBF. Surprisingly, the use of a pacifier for infants during the first 6 months of life showed an OR of 1.68 (95% CI= 1.02-2.75) as compared to infants who did not use a pacifier.

Table **5** shows the patterns of CF and the mean and median age at which plant- and animal-based foods were introduced in the infants' diet. More than half of the mothers started homemade cereal (53.4%), ready-to-eat cereals (63%), fruits (55.9%), and vegetables (56.3%) at 4–6 months of age. Legumes were introduced by 37.1% of mothers after 12 months, by 24.3% mothers at 7–9 months, and by 19.3% mothers at 10–12 months of age in their children. The majority of the mothers preferred to introduce egg (43.1%), red

Table 2: Sociodemographic Characteristics as Predictors for Exclusive Breastfeeding for <6 Months

Parameter	Frequency (%)			P-value (x^2)	OR (95% CI)
	Exclusive breastfeeding duration				
	Total (n = 412)	<6 months (n = 298)	≥6 months (n = 114)		
Age categories (years)					
≤19	10 (2.4)	8 (2.7)	2 (1.8)	0.88	1.47 (0.29-7.35)
20–24	83 (20.1)	61 (20.5)	22 (19.3)	(1.19)	1.02 (0.52-1.97)
25–29	134 (32.5)	98 (32.9)	36 (31.6)		1 (0.55-1.8)
30–34	88 (21.4)	60 (20.1)	28 (24.6)		0.79 (0.42-1.48)
≥35	97 (23.5)	71 (23.8)	26 (22.8)		1
BMI (kg/m^2)					
Underweight	15 (3.6)	13 (4.4)	2 (1.8)	0.151	3.06 (0.67-13.96)
Normal	200 (48.5)	136 (45.6)	64 (56.1)	(5.3)	1
Overweight	130 (31.6)	101 (33.9)	29 (25.4)		1.64 (0.99-2.73)
Obese	67 (16.3)	48 (16.1)	19 (16.7)		1.19 (0.65-2.19)
Family size					
≤5	274 (66.5)	199 (66.8)	75 (65.8)	0.468	1
>6	138 (33.5)	99 (33.2)	39 (34.2)	(0.04)	0.96 (0.61-1.51)
Income level (SR)					
<5000	73 (17.7)	46 (15.4)	27 (23.7)	0.138	0.66 (0.27-1.57)
5000–10000	194 (47.1)	140 (47)	54 (47.4)	(5.52)	1 (0.45-2.21)
10000–20000	109 (26.5)	86 (28.9)	23 (20.2)		1.44 (0.61-3.41)
>20000	36 (8.7)	26 (8.7)	10 (8.8)		1
Mother's education					
Illiterate	6 (1.5)	3 (1)	3 (2.6)	0.019	0.31 (0.06-1.55)
Read and write	19 (4.6)	12 (4)	7 (6.1)	(9.94)	0.52 (0.2-1.38)
Intermediate	92 (22.3)	57 (19.1)	35 (30.7)		0.5 (0.3-0.82)**
Academic	295 (71.6)	226 (75.8)	69 (60.5)		1
Father's education					
Illiterate	3 (0.7)	3 (1)	0 (0)	0.037	ND
Read and write	20 (4.9)	13 (4.4)	7 (6.1)	(8.47)	0.59 (0.23-1.54)
Intermediate	95 (23.1)	59 (19.8)	36 (31.6)		0.52 (0.32-0.85)*
Academic	294 (71.4)	223 (74.8)	71 (62.3)		1
Mother's employment					
Yes	130 (31.6)	107 (35.9)	23 (20.2)	0.002	2.22 (1.32-3.71)**
No	282 (68.4)	191 (64.1)	91 (79.8)	(9.45)	1

*Significant at P < 0.05, ** Significant at P < 0.01.
CI: confidence interval; OR: odds ratio; ND: not determined; SD, Saudi riyal; BMI, body mass index.

meat (66.6%), chicken (54.1%), and fish (64.3%) after 12 months of age in their children, whereas yoghurt was introduced remarkably early, at 4–6 months of age. The mean infant age±SD (median) for introducing homemade cereals, ready-to-eat cereals, fruits, vegetables, and legumes was 4.7±1.3 (4) months, 4.1±1.1 (4) months, 4.9±2 (4) months, 5.1±2.2 (5) months, and 7.7±2.8 (7) months, respectively. On the other hand, egg, red meat, chicken, fish, and yoghurt were introduced at 8.2±2.5 (8) months, 10.4±2.4 (10) months, 8.9±3.1 (9) months, 9.7±1.9 (10) months, and 6.2±3.3 (6) months, respectively. After ingestion of CF, 139 infants (17%) experienced health problems: 50 (6.1%) developed allergies, 48 (5.9%) developed abdominal cramps and 41 (5%) developed diarrhea.

Of the 814 mothers that participated, 156 mothers (19.2%) started bottle-feeding in the first month, 402 (49.4%) at the end of 3 months, and 700 (86%) after 6 months. The average time of introduction of milk formula was 3.9±3.7 months (median, 3 months; range,

Table 3: Health-Related Characteristics of Mothers and Infants as Predictors for Exclusive Breastfeeding for <6 Months

Parameter	Frequency (%)			P-value (χ^2)	OR (95% CI)
	Exclusive breastfeeding duration				
	Total (n = 412)	<6 months (n = 298)	≥6 months (n = 114)		
Current birth					
First	127 (30.8)	92 (30.9)	35 (30.7)	0.542	1
Second	105 (25.5)	76 (25.5)	29 (25.4)	(2.15)	1 (0.56-1.78)
Third	58 (14.1)	46 (15.4)	12 (10.5)		1.46 (0.69-3.07)
Fourth or more	122 (30.8)	84 (28.2)	38 (33.3)		0.84 (0.49-1.45)
Type of delivery					
Normal	275 (66.7)	196 (65.8)	79 (69.3)	0.288	1
Cesarean	137 (33.3)	102 (34.2)	35 (30.7)	(0.46)	1.18 (0.74-1.87)
Sex					
Male	185 (44.9)	133 (44.6)	52 (45.6)	0.742	0.96 (0.62-1.48)
Female	227 (55.1)	165 (55.4)	62 (54.4)	(0.03)	1
Age of birth					
9 months	371 (90)	266 (89.3)	105 (92.1)	0.689	1
≤8 months	18 (4.4)	14 (4.7)	4 (3.5)	(0.75)	1.38 (0.45-4.29)
≥10 months	23 (5.6)	18 (6)	5 (4.4)		1.42 (0.51-3.93)
Infant's weight at birth (kg)					
≤2.5	151 (36.7)	97 (32.6)	54 (47.4)	0.046	2.63 (1.53-4.51)***
2.6–3	74 (18)	52 (17.4)	22 (19.3)	(2.27)	2 (1.04-3.85)*
3.1–3.5	149 (36.1)	123 (41.3)	26 (22.8)		1
≥3.6	38 (9.2)	26 (8.7)	12 (10.5)		2.18 (0.97-4.88)
Chronic disease(s) in mother					
Yes	59 (14.3)	43 (14.4)	16 (14)	0.529	1.03 (0.56-1.92)
No	353 (85.7)	255 (85.6)	98 (86)	(0.01)	1
Postnatal disease(s) in infant					
Yes	33 (8)	29 (9.7)	4 (3.5)	0.038	2.96 (1.01-8.63)*
No	379 (92)	269 (90.3)	110 (96.5)	(3.65)	1
Contraceptive use					
No	133 (32.3)	98 (32.9)	35 (30.7)	0.505	1.24 (0.75-2.06)
Hormonal	113 (27.4)	85 (28.5)	28 (24.6)	(1.37)	1.35 (0.79-2.31)
Not hormonal	166 (40.3)	115 (38.6)	51 (44.7)		1
Mother's smoking status					
Yes	34 (8.3)	28 (9.4)	6 (5.3)	0.12	1.87 (0.75-4.64)
No	378 (91.7)	270 (90.6)	108 (94.7)	(1.86)	1
Second-hand smoking status					
Yes	157 (38.1)	111 (37.2)	46 (40.4)	0.319	0.88 (0.56-1.37)
No	255 (61.9)	187 (62.8)	68 (59.6)	(0.34)	1

* Significant at P < 0.05, ** Significant at P < 0.01, *** Significant at P < 0.001.
CI: confidence interval; OR: odds ratio.

1–12 months). The mean±SD (median) for starting CF and other fluids was 5.7±2.6 (6) months and 4.2±3.4 (4) months, respectively. In addition, 675 (82.9%) mothers introduced solid foods and 732 (89.9%) mothers introduced liquids in the first 6 months of life. During the first 3 months of life, 567 (69.7%) mothers

Table 4: Breastfeeding Habits and Patterns as Predictors for Exclusive Breastfeeding for <6 Months

Parameter	Frequency (%)			P-value (χ^2)	OR (95% CI)
	Exclusive breastfeeding duration				
	Total (n = 412)	<6 months (n = 298)	≥6 months (n = 114)		
Rooming-in					
In mother's room	316 (76.7)	236 (79.2)	80 (70.2)	0.073	1
In separate room	96 (23.3)	62 (20.8)	34 (29.8)	(2.75)	0.62 (0.38-1.01)
Frequency of breastfeeding					
As per demand	327 (81.8)	233 (81.5)	94 (82.5)	0.47	0.94 (0.53-1.65)
As scheduled	73 (18.2)	53 (18.5)	20 (17.5)	(0.05)	1
Number of breastfeeds at night					
0 time	17 (4.2)	14 (4.9)	3 (2.6)	0.319	2.23 (0.61-8.17)
1–3 times	249 (61.9)	182 (63.2)	67 (58.8)	(2.29)	1.3 (0.82-2.05)
≥4 times	136 (33.8)	92 (31.9)	44 (38.6)		1
Use of a pacifier for infants					
Yes	129 (31.3)	102 (34.2)	27 (23.7)	0.025	1.68 (1.02-2.75)*
No	283 (68.7)	196 (65.8)	87 (76.3)	(4.26)	1
Mother is informed about the importance of breastfeeding					
Yes	342 (83)	244 (81.9)	98 (86)	0.201	1
No	70 (17)	54 (18.1)	16 (14)	(0.98)	1.36 (0.74-2.48)

* Significant at $P < 0.05$.
CI: confidence interval; OR: odds ratio; ND: not determined.

Table 5: Patterns of Complementary Foods for Infants (n = 814)

Time of introduction of plant-based CF	Homemade cereals	Ready-to-eat cereals	Fruits	Vegetables	Legumes
<1 month	2 (0.2)	2 (0.2)	0	1 (0.1)	1 (0.1)
1–3 months	26 (3.2)	18 (2.2)	34 (4.2)	26 (3.2)	2 (0.2)
4–6 months	435 (53.4)	513 (63)	455 (55.9)	458 (56.3)	154 (18.9)
7–9 months	193 (23.7)	140 (17.2)	185 (22.7)	198 (24.3)	198 (24.3)
10–12 months	68 (8.4)	52 (6.4)	67 (8.2)	55 (6.8)	157 (19.3)
>12 months	90 (11.1)	89 (10.9)	73 (9)	76 (9.3)	302 (37.1)
Mean infant age (± SD)	4.7±1.3	4.1±1.1	4.9±2	5.1±2.2	7.7±2.8
Median infant age	4	4	4	5	7
Time of introduction of animal-based CF	**Egg**	**Red meat**	**Chicken**	**Fish**	**Yoghurt**
<1 month	0	0	2 (0.2)	0	4 (0.5)
1–3 months	6 (0.7)	1 (0.1)	4 (0.5)	0	32 (3.9)
4–6 months	111 (13.6)	37 (4.5)	69 (8.5)	47 (5.8)	362 (44.5)
7–9 months	201 (24.7)	158 (19.4)	181 (22.2)	82 (10.1)	317 (38.9)
10–12 months	145 (17.8)	76 (9.3)	118 (14.5)	162 (19.9)	74 (9.1)
>12 months	351 (43.1)	542 (66.6)	440 (54.1)	523 (64.3)	25 (3.1)
Mean infant age (± SD)	8.2±2.5	10.4±2.4	8.9±3.1	9.7±1.9	6.2±3.3
Median infant age	8	10	9	10	6

All values are provided as frequency (%).
CF, complementary feeding; SD, standard deviation.

did not provide any supplementary fluid to their infants. However, 154 (18.9%) infants were fed sugary water prepared from diluted dates and water, 68 (8.4%) infants were fed anise tea, and 25 (3%) infants were fed herbal tea.

DISCUSSION

This study is aiming to recognize the determinants of EBF and the practices of CF in Mecca City, Saudi Arabia. The main result of our study was that 80.8% of mothers initiated BF within the first 24 h of their infant's life. In addition, the mean duration of EBF in the total sample was 4.6 months, with the EBF rate showing a sharp decline from 50.6% at birth to 14.4% at 6 months of age. Factors that decreased the likelihood of EBF for <6 months were parents' academic education, employment of mothers, infant's birth weight <3 kg, postnatal disease in infants, and the use of a pacifier for infants. Furthermore, the majority of the mothers introduced plant-based CFs to infants at 4 months of age (median), but animal-based CFs were introduced after 8 months of age (median), except yoghurt, which was started early at 6 months of age (median). Milk formula was started at 3 months (median).

Due to the health and emotional benefits of breast milk for infants and mothers, WHO recommends that mothers follow optimal feeding practices during the first 2 years of their child's life [16]. Specifically, the WHO recommends EBF for the first 6 months of life for the infant; to sustain EBF for this period, the following measures are recommended: early initiation of BF, no additional foods or drinks or even water for infants receiving EBF, BF on demand, infants rooming-in with their mothers immediately after birth, and no use of bottles or pacifiers [16]. Unfortunately, the WHO reported that only 36% of infants worldwide were EBF until the age of 6 months from 2007 to 2014 [17]. The rate of EBF for 6 months varied between studies and locations in Saudi Arabia: 37% in Abha [18], 30.3% in Al-Taif [19], 26.9% in Jazan [20], 25% in Jeddah [21], 24.4% in Al-Hassa [13], and 1.7% in Riyadh [11]; this variation could be attributed to several factors. Riyadh showed the lowest rate of EBF [11], which could be attributed to city urbanization, early supplementation of milk formula, working status of the mother, and mother's parity. On the other hand, the highest rates of EBF were observed in Abha [18] and Al-Taif [19]. These areas comprise many rural regions, where EBF is culturally normative. In addition, education and employment of women are uncommon in these places [8, 11].

In a study in Al Hassa, Amin *et al.* [13] confirmed that EBF was positively affected by mother's rural residency, housewife status, and low education level, and these factors were intercorrelated. Previous findings are in agreement with our results from Mecca City; EBF for ≥6 months was associated with the mother's and father's low education level and unemployment. A recent study in Saudi Arabia showed that the mother's occupation decreased the duration of EBF; 7% and 37% of working and non-working mothers, respectively, practiced EBF during the first 6 months of their infant's life [22]. Generally, educated mothers are employed and provide less EBF for their children than unemployed mothers [11, 13]. Ojong *et al.* reported that unemployed or self-employed mothers were more likely to breastfeed their babies on demand than working mothers, leading to a higher frequency and duration of EBF in the former [23]. Moreover, working mothers have difficulties BF their infants because they cannot provide BF every 2–3 h on demand; therefore, they use bottle-feeding or partial BF as an alternative to EBF [24]. In addition, Saudi Arabia has no legislation that supports EBF for working mothers, as exists in the United Arab Emirates [14]. This matter should be addressed and implemented in all Gulf and Arab countries.

Our results from Mecca showed that working mothers were 2.22-fold less likely to provide EBF for their infants for 6 months as compared to non-working mothers. Moreover, an intermediate education level for the mother and father was associated with the provision of EBF for 6 months. The father's education level and EBF might be indirectly related because the educational level is usually relatively similar between parents, which could have resulted in a significant association between the two factors. Educational levels below the intermediate level (i.e., read/write and illiterate) in both parents showed a positive effect on EBF, but this was not significant.

Other hindrances to EBF resulted from low birth weight and postnatal disease(s) in infants. Infants born with low weight (<3.1 kg), premature infants, infants with medical conditions (e.g., lung, heart, kidney, or liver problems), and infants with infections need critical care and feeding in a hospital to attain a normal weight and optimal physiological functioning [25]. Therefore, such infants are admitted to the neonatal intensive care unit (NICU) in the hospital and kept away from their mothers; thus, EBF may decrease for these infants. Our results showed that infants born with ≤2.5 kg and 2.6–3 kg body weight had 2.63-fold and 2-fold higher odds, respectively, of EBF for <6 months compared to normal birth-weight infants. Furthermore, infants with postnatal disease(s) were approximately 3-fold less likely to receive EBF for 6 months than children born healthy. Infants in the NICU require breast milk after

hospital discharge because it provides beneficial substances for superior nutrition, gastrointestinal tract health, immunity, cognitive function, and long-term health and growth; however, these substances are absent in infants' formula [26]. Therefore, healthcare providers should encourage mothers of infants who admitted to NICU to breastfeed after hospital discharge. However, this could be a challenge to the mothers, considering that they may try for weeks to pump milk from the breast before their infants become physiologically able to directly feed from the breast [27]. A study reported that the rate of EBF at discharge for preterm infants was only 54% in USA [26]; however, no such data are available in Saudi Arabia or the Arab regions. Thus, this issue should be assessed in future studies.

Another constraint to EBF was the use of a pacifier. Infants that used a pacifier had a 1.68-fold higher risk of receiving less EBF than infants who did not use a pacifier. No general recommendations were found in the literature regarding the use of a pacifier and its effect on EBF. However, a recent study including 1598 respondents in US hospitals showed that not using a pacifier was correlated with greater odds of EBF among mothers aged $\geq$30 years compared with mothers who used a pacifier for their infants, but with lower odds among teenage mothers [28]. Many other studies have postulated that the use of a pacifier is negatively associated with BF duration, which could cause early weaning and reduce the motivation to BF among infants [29-31]. On the other hand, a study reported that restricting the use of a pacifier may increase the risk of sudden infant death syndrome and such restriction for infants could be ethically problematic [32]. Some other studies did not find any association between pacifier use and duration of BF [33, 34]. However, as discussed earlier, the WHO recommends that mothers avoid using a pacifier in order to sustain EBF for 6 months by either delaying milk formula and solid foods or promoting BF as much as possible [16].

Although the WHO recommends that mothers initiate BF as early as possible [16], early initiation of BF during the first 24 h of the infant's life was not related to the duration and exclusivity of BF. Our results showed that BF was initiated by 80.8% of mothers and 14.4% continued EBF for 6 months. A study in Riyadh [11] showed that 95% of the study sample initiated BF, but only 1.7% continued EBF for 6 months. These results were mainly due to the early introduction of milk formula, solid foods, and/or liquid feeding [11]. The previous study revealed that 83.4%, 88.9%, and 94% of mothers supplemented their infant's diet with milk formula, solid food, and liquid feeding during the first 6 months, respectively. Our study showed that 86%, 82.9%, and 89.9% of mothers introduced milk formula, CF, and liquids, respectively, during the first 6 months of their infant's life. Partial BF is the most common feeding pattern in Saudi mothers [8] over the last 20 years [35]. Majority of the mothers started plant-based CF earlier than the WHO recommended time (after 6 months), except for legumes, which were started at the appropriate time (median, 7 months). On the other hand, animal-based CFs should be introduced at the age of 6–8 months to compensate for energy, protein, and iron requirements that are not covered by EBF in children; however, egg and fish can be avoided until 12 months of age to prevent any possible allergenicity [1]. Our results indicated that mothers delayed the introduction of red meat and chicken for infants; therefore, their infants may be more susceptible to iron-deficiency anemia and stunting growth [1]. Another study [36] in Saudi infants showed that iron-deficiency anemia could be linked to a delayed introduction of CF, unfortified CF, and EBF beyond the fourth month of life. Mothers in the Mecca region preferred to introduce yoghurt and egg earlier than the time recommended by the WHO, which may compensate for the energy and protein requirements in infants. In addition, some children were fed sugary water prepared by diluting dates in water for religious reasons and because hot weather in Saudi Arabia, specifically in Mecca, could cause dehydration to infants. However, mothers should be informed that breast milk alone can provide infants their requirements of water until 6 months of age, even in hot climatic conditions [37].

Previous studies have reported that children of mothers with low income, multiparity, and old age and who do not use contraceptives as well as those who delivered normally tended to provide EBF for a long duration [8, 11, 13]. However, these factors did not have any significant effect on EBF in our study. This study is limited by its cross-sectional design and recall bias during data collection due to its retrospective nature. Therefore, longitudinal studies are strongly recommended to determine accurate and valid factors associated with EBF as well as patterns of CF in Mecca City and other Saudi Arabia regions, which have not been studied thus far.

CONCLUSION

In summary, 14.4% of mothers in Mecca City provided EBF to their infants for 6 months. The most significant determinant for EBF was postnatal disease(s) in infants, followed by infants' weight at birth ≤2.5 kg, employment of mothers, infants' weight at birth equal to 2.6–3 kg, and the use of a pacifier. Low education among mothers was associated with a long duration of EBF. Saudi mothers introduced CF early for homemade cereals, ready-to-eat cereals, fruits, vegetables, fish, and egg. In addition, they delayed introduction of red meat and chicken in the infant's diet, but introduced legumes and yoghurt at a suitable time, as per the WHO recommendations. Overall, optimal feeding practices in Mecca City are not compliant with the WHO recommendations. Therefore, national campaigns in Mecca and other Saudi cities should be implemented to promote and encourage EBF and to educate mothers about the possible determinants of EBF. In addition, public health programs should be developed by the Ministry of Health and other non-governmental organizations to increase awareness among mothers about CFs and proper time for introducing solid foods in infants.

COMPETING INTERESTS

None.

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