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Predicting perceived exclusive breastfeeding behavior among higher education female students in Saudi Arabia: Application of the theory of planned behavior using structural equation modeling

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Abstract

The decision for infant feeding behaviors is often made early in life, based on the socio-cultural context. Thus, exploring this issue and its influencing factors can create Exclusive Breastfeeding (EBF) culture among future mothers. This study aimed to predict EBF behavior among female higher education students in Saudi Arabia through the application of the Theory of Planned Behavior (TPB) using Structural Equation Modeling (SEM). This descriptive exploratory research was conducted on three university campuses in three cities (Dammam, Jeddah, and Abha). A multistage cluster random sampling was employed to select 600 female students using a digital survey containing three sections: Personal Data and Previous BF Exposure, EBF Knowledge Scale, and The TPB constructs for the EBF scale (attitude, Subjective Norms/SN, Perceived Behavioral Control/PBC, intention, and Perceived Behavior). The results showed that the highest percent of the participants had moderate BF exposure (63.8%) and knowledge (65.7%), positive attitude (85.8%), high SN (66.2%), moderate PBC (75.8%), high intention (55.2%), and positive perceived behavior (55.2%). The SEM had acceptable fit indices were χ^2/df ratio=3.817, GFI=0.935, RMSEA=0.044, NFI=0.942, CFI=0.951, PCFI =0. 924. It showed that the EBF attitude (β=0.607), SN (β=0.123), and PBC (β=0.158) were significant positive and direct predictors of the EBF intention (P<0.001). Both intention (β=0.213) and PBC (β=0.226) were significant positive and direct predictors of the perceived behavior (P<0.001). It accounted for 49.5% of the variance in EBF intention and 70.0% for the behavior. The BF exposure and knowledge were significant positive predictors of EBF intention (β=0.158, β= 0.237) and behavior (β=0.140, β= 0.207) (P=0.000). Thus, the TPB has a good predictive ability for EBF intention and behavior among the studied Saudi female university students. Thus, it can be employed for efficient health promotion and the development of EBF-friendly policies. *(Afr J Reprod Health 2023; 27 [5]: 58-71).*

Keywords: Exclusive breastfeeding, theory of planned behavior, structural equation modeling

Résumé

La décision concernant les comportements d'alimentation du nourrisson est souvent prise tôt dans la vie, en fonction du contexte socioculturel. Ainsi, l'exploration de ce problème et de ses facteurs d'influence peut créer une culture de l'allaitement maternel exclusif (EBF) chez les futures mères, en prédisant le comportement de l'EBF chez les étudiantes de l'enseignement supérieur en Arabie saoudite grâce à l'application de la théorie du comportement planifié (TPB) à l'aide de la modélisation par équation structurelle (SEM). Recherche exploratoire descriptive menée sur trois campus universitaires dans trois villes (Dammam, Jeddah et Abha). Un échantillonnage aléatoire en grappes à plusieurs degrés a été utilisé pour sélectionner 600 étudiantes célibataires ou sans enfants. Une enquête numérique contenait trois sections: données personnelles et exposition antérieure à la BF, échelle de connaissances EBF et constructions TPB pour l'échelle EBF (attitude, normes subjectives/SN et contrôle comportemental perçu/PBC, intention et comportement perçu). Il montre que le pourcentage le plus élevé de participants avait une exposition modérée à la BF (63,8 %) et des connaissances (65,7 %), une attitude positive (85,8 %), un-SN élevé (66,2 %), une PBC modérée (75,8 %), une intention élevée (55,2 %), et un comportement perçu positif (55,2 %). Le SEM avait des indices d'ajustement acceptables étaient le rapport χ^2/df = 3,817, GFI = 0,935, RMSEA = 0,044, NFI = 0,942, CFI = 0,951, PCFI = 0. 924. Il a montré que l'attitude EBF (β = 0,607), SN (β = 0,123) et PBC (β = 0,158) étaient des prédicteurs positifs et directs significatifs de l'intention EBF (P <0,001). L'intention (β = 0,213) et la PBC (β = 0,226) étaient des prédicteurs positifs et directs significatifs du comportement perçu (P <0,001). Il représentait 49,5 % de la variance de l'intention EBF et 70,0 % du comportement. L'exposition et la connaissance du BF étaient des prédicteurs positifs significatifs de l'intention de l'EBF (β = 0,158, β = 0,237) et du comportement (β = 0,140, β = 0,207) (P = 0,000). Le TPB a une bonne capacité prédictive pour l'intention et le comportement EBF parmi les étudiantes universitaires saoudiennes étudiées. Ainsi, il peut être utilisé pour une promotion et une éducation efficaces à la santé et pour le développement de politiques favorables à l'EBF afin d'améliorer le processus de prise de décision des futures mères pour les comportements d'alimentation du nourrisson. *(Afr J Reprod Health 2023; 27 [5]: 58-71).*

Mots-clés: Allaitement maternel exclusif, théorie du comportement planifié, modélisation par équation structurelle

Introduction

Breastfeeding BF is one of the greatest investments for enhancing individuals' and nations' health, economic, and social development. The EBF was conceptualized by the World Health Organization WHO as providing no food or drink other than breastmilk for the growing infants during the first six months of life as it provides an optimal nutrition source for them[1,2]. The WHO also recommended the continuation of BF for up to two years, along with complementary foods that started after six months. EBF can enhance the infants' physical, social, and cognitive development, overall health state, and survival[3]. It also enhances the women's psychological and physical health as evidence shows that it decreases the risk for many health problems such as cardiovascular diseases, diabetes, breast cancer, ovarian cancer, and other reproductive cancers[4-6].

Despite these recommendations and benefits of EBF for mothers and children, it is still very low globally, including in the Arab countries. The WHO, in 2022, estimated that about 2 in every three infants are not receiving EBF, with about 41% of infants under six months being exclusively breastfed. According to UNICEF, in 2020, the rates of EBF are in Asia 22% - 52%, the Middle East 33%, Eastern Europe 32%, and North America 26%[7]. Consequently, EBF was set by the WHO as one of the global 2025 targets to be increased to reach at least 50 percent. Thus, BF is identified as a basic human, sexual, and reproductive health right[8,9].

In Saudi Arabia, the BF initiation rate and duration are diminishing progressively. A review article of 17 cross-sectional studies in 2014 reflected that the EBF rate ranged between 8% and 43%. Despite a higher initiation rate, most women followed a mixed feeding strategy before six months[10]. Two Saudi studies showed that EBF was practiced by 31.4% of the mothers in Tabuk and 37.5% in Riyadh, where most of them discontinue BF after one year[11,12]. Another study added that despite Saudi women having good BF knowledge, they face many challenges initiating and continuing BF[13]. Evidence proves many nonmodifiable factors influence the women's EBF decision, such as women's health and economic factors. Thus, the focus should be on the modifiable factors such as the misconceptions, psychological status, attitudes

of significant others, and socio-cultural variables to increase women's motivation to practice EPF behavior[14]. Evidence showed that the EBF decision is often shaped early in life or pre-pregnancy, which provides a supreme opportunity to influence the growing females' attitudes and intentions for future EBF practice. This makes the university students a promising stage for EBF promotion[15-17].

The TPB is highly applied in the behavioral, social, environmental, and political sciences, education, and public health[18]. It is considered a social cognitive decision-making model that provides a useful framework for predicting and explaining several behaviors[19]. Evidence proved that the TPB is an efficient model for predicting many health behaviors such as alcohol consumption and self-management behaviors of many non-communicable diseases such as cardiovascular diseases[20,21]. However, limited evidence exists for its efficiency in predicting the EBF behavior and its influencing factors, especially among unmarried women[17,22,23].

The TPB was initially developed in 1985 by Icek Ajzen. It extended the theory of reasoned action by adding up the perceived behavioral control PBC domain[24]. It explored three main constructs of beliefs as the main shaping power of the individuals' intention and subsequent behavior. *First,* beliefs about the potential consequences of a certain behavior behavioral beliefs generate a satisfactory or unsatisfactory attitude toward a certain behavior. *Second,* beliefs about others' expectations of a certain behavior normative beliefs can shape the subjective norms SN or the individual's perceived social pressure. *Third,* beliefs about the factors that may facilitate or impede the behavior execution control beliefs. These can develop the individual's self-efficacy or PBC, which moderates the relationship between the individual's attitude, SN, and intention to a certain behavior. Commonly, the more favorable the individual's attitude and the SN, the greater the PBC and the greater the intention for practicing this behavior[25,26].

In the context of EBF behavior, based on the TPB, preparing the growing females with positive beliefs about BF and its benefits for themselves and their future babies, creating a supportive social network that socially approves the EBF behavior, and increasing their self-efficacy or perceived control over their EBF

behavior through equipping them with accurate BF knowledge can shape the road for the future transformation of EBF intention to actual behavior[27,28]. In Saudi Arabia, evidence revealed a negative attitude toward BF, lower practice, and preferring formula feeding among Saudi women[29,30]. Moreover, a gap was detected in the Saudi female students' knowledge and attitudes concerning BF. In addition to the misconception about BF behavior and its conduction in public places, formula feeding, and dietary restrictions throughout the BF duration[15]. This highlights the role of cultural and motivational factors in promoting EBF behavior which explores the need for a theory like the TPB, especially since it is underrepresented concerning BF behavior in general, with no focus on the single or unmarried females in specific. This elaborates the necessity of the current study as a pioneer for predicting EBF behavior among female university students using Structural Equation Modeling SEM. Figure 1 illustrates the theoretical framework adopted in the current study based on the TPB. In line with the TPB, the researchers assumed that the female students' EBF behavior is affected by their intention and PBC. Besides that, the attitude, SN and PBC are correlated and have a direct effect on their EBF intention.

Methods

Research questions

- What is the level of the studied female students' EBF attitude, SN, PBC, intention, and perceived behavior?
- What is the ability of the TPB in predicting EBF intention and perceived behavior?
- What is the extent of the studied female students' EBF knowledge and previous exposure?
- What is the effect of EBF knowledge and previous exposure on the EBF intention and perceived behavior?

Study design and setting

A descriptive exploratory research design was employed. The study was accomplished on three different University Campuses which are in three different cities: Dammam, Jeddah, and Abha.

Subjects and sampling

A sample of 600 higher education female students was incorporated into the study using the multistage cluster random sampling technique. First, three different cities were randomly chosen Dammam, Jeddah, Abha. Second, in each city, two university campuses were randomly chosen. Third, in each campus, the convenience sampling technique was followed to select the participants using the equal allocation technique from each city 200 students and campus 100 students. The inclusion criteria for the female students were being single or married/divorced/widowed but had no children and agreed to participate in the study. Those who had children, were married, widowed, or divorced, were excluded from the study.

The required sample size was calculated based on the total number of female students enrolled in the selected universities campuses for the academic year 2020/2021. The researchers adopted the Steven K. Thompson formula[31] to calculate the sample size. It yielded a minimum required sample size of 355, which was upgraded to 600 after considering the effects of the study design, cluster size, and possible nonresponse.

$$n = \frac{[N \times p(1-p)]}{\left[\left[N - 1 \times \left(\frac{d^2}{z^2}\right)\right] + p(1-p)\right]}$$

✓ Where n: Sample size, N: population size 9550, p: Probability 50%, d: Precision or Error proportion 0.05 and Z: Confidence level at 95% 1.96.

Survey development

The researchers designed a digital survey after a thorough review of relevant recent literature that contained three main sections as follows: -

Section I: Sociodemographic data and previous exposure to BF

- **Sociodemographic data:** age, marital status, academic year, college, branch, and perceived income level.
- **Previous exposure to BF scale:** it contained five items that measured the female students' BF experience in infancy, previous exposure to BF education, ever seen a woman breastfeeding, and knew someone who breastfed her baby. The scale

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- items were rated yes (2), no, or unsure (1). This created a total score ranging from 5 to 10, which was categorized into three levels as low (5-6), moderate (7-8), or high (9-10) BF exposure[32-34].

Section 2: EBF Knowledge Scale

It contained 11 items scored as yes (2) and no or do not know (1). The score was reversed for seven items that were falsely stated. The total score was calculated and ranged between 11 to 22. It was leveled as low (11-14), moderate (15-18), or high (19-22). The higher the score, the better the BF knowledge level among female students[33,34].

Section 3: TPB constructs for EBF

It consisted of the following five scales:

- **EBF Attitude**: It measured an individual's behavioral beliefs or attitude toward BF. It was adapted from the Iowa infant feeding attitude scale to be compatible with the study sample[35]. It comprised seven items with a five-point Likert scale that ranges from (1) strongly disagree to (5) strongly agree. The negatively stated three items had reversed scores; thus, higher scores represent a more positive attitude toward EBF. The total scores ranged from 7 to 35 and were categorized as positive (26-35), neutral (16-25), and negative (7-15).

- **Perceived SN Scale:** It assessed the influence of significant others on the female students' EBF intention mother, family, friends, future husband, and health staff. It contained five items rated on a five-point Likert scale that ranges from (1) extremely unlikely to (5) extremely likely. The total score ranged from 5 to 25 and was categorized as low (5-11), moderate (12-18), and high (19-25). The higher score indicates the role of SN in shaping the future EBF intention and behavioral decisions[34,36].

- **PBC Scale:** It was developed based on Giles M *et al*. 2015 to assess the females' perceived level of control over EBF behavior and their beliefs about several external factors that could motivate or hinder their decision. It contained six items rated on a five-point Likert scale that ranges from (1) extremely unlikely to (5) extremely likely. The total score ranged between 7 and 35 and was categorized as low (6-14), moderate (15-22), or high (23-30). A higher score reflects a higher perceived level of control over EBF behavior[36].

- **EBF Intention Scale**: It was composed of 5 items rated on a five-point Likert scale from (1) strongly disagree to (5) strongly agree. The total score ranged from 5 to 25 and leveled into low (5-11), moderate (12-18), and high (19-25). A higher score reflects the higher intention among females to exclusively breastfeed their future babies[37,38].

- **Perceived EBF Behavior Questionnaire.** It was first developed by Libbus in 1992 in English to assess women's perception of their BF behavior[39]. It was translated into many languages; the Arabic version was adopted in this study which was validated by Charafeddine *et al.* 2020 ($\alpha = 0.78$)[40]. It consisted of 12 hypothetical scenarios of different situations a woman might encounter during BF. These scenarios are concerned with measuring the women's decision to breastfeed their future babies even in conflicting situations or opinions from others. The level of agreement with each scenario was measured on 6 points Likert scale creating a total score of 12-72. It was categorized into three levels where lower scores signified better EBF behavior: Positive (53-72), indifferent (33-52), and negative (12-32).

Instrument validity and reliability and Pilot testing

The instrument except the perceived EBF behavior questionnaire was translated into Arabic with back translation Arabic to English to guarantee the accuracy, and a different researcher performed that. Six experts were invited to evaluate the content validity of the survey instrument. Based on their feedback, the Content Validity Index (CVI) per item level (I-CVI) ranged between 0.8 to 1.0, and the overall scale CVI-level (S-CVI) was 0.93. The instrument internal consistency reliability was confirmed using the Cronbach's α coefficient which showed an acceptable level for all respective scales: knowledge ($\alpha = 0.812$), BF exposure ($\alpha = 0.834$), attitude ($\alpha = 0.798$), SN ($\alpha = 0.795$), PBC ($\alpha = 0.756$), intention ($\alpha = 0.815$), and perceived EBF behavior ($\alpha = 0.805$).

The survey was piloted with 60 female students excluded from the main sample. This aid in testing the clarity, accuracy, and readability of the survey's items. In addition to estimating the average filling time of the survey based on the time recorded on the Survey Monkey Program (8-12

minutes). According to the female students' feedback, minimal words were modified, and no items were deleted in this stage. The discriminative ability of the instrument was assessed by Pearson's correlation coefficient between items and their respective subscales. Accordingly, two items were deleted due to low correlation coefficients (<30) and insignificance (P>0.05). The instrument's construct validity was investigated by Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), where another three items were removed at this stage[41,42].

Data collection

The Survey Monkey program was deployed for designing the digital survey. An official approval of the data collection process was gained from the university of higher education with the names of the randomly selected universities campuses in the three different cities. After approval, the survey's link was released by the female students' affairs enrolled in the selected campuses using their official emails. The desired sample size was reached within three months, from the start of February till the end of April 2022. After taking the students' consent for the study participation, filtered questions were placed at the start of the survey to ensure the unity of the female students with the study eligibility criteria. The recorded average time for survey completion was 8-12 minutes on Survey Monkey Program with a higher response rate 96%.

Statistical analysis

Raw data were exported in an excel sheet from the survey monkey program. Then it was entered and analyzed using SPSS 26.0 software SPSS, Inc., Chicago, IL, USA. The frequency, percentage, mean, standard deviation, and confidence interval were employed to describe the studied variables. The one-sample t-test was used to guarantee the significance of the mean difference. Pearson's linear correlation analysis examined the correlation of the studied variables. The SEM was employed to investigate the relationship between the latent and observed variables based on the constructs of the TPB. The AMOS 26.0 SPSS, Inc., Chicago, IL, USA was deployed for model specification, estimation, testing, and modification. The model parameters were assessed using the maximum

likelihood estimation. Model fit was judged using the following indices along with their cutoff values: the absolute fit measures, including the Chi-square value/degrees of freedom ratio ($\chi2/df <$ 5), Goodness of Fit Index (GFI >0.90), Root Mean Square Error of Approximation (RMSEA< 0.05). Incremental fit measures including Normed Fit Index (NFI >0.90) and Comparative Fit Index (CFI> 0.90). The Parsimony Comparative Fit Index (PCFI >0.50). The effect of EBF knowledge and previous exposure on the EBF intention and behavior was examined using linear regression analysis[43,44].

Ethical considerations

This study was accomplished in line with the Declaration of Helsinki and ethically approved by the Institutional Review Board of the research ethics committee in the Saudi Electronic University (IRB number: SEUREC22006). The female students get the survey's link with elaborating the study's aim and all the required directions and explanations for answering the questions. Digital informed consent was gained from all respondents before proceeding with the questionnaire. This assured voluntary participation, where the female students have the full right to disagree or decline the participation at any time. The respondents' answers were anonymous and used only for fulfilling the study's purpose.

Results

Descriptive analysis

Table 1 illustrates that 44.5% of the participants aged between 23-25 years with a mean age of 21.80±2.17, 74.5% were single, and 61.5% reported having enough income. Most participants had BF during infancy, knowing a woman who breastfed her baby and saw a woman breastfeeding (78.5%, 90.8%, 95.2%, respectively). However, most of them never received BF education 66.7% or watched videos 60.8% about BF.

Table 2 shows that the highest percent of the studied participants had moderate previous BF exposure (63.8%) and knowledge (65.7%). The highest percentage of participants had a positive attitude toward EBF (85.8%) and high SN (66.2%). Most of them had moderate PBC (75.8%), high EBF intention (55.2%), and positive perceived
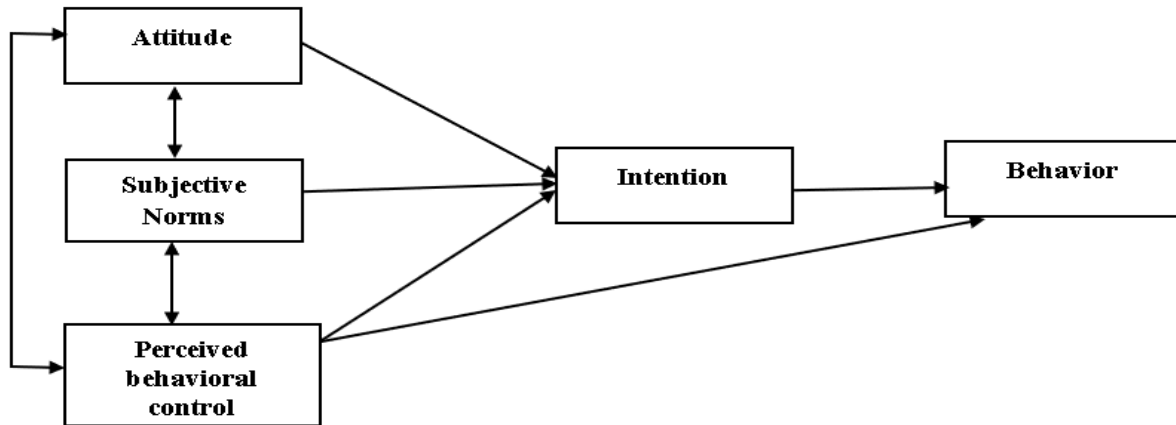
Figure 1: Conceptual framework of the study[24]

Table 1: The female students' basic data and previous BF exposure

Parameters	Frequency	%
Age in years		
> 20	128	21.3
22 – 22	205	34.2
23 -25	267	44.5
Mean ± SD	**21.80±2.17**	
Marital status		
Single	447	74.5
Married without children	129	21.5
Widow or divorced without children	24	24
Perceived income level		
Not enough	119	19.8
Enough	369	61.5
Enough and saving	112	18.7
Ever been breastfed		
Yes	471	78.5
No, or do not know	129	21.5
Knowing any woman who breastfed her baby		
Yes	545	90.8
No	55	9.2
Ever seen a woman breastfeeding		
Yes	571	95.2
No	29	4.8
Ever received BF education		
Yes	200	33.3
No	400	66.7
Ever watching BF videos		
Yes	235	39.2
No	365	60.8

BF: Breastfeeding

Table 2: Distribution of the female students by the total scores of the studied variables

Variables	Frequency	%	Total Score	Mean ± SD 95% CI
Previous BF Exposure				
Moderate	383	63.8	5-10	8.41 ± 1.03
High	217	36.2		8.33-8.50***
BF knowledge				
Moderate	394	65.7	11-22	18.13± 1.46
High	206	34.3		18.01-18.25***
Attitude				
Positive	515	85.8		
Neutral	81	13.5	7-35	30.15 ±4.21
Negative	4	0.7		29.81-30.49***
Subjective norms				
Low	1	0.2		
Moderate	202	33.7	6-30	23.87± 3.81
High	397	66.2		23.56-24.18***
Behavioral control				
Low	68	11.3		
Moderate	455	75.8	7-35	20.70 ± 4.64
High	77	12.9		20.32-21.07***
Intention				
Low	15	2.5		
Moderate	254	42.3	5- 25	18.96 ± 3.68
High	331	55.2		18.67-19.26***
Perceived EBF behavior				
Negative	23	3.8		
Indifferent	246	41.0	12-72	51.06 ± 3.28
Positive	331	55.2		50.80-51.33***

BF: Breastfeeding   CI: Confidence Interval   ***P<0.001 one sample t-test

Table 3: Correlation matrix between the study variables

Variables	Age	Exposure	Knowledge	Attitude	SN	PBC	Intention
Exposure	0.214**						
Knowledge	0.237**	0.135**					
Attitude	0.179**	0.243**	0.308**				
SN	- 0.092*	0.073	0.018	0.255**			
PBC	- 0.081*	0.053	0.093*	0.181**	0.03**		
Intention	0.087*	0.189**	0.257**	0.424**	0.226**	0.126**	
EBF behavior	0.98*	0.172**	0.231**	0.398**	0.280**	0.158**	0.625**

Notes: **P < 0.01, *P<0.05   SN: Subjective Norms, PBC: Perceived Behavioral Control, EBF: Exclusive Breastfeeding

Table 4: The standardized total, direct, and indirect effects of the SEM variables

Pathway	Total Effect	Direct Effect	Indirect Effect
Attitude ⟶ Intention	0.607	0.607***	-
SN ⟶ Intention	0.123	0.123***	-
PBC ⟶ Intention	0.153	0.153***	-
Intention ⟶ Perceived EBF Behavior	0.213	0.213***	-
Behavioral control ⟶ Perceived EBF Behavior	0.258	0.226***	0.033

Notes: ***P< 0.001, SN: Subjective Norms, PBC: Perceived Behavioral Control, EBF: Exclusive Breastfeeding
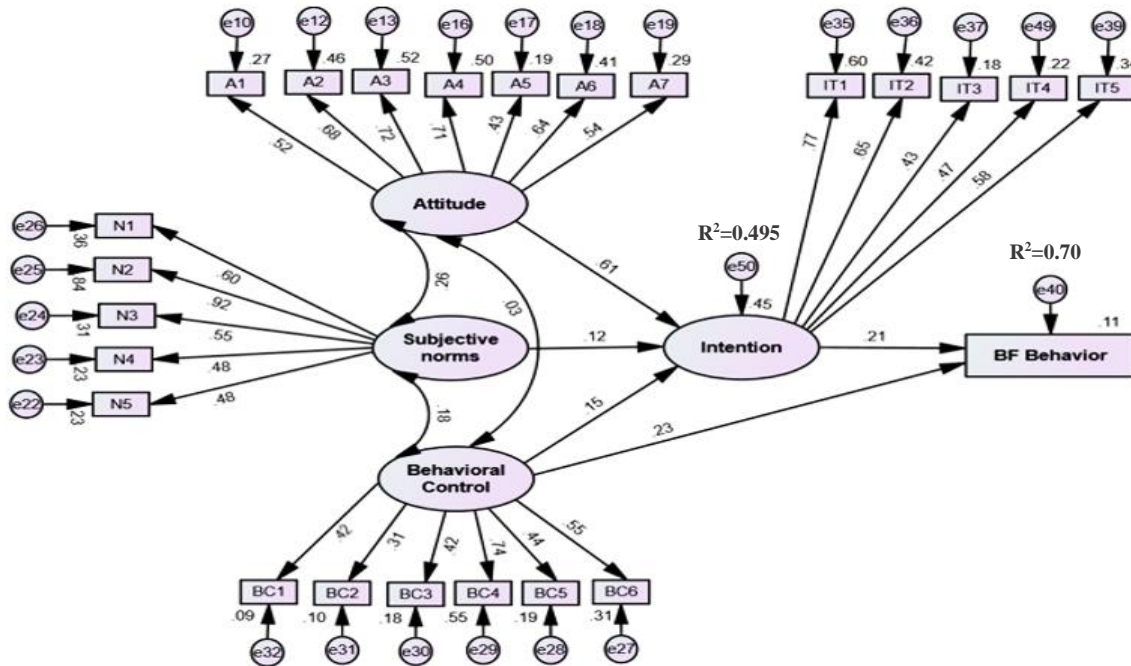
Figure 2: SEM for the EBF intention and perceived behavior of the female students with the Standard direct regression weights

Table 5: Linear regression model of the predictors of BF intention and perceived behavior

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	T	Sig.
Intention	**Constant**	2.978		1.313	0.190
	BF Exposure	0.561	0.158	3.930	0.000**
	BF Knowledge	0.594	0.237	5.862	0.000**
	Age	-0.004	-0.003	-0.063	0.950
R² =0.091					
Perceived behavior	**Constant**	0.828		0.406	0.685
	BFF Exposure	0.443	0.140	3.447	0.000**
	BF Knowledge	0.464	0.207	5.087	0.000**
	Age	0.029	0.019	0.471	0.638
R²=0.074					

Variance Inflation Factor (VIF)= 1.056 -1.099   **P<0.001   BF: Breastfeeding

EBF behavior (55.2%). All the variables had significant mean differences based on the one-sample t-test P<0.001.

Correlation of the study variables

Table 3 depicts that EBF intention and behavior had significant positive correlations to each other and all the TPB constructs besides the participants' age, BF exposure and knowledge (P<0.001). Age had significant negative correlations with SN (r= -0.092, P>0.05) and PBC (r=-0.081, P>0.05). BF knowledge had also significant positive correlations with attitude and PBC (P<0.001) while

it had insignificant correlation with SN (r = 0.018, P>0.05). In addition, BF exposure has insignificant correlations with SN and PBC (P>0.05). The PBC also had significant positive correlation with BF attitude (r=0.181, P<0.05).

Structural Equation Model SEM of the constructs on the TPB

The SEM was deployed to test the consistency of the TPB model with the identified variables' correlations. After adjusting the model using the modification indices, the results of the model-fit indices were χ2/df ratio=950.470/249=3.817,

GFI=0.935,   RMSEA=0.044,   NFI=0.942, CFI=0.951, PCFI =0. 924, which reflects the model fit with the study data.

Based on the final SEM model in figure 2 and table 4 findings, the attitude (β=0.607, P<0.001), SN (β=0.123, P<0.001), PBC (β=0.158, P<0.001) were significant positive and direct predictors of the EBF intention. Both intention (β=0.213, P<0.001) and PBC (β=0.226, P<0.001) were significant positive and direct predictors of the perceived EBF behavior. Based on the values of R^2, the SEM accounted for 49.5% of the variance in EBF intention and 70.0% of the variance in EBF behavior.

The BF exposure and knowledge as predictors of EBF intention and behavior

Table 5 illustrates that linear regression models were significant for predicting EBF intention (R^2 =0.091) and behavior (R^2 =0.074). There is no multicollinearity between the exploratory variables where the Variance Inflation Factor (VIF) is below 10 (1.056 and 1.099) and tolerance over 2. The BF exposure and knowledge were significant positive predictors of EBF intention (β=0.158, β= 0.237, P=0.000, respectively) and EBF behavior (β=0.140, β= 0.207, P=0.000, respectively). However, participants' age was an insignificant predictor of neither EBF intention nor behavior (P>0.05).

Discussion

The current study portrays that the highest percent of the studied female students had a positive attitude toward EBF, high SN, moderate PBC, high intention, and positive perceived EBF behavior with significant positive associations with each TPB construct. This explained the importance of the individuals' beliefs toward EBF and the role of the psychosocial variables, including motivation and self-efficacy, in shaping the females' EBF intention and future behavior. Besides, the significant role of the social pressure and norms of the group for which the female belongs in shaping her attitude toward EBF, intention, and future practice of EBF. Conveniently, Jamei *et al.,* 2017 proved that the constructs of the TPB Attitude, SN, and PBC were significantly correlated with EBF intention among Iranian mothers[45]. Consistent findings were proved by a recent Saudi study by

Khresheh, 2020, which showed that most of the studied university girls had a positive attitude toward EBF, which had a significant positive relationship with EBF intention[15]. An Indian study by Padmanabhan *et al.,* 2018 revealed good EBF attitude and intention among the studied female college students[46]. Moreover, many studies among female college students revealed a positive attitude toward EBF, as a study in Nigeria by Leshi *et al.,* 2016 and Lebanon and Syria by Hamade *et al.* 2014[32,37]. However, the former proved average EBF intention among young Nigerian females. A Malaysian study by Abdul Hamid and Yahya, 2018 among unmarried college girl students found low EBF attitude with no significant association with intention, despite revealing high EBF intention[17]. However, BF attitude significantly predicts 22% of the variance in the intention. This explained that not all the time, the positive attitude reflects good intention as there are many interweaving socio-cultural factors such as the role played by others in the growing female life SN, which proved to be high in the present study, and positively correlated with the PBC. This explains the need for exploring the variance in EBF intention and future behavior based on an evidence-based theory such as the TPB.

The present study is the pioneer in Saudi Arabia that predicts EBF intention and behavior through the TPB using the SEM that helps show the theoretical constructs' direct and indirect effect pathways. It confirmed the predictive ability of the TPB in predicting the EBF intention and perceived behavior. The constructs of the TPB explained 49.5% of the variance in EBF intention and 70.0% of the variance in EBF behavior among the studied female university students. EBF attitude, SN, and PBC were direct and positive predictors of EBF intention. The attitude was the strongest predictor of the EBF intention 61.0%, followed by PBC 15.0% and SN 12.0%. Both PBC and intention were the direct positive predictors of the EBF behavior. The PBC predicted 23.0% of the EBF behavior while the EBF intention predicted 21.0% among the studied females. This explains the essential role of the cultural context in shaping the growing females' beliefs about EBF, which further determines the level of PBC to overcome the associated barriers to the practice of EBF. Besides, the role of social pressure and approval of EBF behavior by significant others such as mothers,

peers, and relatives in shaping the EBF intention is a direct positive predictor of the decision to practice EBF among future mothers. Many studies confirmed the predictive ability of the TPB but with variation in its predictive power based mainly on the cultural context or the participants' background characteristics. Obliviously the SEM was not conducted to predict EBF intention and behavior among single and nonmothers women. Despite the wide application of the theory among mothers, the use of SEM is deficient. An Iranian study by Bajoulvand *et al.,* 2020 proved acceptable fitness indices of the SEM in predicting EBF intention and behavior among pregnant women[23]. The study proved that the constructs of the TPB explained 50% of the variance in the EBF intention, which is nearly identical to the current study 49.5%. It also showed that PBC and intention predict 79% of the variance in EBF behavior, which is higher than the present study. This may be related to the difference in the sample criteria as this study was conducted on mothers compared to single or nonmothers women in the present study. Jamei *et al.,* 2017 proved a lower figure where SN, PBC, and EBF intention predicted 13.8% of the variance in the Iranian mothers' BF behavior[45]. A Malaysian study by Tengku Ismail *et al.,* 2016 concluded a good predictive ability of the TPB in explaining EBF intention and behavior among women[47]. It showed a comparable figure to the present study, where TPB accounted for 51.0% of the variance in BF intention with a low variance concerning BF behavior 10.0%. It also elaborated that the PBC and attitude were the significant predictors of BF intention, which might be modified to boost the intention for BF. Consistent findings were confirmed by Rafizadeh *et al.* 2019, who proved good fitness of the SEM indices for predicting EBF intention and behavior where the BF attitudes had the highest effect on BF intention, followed by the self-efficacy and perceived social support[48]. It also showed a positive correlation between BF intention and behavior among Iranian women. An Omani study by Al-Barwani 2017 supported the TPB use in explaining BF intention among mothers[49]. It proved that all the TPB constructs were significantly and positively associated with BF intention that strongly predicted BF behavior. It added that the strongest predictor of BF intention was the SN 7% compared to 12% in the current study. This revealed that perceiving

approval and support from the key persons in women's life creates a stronger intention to BF. A meta-analytic study by Guo et al., 2016 used the SEM and proved that all the TPB constructs were significant predictors of BF intention, which was the strongest predictor of BF behavior[50]. The present study proved that PBC 23% was slightly higher than intention 21% in predicting EBF behavior which may be related to the lower age group of the studied females who were mainly single or had no children. Thus, lacked previous experience with pregnancy and lactation. The high level of the SN among two-thirds of them explained the influencing role of others on the growing female's intention and future decisions.

Conversely, a recent longitudinal study by Esquerra-Zwiers *et al.,* 2022 revealed an unfit structural model of the TPB to predict EBF with poor fit statistics[51]. The authors attributed this to the use of outdated tools that may dearth the cultural relevance or a change in the social norms or the potential interference of the social media in the digital era. Such null findings in comparison with the present study, away from the cultural difference as this study were done in the USA; a great reason may be the variation in the sample criteria. This contradictory study used a very small sample size of 100 pregnant women compared to the large sample size in the current study, who were single or nonmothers women.

Regarding the role of previous BF exposure and knowledge, the current study proved that around two-thirds of the studied female students had moderate BF exposure and knowledge. The latter predicted 23.7% of BF intention and 20.7% of the perceived behavior, while BF exposure predicted 15.8% of EBF intention and 14.0% of the perceived behavior. Both are insignificantly correlated with PBC whenever knowledge positively correlates with SN, whereas previous BF exposure was not. The participants' age was an insignificant predictor of BF intention and behavior. It was positively correlated with all the studied variables and negatively correlated with SN and PBC. This can be attributed to the homogeneity of the studied sample age 20 to 25 years, where this young age can be open to the influence of significant others or social pressure to use formula feeding than EBF, which is prevalent in Saudi Arabia, as evidenced by moderate PBC among most of them and high

SN[10,13]. Consistent findings were proved by a recent Saudi study by Khresheh 2020[15]. It showed that most of the studied university girls had good EBF knowledge and a positive attitude, whereas they had several misconceptions aligned with the current study. These are mainly related to restriction or concentration on specific foods during BF and a painful procedure. It proved that BF knowledge has a significant relationship with attitude, exposure, and EBF intention and between attitudes and intention. It also confirmed that EBF knowledge and attitude were independent positive predictors of EBF intention. An Omani study by Al-Barwani 2017 proved that women with higher BF knowledge had a significantly higher positive attitude, SN, and PBC and significantly lower negative attitude[49]. Two earlier studies by Leshi *et al*. 2016 in Nigeria and Hamade *et al*. 2014 in Lebanon and Syrian revealed that young female students had an average BF knowledge which was significantly associated with their BF attitude and intention[32,37]. They explored knowledge gaps with negative perceptions linked to BF in public and among working women. This put such a group as a priority for education intervention for awareness-raising toward EBF.

In contrast, Abdul Hamid and Yahya 2018 proved a low level of BF knowledge with high exposure among the single Malaysian college female students. This may be due to the socio-cultural differences with non-Arabic countries. However, this conflicting study proved a significant association between BF knowledge and attitude and prior BF exposure, which is further associated with EBF intention[17].

Conclusion

The current study concluded that the TPB effectively predicted the EBF intention and perceived behavior. All the TPB constructs Attitude, SN, PBC were significant positive and direct predictors of the EBF intention. Both intention and PBC were significant positive and direct predictors of the perceived EBF behavior. Moreover, the highest percent of the studied female students had moderate BF exposure and knowledge, positive attitude, high SN, moderate PBC, high BF intention, and positive perceived behavior. Moreover, the higher the previous BF exposure and knowledge, the higher the EBF intention and perceived behavior among the studied female university students.

Recommendations

Based on the current study findings, it is recommended to:
Designing mass media and social media campaigns to promote public awareness about EBF and promote a positive attitude as an influencing power for the growing females.
Developing and implementing targeted BF educational intervention for the female university students to prepare them for their future mother's role with sufficient and accurate knowledge about the EBF to foster their intention for initiation and sustenance of EBF.
Develop BF-related curricula even in non-health colleges.
Establish BF hotlines to support the mothers during BF duration and manage arising problems to decrease the discontinuation rate as a prevalent problem in Saudi Arabia.

Strengths and limitation

To our knowledge, this study is the first one in Saudi Arabia that employed the SEM as a framework to address the EBF intention and behavior in female university students, which allows analyzing the causal pathways for explaining the findings. Besides, using a representative higher sample size. The limitation may be the homogeneity of the studied females' age group, which limits the variation of data, or the use of online surveys that limit the responses.

Conflict of interest

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Author contributions

Sayed contributed to the conceptualization and design of the study, the analysis and interpretation of data, and the development of the article's first draft. *Bugis* contributed to the study data collection and critical revision of the article's first draft, with final approval of the version to be submitted. *Sayed and Bugis* developed the second draft of the article and revised it critically for important intellectual content with the final approval of the version to be submitted to the journal.

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