A Path Analysis to Identify Factors Influencing the Provision of Water in Addition to Breast Milk by Mothers of Infants under Six Months of Age in Conakry and Kindia Regions, Republic of Guinea

Nèmanan R. Ninamou[1,*], Jérémie B. Dupuis[2], Noël-Marie Zagré[3], Mamady Daffé[4] and Sonia Blaney[1]

[1]*École des Sciences des aliments, de nutrition et d'études familiales, Université de Moncton, Moncton, New Brunswick, Canada*

[2]*Faculté des Sciences de l'éducation, Université de Moncton, Moncton, New Brunswick, Canada*

[3]*UNICEF – Gabon, National Office, Libreville, Gabon*

[4]*Ministry of Health, Republic of Guinea*

Abstract: Water provision to infants under six months of age (IU6M) can hamper exclusive breastfeeding (EBF). Understanding factors and their relationships influencing this practice is needed to tailor EBF promotion programs. Using a validated questionnaire, this study aims to identify pathways in which individual factors and the environment interact to affect the provision of water in addition to breast milk among 300 mothers of IU6M. Our finding shows that 75% of mothers intended to provide water in addition to breast milk to their IU6M and that about 60% reported doing it. Results of the final path show that the subjective norm/SN ($\beta = 0.432$, $p < 0.001$), the attitude ($\beta = 0.349$, $p < 0.001$), and to a lesser extent the perceived control/PC ($\beta = 0.141$, $p = 0.005$) predict the intention of mothers to provide water in addition to breast milk to their IU6M. The environment scores predict the attitude ($\beta = 0.210$, $p = 0.001$) and the SN ($\beta = 0.284$, $p < 0.001$). Having the mother practicing early breastfeeding initiation at birth positively predicted the PC score ($\beta = 0.157$, $p = 0.017$) and predicted an increasing score of SN ($\beta = 0.221$, $p = 0.003$). Even though predicting the final behavior is complex, this research provides directions to nutrition education programs to tailor their content to the context and be more efficient in reducing the proportion of women providing water to their IU6M, hence contributing to the improvement of EBF.

Keywords: Breastfeeding, water, psychosocial and environmental factors, infants, theory of planned behavior, path analysis.

INTRODUCTION

Breastfeeding is a cost-effective, proven public health intervention with significant positive impacts on child morbidity and mortality while also providing health benefits to mothers. It is estimated that widespread breastfeeding would prevent worldwide 823,000 deaths per year, or 13.8% of deaths of infants under 24 months in 75 countries, in addition to averting 20,000 maternal deaths annually [1].

Despite progress in recent years, only 42% of children under six months are exclusively breastfed globally [2]. In the West and Central Africa region, the rate is lower at 32% [2]. One practice that undermines exclusive breastfeeding is the provision of water to babies aged below six months. In the Republic of Guinea, 35% of children under six months are provided water in addition to breast milk, a practice that may be detrimental to their nutritional and health status and development [3].

*Address correspondence to this author at the École des Sciences des aliments, de nutrition et d'études familiales, 51 Avenue Antonine-Maillet, Université de Moncton, Moncton, Nouveau-Brunswick, E1A 3E9, Canada; Tel: +1 438-992-2551; E-mail: enn9139@umoncton.ca

Individual and environmental factors determine the mother's decision to provide water to their baby under six months, hence not exclusively breastfeeding [4, 5]. To address the provision of water to infants under the age of 6 months, it is essential to understand the underlying factors of this practice for effective behavior change interventions [6]. As such, behavioral theories are of valuable use to investigate which factors, either individual or environmental-related, determine the provision of water [7].

The theory of planned behavior (TPB) has been used to understand what predicts or explains breastfeeding-related behaviors [8]. According to the TPB, the attitude, the subjective norm, and the perceived control over a behavior are key determinants of behavior [9]. Research using the TPB has shown a positive association between the attitude and the intention to breastfeed [10-20]. Regarding the perception of the subjective norm, results are mixed as some studies have shown a positive relationship to breastfeeding [12,14,16,20] while others do not [11,15,21]. Some studies have revealed that perceived behavioral control has a significant positive effect on

E-ISSN: 1929-4247/21

exclusively breastfeeding intention [14-16,18,20,22]. Environment-related factors such as the existence of community-based interventions (e.g., provision of group counseling or education) and work conditions (e.g., access to maternity leave and pay breaks) also appear to be conducive to exclusive breastfeeding [4].

To our knowledge, there is no comprehensive study that has investigated at the same time individual and environmental factors underlying the provision of water in addition to breast milk among infants under six months of age, neither the interrelationships between these factors. Therefore, using an extended version of the theory of planned behavior [23], this study aims to identify pathways by which individual factors (attitude, subjective norm, and behavioral control) and the environment interact to affect the provision of water to infants under six months of age in addition to breast milk. This research will help define an intervention, implement it and assess its impact on the exclusive breastfeeding (EBF) rate among this population.

MATERIALS AND METHODS

Study Area

This study was conducted in Conakry and Kindia regions in the Republic of Guinea. Both regions contain 30% of Guinea's total population and encompass the bulk of urban households [24].

The Republic of Guinea is located on the Atlantic coast of the West Africa region, with about 13 million inhabitants [25]. With a human development index of 0.477, the country is in the "low human development" category [26]. The overall literacy rate is 32%, standing at 44% among men and 22% among women. The gross domestic product per capita was estimated at 962.84 US$ in 2019 [27].

In the Republic of Guinea, the mortality rate among children under five years has declined from 177/1,000 live births in 1999 [28] to 111/1,000 live births in 2018 [3]. During the same period, neonatal mortality decreased from 48/1,000 to 32/1,000 live births. The EBF rate increased from 11% in 1999 to 33% in 2018. No regional data are available on EBF practice.

This study is part of larger research investigating psychosocial and environmental factors associated with the provision of water in addition to breast milk by mothers to infants under six months of age; subsequently, to define, implement and assess an intervention to reduce the proportion of mothers implementing this practice.

Design and Sampling

This research has a quasi-experimental design. The sample size was determined to enable the detection of a ten-percentage point difference between proportions of mothers in the control and intervention groups who give water in addition to breast milk following the implementation of the intervention assuming an 80% power and 5% significance level and a 10% dropout rate [29]. The most recent data indicate that 34.5% of mothers give water to their children under six months of age [3]. The sample included 300 mothers of infants under six months of age, with 150 spread out in each study's arm, namely the control and the intervention group.

All health centers with their population coverage were listed in each region, and four were randomly selected, with two per region. In each health center, all mothers of infants under six months of age were invited to participate.

To be included in this study, the mother has to be aged 20 years or older and having given birth, through normal vaginal delivery, to a unique child with a birth weight greater than 2.5 kg. Whether or not the child was exclusively breastfed was not a selection criterion. The study excluded mothers of infants under six months of age who had severe medical (e.g., mental health issues), obstetric complications (c-section), babies with severe medical conditions (e.g., HIV/AIDS), or congenital malformations, and mothers aged below 20 years. Each mother's maternal and child health card was examined to check if the inclusion criteria were met.

Preparatory Work

As described previously [30], eight local enumerators were recruited and trained on the study methodology. The theoretical training was complemented by in-class and field practical exercises. During the training, questionnaires were translated into the three main local languages (Soussou, Maninka, and Pular) spoken in both regions and tested among a group of women to ensure its clarity.

Theoretical Framework

The extended model of the theory of planned behavior/TPB [23,31,32] was used to guide this

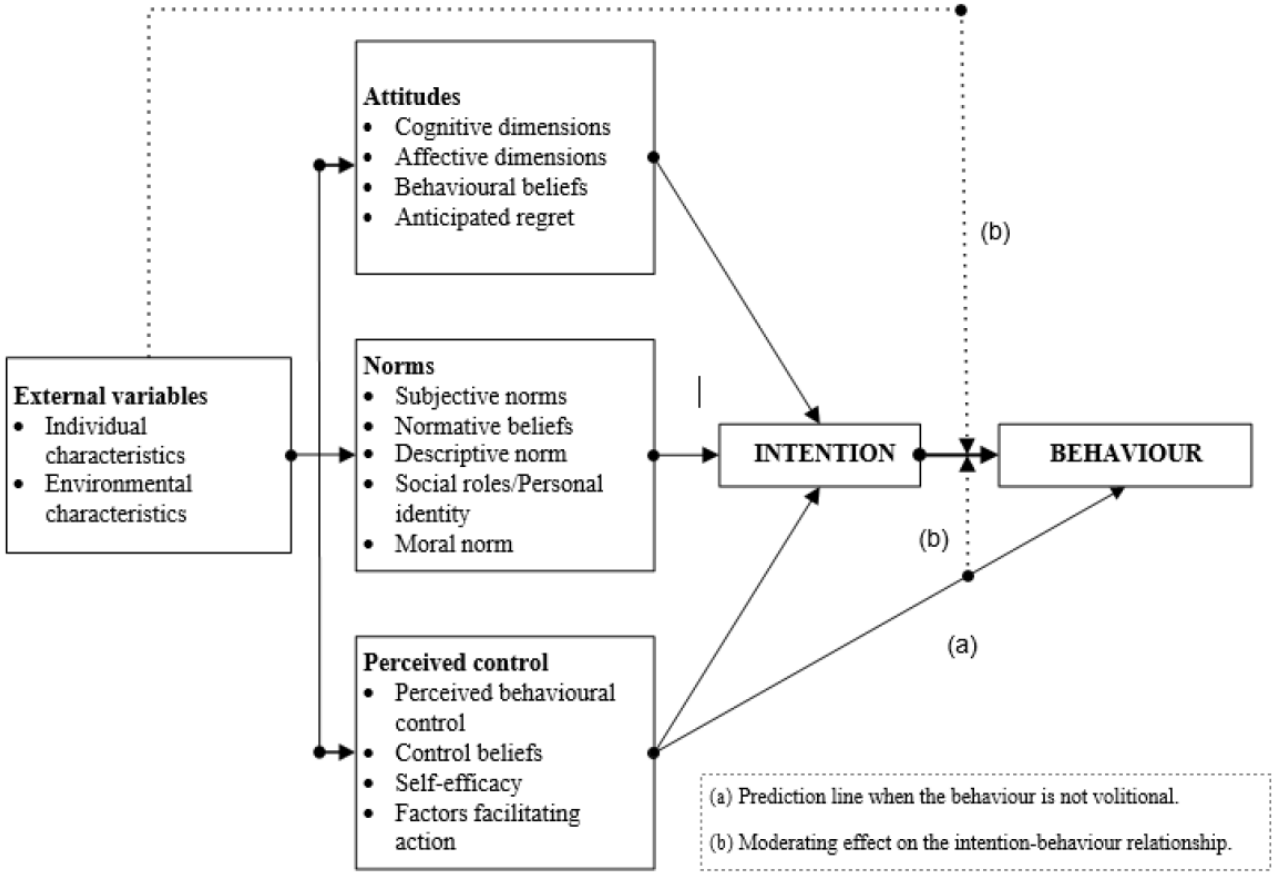

Figure 1: Extended theory of planned behavior (eTPB).

research (Figure **1**). According to the TPB, the intention of an individual is the main predictor of behavior. Based on the TPB, in our setting, the mother's intention to provide water in addition to breast milk would be determined by three constructs, a) her attitude toward the behavior, b) her perception of the subjective norm about the behavior, and c) her perceived control over the behavior [9]. In turn, the mother's beliefs ("behavioral belief") will determine the attitude about the behavior as well as the evaluation she makes about consequences ("evaluation of consequences") in adopting it or not [9]. The subjective norm is determined by the importance mother attaches to the opinion of people or groups of people around her ("normative beliefs") and by her "motivation to comply" with their opinion [9,33]. The perceived control is composed of the "control beliefs" and the "perceived behavioral control"; in other words, the mother's degree of control believes she can exercise over a given behavior.

Moreover, the perceived control might also directly predict the behavior [9,33]. Environmental factors are external social and physical characteristics that can influence the three constructs of the TPB (through moderation) as well as the transition from the intention to a concrete behavior [23]. They refer but are not limited to health centers, family, workplaces, community, maternity and paternity leave policies, childcare benefits and health insurance, socio-demographic characteristics.

Data Collection

The data collection was performed in December 2020. Data on EBF and the provision of water (the behavior under study) were collected using the infant and young child feeding module part of the Demographic and Health Survey questionnaires package used in the Republic of Guinea. Socio-demographic characteristics (household composition, namely age, gender and level of education of each member, housing characteristics, ownership of assets) were collected using an adapted version of the household questionnaire of the same package [3]. This data was collected through a face-to-face interview with the household head and/or the mother of each infant at home. The health card of each child was also checked to record their date of birth.

Data on each theoretical framework's construct was collected using a validated and reliable questionnaire [30], developed based on qualitative information collected through focus-group discussions. This questionnaire includes 58 items (including one item to measure the intention) spread out, as follows for each construct: attitude, 20; subjective norm, 11; perceived control, 12; environment-related factors, 14 items. The questionnaire was administered to each mother during a face-to-face interview conducted by enumerators at home. Beforehand, the enumerator explained to each participating mother how to express their answers on the questionnaire items on a Likert scale before reading each item and responses' options. Each mother was invited to indicate with her finger or mark each respective scale's selected answer with a pen for every item.

Data Analysis

Behavior Understudy

To assess if the child was provided water, the following questions of the infant and young child feeding module were used: a) if the child was breastfed yesterday (day or night), b) if plain water was offered to the child yesterday (day or night), and c) if any other liquid was offered to the child as it may indicate the provision of water under a different name/format such as bottle water. If the mother responded "yes" to the first question, "no" to question b, and "no" to question c, the mother was classified as not providing water to her baby and was assigned a score of zero. If the answer to the first question "a" was no or the answer to one of the questions "b" and "c" was a "yes", a score of one (1) was given.

The EBF status and whether the infant benefited from early initiation after birth were assessed using WHO guidelines [34].

Child, Mother, and Household Characteristics

Household, mother, and child socio-demographic data were entered directly into version 25.0 of IBM's SPSS. Descriptive analyses (chi-square tests) were performed to assess differences in proportions of mothers providing water to their infants between categories of the child, mother, and household characteristics.

A factor analysis using principal axis factoring was performed on the correlation matrix to define each household's socioeconomic score. Initially, 39 items on ownership of assets and housing conditions were used. Items for which the frequency of distribution indicated that at least 90% of households were having or not the items or benefited from a particular service were removed. The final score considered 20 items (animals and farming land, radio, television, refrigerator/freezer, gas stove, table and chairs, wardrobe, couch, clocks, shelves, air conditioner, cell phone, motorcycle, bicycle, bank account or participate to community funds called "tontine", van), which explains 20,94% of the factor's total variance and composition of the socioeconomic score. The Kaiser-Meyer-Olkin Test, which assesses the data's suitability for the factor analysis, was 0.775, which is satisfactory [35].

Measurement of Psychosocial and Environmental Constructs

For each item of the questionnaire and each mother, a numeric value ranging from -2 (e.g., strongly disagree/unlikely/disapprove) to +2 (e.g., strongly agree/likely/approve) was assigned to each response on the Likert scale [32]. Thereafter, frequency distributions were performed to check for data completeness and accuracy.

Also, in preparation for subsequent analysis, scores of worded items so that the option to answer "in agreement" with a statement that did not reflect a positive attitude towards the behavior were reversed. For instance, for the question to the mother on her intention to provide water to the child, which was formulated as follows:" I intend to give water to my child under six months in addition to breast milk," responses options ranged from less likely (score of -2) to very likely (+2). For such items, responses were reversed or, in other words, a negative score (-2) was assigned to "very likely" while a score of +2 was allocated to the "very unlikely" response option.

Two types of measures were used to assess the extended TPB psychosocial constructs: indirect and direct, usually strongly associated [36,37]. According to Montaño and Kasprzyk [37], both measures are interesting if one focuses on intervention messages. Indirect measures help understand what "drives behaviors", while direct constructs are usually more associated with the intention. Investigating the relationship between each item under each construct and the indirect measure is also recommended [36]. Consequently, indirect measures were computed for the attitude by multiplying each mother's score on a behavioral belief concerning an outcome by the corresponding outcome (Supplementary material) [36,37]. For example, the mean score on the item

"giving water help prevent constipation" (a behavioral belief concerning an outcome) and "for you, preventing your child from getting constipated" (the corresponding consequence of giving water) were multiplied. The same procedure was applied to other pairs of items used to assess the attitude construct (see Supplementary material) as well as to items of the subjective norm and the perceived control. After that, for each of the three constructs and each mother, the indirect measure was calculated by averaging all mean scores of paired items and individual items' raw scores. Besides, for each mother, direct measurements of each construct were calculated based on responses of items (attitude, the score of one unique item; subjective norm, mean of the score of two items; perceived control, mean score of three items). These direct measurements were differently worded from a semantic perspective. Instead, they asked the mother to rate behavior as useful / not useful, in agreement/disagreement, or as under her control of not [37]. For the environment construct, the mean score of all items was calculated for each mother.

Spearman correlations were performed to investigate bivariate relationships between a) categorical scores of individual items for each behavioral, normative and control beliefs and mean scores of indirect and direct measures for the attitude, the subjective norm and the perceived control constructs, b) mean scores of indirect and direct measures, c) categorical (only for the attitude given that there was only one item) or continuous scores (subjective norm and perceived control) of direct measures and the categorical (and reversed) score on the intention.

Path analyses with version 1.6 of MPlus 8 [38] were used to investigate pathways by which psychosocial and environmental factors influenced the provision of water in addition to breast milk among mothers at baseline. Figure **2** presents the hypothesized pathways with each external and environmental variable predicting the three directly measured constructs, as suggested by Godin [23]. Figure **3** shows the hypothesized pathways with external and environmental variables moderating the relationship between the intention and behavior as indicated by the same author.

The assessment of the final model fit was performed using the following indicators and criteria: a) chi-square statistic above 0.05, b) a root mean square error for approximation (RMSEA) < 0.08 with confidence intervals < 0.10, c) comparative fit index (CFI) and Tucker-Lewis index (TLI) > 0.90, and standardized root mean residual (SRMR) < 0.08.

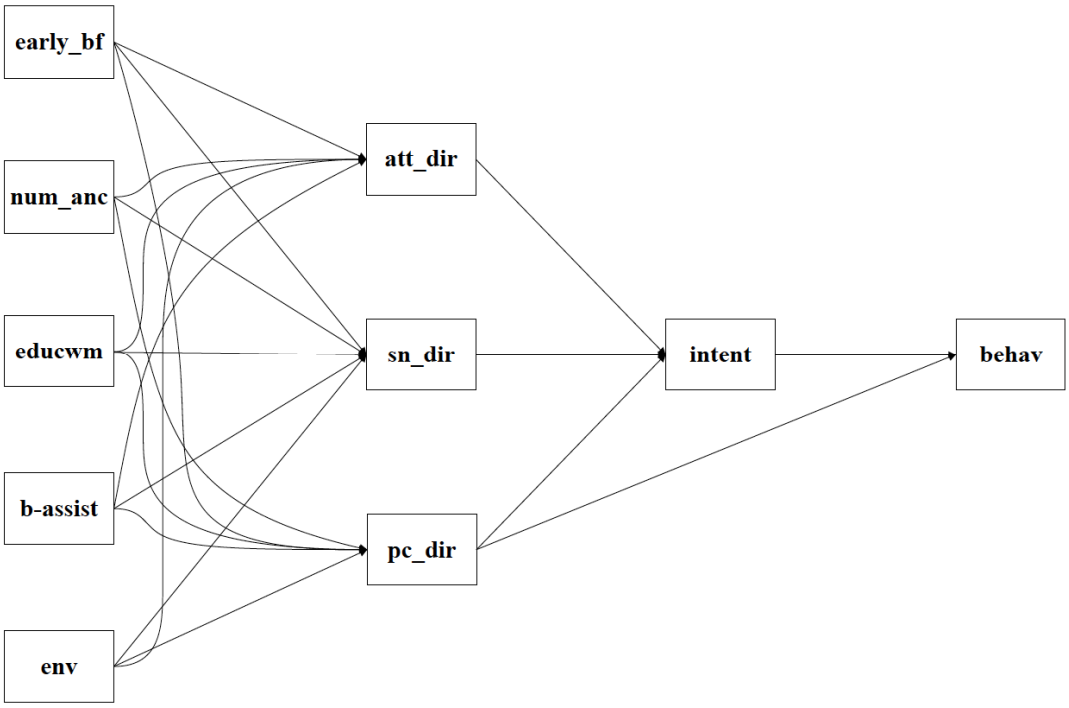

Figure 2: Hypothesized pathways between psychosocial (attitude: att_dir, subjective norm: sn_dir, perceived control: pc_dir) and environment (env) and socio-demographic (education of mothers: educwm, early initiation of breastfeeding: early_bf, number of antennal care visits: num_anc, birth assisted by a skilled birth attendant: b-assist) factors, the intention (intent) and the behavior (behave): model A.

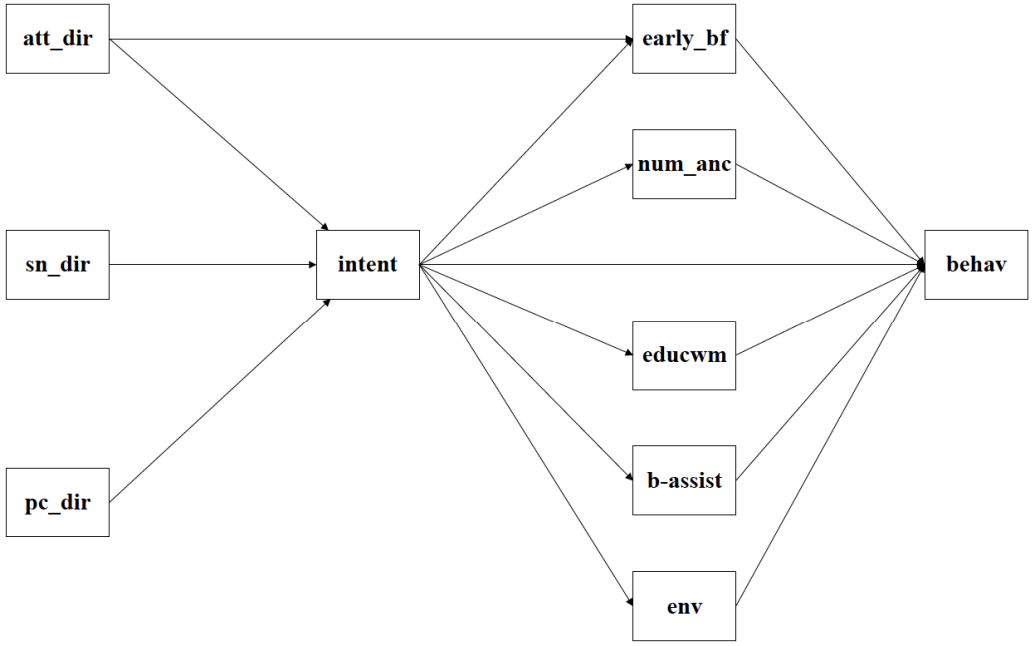

Figure 3: Hypothesized pathways between psychosocial (attitude: att_dir, subjective norm: sn_dir, perceived control: pc_dir) and environment (env) and socio-demographic (education of mothers: educwm, early initiation of breastfeeding: early_bf, number of antennal care visits: num_anc, birth assisted by a skilled birth attendant: b-assist) factors, the intention (intent) and the behavior (behav): model B.

Insignificant pathways were removed using the Wald method while adding pathways was done with the Lagrange Multiplier method [39]. Theoretical considerations of possible pathways were examined before making changes to the model. For the final model to be accepted, all postulated pathways had to be statistically significant ($p < 0.05$). Standardized regression coefficients were computed for all remaining pathways to the size of each statistically significant path's relation.

RESULTS

Populations' Characteristics and Descriptive Analysis

Tables **1** and **2** depict the socio-demographic characteristics of infants, mothers, households, and differences in proportions of mothers providing water to their children for each characteristic. Children's mean age was 1.83 months (standard deviation / SD = 1.03), while their mother's average age was 24.8 years (SD = 4.9). About 50% of mothers were housewives, were from the Soussou ethnic group, and had some primary school education. Almost 60% received at least 4 antenatal care (ANC) visits in their last pregnancy. The majority (68%) gave birth in a public health facility and were assisted by a skilled birth attendant. More than half of the mothers (57%) reported giving their children water in addition to breast milk (result not shown). Among women who practiced early initiation of breastfeeding and those who attended at least 4 ANC visits, the proportions of mothers giving water to their children were lower than women who did not initiate breastfeeding within the hour after birth ($p = 0.022$). The same findings were found for those whom a skilled birth attendant assisted at delivery. Moreover, the proportion of mothers giving water to their infants was higher among those who did not attend at least 4 ANC visits ($p < 0.001$, Table **1**).

Tables **3a** and **3b** report frequency distributions on five-response scales and mean scores for each item of the questionnaire and mean scores for indirect and direct constructs. Overall, about 75% of mothers intended to provide water in addition to breast milk to their babies. The mean score on the intention was 0.86 out of a maximum of 2. Over 70% of mothers agree that implementing the behavior is necessary because water is the drink for the child or will avoid fatigue due to thirst or the throat becoming dry. The same proportion also believes that providing water in addition to breast milk will not cause abdominal pain. Over 80% of mothers consider it as important/very important to give water to prevent the child from being thirsty, having a fever, losing weight, or having abdominal pain and getting constipated. Around 70% of mothers considered giving water in addition to breast milk to their children as useful/very useful. Mean scores for the

Table 1: Socio-Demographic Characteristics of Infants and Mothers (N = 300)

Characteristic	N	%	Mean + SD	Women who give water	*p*-value*
Infants characteristics N=300					
Age (days)			1.83 ± 1.03		
Sex					
Male	146	48.7		55.5	0.922
Female	154	51.3		57.8	
Early initiation of breastfeeding (< 1 h)					
Yes	155	51.7		48.4	0.022
No	145	48.3		67.2	
Birth weight (kg)			3.20 ± 0.48		
2.5-2.9	156	52.0		51.9	0.244
≥ 3	112	37.3		59.8	
Not available	32	10.7		68.8	
Mothers' characteristics					
Age groups (years)			24.8 ± 4.9		
20-24	157	52.3		58.0	0.720
25-29	86	28.7		52.3	
30-34	41	13.7		65.9	
35-39	12	4.0		41.7	
≥ 40	4	1.3		50.0	
Occupation					
Housewife	140	46.7		58.6	0.007
Employee/private	80	26.7		57.5	
Merchant	38	12.7		63.2	
Unemployed	11	3.7		36.4	
Student	31	10.3		45.2	
Education level					
No formal education	99	33.0		66.7	0.032
Primary (incomplete/complete)	89	29.7		65.2	
High school (incomplete/complete)	88	29.3		44.3	
University	24	8.0		54.2	
Religion					
Muslim	273	91.0		57.1	0.629
Christian	25	8.3		48.0	
Animist	2	0.7		100	
Ethnic group					
Soussou	149	49.7		65.8	0.078
Poular	49	16.3		49.0	
Malinka	56	18.7		39.3	
Kissi	9	3.0		22.2	
Toma	11	3.7		54.5	
Guèrzé	14	4.7		71.4	
Others	12	4.0		81.8	

(Table 1). Continued.

Characteristic	N	%	Mean + SD	Women who give water	*p*-value*
Number of antenatal care (ANC) visits			3.6 ± 1.2		
1 - 3 ANCs	120	40.0		66.7	< 0.001
≥ 4 ANCs	170	56.7		50.0	
Don't know	10	3.3		50.0	
Place of birth					
Public health facility	204	68.0		55.9	0.177
Private health facility	70	23.3		58.6	
Others	26	8.7		57.7	
Birth assisted by a skilled birth attendant					
Yes	291	97.0		56.7	< 0.001
No	9	3.0		55.6	

*Indicate significant difference ($p<0.05$) between proportions of mothers who gave water to their child for each socio-demographic characteristic.

Table 2: Socio-Demographic Characteristics of Husbands/Partners and Households (N = 300)

Characteristic	N	%	Mean + SD	Women who give water	*p*-value*
Husband/partner characteristics					
Age groups (years)			35.6 ± 8.3		
20-24	22	7.3		63.6	0.103
25-29	42	14.0		61.9	
30-34	74	24.7		50.0	
35-39	61	20.3		47.5	
≥ 40	101	33.7		63.4	
Education level					
No formal education	105	35.0		52.4	0.780
Primary (incomplete/complete)	35	11.7		60.0	
High school (incomplete/complete)	81	27.0		59.3	
University (incomplete/complete)	79	26.3		58.2	
Religion					
Muslim	271	90.3		56.8	0.877
Christian	29	9.7		55.2	
Ethnic group					
Soussou	127	42.3		66.9	0.022
Poular	69	23.0		44.9	
Malinka	59	19.7		40.7	
Kissi	11	3.7		54.5	
Toma	3	1.0		0.0	
Guèrzé	16	5.3		75.0	
Others	15	5.0		78.6	

(Table 2). Continued.

Characteristic	N	%	Mean + SD	Women who give water	*p*-value*
Households' characteristics					
Number of household members			5.0 ± 2.0		
3	80	26.7		46.3	0.790
4	58	19.3		51.7	
5	66	22.0		60.6	
≥ 6	96	32.0		62.1	
Number of under-5 children			1.5 ± 0.7		
1	181	60.3		51.9	0.314
2	90	30.0		62.2	
≥ 3	29	9.7		74.1	
Socioeconomic quintile					
Quintile 1			-0.9 ± 0.2	61.7	0.485
Quintile 2			-0.6 ± 0.1	56.7	
Quintile 3			-0.3 ± 0.1	63.3	
Quintile 4			0.3 ± 0.2	55.0	
Quintile 5			1.6 ± 0.6	48.0	

†Indicate significant difference (p<0.05) between proportions of mothers who gave water to their child for each socio-demographic characteristic.

Table 3a: Frequency Distributions (%) of Responses and Mean Score (± Standard Deviation /SD) for each item of the Questionnaire, Direct (DM) and Indirect Measurements (IM) of each Construct (N = 300)

Construct, items number, and description	Scores and choices of responses					Mean	SD
	-2	-1	0	1	2		
Intention	Very unlikely	Unlikely	+/- Likely	Likely	Very likely		
I intend to give water to my child under six months of age (IU6M) in addition to breast milk.	12.0	11.0	1.0	31.3	44.7	0.86	1.40
Attitude (ATT)							
Behavioral beliefs	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree		
Giving water to IU6M in addition to breast milk (BM) is good for their growth.	12.0	15.3	9.7	42.3	20.7	0.44	1.30
Giving water to the IU6M … is necessary because milk is the food, and water is the drink.	5.7	20.3	3.3	40.0	30.7	0.70	1.26
Giving water to my IU6M … helps prevent constipation…	6.7	22.3	11.7	38.0	21.3	0.45	1.25
Children U6M should be given water … when there is little or no milk production	11.3	25.3	5.3	38.3	19.7	0.30	1.34
Children U6M should be given water … to avoid fatigue due to thirst.	9.7	15.0	2.3	46.7	26.3	0.65	1.28
Children U6M must be given water … to breast milk, or their throats will become dry.	10.0	15.3	0.7	37.0	37.0	0.76	1.36
Milk of certain colors causes tingling of the tongue/diarrhea, so it is necessary to give water…	10.3	21.3	21.3	34.7	12.3	0.17	1.20
Giving water to my IU6M, …, allows him to get used to water	11.0	22.3	10.0	41.7	15.0	0.27	1.27
Giving my IU6M water … will not cause abdominal pain.	11.3	58.7	11.0	12.7	6.3	-0.56	1.05

(Table 3a). Continued.

Construct, items number, and description	Scores and choices of responses					Mean	SD
	-2	-1	0	1	2		
Giving my IU6M water … will help prevent constipation.	5.0	34.3	8.3	39.0	13.3	0.21	1.19
Children U6M should be given water when given medication.	4.3	35.7	3.7	47.3	9.0	0.21	1.15
Evaluation of consequences	Not very important	Not important	+/-important	Important	Very important		
For you, preventing your IU6M from becoming thirsty is…	4.7	10.7	4.3	29	51.3	1.12	1.18
For you, preventing your IU6M from having a fever is…	2.7	6.0	4.3	37.7	49.3	1.25	0.98
For you, preventing your IU6M from losing weight is…	2.0	5.7	4.7	44.7	43.0	1.21	0.92
For you, preventing your IU6M from having abdominal pain … is…	2.0	5.7	2.3	35.0	55.0	1.35	0.93
For you, preventing your IU6M from making gurgling noises is…	1.7	6.0	1.7	49.3	41.3	1.23	0.88
For you, preventing your IU6M from getting tingling tongue/diarrhea … is…	6.0	20.3	5.7	44.0	24.0	0.60	1.22
For you, preventing your IU6M from reacting abnormally to the introduction of water is…	1.7	19.7	3.7	50.3	24.7	0.77	1.08
For you, preventing your IU6M from getting constipated is…	1.3	6.7	4.3	58.0	29.7	1.08	0.85
Indirect measure*						0.51	0.98
	Very useless	*Useless*	*+/- Useful*	*Useful*	*Very useful*		
For me, giving water to my IU6M in addition to breast milk would be	*7.7*	*17.0*	*3.7*	*36.7*	*35*	*0.74*	*1.30*
Direct measure						*0.74*	*1.30*
Subjective norms							
Normative beliefs	Strongly disapprove	Disapprove	+/- approve	Approve	Strongly approve		
Your Mother-in-law	6.3	11.0	31.3	15.7	35.7	0.63	1.25
Your spouse's grandmother	7.0	9.0	49.7	14.0	20.3	0.32	1.11
Your grandmother	8.0	3.7	42.7	20.3	25.3	0.51	1.15
Your mother	8.3	10.3	28.3	16.3	36.7	0.63	1.30
Motivation to comply	Very unlikely	Unlikely	+/- Likely	Likely	Very likely		
Your Spouse/Partner	25.7	20.0	16.0	27.3	11.0	-0.22	1.38
Your Mother-in-law	15.7	24.0	31.3	17.7	11.3	-0.15	1.22
Your spouse's grandmother	11.7	18.3	49.3	12.7	8.0	-0.13	1.04
Your grandmother	12.3	17.0	44.7	17.0	9.0	-0.07	1.09
Your mother	14.0	25.7	23.0	21.7	15.7	-0.01	1.29
Indirect measure						0.41	1.13
	Strongly disagree	*Disagree*	*+/- Disagree*	*Agree*	*Strongly agree*		
The most influential people … think I should give water to my IU6M…	*18.3*	*13.0*	*8.0*	*23.0*	*37.7*	*0.49*	*1.54*
If I give my IU6M water in addition to breast milk, most of the most influential people in my family will …	*16.7*	*5.3*	*13.7*	*21.0*	*43.3*	*0.69*	*1.48*
Direct measure						*0.59*	*1.47*

*As stated in the core text, indirect measures are a combination of scores of paired and individual items.

Table 3b: Frequency Distributions (%) of Responses and Mean Score (± Standard Deviation /SD) for each Item of the Questionnaire and for Direct and Indirect Measurements of each Construct (N = 300)

Construct, items number, and description	Scores and choices of responses					Mean	SD
	-2	-1	0	1	2		
Perceived control	Very unlikely	Unlikely	+/- Likely	Likely	Very likely		
Control beliefs I feel able not to provide water ...							
If I do not have the financial means to buy the water.	21.0	46.3	8.0	13.7	11.0	-0.53	1.27
If I do not return to work.	7.0	66.0	5.3	11.3	10.3	-0.48	1.11
If I do not leave him/her with someone at home.	9.3	61.3	3.7	17.7	8.0	-0.46	1.13
If I do not give him/her a syrup or any other medication.	11.3	42.7	6.7	29.7	9.7	-0.16	1.24
If I do not give him/her breast milk substitutes	16.3	47.7	5.3	22.0	8.7	-0.41	1.25
Perceived behavioral control The following factors will prevent me from providing water...							
Being sensitized about the benefits of EBF.	3.3	21.7	5.7	41.0	28.3	0.69	1.19
Always staying with my IU6M	4.7	43.3	5.7	24.3	22.0	0.16	1.31
Being able to ensure a good milk supply after childbirth.	5.0	43.7	4.7	27.3	19.3	0.12	1.29
The fact of having my mother … who takes care of my IU6M.	10.3	51.0	5.7	24.3	8.7	-0.30	1.20
Indirect measure						*0.01*	*0.73*
If I wanted to, I could easily decide not to give water to my IU6M	*7.3*	*25.3*	*9.3*	*38.0*	*20.0*	*0.38*	*1.26*
	Very difficult	*Difficult*	*+/-Difficult*	*Easy*	*Very easy*		
For me, not giving water to my IU6M … would be	*21.3*	*22.7*	*10.0*	*28.7*	*17.3*	*-0.02*	*1.44*
	Very uncontrollable	*Uncontrollable*	*+/- Uncontrollable*	*Controllable*	*Very controllable*		
How much control do you feel you have when you decide not to give water to your IU6M	*12.3*	*41.0*	*16.3*	*23.3*	*7.0*	*-0.28*	*1.16*
Direct measure						*0.03*	*1.08*
Environment	Very unlikely	Unlikely	+/-Likely	Likely	Very likely		
The following factors may stop me from providing water...							
Not having access to individual counseling sessions on EBF during antenatal care visits.	19.0	44.7	5.3	24.7	6.3	-0.45	1.23
Not having access to group education sessions on EBF during antenatal care visits.	20.7	42.7	6.0	23.0	7.7	-0.46	1.26
Not having access to individual counseling sessions on EBF during immunization.	21.0	41.3	7.0	21.3	9.3	-0.43	1.29
Not having access to group education sessions on EBF during immunization.	21.0	40.7	7.3	22.7	8.3	-0.43	1.27
Not having given birth in a health facility.	17.3	43.7	14.0	18.7	6.3	-0.47	1.16
Not to be assisted by qualified personnel to give birth.	20.7	42.7	12.7	18.7	5.3	-0.55	1.17
Not having received support at birth in the hospital/health center to initiate EBF.	21.3	45.7	7.3	22.0	3.7	-0.59	1.16
Not being able to bring my IU6M to my workplace … spend the day with him/her	10.7	51.3	8.7	23.0	6.3	-0.37	1.14

(Table 3b). Continued.

Construct, items number, and description	Scores and choices of responses					Mean	SD
	-2	-1	0	1	2		
The following factors may facilitate me to provide water...							
Having my child exposed to the sun at my workplace or activity.	3.0	21.3	4.3	22.7	48.7	0.93	1.29
Having received BMS donation at the health facility	4.0	45.7	11.0	26.7	12.7	-0.02	1.18
Having been exposed to BMS advertising.	6.3	43.0	12.7	24.7	13.3	-0.04	1.21
Receiving information that encouraged me to give my child water…	5.7	24.7	6.7	45.3	17.7	0.45	1.20
Having a place nearby to get good quality water.	16.7	37.7	10.7	21.7	13.3	-0.23	1.32
Having the financial means to buy good quality water.	18.7	42.0	6.0	23.0	10.3	-0.36	1.30
Environment						-0.32	0.68

indirect and direct measurements of the attitude construct were respectively 0.51 and 0.74.

About 40% of mothers believe that their mother-in-law, the grandmother of the spouse, their grandmother, and their mother will approve/strongly approve if they give water in addition to breast milk to their babies. About a third of the mothers were motivated to comply or adhere to these persons' perceived opinions. Moreover, around 60% of mothers agree/strongly agree that the most influential people in their surroundings think that water should be given to their children. Mean scores of the indirect and direct measurements of the subjective norm construct were 0.49 and 0.59, respectively.

Regarding the construct on the perceived control, it was unlikely/very unlikely for 7 out of 10 mothers to not provide water if they do not have financial means, do not return to work, or do not leave their baby with someone else. For five and six out of 10, respectively, it was also unlikely/very unlikely that they would not provide water if they did not have to give medication or breast milk substitutes. For about 60% of them, it was likely/very likely that, if they wanted to, they could easily not provide water to their child in addition to breast milk. However, around 45% perceived it as difficult/very difficult to not giving water to their baby. The mean scores for the indirect and direct constructs on the perceived control were both around 0.

Environment-related items that may stop or facilitate mothers to provide water in addition to breast milk to their children are listed in Table **2**. For more than 60%, it was unlikely/very unlikely that not having access to individual counseling or education group would stop them from providing water. The same findings were observed regarding giving birth in a health facility, being assisted by a skilled birth attendant at delivery, or receiving support to initiate breastfeeding after birth. On the other hand, more than 50% reported that it was likely/very likely that having the child exposed under the sun at the workplace or elsewhere may facilitate the provision of water. About 40% responded that it was likely/very likely that having received breast milk substitutes donation or being exposed to their advertising may facilitate the provision of water. For about 3 out of 10 mothers, it was likely/very likely that having a place to get water of good quality and financial means to buy it may facilitate the provision of water in addition to breast milk. The mean score of the environment construct was -0.34.

Tables **4** to **6** show correlation results between items and indirect measurement as well as between indirect and direct measures for each psychosocial construct of the TPB. For the attitude, all individual items related to behavioral beliefs were correlated ($p < 0.01$) to the indirect measurement of the construct and to a lesser extent to its direct measurements, too (Table **4**). For the subjective norm beliefs, all individual items were correlated to the construct's direct measurement; except for one item, none was associated with the indirect measurement (Table **5**). As for the perceived control, all items assessing control beliefs were associated with the indirect measurement and, to a lesser extent, with the direct measure of the perceived control construct except one item (Table **6**). For each construct, indirect and direct measurements were correlated ($p < 0.01$). Besides, except for the indirect measurement of the perceived control, all constructs of the extended TPB, either direct

Table 4: Correlations between Individual Items on Behavioral Beliefs, Direct (DM) and Indirect Measurements (IM): Attitude (N = 300)†

Items	1	2	3	4	5	6	7	8	9	10	11	DM	IM
1	1.000												
2	0.698**	1.000											
3	0.743**	0.708**	1.000										
4	0.615**	0.554**	0.629**	1.000									
5	0.661**	0.722**	0.670**	0.596**	1.000								
6	0.664**	0.712**	0.570**	0.497**	0.799**	1.000							
7	0.550**	0.494**	0.590**	0.592**	0.561**	0.473**	1.000						
8	0.548**	0.481**	0.598**	0.583**	0.513**	0.494**	0.685**	1.000					
9	0.301**	0.251**	0.278**	0.197**	0.209**	0.241**	0.185**	0.139*	1.000				
10	0.347**	0.384**	0.490**	0.334**	0.354**	0.294**	0.266**	0.358**	-0.028	1.000			
11	0.363**	0.356**	0.486**	0.353**	0.391**	0.293**	0.375**	0.407**	0.230**	0.411**	1.000		
DM	0.563**	0.625**	0.575**	0.509**	0.626**	0.667**	0.404**	0.442**	0.285**	0.304**	0.260**	1.000	
IM	0.731**	0.684**	0.751**	0.652**	0.661**	0.637**	0.683**	0.639**	0.395**	0.465**	0.507**	0.566**	1.000

**Significant at p < 0.01 level (2-tailed).
*Significant at p < 0.05 level (2-tailed).
†Please, refer to Table **3a** for the listing of behavioral beliefs.

Table 5: Correlations between Individual Items on Normative Beliefs, Direct (DM), and Indirect Measurements (IM): Subjective Norm (N = 300)†

Items	1	2	3	4	DM	IM
1	1.000					
2	0.662**	1.000				
3	0.528**	0.667**	1.000			
4	0.645**	0.590**	0.492**	1.000		
DM	0.611**	0.501**	0.398**	0.600**	1.000	
IM	0.033	0.073	-0.062	0.144*	0.273**	1.000

**Significant at p < 0.01 level (2-tailed).
*Significant at p < 0.05 level (2-tailed).
†Please, refer to Table **3a** for the listing of normative beliefs.

Table 6: Correlations between Individual Items on Control Beliefs, Direct (DM), and Indirect Measurements (IM): Perceived Control (N = 300)†

Items	1	2	3	4	5	DM	IM
1	1.000						
2	0.436**	1.000					
3	0.330**	0.648**	1.000				
4	0.187**	0.484**	0.587**	1.000			
5	0.462**	0.581**	0.636**	0.567**	1.000		
DM	0.029	0.245**	0.274**	0.309**	0.165**	1.000	
IM	0.517**	0.621**	0.655**	0.634**	0.772**	0.394**	1.000

**Significant at p < 0.01 level (2-tailed).
*Significant at p < 0.05 level (2-tailed).
†Please, refer to Table **3b** for the listing of control beliefs.

Table 7: Correlations between Indirect (IM), Direct Measurements (DM) for all Constructs (Attitude/ATT, Subjective Norm /SN, Perceived Control/PC and Environment/ENV) and the Intention/INT (N = 300)

Items	ATT, DM	ATT, IM	SN, DM	SN, IM	PC, DM	PC, IM	ENV	INT
ATT, DM	1.000							
ATT, IM	0.566**	1.000						
SN, DM	0.527**	0.625**	1.000					
SN, IM	0.133*	0.184**	0.273**	1.000				
PC, DM	0.351**	0.374**	0.266**	0.205**	1.000			
PC, IM	0.105	-0.062	0.064	0.050	0.394**	1.000		
ENV	0.389**	0.278**	0.278**	0.126*	0.045	0.118*	1.000	
INT	0.594**	0.535**	0.520**	0.132*	0.304**	0.101	0.357**	1.000

**The correlation is significant at the 0.01 level (2-tailed).
*The correlation is significant at the 0.05 level (2-tailed).

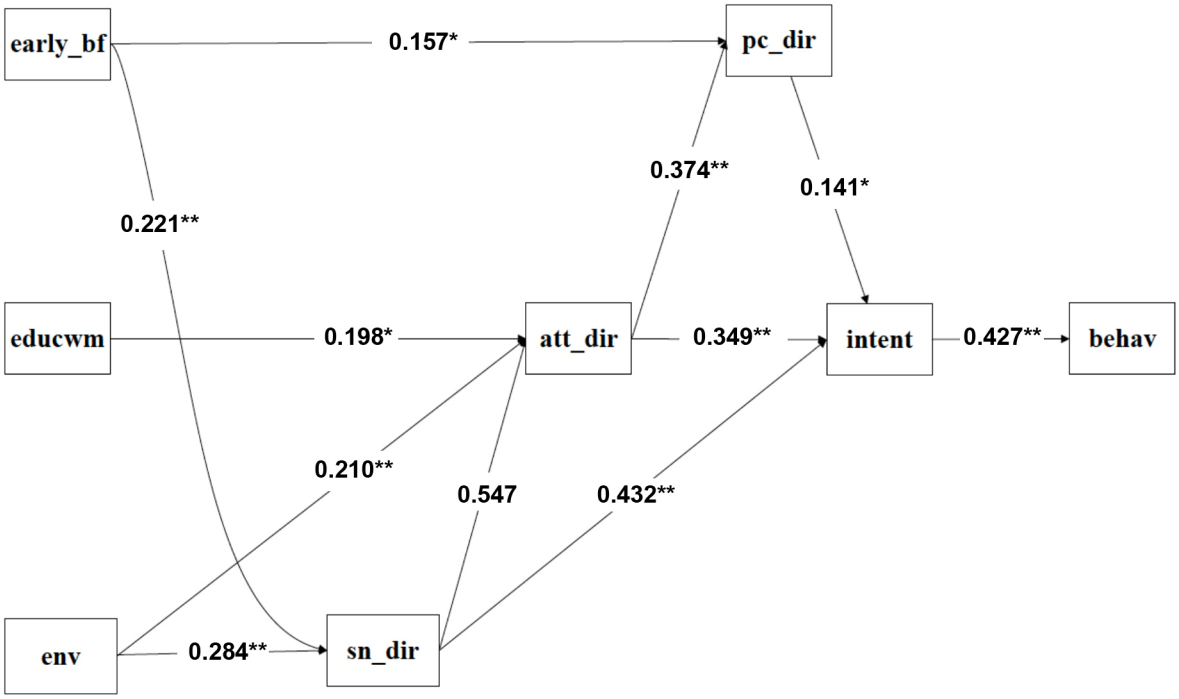

Figure 4: Final model of the hypothesized pathways between psychosocial (attitude: att_dir, subjective norm: sn_dir, perceived control: pc_dir) and environment (env) and factors socio-demographic (education of mothers: educwm, early initiation of breastfeeding: early_bf) factors, the intention (intent) and the behavior (behav), with standardized estimates for the structural equation model.

*p < 0.05 **p < 0.001.

or indirect, were correlated to the intention of providing water in addition to breast milk among mothers (Table **7**). Correlation coefficients between measurements of direct and indirect constructs and the intention were respectively significant at p < 0.001 and p < 0.05.

Final Path Models

The results of the path analysis, including the standardized regression coefficients, are presented in Figure **4**. Values of fit indices of the final model presented in Figure **4** are as follows: a) chi-square (10) = 22.58, p = 0.012, b) RMSEA at 0.07 with confidence intervals between 0.03 and 0.10, c) CFI = 0.97 and TLI = 0.94, and d) SRMR at 0.05. Results indicate that the subjective norm (β = 0.432, p < 0.001), the attitude (β = 0.349, p < 0.001), and to a lesser extent the perceived control (β = 0.141, p = 0.005) predict the intention of mothers to provide water in addition to breast milk to their infants under six months of age. The environment

scores also predict the attitude (β = 0.210, p = 0.001) and the subjective norm (β = 0.284, p < 0.001), but not on the perceived control. Having the mother practicing early breastfeeding initiation at birth positively predicted the perceived control score (β = 0.157, p = 0.017) and predicted a diminishing score of the subjective norm (β = 0.221, p = 0.003). The subjective norm predicted the attitude (β = 0.547, p < 0.001), while, in turn, the attitude could predict the perceived control score (β = 0.374, p < 0.001). As for the explained variance of each endogenous variable in the model, 13.2% of the subjective norm score was explained, 43.9% of the attitude score, 17.8% of the perceived control score, 59.2% of the intent score, and finally, 18.2% of the behavior.

DISCUSSION

This research used the extended theory of planned behavior to identify pathways in which individual factors (attitude, social norm, and perceived control) and the environment interact to influence the provision of water by mothers to their infants under six months of age in addition to breast milk.

Unfortunately, no regional data could be retrieved in the literature regarding the proportion of infants below six months of age receiving water in addition to breast milk. In our setting, findings indicated that most mothers (57%) reported giving water to their infants in addition to breast milk. This proportion is much higher than the national figure of 35% [3]. Moreover, the vast majority of mothers (about 75%) indicated that they intend to provide water in addition to breast milk to their babies. To our knowledge, no studies have investigated the mother's intention of providing water to their baby aged below six months in Africa. However, in India, Behera and Anil Kumar reported that 30% of pregnant women intended to exclusively breastfeed their baby without providing them with extra fluid or other foods [18]. To determine women's intention to practice EBF, the authors asked three questions. One of them was related to their intention to give water to their baby during EBF. Unfortunately, data on responses to this specific question were not presented in their paper.

Among our population, it seems that the intention was somewhat translated into actual behavior. In fact, the final path analysis model shows that the intention was associated with the behavior but that perceived control does not directly influence it. This result was expected as, according to the TPB, the intention is the strongest predictor of the behavior [9]. Although not explicitly related to the provision of water, our findings are consistent with previous studies that have assessed factors influencing EBF in different contexts and observed an association between the intention and the behavior [12,14-16,20,40]. Moreover, in a meta-analysis and structural equation modeling on the efficacy of the TPB in predicting breastfeeding, the path estimates between breastfeeding intention and the behavior were 0.45, a value similar to ours (0.426). Identical to our context, results from the meta-analysis mentioned above revealed that the perceived control was not a direct and significant predictor of breastfeeding [41].

The final analysis also shows that all the constructs (subjective norm, attitude, and perceived control) influence the mothers' intention to provide water in addition to breast milk to their infants under six months of age. However, the subjective norm and attitude appear to have a more significant influence. Moreover, the subjective norm influenced the attitude, which in turn also impacted the perceived control positively. Our results concur with Guo *et al*.'s [41] findings from high-income countries, which show that all three constructs were significant predictors of breastfeeding (any). The authors observed a strong, though a two-way relationship as opposed to one-way association in our context, between the attitude with the subjective norm, the perceived control and the subjective norm as well as between the attitude and the perceived control. This result is an interesting finding that may be attributed to different contexts, high- *vs*. low- and middle-income countries, which certainly deserve further research. In any case, perceiving the subjective norm as favorable to water provision in our areas could lead to a mothers' attitude favorable to providing water. In turn, a positive attitude may lead them to be perceived as more capable of doing it.

Our findings are similar to previous studies investigating the relationship between women/mothers' attitude and their intention to initiate, pursue or implement any breastfeeding [12,15,16,18,20-22,42]. In their meta-analysis, Guo *et al*. [41] found that attitude was the strongest predictor of mothers' breastfeeding intention. In our context, mothers' behavioral beliefs and the evaluation of consequences of not providing water contributed to a less favorable attitude regarding the behavior under study. Thus, behavior change communication strategies to improve EBF rates should address these beliefs and their consequences for which an important proportion of mothers agree and/or

strongly agree with such as the importance of giving water because milk is the food and water is the drink or because water will avoid fatigue due to thirst or the throat becoming dry.

Furthermore, the results showed that the subjective norm was a strong and positive predictor of intention. These results indicate that the mother's perception of her immediate surroundings (her spouse, her mother, her mother-in-law, her sister) was supportive in giving water in addition to breast milk, which directly influenced her intention to provide water. The relationship between the subjective norm and breastfeeding has also been reported in previous studies [18,20,41]. Hence, to be efficient, interventions targeting mothers of infants below six months of age aiming to reduce water provision in addition to breast milk should also involve influential peoples of their immediate surroundings to ensure that they will be more supportive to the mother. In turn, this may lead to a change in the mother's normative beliefs and compliance with these beliefs, which will be more conducive to the non-provision of water.

Moreover, and as also observed in other settings [18,20,41], the perceived control affects the mother's intention to breastfeeding the provision or not of water in addition to breast milk. In our context, mothers could be supported to overcome what they perceived as barriers in not providing water. As such, making efforts to implement solutions (or what we have identified as factors that could prevent them from providing water in our study) that they have themselves identified could be a good start.

In research areas, the impact of the environment on the behavior was through mediation instead of a modulation role to the operationalization of the intention to the actual behavior as postulated in model B. The environment directly influenced mothers' attitudes and subjective norms. Thus, acting on specific elements of the environment such as improving access to counseling and group session on EBF supporting environment could contribute to a more positive mothers' attitude as well as leading to a perception of her subjective norm, which may be more favorable to the non-provision of water and ultimately, increases her intention not to provide water. Besides, the provision of support at birth for early initiation of breastfeeding has a positive and direct impact on the perceived control, as well as the subjective norm. Support for early breastfeeding initiation at birth has been associated with EBF practice in other contexts [43,44]. The positive relationship between early breastfeeding initiation and the subjective norm may help make breastfeeding the norm in society.

In accordance with Montaño and Kasprzyk's [37] reflections, in our context, direct construct measurements were more strongly associated with the intention than indirect measurements, and both were correlated. Besides, investigating the relationship between each item under each construct and the indirect measure has contributed to identifying specific content that drives behavior and could be delivered through behavior change strategies [36].

Findings from this research reiterate the need to create a supportive environment for behavior change to influence mothers' attitudes and hence, address specific beliefs and knowledge gaps. It also highlights the importance of targeting mothers with behavior change programs but also people in their surroundings who significantly influence their behavior if one wants to change their perception of the subjective norm and ensure that EBF will be the social norm. In Guinea, improving access to regular individual counseling and group education sessions on EBF during ANC visits and/or immunization as well as providing support to initiate breastfeeding at birth could shape the attitude, the subjective norm, and the perceived control to make them favorable to the non-provision of water in the first six months.

This research has many strengths that need to be acknowledged. This is the first study that examines pathways through which individual and environmental factors influence water provision among mothers of infants under six months. Second, a valid and reliable measurement tool was used to identify interest behavior determinants and was initially theory-based. Third, our findings offer significant directions for improving the content of behavior change programs in Guinea and personalized them to enhance their efficacy. Our research also has some limitations. First, the results cannot be generalized to the entire mothers of infants below six months. Second, given the dichotomic measure of the behavior, this may have limited the path analysis's ability to explain the variance associated with the behavior.

CONCLUSIONS

This research suggests that the intention to give water can be thoroughly predicted by the mother's

attitude, perceived control, and subjective norm scores, but predicting the final behavior is more complex than simply considering the intent. Yet, our findings can help tailor nutrition education programs to reduce the proportion of mothers providing water to their infants, and therefore improved breastfeeding rates.

DISCLOSURE STATEMENTS

The authors declare that they have no conflicts of interest.

ACKNOWLEDGEMENTS

The authors are grateful to the participants of the research and the enumerators. We also would like to thank the Food and Nutrition Department of the Guinean Ministry of Health and the Communal/ Prefecture's Health Departments of Conakry and Dubreka for their substantial support to the success of this research. The Université de Moncton funded this study.

FINANCIAL SUPPORT

This research was funded by the Université de Moncton.

AUTHORSHIP

NRN and SB designed the research. NRN conducted the research. NRN, SB, and JD analysed and interpreted the data. NRN wrote the first draft of the manuscript and had the primary responsibility for its final content. All authors critically revised the manuscript. All authors also contributed to and approved the final version of the manuscript.

ETHICAL STANDARDS DISCLOSURE

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the *Comité d'éthique de la recherche avec des êtres humains* of the Université de Moncton (Moncton, New Brunswick, Canada, #1920-073) as well as the *Comité d'éthique* of the *Ministère de la santé* of the Republic of Guinea (#132/CNERS/20).

For each mother, verbal and written informed consent was obtained. Their participation in the study was voluntary, and they can withdraw at any time without negative consequences or prejudice and without having to justify their decision.

SUPPLEMENTAL MATERIALS

The supplemental materials can be downloaded from the journal website along with the article.

REFERENCES

[1] Victora CG, Bahl R, Barros AJD, França GVA, Horton S, Krasevec J, *et al*. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. The Lancet 2016; 387: 475-90. https://doi.org/10.1016/S0140-6736(15)01024-7

[2] UNICEF. The State of the World's Children 2019 - Children, food, and nutrition: Growing well in a changing world [Internet]. New York: United Nations Children's Fund; 2019. Available from: https://www.unicef.org/media/63016/file/ SOWC-2019.pdf

[3] Institut National de la Statistique de la Guinée & ICF. Enquête Démographique et de Santé en Guinée 2018. 2018. Available from: https://dhsprogram.com/pubs/pdf/FR353/ FR353.pdf

[4] Rollins NC, Bhandari N, Hajeebhoy N, Horton S, Lutter CK, Martines JC, *et al*. Why invest, and what it will take to improve breastfeeding practices? The Lancet 2016; 387: 491-504. https://doi.org/10.1016/S0140-6736(15)01044-2

[5] Kavle JA, LaCroix E, Dau H, Engmann C. Addressing barriers to exclusive breastfeeding in low- and middle-income countries: a systematic review and programmatic implications. Public Health Nutr 2017; 20: 3120-3134. https://doi.org/10.1017/S1368980017002531

[6] Lamstein ST, Stillman P, Koniz-Booher A, Aakesson B, Collaiezzi T, Williams KB, *et al*. Evidence of effective approaches to social and behavior change communication for preventing and reducing stunting and anemia: Report from a systematic literature review; 2014.

[7] Bai YK, Lee S, Overgaard K. Critical review of theory use in breastfeeding interventions. J Hum Lact 2019; 35: 478-500. https://doi.org/10.1177/0890334419850822

[8] Godin G, Kok G. The theory of planned behavior: A review of its applications to health-related behaviors. Am J Health Promot 1996; 11(2): 87-98. https://doi.org/10.4278/0890-1171-11.2.87

[9] Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process 1991; 50: 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

[10] Duckett L, Henly S, Avery M, Potter S, Hills-Bonczyk S, Hulden R, *et al*. A theory of planned behavior based structural model for breastfeeding. Nurs Res 1998; 47: 325-335. https://doi.org/10.1097/00006199-199811000-00006

[11] Kloeblen-Tarver AS, Thompson NJ, Miner KR. Intent to breastfeed: the impact of attitudes, norms, parity, and experience. Am J Health Behav 2002; 26: 182-187. https://doi.org/10.5993/AJHB.26.3.3

[12] Swanson V, Power KG. Initiation and continuation of breastfeeding: Theory of planned behaviour. J Adv Nurs 2005; 50: 272-282. https://doi.org/10.1111/j.1365-2648.2005.03390.x

[13] Dyson L, Green JM, Renfrew MJ, McMillan B, Woolridge M. Factors influencing the infant feeding decision for socioeconomically deprived pregnant teenagers: The moral dimension. Birth 2010; 37: 141-149. https://doi.org/10.1111/j.1523-536X.2010.00394.x

[14] Bai Y, Middlestadt SE, Peng C-YJ, Fly AD. Predictors of continuation of exclusive breastfeeding for the first six months of life. J Hum Lact 2010; 26: 26-34. https://doi.org/10.1177/0890334409350168

[15] Lawton R, Ashley L, Dawson S, Waiblinger D, Conner M. Employing an extended Theory of Planned Behaviour to predict breastfeeding intention, initiation, and maintenance in White British and South-Asian mothers living in Bradford. Br J Health Psychol 2012; 17: 854-871. https://doi.org/10.1111/j.2044-8287.2012.02083.x

[16] Cabieses B, Waiblinger D, Santorelli G, McEachan RRC. What factors explain pregnant women's feeding intentions in Bradford, England: A multi-methods, multi-ethnic study. BMC Pregnancy Childbirth 2014; 14: 1-13. https://doi.org/10.1186/1471-2393-14-50

[17] Mutuli LA, Walingo MK. Applicability of Theory of Planned Behavior in understanding Breastfeeding Intention of Postpartum Women. Int J Multidiscip Curr Res 2014; 2: 258-266.

[18] Behera D, Anil Kumar K. Predictors of exclusive breastfeeding intention among rural pregnant women in India: a study using theory of planned behaviour. Rural Remote Health 2015; 15: 3405. https://doi.org/10.22605/RRH3405

[19] Tengku Ismail TA, Wan Muda WA, Bakar MI. The extended Theory of Planned Behavior in explaining exclusive breastfeeding intention and behavior among women in Kelantan, Malaysia. Nutr Res Pract 2016; 10: 49-55. https://doi.org/10.4162/nrp.2016.10.1.49

[20] Zhang Z, Zhu Y, Zhang L, Wan H. What factors influence exclusive breastfeeding based on the theory of planned behaviour. Midwifery 2018; 62: 177-182. https://doi.org/10.1016/j.midw.2018.04.006

[21] Tengku Ismail TA, Wan Muda WA, Bakar MI. Intention of pregnant women to exclusively breastfeed their infants: The role of beliefs in the theory of planned behaviour. J Child Health Care 2014; 18: 123-132. https://doi.org/10.1177/1367493512473857

[22] Thomas JS, Yu EA, Tirmizi N, Owais A, Das SK, Rahman S, *et al*. Maternal Knowledge, Attitudes and Self-efficacy in Relation to Intention to Exclusively Breastfeed Among Pregnant Women in Rural Bangladesh. Matern Child Health J 2014; 19: 49-57. https://doi.org/10.1007/s10995-014-1494-z

[23] Godin G. L'éducation pour la santé : les fondements psycho-sociaux de la définition des messages éducatifs. Sciences Sociales Et santé 1991; 9(1): 67-94. https://doi.org/10.3406/sosan.1991.1185

[24] Ministère du Plan et de la Coopération Internationale. Troisième Recensement Général de la Population et de l'Habitation. 2015. Available from: http://www.stat-guinee.org/images/Documents/Publications/INS/rapports_enquetes/RGPH3/INS_RGPH_2014_decret.pdf

[25] World Bank. Population, total - Guinea. 2019. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=GN

[26] United Nations Development Programme. Human Development Report 2020. The Next Frontier: Human Development and the Anthropocene, Guinea. New York, NY, USA: UNDP; 2021. Available from: http://hdr.undp.org/sites/ default/files/hdr2020.pdf

[27] World Bank. GDP per capita (current US$) - Guinea. 2019. Available from: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=GN

[28] Institut National de la Statistique de la Guinée & Macro International. Enquête Démographique et de Santé en Guinée 1999. 2000. Available from: https://dhsprogram.com/pubs/pdf/FR109/FR109.pdf

[29] Whitley E, Ball J. Statistics review 4: Sample size calculations. Crit Care 2002; 6: 335-341. https://doi.org/10.1186/cc1521

[30] Ninamou NR, Dupuis JB, Zagré N-M, Daffé M, Blaney S. A tool to assess underlying factors to water provision among Guinean children. Matern Child Nutr 2021; e13249. https://doi.org/10.1111/mcn.13249

[31] Ajzen I. Attitudes, personality, and behavior. Chicago, IL: Dorsey Press; 1988.

[32] Ajzen I, Fishbein M. Understanding attitudes and predicting social behavior. Pbk. ed. Englewood Cliffs, N.J: Prentice-Hall; 1980.

[33] Ajzen I, Madden TJ. Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. J Exp Soc Psychol 1986; 22: 453-474. https://doi.org/10.1016/0022-1031(86)90045-4

[34] WHO, UNICEF, USAID, AED, UCDAVIS, IFPRI. Indicators for assessing infant and young child feeding practices. Part II Measurement. World Health Organization; 2010. Available from: https://www.who.int/nutrition/publications/infantfeeding/9789241599290/en/

[35] Durand C. L'analyse factorielle et l'analyse de fidélité: notes de cours et exemples. Montréal, Québec, QC, Canada; 2003. Université de Montréal.

[36] Gagné C, Godin G. Les théories sociales cognitives : guide pour la mesure des variables et le développement de questionnaire. Groupe de recherche sur les aspects sociaux de la santé, Université Laval, QC, Canada; 1999.

[37] Montaño DE, Kasprzyk D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In: Health behavior and health education: Theory, research, and practice, 4th ed. San Francisco, CA, US: Jossey-Bass; 2008.

[38] Muthén BO, Muthén LK. Mplus user's guide: statistical analysis with latent variables. Los Angeles: Muthén & Muthén; 2017. Available from: https://www.statmodel.com/download/usersguide/MplusUserGuideVer_8.pdf

[39] Byrne BM. Structural Equation Modeling with Mplus: Basic Concepts, Applications, and Programming. 1st ed. Routledge/Taylor & Francis Group; 2012. https://doi.org/10.4324/9780203807644

[40] Kools EJ, Thijs C, de Vries H. The behavioral determinants of breastfeeding in The Netherlands: predictors for the initiation of breastfeeding. Health Educ Behav 2005; 32: 809-824. https://doi.org/10.1177/1090198105277327

[41] Guo JL, Wang TF, Liao JY, Huang CM. Efficacy of the theory of planned behavior in predicting breastfeeding: Meta-analysis and structural equation modeling. Appl Nurs Res 2016; 29: 37-42. https://doi.org/10.1016/j.apnr.2015.03.016

[42] Bai YK, Middlestadt SE, Peng CYJ, Fly AD. Psychosocial factors underlying the mother's decision to continue exclusive breastfeeding for 6 months: An elicitation study. J Hum Nutr Diet 2009; 22: 134-140. https://doi.org/10.1111/j.1365-277X.2009.00950.x

[43] Beyene AM, Liben ML, Arora A. Factors associated with the early termination of exclusive breastfeeding among mother-infant dyads in Samara-Logia, Northeastern Ethiopia. BMC Pediatr 2019; 19: 428. https://doi.org/10.1186/s12887-019-1803-1

[44] Wallenborn JT, Masho SW. Association between Breastfeeding Duration and Type of Birth Attendant. J Pregnancy 2018; 1-7. https://doi.org/10.1155/2018/7198513

Received on 10-09-2021 Accepted on 09-11-2021 Published on 31-12-2021

https://doi.org/10.6000/1929-4247.2021.10.04.1