



A theory-based behavioural change communication intervention to decrease the provision of water to infants under 6 months of age in the Republic of Guinea

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Abstract

Objective: In many countries, the provision of water in the early months of a baby's life jeopardises exclusive breast-feeding (EBF). Using a behavioural theory, this study assessed the impact of a behaviour change intervention on mothers' intention to act and, in turn, on the water provision in addition to breast milk to their infants under 6 months of age (IU6M) in two regions of Guinea.

Design: A quasi-experimental design. Data on individual and environmental factors of the theoretical framework, sociodemographic and outcomes were collected using validated questionnaires before and after the intervention. The outcomes examined were the intention to provide water to IU6M, the provision of water and EBF. Path analyses were performed to investigate pathways by which psychosocial and environmental factors influenced the water provision in addition to breast milk.

Setting: Four health centres were assigned randomly to each study's arm (one control/CG and one intervention group/IG per region).

Participants: The sample included 300 mothers of IU6M: 150 per group.

Results: In IG, the proportion of mothers providing water decreased from 61 % to 29 % before and after the intervention ($P < 0.001$), while no difference was observed in CG ($P = 0.097$). The EBF rate increased in IG (from 24.0 % to 53.8 %, $P < 0.001$) as opposed to CG (36.7 % to 45.9 %, $P = 0.107$). An association ($P < 0.001$) between the intention and the behaviour was observed in both groups.

Conclusions: An intervention developed using a sound framework reduces the provision of water among IU6M and improves EBF.

Keywords
Breast-feeding
Water
Behaviour
Infant
Intervention

Exclusive breast-feeding (EBF) is a proven effective practice for optimal child health, survival and development⁽¹⁾. Yet, despite progress in the EBF rate in the first 6 months at the global level, about half of infants under 6 months of age (IU6M) are also fed with other food or fluids such as water^(2,3). Hence, efforts are required to achieve the 50 % target for EBF set by 2025⁽⁴⁾, especially in the West and Central Africa region, where the rate is 34 %⁽⁵⁾.

Behavioural change strategies can help prevent mothers from providing water in addition to breast milk to their babies and, in turn, improve the EBF rate^(6–10). In a recent systematic review, Lassi and colleagues reported that

education strategies increase the EBF rate by 53 % at 6 months⁽¹¹⁾. Behaviour change interventions were also effective when delivered either in facilities or in community and home levels, although they have proven more successful when conducted by health professionals and adapted for a specific context⁽¹²⁾.

Yet, to be successful, behavioural change interventions need to be grounded on a good understanding of factors that may impede or facilitate a specific behaviour⁽¹³⁾. A theoretical framework could be valuable to identify what motivates mothers to perform a particular behaviour, such as providing water to their baby in addition to breast milk^(13,14). Findings

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could subsequently be used to design contextually compelling messages. As pointed out by Osendarp and Roche, an assessment of how the intervention impacts the behaviour could also be valuable to understand why the outcome has been achieved or not as well as pathways through which the intervention impacts a behaviour⁽⁸⁾. Individual and environmental-related factors should be considered in a situation analysis as they both may impact behaviour^(12,15).

While most interventions have focused on breastfeeding outcomes, little is known about what could be done to reduce water provision among IU6M, a practice impeding EBF. Yet, studies have revealed that mothers may give water to their children to protect them against stomach problems⁽¹⁶⁾, because of a warm climate and cultural beliefs related to the necessity to provide water for optimal digestion of human milk⁽¹⁷⁾ or simply because they think mother's milk does not contain enough water⁽¹⁸⁾.

In the Republic of Guinea, 33 % of IU6M receive water in addition to breast milk⁽¹⁹⁾. To contribute to the improvement of the EBF rate, based on an extended version of the theory of planned behaviour (TPB)⁽¹⁴⁾, formative research has been undertaken to identify psychosocial factors (attitude, subjective norm and the perceived control) underlying the intention of mothers to provide water to babies⁽²⁰⁾, so as to develop a behaviour change intervention to reduce the provision of water among IU6M. Elements of the environment that could potentially influence psychosocial factors and the behaviour itself have also been investigated. Following these steps, a questionnaire was developed and validated, then used to collect data on each construct of the extended TPB among a group of 300 mothers of IU6M⁽²¹⁾. For each construct, direct and indirect measurements were computed^(14,22). Results of path analyses have shown that mothers' attitude and perception of the subjective norm were more associated with the intention of providing water⁽²⁰⁾. In contrast, a positive environment was associated with a favourable attitude and the subjective norm. Specific behavioural, normative and control beliefs were also identified.

Using data from the aforementioned research in Guinea as the baseline measure⁽²⁰⁾, this study aims to assess the impact of a behaviour change intervention on mothers' intention and the actual behaviour of providing water to their IU6M in addition to breast milk.

Methods

Study area

This study was conducted in Conakry and Kindia regions in the Republic of Guinea. These two regions account for approximately 30 % of the population, but they were selected because they are cosmopolitan, with almost all of Guinea's ethnic groups represented. Therefore, they are similar from a sociodemographic, economic and

geographic point of view. Moreover, Coyah and Dubreka in the Kindia region are peri-urban areas of Conakry⁽²³⁾.

The Republic of Guinea is a West African country with roughly 13 million inhabitants⁽²⁴⁾. It ranks in the 'low human development' category of the Human Development Index of 0.477⁽²⁵⁾. While the overall literacy rate is 32 %, it remains low for women (22 %) compared to men (44 %). The country's economic situation remains weak, as reflected in the estimated annual gross domestic product per capita of 963 US\$⁽²⁴⁾.

Child mortality has fallen over the last few decades but at a slower pace. Between 1999 and 2018, the under-five mortality rate declined by about 37 %, from 177⁽²⁶⁾ to 111⁽¹⁹⁾ per 1000 live births. In the same period, the country reduced neonatal mortality by 32 %, from 48 to 32 deaths per 1000 live births. Moreover, during the same period, significant progress has been achieved in increasing the rate of EBF from 11 % in 1999 to 33 % in 2018⁽¹⁹⁾. In Guinea, the proportion of mothers of children under 6 months is 4.5 %, representing 585 000 women⁽¹⁹⁾.

Study design and participants

This research, which used a quasi-experimental design, was conducted in four health centres divided into the two previously mentioned regions^(20,21).

Inclusion criteria for mothers of IU6M were the following: having a child aged below 3 months, being aged 20 years or older, having given birth through vaginal delivery and to a singleton child with a birth weight greater than 2.5 kg, and being willing to participate in the study, irrespective of whether the child is exclusively breastfed or not. Mothers of babies with severe medical conditions (e.g. AIDS and cancer), mental health issues, obstetric complications (e.g. c-section), babies with severe medical conditions (e.g. AIDS) or congenital malformations were excluded. To ensure that the inclusion/exclusion criteria are met, information was checked in the mother's and child's health records.

Sampling

The sample size for this research was determined based on a statistical power of 80 % to detect a 10 % point difference between proportions of mothers in the control/CG and intervention/IG groups who give water in addition to breast milk following the implementation of the intervention at a significance level of 95 % ($\alpha = 0.05$)⁽²⁷⁾. With a proportion of 34.5 % of mothers giving water to their IU6M⁽¹⁹⁾ and an attrition rate of 10 %, the sample was estimated at 300 mothers of IU6M, with 150 mothers assigned to each study's arm, namely the CG and the IG.

Since twenty health centres (ten out of twenty-nine in Conakry and ten out of sixteen in the Kindia region, Fig. 1) were included in the questionnaire development phase, two centres were randomly selected respectively from the remaining nineteen health facilities in Conakry

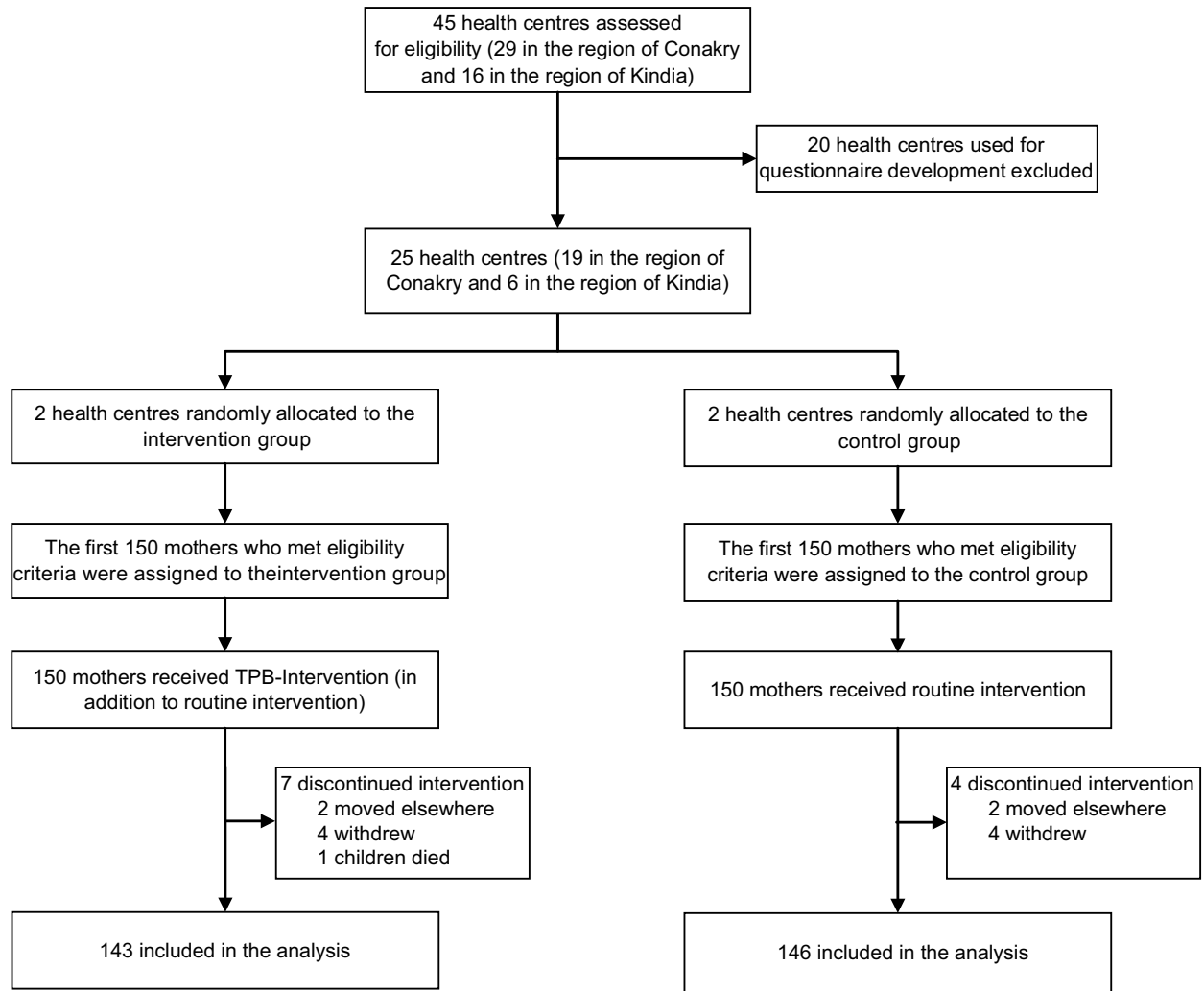


Fig. 1 Flow chart of participants' recruitment

and two from six in Kindia⁽²¹⁾. Therefore, four health centres, two in each region, were assigned randomly to each study's arm (one control and one intervention per region) (Fig. 1). There were 14 km between the CG and IG in the region of Kindia and 6.5 km between the CG and IG in Conakry.

We used convenience sampling proportional to the expected population for Tuberculosis (Bacille Calmette-Guérin vaccine) and Pentavalent (doses 1 and 2) vaccination coverage for recruiting mothers. In each health centre of both groups, mothers of children under 3 months attending the aforementioned immunisation sessions were invited to participate in the study. Mothers were assigned to a group based on the date of the scheduled visit for child vaccination until the number in each selected health centre was met. They were given mineral water during the surveys or the group session.

Each region's programme managers of the communal/prefectural health departments and data collection team members were not informed about group assignment.

Health workers of each selected health centre who were supposed to support the intervention implementation also were not explicitly informed of their assigned group. However, they were told that the current study focused on general feeding practices among IU6M.

Interventions description

Mothers in the CG received routine health and nutrition behaviour change interventions. These activities were delivered by health workers and consisted of individual counselling provided on a case-by-case basis, as well as group sessions on maternal, newborn, and child health and nutrition. As these sessions were part of the usual programming for these centres, no specific invitation was given to mothers from the CG to attend them. They also were not obliged to attend these sessions. These sessions were held using existing communication materials available at the health centre, and they did not focus on the provision of water.

The IG received four messages developed using data on beliefs from the baseline research and delivered through

one group session in each of the two health centres (see online Supplemental Material I).

Beforehand, the path analysis results were used to define the intervention⁽²⁰⁾. Results indicate that the subjective norm, the attitude, and to a lesser extent, the perceived control predict the intention of mothers to provide water in addition to breast milk to their IU6M, with the attitude being the most strongly associated with the intention. The intervention was thus designed to develop a more positive attitude among mothers towards the non-provision of water to their babies. Therefore, information on behavioural beliefs that were not favourable to the non-provision of water⁽²²⁾ was used to design the following key messages to be delivered to the intervention group: (i) breast milk contains all the water a baby needs for the first 6 months of life, even in a hot, dry climate; (ii) even if you have the feeling that you do not have enough milk in your breast, the amount you give to your baby will meet his or her nutritional needs for the first 6 months of life; (iii) the more your baby sucks, the more breast milk you will produce to feed him. So, you will not need to give him/her water until he/she is 6 months old; and (iv) giving water to a baby under 6 months old can make him/her sick.

A facilitation guide was developed to ensure consistency of the intervention throughout the sessions held in the intervention group. These messages and the facilitation guide were reviewed by the National Nutrition Technical Group (see online Supplemental Material I). The messages, as well as the approach, were tested among a sample of five lactating mothers to ensure their clarity and consistency, which has helped make some minor modifications to the guide. For each key message, colour images printed on A2 size paper were used to support the session. During each session, the above messages were directly translated into the three local languages (Soussou, Maninka and Pular).

Every group session was intended to last a maximum of 30 min and delivered through one unique group session per health centre, with 10 to 15 mothers per session. One week after the baseline survey, the group sessions were held in the health centre based on the scheduled child vaccination visit date. Given the COVID-19 pandemic, each mother was provided with a face mask to minimise the risk of transmission. The principal investigator, a medical doctor, facilitated the sessions, assisted by a health worker from the nutrition unit of the health centre. As the person in charge of nutrition behaviour change activities in the facility, the health worker's role was to welcome mothers and summarise all messages at the end of each session. Details on how each session was conducted are provided in Supplemental Material I. At the end of each session, mothers' concerns or questions about breast-feeding were addressed. They were also encouraged to consult the nutrition unit health worker for any breast-feeding difficulty. Participants were also encouraged to practice and share what they learned from the session with their family members.

Measures

Main outcome variables

The primary outcome variables were the intention to provide water to IU6M, the provision of water to IU6M and EBF.

Sociodemographic characteristics

At the baseline, a face-to-face interview was conducted at home with the head of the household and/or the mother of each child in each group using the household questionnaire of the Demographic and Health Survey (DHS) questionnaires package to collect data on household sociodemographic characteristics⁽¹⁹⁾. The children's health card was also checked to record their birth date, weight and the number of antenatal care (ANC) visits attended by their mothers.

At the baseline and the endline, the women's questionnaire (which includes the WHO's IYCF module⁽²⁸⁾) of the same DHS questionnaires package to collect data on infant and young child feeding practices/IYCF (including the water provision and the behaviour of interest) was also administered during the interview. To assess if the child was provided water in addition to breast milk, the following questions of the 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 provided 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 the question if no water under any form was provided, the mother was classified as not giving water to her baby and was assigned a score of 0. If the answer to the first question 'a' is no or the answer to one of the questions 'b' and 'c' was a 'yes', a score of 1 was given.

The EBF status and whether the child benefited from early initiation after birth were also assessed using WHO guidelines at the baseline and the endline in each group⁽²⁸⁾.

In both groups (control and intervention), using the validated questionnaire⁽²¹⁾, data were collected on each of the theoretical framework's constructs before (baseline) and after (endline) the intervention, precisely 1 month after its implementation.

Data analysis

Household, mother and child sociodemographic data were entered directly into SPSS (IBM SPSS Statistics for Windows, version 25.0, IBM Corp.). Chi-square/Fisher's exact statistics and *t* tests were performed to assess differences in proportions or means.

As described previously⁽²¹⁾, for each item of the questionnaire, for each construct and every participating mother, a numeric value ranging from -2 (e.g. strongly disagree/unlikely/disapprove) to +2 (e.g. strongly agree/likely/approve) was assigned to corresponding responses



on the Likert scale⁽²⁹⁾. Scores of worded items so that the option to answer 'in agreement' with a statement that did not reflect a positive attitude towards the behaviour were also reversed after the data collection. Two types of measures were used to assess each psychosocial construct of the extended TPB, indirect and direct measures⁽²²⁾. Correlations between each item under each construct and its indirect measurement as well as between indirect and direct measurements of each construct were also performed⁽¹⁴⁾.

Path analyses with version 1.6 of Mplus software⁽³⁰⁾ were performed to investigate pathways by which psychosocial and environmental factors influenced the provision of water in addition to breast milk among mothers of each group at the baseline and endline. Given that a specific pathway was identified at the baseline in the overall group (control and intervention together, n 300), the same model⁽²⁰⁾ was tested in the current study. This model included the following variables of the extended TPB: the intention, direct measures of the attitude, the subjective norm, the perceived control and the environment.

Chi-square tests were performed to assess differences in baseline and endline proportions for specific behavioural, normative and control beliefs-related items, for indirect measures of each variable of the extended TPB and the behaviour itself. Using SPSS, Cohen's b values were also calculated to compare the differences in baseline and endline proportions in primary outcomes among each group to determine if the differences were significant. The differences' size was considered small, medium or large when b thresholds were 0.20, 0.50 and 0.80, respectively⁽³¹⁾. A P -value below 0.05 was considered significant for all tests.

Results

In the whole sample, the mean age was 1.83 months ($SD = 1.03$) for the children and 24.8 years ($SD = 4.9$) for their mothers. Approximately 50% of the mothers were housewives, belonged to the Soussou ethnic group and had received primary education; nearly 60% of them had received at least four ANC visits during their last pregnancy. Most mothers (68%) gave birth in a public health facility with a skilled birth attendant. Over half of the mothers (57%) stated that they gave their infants water in addition to breast milk. The proportions of mothers providing water to their infants were lower among women who initiated breast-feeding early and those who attended at least four ANC visits than those who did not initiate breast-feeding within 1 h of birth ($P = 0.022$). These results were similar for those who were assisted at delivery by a skilled birth attendant. In addition, a higher proportion of mothers gave water to their infants among those who had not attended at least four ANC visits ($P < 0.001$)⁽²⁰⁾.

The presentation of the group sessions was held in the health centre 1 week after the baseline survey, and the endline survey was conducted 1 month after.

In total, 300 mothers participated in the baseline survey (Fig. 1), while 289 remained in the endline survey. Children's mean age was higher in the IG (2.0 months \pm 1.04) than in the CG (1.63 \pm 0.99, $P < 0.001$, Table 1). In the latter, a higher proportion of mothers practised early initiation of breast-feeding at birth (73% *v.* 31%, $P < 0.001$) as well as EBF (37% *v.* 24%, $P = 0.017$). Differences in proportions between CG and IG were also observed according to the mother's education level and of her partner ($P = 0.007$ and $P = 0.008$) as well as according to their religion ($P = 0.015$ and $P = 0.032$), the number of ANC visits ($P < 0.001$), household size ($P < 0.001$) and the socio-economic quintile ($P < 0.001$). At the baseline, no differences (61% *v.* 52%, $P = 0.103$) were observed in the proportions of mothers who were providing water in addition to breast milk between the IG and CG. Logistic regressions were performed to investigate if the above-mentioned sociodemographic variables could predict the provision of water to IU6M. When adding all the sociodemographic variables in the same block of the logistic regression, the addition of this block to the model contributed significantly to the ability to predict the provision of water at the baseline for both the CG (χ^2 (24) = 74.179, $P < 0.001$) and the IG (χ^2 (21) = 36.164, $P = 0.021$). At the endline, the addition of this block did not significantly improve the model's ability to predict the provision of water for both groups, hinting that another factor might have come into play (e.g. the intervention).

Findings on primary outcomes showed that the proportion of mothers who were providing water to their IU6M in addition to breast milk significantly decreased from 61.3% to 28.7% between baseline and endline in the IG ($P < 0.001$; Cohen's $b = 0.67$). In contrast, in the CG, the percentage went down from 52.0% to 39.0% but was not significant ($P = 0.097$; Cohen's $b = 0.26$). Moreover, the EBF rate significantly increased from 24.0% to 53.8% between baseline and endline in the IG ($P < 0.001$; Cohen's $b = 0.62$), while in the CG, the percentage went up from 36.7% to 45.9% but was not significant ($P = 0.107$; Cohen's $b = 0.19$). In the IG, the proportion of mothers who reported that it was very likely (or intend) that they will provide water in addition to breast milk to their babies decreased from 41% at the baseline to 11% at the endline (Cohen's $b = 0.71$) (see online Supplemental Material IIa), while no differences were observed in the CG (Cohen's $b = 0.38$) (see online Supplemental Material IIb). At the endline, in the IG, the proportion of mothers who were very likely to give water in addition to breast milk was also lower (11% *v.* 30%) than in the CG (see online Supplemental Material IIc).

Overall, with regard to the attitude, the proportion of mothers in the IG who reported that it would be useful/very useful to provide water in addition to breast milk decreased from 77% to 24% from baseline to endline (see online Supplemental Material IIa), while no significant difference

**Table 1** Sociodemographic characteristics of the group under study at baseline*

Characteristic	Intervention (<i>n</i> 150)		Control (<i>n</i> 150)		<i>P</i> -value
	Mean	SD	Mean	SD	
Children' characteristics					
Age in months	2.02	1.04	1.63	0.99	0.001§
	%		%		
Sex					1.000†
Male	48.7		48.7		
Female	51.3		51.3		
Early initiation of breast-feeding					<0.001†
Yes	30.7		72.7		
No	69.3		27.3		
Exclusive breast-feeding					0.017†
Yes	24.0		36.7		
No	76.0		63.3		
Provision of water					0.103†
Yes	61.3		52.0		
No	38.7		48.0		
Birth weight (g)	Mean	SD	Mean	SD	0.882§
	3196.74	477.69	3205.38	478.42	
Mothers' characteristics					
Age groups (years)	24.9	5.1	24.6	4.8	0.583§
	%		%		
Occupation					0.402†
Housewife	45.3		48.0		
Employee/private	30.0		23.3		
Merchant	13.3		12.0		
Unemployed	9.3		11.3		
Student	2.0		5.3		
Education level					0.007†
No formal education	24.7		41.3		
Primary (incomplete/complete)	35.3		24.0		
High school (incomplete/complete)	29.3		29.3		
University	10.7		5.3		
Religion					0.015‡
Muslim	95.3		86.7		
Christian	4.7		12.0		
Animist	0.0		1.3		
Ethnic group					<0.001‡
Soussou	52.7		46.7		
Poular	12.7		20.0		
Malinka	22.7		14.7		
Kissi	1.3		4.7		
Toma	0.0		7.3		
Guèrzé	4.7		4.7		
Others	6.0		2.0		
Number of antenatal care (ANC) visits					<0.001‡
1–3 ANC	51.3		28.7		
≥ 4 ANC	48.0		65.3		
Don't know	0.7		6.0		
Place of delivery					0.131†
Public health facility	62.7		73.3		
Private health facility	26.7		20.0		
Others	10.7		6.7		
Birth assisted by a skilled provider					0.500‡
Yes	96.7		97.3		
No	3.3		2.7		
Husband/partner characteristics					
Age groups (years)	Mean		SD		0.057§
	9.3		6.9		
	%		%		
Education level					0.008†
No formal education	28.0		42.0		
Primary (incomplete/complete)	16.7		6.7		
High school (incomplete/complete)	26.0		28.0		
University (incomplete/complete)	29.3		23.3		
Religion					0.032†
Muslim	94.0		86.7		
Christian	6.0		13.3		

**Table 1** *Continued*

Characteristic	Intervention (n 150)		Control (n 150)		P-value
	Mean	SD	Mean	SD	
Ethnic group					0.148‡
Soussou	40.0		44.7		
Poular	22.0		24.0		
Malinka	25.3		14.0		
Kissi	3.3		4.0		
Toma	0.0		2.0		
Guèrzé	4.0		6.7		
Others	5.3		4.7		
	Mean	SD	Mean	SD	
Households' characteristics					
Number of household members	5.5	2.07	4.6	1.87	<0.001§
Number of under-five children	1.49	0.71	1.50	0.69	0.805§
Socio-economic quintile					<0.001
Quintile 1	-1.00	0.23	-0.94	0.17	
Quintile 2	-0.61	0.09	-0.59	0.09	
Quintile 3	-0.22	0.12	-0.29	0.12	
Quintile 4	0.26	0.20	0.32	0.19	
Quintile 5	1.23	0.52	1.69	0.58	

*Values are in percentages (%) or mean (M) ± SD.

†Chi-square test.

‡Fisher's exact test.

§Student t test.

was observed in the CG between the two times of measures (65% *v.* 49%, see online Supplemental Material IIb). Similarly, at the endline, the proportion of mothers who reported that it would be very useful to give water was lower in the IG than in the CG (8.4% *v.* 26.0%, see online Supplemental Material IIb). Accordingly, at the endline, percentages of mothers who agreed or strongly agreed with several specific behavioural beliefs in the IG (eight out of eleven mothers) were also lower than the CG (see online Supplemental Material IIb).

As for the subjective norm, proportions of mothers who strongly agree with statements that the most influential people in their surroundings think or will strongly agree that they should give water in addition to breast milk decreased between baseline and endline from about 45% to less than 10% in the IG (see online Supplemental Material IIa). In the CG, the percentage of mothers who strongly agree that the most influential people think they should give water also decreased from about 31% to 10%. At the endline, proportions of mothers who either agree (18.9% *v.* 43.8%) or strongly agree (8.4% *v.* 26.0%) with the two aforementioned statements were also lower in the IG (see online Supplemental Material IIc). Changes in perceived normative beliefs or, in other words, mothers' perception about people that will approve or disapprove of the behaviour were noted for their mothers-in-law, the grandmother of their spouse/partners, their grandmother and mother. At the endline, mothers in the IG were also less likely to comply with what people in their surroundings thought about the behaviour (see online Supplemental Material IIc).

Between baseline and endline, proportions of mothers whose responses to the three statements related to the perceived control over the behaviour were positive (very

likely/easy/controllable) increased in the IG (see online Supplemental Material IIa). In the CG, responses were more positive only for one statement (see online Supplemental Material IIb). Regarding the environment construct, few differences were observed in the CG and the IG between baseline and endline regarding responses to statements on elements that could stop mothers from providing water in addition to breast milk to their IU6M (see online Supplemental Material IIa&IIb). Similarly, no differences were observed for the perceived control between the two groups at the endline regarding how mothers responded to statements (see online Supplemental Material IIc).

Figures 2 and 3 show associations between variables of the postulated model in each group. First, for both groups, the results of path analysis indicate strong associations ($P < 0.001$) between the intention and the behaviour, especially at the endline ($\beta = 0.926$ and 0.946 for the CG and the IG, respectively). The subjective norm was not associated with the intention in both groups, either at baseline or endline. At the same time, significant relationships were observed between the attitude and the intention in the IG at both times, but only at the endline in the CG. Similarly, in the IG, the perceived control was associated with the intention at the baseline and endline – although slightly stronger at the endline – while the relationship was significant only at the baseline in the CG. In both groups, either at baseline or endline, the subjective norm was positively associated with the attitude, which was associated with the perceived control.

The environment was positively associated with the attitude and the subjective norm in the IG at baseline and endline. In the CG, besides the relationship between the environment and the subjective norm at the baseline, the environment was unrelated to any psychosocial factor. Early initiation of

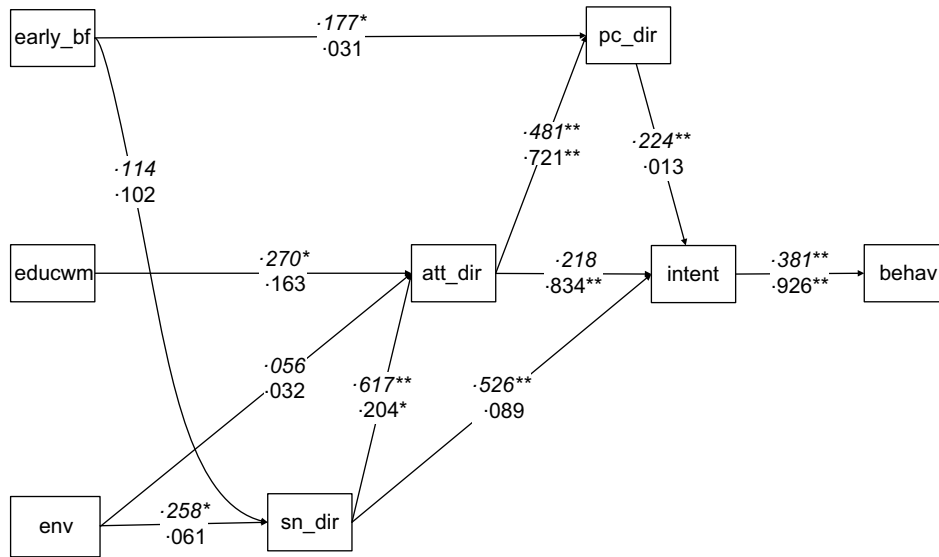


Fig. 2 Final model with standardised coefficients for the structural equation model between the provision of water in addition to breast milk (behave), the intention (intent), psychosocial (attitude: att_dir, subjective norm: sn_dir, perceived behavioural control: pc_dir), and environmental (env) and sociodemographic (education of mothers: educwm, early initiation of breast-feeding: early_bf) factors at baseline (italic characters) and endline (bold) for the control group (*n* 150). **P* < 0.05, ***P* < 0.001

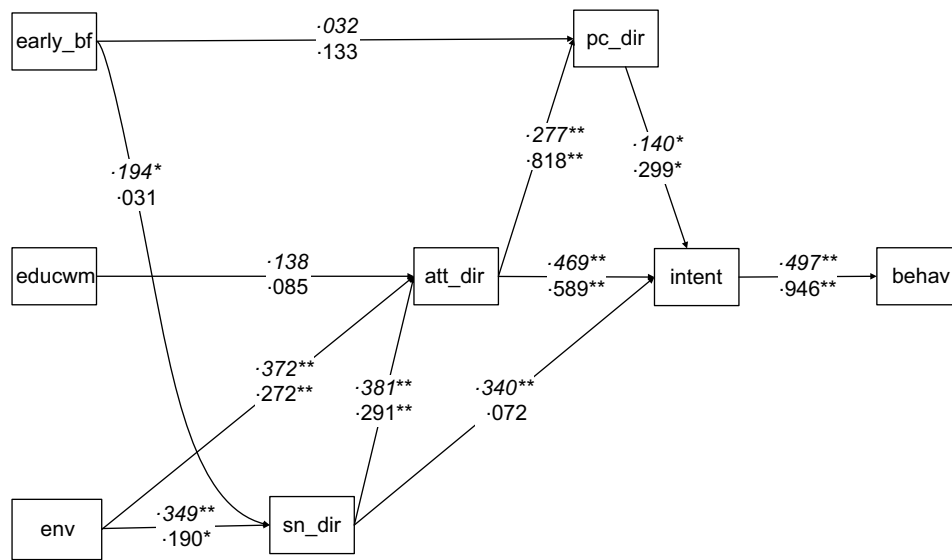


Fig. 3 Final model with standardised coefficients for the structural equation model between the provision of water in addition to breast milk (behave), the intention (intent), psychosocial (attitude: att_dir, subjective norm: sn_dir, perceived behavioural control: pc_dir), and environmental (env) and sociodemographic (education of mothers: educwm, early initiation of breast-feeding: early_bf) factors at baseline (italic characters) and endline (bold) for the intervention group (*n* 150). **P* < 0.05, ***P* < 0.001

breast-feeding was associated with the subjective norm in the IG at the baseline. Moreover, mothers' level of education was related to the attitude in the control group. At the endline, these associations were no longer significant.

Discussion

The research findings show that the intervention was successful – though the impact was deemed medium by

Cohen's *b* estimates – in reducing the proportion of mothers who were providing water in addition to breast milk, it also contributed to the increase of EBF rates. At the baseline, a lower proportion of mothers were practising EBF in the IG than in the CG, while at the endline, a higher proportion of mothers were practising EBF in the IG than in the CG, illustrating the impact of the intervention. The path analysis examined how the extended TPB's different constructs impact water provision. The pathways show a strong association between the intention and the behaviour



in both groups. After implementing the intervention, significant associations were observed between the perceived control and intention as well as between the attitude and the intention in the IG. Yet, the relationship was significant only between the attitude and the intention in the CG. At the baseline, the environment was positively associated with the attitude and the subjective norm in both groups, while these relationships were significant only in the IG at the endline.

The results of this research concur with the current literature. Although not specifically on the provision of water in addition to breast milk, the positive impacts of behaviour change communication intervention have been documented on EBF^(7,10,32,33). Findings from a meta-review and meta-analysis conducted by Kim and colleagues⁽³³⁾ have also revealed that postnatal interventions have more significant effects on EBF than prenatal interventions⁽³³⁾. Interestingly, the authors have reiterated that the use of a systematic protocol that delineates key components of the intervention for the effective implementation resulted in higher EBF rates, which is also a procedure that has been opted in the current research to ensure consistency of interventions to all mothers of the intervention group^(33,34).

In light of the above, it appears that the intervention impacted the different constructs of the behavioural theory and has changed some of the associations initially observed at the baseline. Even though the intervention essentially aimed at modifying the mothers' attitudes to be more supportive of not providing water, the descriptive analysis showed that the attitude and the perceived control were more favourable towards the behaviour under study at the endline in the IG. This observation was generally not the case in the CG group. Also, differences were observed at the endline between the IG and CG regarding responses to specific behavioural beliefs that were not in favour of the water provision, which was expected. However, after the intervention, the relationships between the attitude, the perceived control and the subjective norm remained relatively unchanged in both groups. Still, results of path analysis seem to indicate that the intervention, directed towards an improvement of the attitude, may have positively influenced the perceived control over the behaviour, which, in turn, has increased the intention of executing the behaviour and, thus, may have contributed to its actual implementation. It could be that a more positive attitude, caused by sensitisation to EBF and milk production, may have reinforced the mothers' ability to stop providing water to their IU6M. These findings align with Joshi and colleagues, indicating a consistent increase in perceived control scores in the IG after breast-feeding education⁽³⁵⁾.

Furthermore, in both groups, the association between the subjective norm and the intention became non-significant after the intervention. Could it be that given a more positive attitude of the mothers about the non-provision of water, they perceived to a lesser extent an influence by their surroundings on the decision about this behaviour?

Although the intervention was planned to be implemented once in the IG, it is possible that health workers repeated it during the 1-month delay between baseline and endline surveys. This could have contributed to the greater integration of the key messages and a more favourable attitude among mothers of the IG. Another factor that may contribute to the improved attitude towards the non-provision of water after the intervention was the higher education level of mothers in the IG. However, although mothers' education level was an essential factor at baseline in both groups, it did not appear to be significant after the intervention. In addition, even though the whole objective of the study was not divulged to health workers in control areas, given that mothers had to respond to the questionnaire at baseline, it is possible that health staff were subsequently informed about its content. If this was the case, they might have adjusted routine behaviour change activities on infant feeding and added a focus on the water provision. In any case, the comprehensive analysis of psychosocial and environmental factors that were facilitating the provision of water in addition to breast milk was conducted beforehand, and the use of this information to design the intervention likely contributed to its effectiveness^(33,36).

As for the other studies^(37–44), although not explicitly related to the provision of water, the strong association between the intention and the behaviour in both groups was common. However, a strong intention did not necessarily translate into actual and targeted behaviour. In fact, in the IG, mothers' intention to provide water in addition to breast milk to their children decreased compared to the CG, which may have been translated into a higher implementation of the actual behaviour. Inexplicably, the association between the intention and the behaviour was much stronger at the endline for both groups. Could it be that responses to the questionnaire were most accurate, or questions better understood at the endline?

Results from a meta-analysis and structural modelling on the efficacy of the TPB in predicting breast-feeding conducted by Guo and colleagues⁽²⁹⁾ showed that the attitude, the subjective norm and the perceived control were all significant predictors of the intention to breastfeed. This finding is in line with the baseline results of our research. Yet, after the intervention, the association between the subjective norm and the intention was no longer significant in the two groups, as well as the relation between the perceived control and the intention in the CG.

As opposed to the CG, the relationships between the environment and the attitude, as well as with the subjective norm, also remain significant in the IG at the endline. Might the reason be that the intervention was delivered throughout the health facility and, in addition to impacting mothers' attitude, it has also exerted an influence on their perception of the subjective norm? To our knowledge, besides results from a school-based intervention in Ireland by Giles and colleagues⁽³⁶⁾, no study has evaluated the impact of an intervention on the different constructs of the TPB related

to breast-feeding-related behaviour, including the provision of water in addition to breast milk among IU6M.

This current research has several strengths that deserve to be highlighted. First, it shows that a simple intervention designed based on a context-specific behavioural theory and thus, addresses underlying beliefs to behaviour can be effective. Second, a validated questionnaire is also of quite valuable use to assess the situation pre- and post-intervention to evaluate its effect. Third, knowledge on pathways through which psychosocial and environmental factors may influence the provision of water in addition to breast milk among IU6M has also been generated, constituting a unique contribution to the current literature. Finally, in the IG, sessions were planned to coincide with a scheduled clinic visit, and reminders were sent to either the mothers or their husbands/partners, resulting in a very low attrition rate.

Despite these successes, it is also essential to acknowledge that this research has some limitations. First, the time between the intervention and the final data collection may not have been sufficient to allow mothers to internalise the received messages raising questions about the sustainability of the behaviour. Second, responses may have been biased by the social desirability, especially at the endline in both groups, as the questionnaire content has primarily focused on the provision of water, a particular behaviour that mothers already know as the research topic. This bias could be more considerable in the IG as a result of nutrition education. Third, a clustering effect between participants may also have arisen, given that the intervention was applied to the group while the measurements were performed at the individual level. A larger sample size could help counteract this potential cluster effect in future research. Fourth, no measures were taken prior to the random selection of health centres to ensure an appropriate distance between IG and CG in each region. However, given that the setting was urban/peri-urban, it is unlikely that there was significant (if any) cross-contamination between the IG and CG groups in each region, even though the distance was 6.5 km between the two groups in the Conakry region. Fifth, in our study, similarities between the counselling and group session content delivered in each health may have influenced mothers' behaviours. However, the group session approach in the IG was very rigorous with an emphasis on water provision; therefore, the influence of this similarity could be minimised. Finally, one of the limitations of this study is that women below the age of 20 years and those with a c-section were not included.

Besides these limitations, the sustainability of the intervention is not assured and remains a key challenge not only in our setting but elsewhere, even for effective programmes⁽⁴⁵⁾. One can argue that a concise and straightforward intervention that only necessitates limited financial resources may have more chance to be sustained. Still, other factors need to be considered for its sustainability, such as continued training and

supportive supervision of staff, integration into existing programmes, and institutional strengths, to name a few⁽⁴⁵⁾. As a matter of fact, the Ministry of Health of Guinea, a key partner in this research, took ownership of all the research material to replicate it in other settings with the support of development partners. In addition, the research results were shared with the Ministry of Health staff of five West African countries to implement in other settings. In our setting, the person who facilitated the session was well trained on the topic (e.g. had the knowledge and skills and did translate this knowledge to provide a high-quality session), but this was not the case for the health worker. However, despite these limitations, it is not time-consuming to conduct the group session⁽⁴⁵⁾, which may contribute to its sustainability. Lastly, even though multi-component and long-term interventions covering pre-natal and postnatal periods have been recommended for optimal breast-feeding practice^(7,32,33), in this study's setting, a behavioural change intervention delivered through a group session, in addition to the routine activities offered at the health centre, has led to noteworthy results.

Conclusions

Our findings provided evidence of the valuable use of a behavioural theory to design and assess the impact of an intervention to reduce the provision of water in addition to breast milk among IU6M. Further studies are warranted in other settings of Guinea (e.g. rural or other urban areas in different regions), in other countries, as well as in more vulnerable groups (e.g. mothers aged below 20 years and mothers with a C-section) to validate the suggested process. However, these results are encouraging, showing that a structured approach addressing underlying behaviour-related factors represents a promising avenue for improving EBF.

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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). Written and verbal informed consent was obtained from all subjects. Verbal consent was witnessed and formally recorded.

Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980022001732>

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