A Longitudinal Study to Describe Changes in Breastfeeding, Milk Intake and Infant Feeding Practices in Côte d'Ivoire between December 2022 and June 2024

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Abstract

Background and Aims: In Ivory Coast, since the ministerial decree number 689/MSHPCMU/MCI on August 2, 2021, pharmacies have become the exclusive points of sale for infant formula (0 - 36 months). This study assesses the impact of this regulation on infant feeding practices. **Methods:** This study was conducted in 3 waves: December 2022 (n = 632), September 2023 (n = 716), and June 2024 (n = 629). Mothers with infants under 24 months from Ivory Coast's four main regions were interviewed face-to-face, with participants stratified by residence, socio-economic class, and infant age. **Results:** The restriction on infant formula sales did not have a significant impact neither on total nor exclusive breastfeeding (EBF) rates before 6 months. The introduction of non-adapted beverages (water, teas and herbal drinks) and foods before 6 months remains high and unchanged. If those were removed, the EBF rate would be 85% in 2024. The average age for stopping breastfeeding remains at 17 months. The new legislation had a neutral (41%) or positive (52%) impact on mothers' perceptions of infant formula quality. There was no significant change in the use of infant formula before 6 months (23% in 2022 and 25% in 2024). Family milk remains the primary milk alternative to breastmilk for one year. **Conclusions:** The new legislation has not significantly impacted breastfeeding practices or the use of infant formula and non-adapted foods and drinks before 6 months in Ivory Coast between 2022 and 2024.

Keywords

Breastfeeding, Exclusive Breastfeeding, Infant Formula Regulation, Infant Feeding Practices, Côte d'Ivoire, Public Health Policy,

Early Childhood Nutrition

1. Introduction

The early years of life are critical for the growth and development of infants, with proper nutrition playing a fundamental role, especially during the first 1000 days. Providing the right food at the right time is essential for ensuring long-term health and well-being. In recent years, the implementation of the national breastfeeding strategy and the "Infant and Young Child Feeding" (IYCF) services has significantly improved the nutritional care of infants and young children in Côte d'Ivoire, as well as the management of malnutrition among children under five [1].

Despite these efforts, Côte d'Ivoire continues to face alarming levels of malnutrition. According to the World Health Organization (WHO), nearly one in three children under five suffers from anemia, with approximately half of these cases attributed to iron deficiency. Additionally, the stunting rate remains high at 20.2%, underscoring persistent nutritional challenges in the country [2]-[4].

Breastfeeding is widely recognized as the optimal source of nutrition for infants. The WHO recommends exclusive breastfeeding for the first six months of life, defined as giving an infant only breast milk, without any additional food or drink, not even water, followed by continued breastfeeding up to two years of age [5]. In 2012, the World Health Assembly set global nutrition targets to be achieved by 2025, including increasing the rate of exclusive breastfeeding during the first six months to at least 50% [6]. In Côte d'Ivoire, the most recent data from the 2021 Demographic and Health Survey (DHS) indicate an exclusive breastfeeding rate of 34% [7].

While the benefits of breastfeeding are universally acknowledged, exclusive breastfeeding is not always feasible or chosen. In such cases, infant formula serves as the only legitimate, safe, and nutritionally complete alternative [8]. Access to this alternative is vital, as it can be life-saving and essential for preventing nutritional deficiencies and malnutrition.

Since March 1, 2023, following Ministerial Decree No. 689/MSHPCMU/MCI of August 2, 2021, pharmacies in Côte d'Ivoire have become the exclusive retail outlets for infant formula (for ages 0 - 36 months) [9]. As a result, infant formulas have been withdrawn from supermarkets and neighborhood stores to ensure product quality, reduce the risk of counterfeiting, and promote breastfeeding. In 2022, Côte d'Ivoire had approximately 32,000 retail and local distribution points, 1280 pharmacies, and 2000 pharmaceutical depots selling infant formula. Consequently, private pharmacies accounted for only 40% of the total storage and distribution volume of infant formula for children aged 0 - 36 months [10].

This longitudinal study, conducted between December 2022 and June 2024, aims to assess the impact of this regulation on breastfeeding practices and milk

consumption among young children in Côte d'Ivoire.

2. Materials and Methods

2.1. Study Design and Participants

This longitudinal study employed a repeated cross-sectional design and was conducted in Côte d'Ivoire among mothers of infants aged 0 to 24 months. Data collection occurred in three waves: December 2022, prior to the implementation of the decree (n = 632); September 2023, approximately six months post-implementation (n = 716); and June 2024, approximately sixteen months after implementation (n = 629).

Each wave involved an independently drawn random sample of Ivorian mothers with at least one child aged 0 - 24 months, who were either solely or jointly responsible for decisions regarding the child's nutrition. As the participants differed across waves, the study did not involve individual follow-up but instead analyzed population-level trends over time.

Data were collected through face-to-face interviews conducted in participants' homes by trained interviewers from a market research firm. Mothers were first asked to complete a consent form and provide socio-demographic information about their household and child. As part of this socio-demographic questionnaire, participants were also asked about the education level of the head of household, to support socio-economic classification; however, this variable is not analyzed in detail in the present paper. This was followed by a structured interview lasting approximately 30 minutes. The questionnaire addressed topics such as infant nutrition, breastfeeding practices, and the use of breast-milk substitutes. It was carefully designed to ensure clarity, using language and terminology familiar to the mothers. The questionnaire was developed in collaboration with an international market research institute with extensive experience conducting similar studies in West Africa. It was pre-tested on an initial sample of participants before the launch of wave 1 to ensure comprehension and consistency of the data collected. The study protocol and questionnaire were approved by the Ethics Committee of the Gbêkê Regional Health Department.

To ensure broad representativeness, the sample included both urban and rural areas across Côte d'Ivoire's major cities: Abidjan, Bouaké, San Pedro, and Korhogo, covering diverse geographic zones within each city. No finer geographic data such as neighborhood-level information were collected. Demographic quotas were applied to refine the analysis by geographic location, child's age group (0 - 5 months, 6 - 11 months, and 12 - 24 months), and socio-economic class (AB, C1, C2, and DE). These socio-economic classes are commonly defined as follows [11]:

- Class A: Very affluent—Individuals with high incomes, holding executive or leadership roles, and leading premium lifestyles with access to luxury goods and services.
- Class B: Affluent—Individuals with comfortable incomes, typically in professional or skilled occupations, and frequent consumers of branded products.

- Class C1: Upper middle class—Skilled workers with stable incomes and moderate but consistent consumption habits.
- Class C2: Lower middle class—Qualified manual laborers with modest incomes, whose consumption is more cautious and pragmatic.
- Class D/E: Working class—Individuals with low or unstable incomes, often facing limited access to goods and services.

Although the sampling strategy aimed to maintain balanced quotas across waves for key characteristics, some variations were observed. These discrepancies were primarily due to practical fieldwork constraints: interviews were conducted with eligible respondents encountered in the field, and quota fulfillment sometimes varied depending on the availability and accessibility of certain population subgroups.

The study sample was balanced across urban and rural settings, with approximately half of respondents living in each area (Table 1). The sample also included a high proportion of households classified in socio-economic groups C2 and DE, reflecting the diversity of living conditions in Côte d'Ivoire.

Table 1. Description of the samples by survey waves (T1, T2, T3).

Characteristics	T1	T2	T3
Total sample size (n)	632	716	629
Study sites			
Abidjan	303	347	273
Bouake	89	101	126
San Pedro	139	152	117
Korogho	101	116	113
Place of residence			
Urban area	303	347	327
Rural area	329	369	302
Age of the child			
0 - 5 months	120	165	178
6 - 11 months	196	193	242
12 - 17 months	158	179	107
18 - 24 months	158	179	98
Socioeconomic status			
AB	68	78	76
C1	106	121	131
C2	119	135	223
DE	339	383	199

To ensure robust and representative findings, the target sample size was set at approximately 600 mothers per wave. This sample size was chosen to limit the margin of error to 4%, thereby ensuring statistically reliable results (**Figure 1**). Increasing the sample size beyond this point would have yielded only marginal improvements in precision while significantly increasing resource requirements. Additionally, comparative analyses between urban and rural areas were made possible by including approximately 300 respondents per zone, corresponding to a margin of error of around 6%—an acceptable threshold for subgroup-level analysis in this type of study (**Figure 1**).
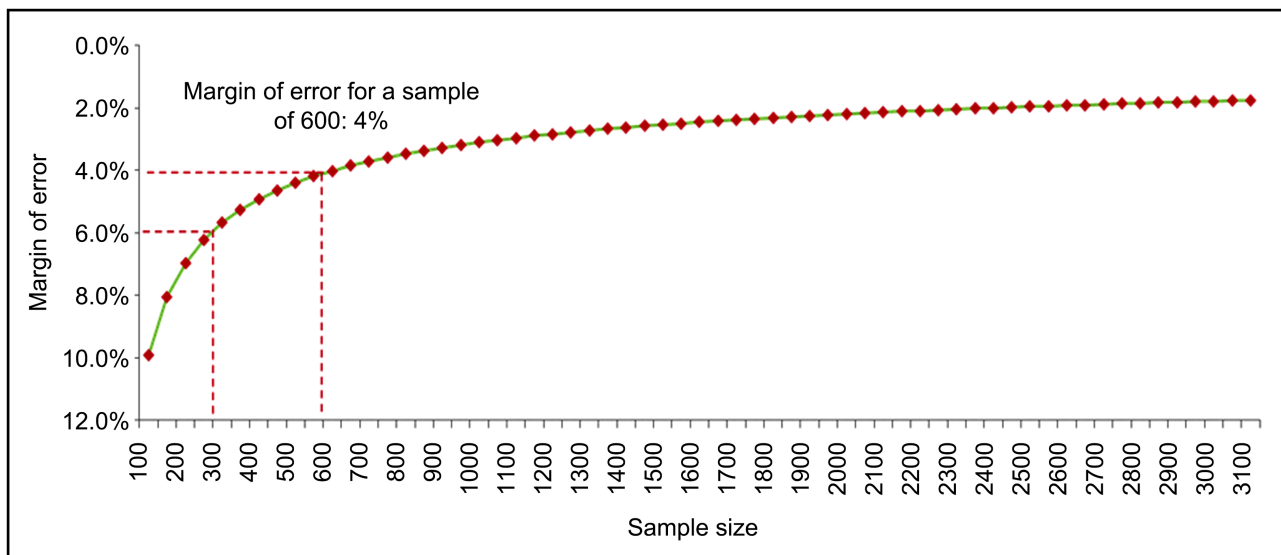

Figure 1. Theoretical relationship between sample size and margin of error (%).

2.2. Statistical Analyses

Statistical comparisons were performed using Z-tests, with a significance level set at $\alpha = 0.05$. All analyses were conducted using IBM SPSS Statistics (version 25) and IBM Survey Reporter (version V6.0.1). Missing data and outliers were neither replaced nor imputed for inclusion in the analyses. Continuous variables were summarized using the number of observations, mean, and standard deviation, while categorical variables were described by the frequency distribution of infants across categories [12].

3. Results

3.1. Evaluation of Breastfeeding Practices in Côte d'Ivoire

3.1.1. Evaluation of Breastfeeding Practices before 6 Months

The proportion of mothers initiating breastfeeding within the first hour after birth indicated a strong start to breastfeeding practices in Côte d'Ivoire: 86% at T1, 77% at T2 (significantly lower than T1, $p < 0.05$), and 81% at T3 (also significantly lower than T1, $p < 0.05$) (**Table 2**). At 10 days postpartum, the proportion of breastfeeding mothers remained consistently high at 96% across all three waves.

Breastfeeding prevalence before six months of age was also very high (≥97%) and remained relatively stable over time. However, the rate of exclusive breastfeeding (defined according to the WHO as giving infants only breast milk, with no additional food or drink, not even water) was considerably lower. It dropped to 16% at T2, which was significantly lower than the 26% observed at T3 (p < 0.05), indicating a modest recovery in exclusive breastfeeding practices in the most recent wave.

Table 2. Evaluation of feeding practices during the first 6 months (%).

	T1	T2	T3
Evaluation of breastfeeding during the first 6 months			
Mothers who gave breast milk in the 1st hour after birth (%)	86 (n = 632)	77[a] (n = 716)	81[c] (n = 629)
Mothers who gave breast milk within 10 days of birth (%)	96 (n = 632)	96 (n = 716)	96 (n = 629)
Mothers currently breastfeeding their infants under 6 months (%)	99 (n = 120)	97 (n = 165)	98 (n = 178)
Mothers currently exclusively breastfeeding their infants under 6 months (%)	22 (n = 120)	16 (n = 165)	26[b] (n = 178)
Other recurrent feeding practices in infants under 6 months of age			
Mothers who give water to their infants under 6 months (%)	64 (n = 120)	69 (n = 165)	67 (n = 178)
Mothers who have used traditional therapeutic practices on infants under 6 months of age (%)	35 (n = 120)	44 (n = 165)	39 (n = 178)
Herbal decoctions (%)	19 (n = 120)	24 (n = 165)	22 (n = 178)
Wetting the infant's throat before feeding (%)	14 (n = 120)	20 (n = 165)	20 (n = 178)
Mothers giving food before 6 months (%)	22 (n = 120)	34[a,b] (n = 165)	18 (n = 178)

[a]*P value* < 0.05 for statistic test between T1 and T2; [b]*P value* < 0.05 for statistic test between T2 and T3; [c]*P value* < 0.05 for statistic between T1 and T3.

3.1.2. Assessment of Other Infant Feeding Habits before 6 Months of Age

Across all three waves, the primary barrier to exclusive breastfeeding was the widespread practice of giving water to infants before six months of age, reported by at least 64% of mothers (Table 2). Traditional therapeutic practices were also common during this period, with over 35% of mothers reporting their use. These included the administration of herbal decoctions (≥19%) and the practice of wetting the infant's throat before feeding (≥14%). The early introduction of inappropriate liquids such as water, tea, and herbal infusions remained significant and relatively stable across the study period.

Given the high prevalence of water provision before six months, an additional question was introduced at T2 to better understand maternal motivations: "*What are the reasons for giving your infant water in addition to breast milk*?" The response options were read aloud in random order, and mothers could select up to three reasons. In both T2 and T3, the same three reasons were most frequently cited:

- the belief that breast milk does not provide sufficient hydration (44% at T2 and T3),
- the perception that water is essential for the infant's survival (43% at T2 and 44% at T3), and
- the idea that water helps soothe the infant when crying (39% at T2 and 42% at T3) (Table 3).

Table 3. List of reasons given by mothers to explain their choice to give water in addition to breast milk before 6 months (%).

	T2 (n = 109)	T3 (n = 117)
To quench my baby's thirst because breast milk does not provide sufficient hydration	44	44
Giving water is necessary to prevent dehydration and ensure my baby's survival	43	44
Water calms my baby when he cries	39	42
Water cleanses and stimulates my baby's appetite	29	24
Breast milk must be diluted with water	29	36
To satisfy my baby when I do not have enough breast milk	22	18
Water protects babies against disease	16	19
Water is a good alternative to my milk when I'm away	10	11
Others	6	3

[a]*P value* < 0.05 for statistic test between T1 and T2; [b]*P value* < 0.05 for statistic test between T2 and T3; [c]*P value* < 0.05 for statistic between T1 and T3.

The early introduction of complementary foods before six months also represents a significant barrier to exclusive breastfeeding. The proportion of mothers introducing food before this age ranged from 18% at T3 (the lowest) to 34% at T2 (the highest). This indicates a notable and temporary increase in early food introduction during the second wave of the study (T2) (Table 1). The trend suggests that, despite overall efforts to promote exclusive breastfeeding, certain practices such as early feeding persist and may fluctuate over time.

3.1.3. Evaluation of Breastfeeding after 6 Months

Breastfeeding rates remained very high (≥91%) up to the 6 – 12 months age group and continued to be substantial (≥61%) among children aged 13 - 18 months (Figure 2). However, there was a marked decline in the 19 – 24 months age group. Overall, breastfeeding rates were relatively stable across the three waves of the study, with one notable exception: in the 19 – 24 months group, the rate dropped significantly in T3, falling to 17%, compared to 34% in T1 and 30% in T2 ($p < 0.05$).
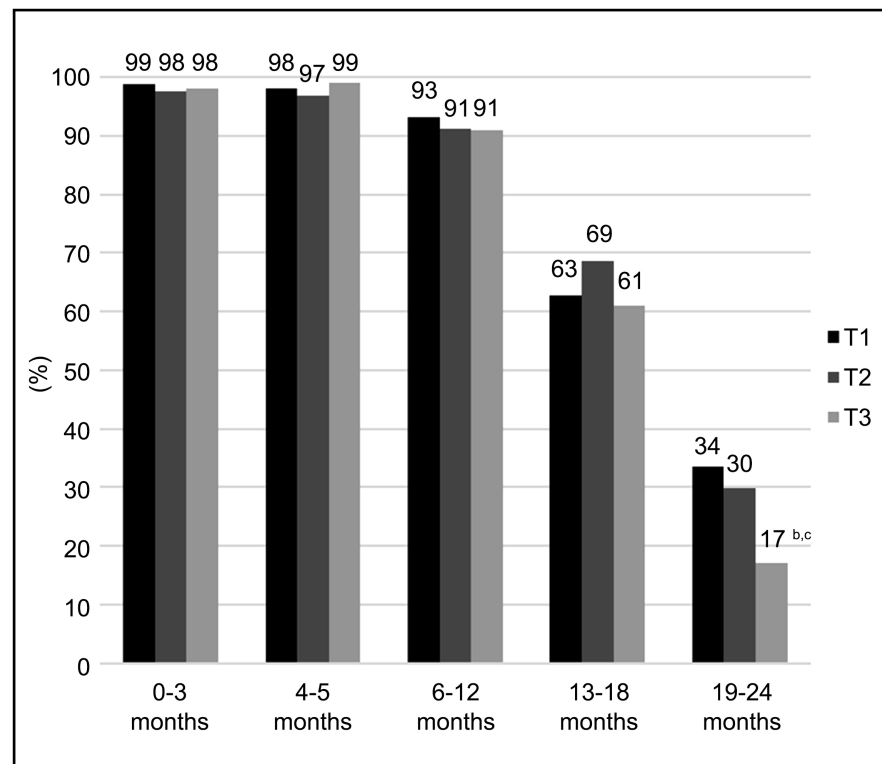
[b] *P value* < 0.05 for statistic test between T2 and T3; [c] *P value* < 0.05 for statistic between T1 and T3.

Figure 2. Mothers breastfeeding their children in Côte d'Ivoire by age (%).

3.1.4. Assessment of Mothers' Motivations for Breastfeeding and Reasons for Stopping

Mothers were asked: "*Why did you choose to breastfeed your baby?*" The response options were read aloud in random order, and each mother could select up to

three reasons. Across all three waves, the natural quality of breast milk consistently emerged as the primary motivation for breastfeeding, cited by at least 45% of respondents (Table 4). In addition, the health benefits of breast milk were among the most frequently mentioned reasons throughout the study period.

Table 4. List of reasons given by mothers for choosing to breastfeed (%).

Motivation given	T1 (n = 453)	T2 (n = 513)	T3 (n = 482)
It's the most natural (%)	45	57[a]	55[c]
It's the best way to protect my baby against disease and promote good health (%)	36	19[a]	30[b]
It's the best way to develop my baby's brain and intelligence (%)	27	20[a]	20[c]
It's the best for my baby in terms of nutrition (%)	27	26	21[c]
It's what's best for his physical growth (%)	21	22	17
It strengthens the bond with my baby (%)	17	16	19
I can guarantee its quality (%)	14	17	19[c]
My baby likes the taste of breastmilk (%)	14	15	13
It is available at any time (%)	13	17	12[b]
It's free, it saves me money (%)	12	8[a]	10
It reassures and comforts my baby (%)	12	12	11
It was recommended to me (%)	10	13	16[c]
It makes my life easier, it's practical (%)	9	11	16[b,c]
For religious and traditional reasons (%)	4	4	3
Other reasons (%)	0	3[a]	0[b]

[a]*P value* < 0.05 for statistic test between T1 and T2; [b]*P value* < 0.05 for statistic test between T2 and T3; [c]*P value* < 0.05 for statistic between T1 and T3.

As with the previous question, mothers who were not breastfeeding or who had stopped breastfeeding were asked: "*Why didn't you breastfeed your baby, or why did you stop?*" The responses were categorized into four main groups: Personal motivations, Concerns about breastfeeding, External events, and Replacement of breast milk by other foods (Table 5). Across all three waves of the study, the child's age consistently emerged as the most frequently cited reason, mentioned by at least 50% of respondents.

Table 5. List of reasons given by mothers for the permanent cessation of breastfeeding given by mothers for choosing to breastfeed (%).

Motivation given	T1 (n = 179)	T2 (n = 203)	T3 (n = 147)
Personal motivations (%)	75	73	60[b,c]
My baby is too big, it was time to stop (%)	57	60	50
I didn't want to (%)	21	20	11[b,c]
Breastfeeding is not practical and requires too much time, effort and stress (%)	6	3	10[b]
I wanted to find freedom, rest and be able to delegate my baby's feeding to those around me (%)	19	5[a]	8[c]
Breastfeeding affects my body image (%)	1	3	1
Concerns about breastfeeding (%)	27	34	37
My baby doesn't like it/refuses it (%)	16	18	20
My milk is not of sufficient quality/not satiating enough, my baby is not gaining enough weight and cries a lot (%)	13	15[a]	20
I couldn't do it/It was too painful (%)	3	4	2
External event (%)	35	25	37[b]
Resuming work (%)	26	15	23
A health professional recommended it to me for health reasons concerning my baby (%)	4	2	7[b]
A health professional recommended it to me for health reasons that concern me (%)	4	1	10[b,c]
I got pregnant (%)	2	2	3
My entourage (husband/family/friends) discouraged me (%)	1	6[a]	3
For religious/traditional reasons (%)	0	1	0
Replacing breast milk with other foods (%)	44	49	32[b,c]
To replace it with something healthier/more beneficial (%)	25	35[a]	14[b,c]
I have no/no more breast milk (%)	21	16	18
Other reasons (%)	10	18[a]	12

[a]*P value* < 0.05 for statistic test between T1 and T2; [b]*P value* < 0.05 for statistic test between T2 and T3; [c]*P value* < 0.05 for statistic between T1 and T3.

3.2. Evaluation of the Use of Breast-Milk Substitutes

3.2.1. Evaluation of Infant Formula Use

Infant formula was almost exclusively used as a supplement to breast milk before six months of age, with only 2% of infants receiving it as their sole source of milk. The pattern of infant formula consumption by age followed an approximate bell-shaped distribution peaking between 6 and 12 months, then gradually declining through the 18 – 24 months age group (**Figure 3**). Overall, infant formula consumption remained relatively stable across the three waves of the study, with one notable exception: among children under six months at T2, a significant increase was observed (38% at T2 vs. 22% at T1, p < 0.05). This increase was temporary, as the proportion of mothers using infant formula returned to 24% in the third wave (T3).
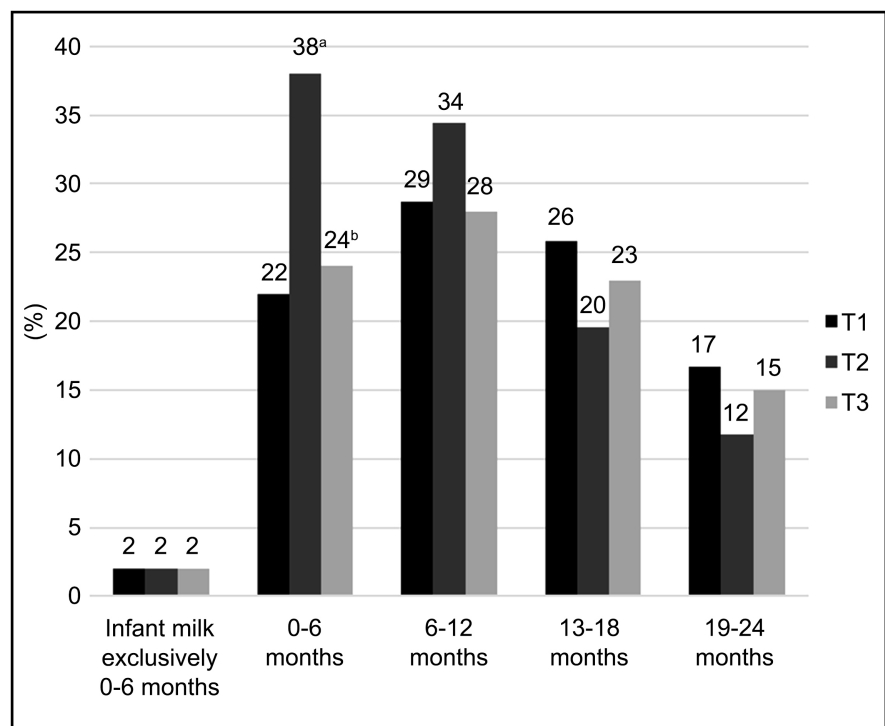
^{a}*P value* < 0.05 for statistic test between T1 and T2; ^{b}*P value* < 0.05 for statistic test between T2 and T3.

Figure 3. Mothers giving infant milk to their children in Côte d'Ivoire, by age (%).

Beginning with the second wave (T2), mothers were asked about their reasons for practicing mixed feeding (combining infant formula with breast milk): "*Why did you choose to practice mixed breastfeeding*?" Response options were read aloud in randomized order, and participants could select up to three reasons.

Across both T2 and T3, the most frequently cited reason was maternal concern about the perceived insufficiency of breast milk either in terms of quality or quantity. Specifically, 40% of mothers at T2 and 27% at T3 reported: "*My milk is not of sufficient quality/not nourishing enough; my baby is not gaining enough weight*

and cries a lot when breastfed alone" (Table 6). The second most common reason was the belief that the child was growing and no longer needed exclusive breast-feeding, cited by 30% of mothers at T2 and 26% at T3.

Table 6. List of reasons given by mothers to justify their choice of mixed breastfeeding with infant milk (%).

Motivation given	T2 (n = 123)	T3 (n = 143)
My milk is not of sufficient quality/not satiating enough, my baby is not gaining enough weight and cries a lot when breastfeeding alone	40	27b
My baby is growing up, it was time to vary his diet	30	26
A health professional recommended it to me for health reasons that concern me	28	20
I didn't have enough breast milk to breastfeed alone	26	20
I went back to work	17	17
I wanted to regain my freedom, rest and be able to delegate my baby's feeding to those around me	17	12
To replace breast milk with something healthier/more beneficial	14	20
Breastfeeding alone is not practical and takes too much time, effort and stress	14	13
Those around me (husband/family/friends) discouraged me from breastfeeding alone	13	6
I didn't make it/it was too painful to just breastfeed	9	1
I didn't want to give only breast milk anymore	7	8
Only breastfeeding affects my body image (aesthetics, partner's gaze)	4	7
A health professional recommended it to me for health reasons concerning my baby (such as weight gain…)	4	14b
For religious/traditional reasons	0	1

[b]*P value* < 0.05 for statistic test between T2 and T3.

Following the implementation of the decree (beginning at time point T2), mothers were asked the following question: "*Do you have any difficulties finding your baby's infant milk?*" At T2, only 6% of respondents reported experiencing difficulties in obtaining infant formula (Figure 4). This proportion decreased further at T3, with 4% of mothers reporting difficulties, 3% indicating minor difficulties and 1% reporting major difficulties.
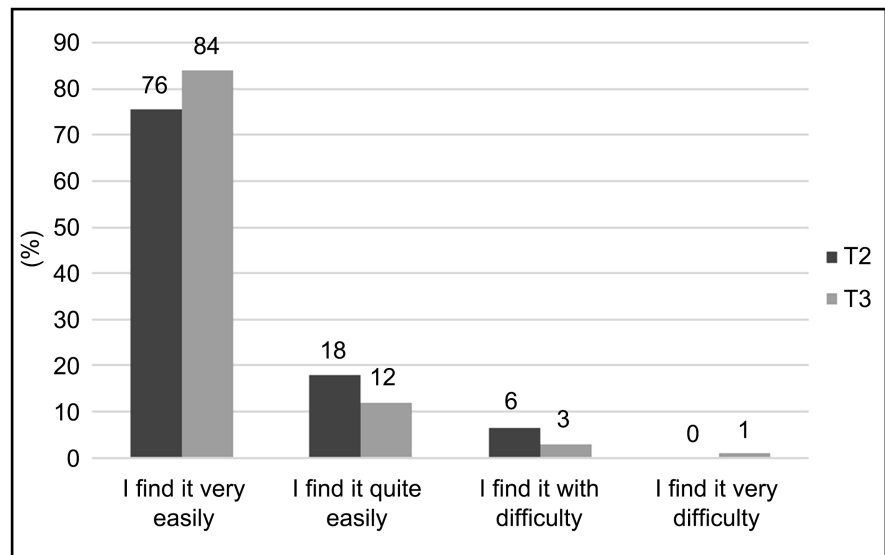
Figure 4. Mothers' assessment of the ease of access to infant formula after the implementation of the decree (%).

To better understand the increase in infant formula consumption observed at T2 among infants under six months of age, an additional question was posed to mothers at T3: "*Infant formula is now only available in pharmacies* (*and is no longer sold in supermarkets, mini-markets, or grocery stores*). *In your opinion, which statement best reflects your perception*?"

Over half of the respondents (52%) indicated that this regulatory change enhanced their confidence in the product. In contrast, 41% reported that it had no effect on their perception, while 7% stated that it discouraged them from purchasing infant formula (**Figure 5**).
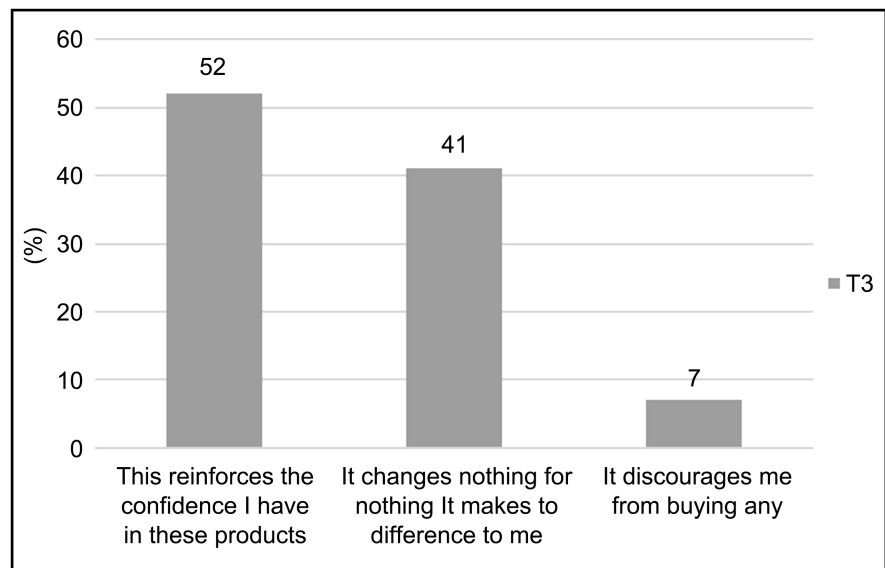

Figure 5. Statement chosen by mothers to describe what comes closest to their feelings following the introduction of the decree on infant formula (%) (n = 629).

3.2.2. Evaluation of the Use of Family Milk

The proportion of mothers providing family milk before the age of six months remained very low (≤6%) (**Figure 6**). This proportion increased progressively with age, reaching at least 54% at T3 among children aged 19 - 24 months. Consumption patterns remained stable between T1 and T2. However, a downward trend in family milk consumption was observed across all age groups at T3.
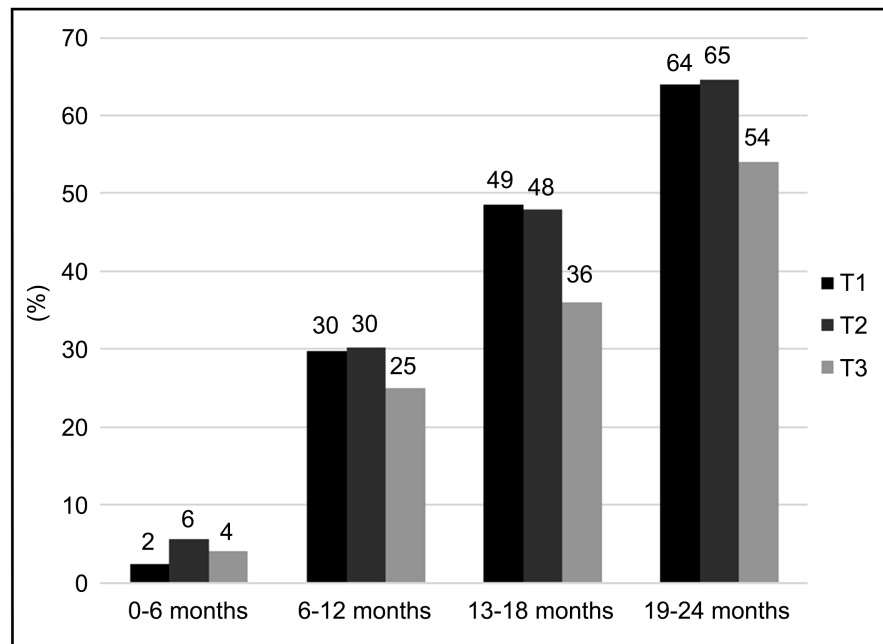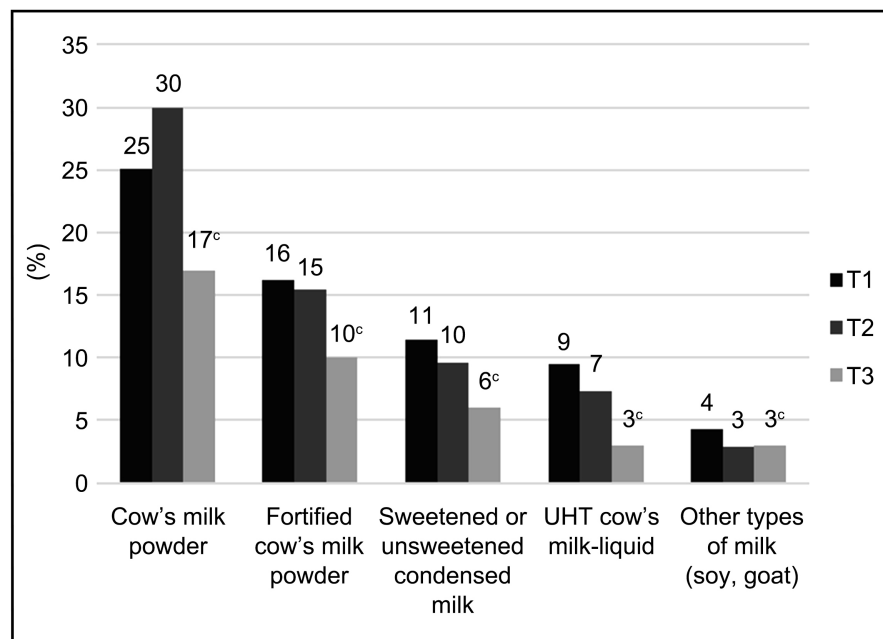

Figure 6. Mothers giving family milk to their children in Côte d'Ivoire, by age (%).

cP value < 0.05 for statistic between T1 and T3.

Figure 7. Of infant formula given to children aged 0 - 2 (%).

Among the various types of family milk reported, cow's milk powder was the most commonly used, followed by fortified cow's milk powder. In contrast, soy milk and goat's milk were rarely consumed (≤6%) (**Figure 7**).

4. Discussion

To date, the implementation of the decree does not appear to have significantly influenced breastfeeding practices. Overall breastfeeding rates remained remarkably stable across the three survey waves for all age groups up to 18 months. However, a notable decline was observed at T3 among children aged 19 - 24 months, with breastfeeding rates dropping to 17%, compared to 34% at T1 and 30% at T2. This decrease is difficult to interpret and is unlikely to be directly attributable to the decree.

Regarding exclusive breastfeeding, a temporary decline was observed at T2 (16%) following the decree's implementation, compared to 22% at T1 and 26% at T3. This dip may be partially explained by an increase in early dietary diversification at T2 (34%, versus 22% at T1 and 18% at T3), as well as a sharp rise in infant formula consumption before six months (38% at T2, compared to 22% at T1 and 24% at T3). This unexpected increase may have been influenced by the decree's communication campaign, which included billboards referencing infant formula. Interestingly, restricting sales to pharmacies appears to have enhanced trust in these products for over half of the mothers (51%). Despite a reduction in the number of sales outlets, mothers did not report difficulties accessing infant formula. In addition, the study explored mothers' exposure to the decree communications related to infant formula, which may have influenced their perceptions and practices beyond the sole application of the decree. In the first wave, 40% of mothers reported having been exposed to information about infant feeding. Among them, 59% mentioned it related to infant formula, 55% to complementary feeding, and 38% to breastfeeding. The majority of this exposure came through television (82%), while 11% cited urban displays or billboards. In the subsequent waves (T2 and T3), similar patterns of exposure were observed. These results may suggest that the communication about the new decree had a good reach & contributed to reassuring mothers about the quality of products specifically designed for infants when sold in pharmacies.

Exclusive breastfeeding rates across the three waves (22% at T1, 16% at T2, and 26% at T3) remain below the 34% reported in the 2021 Demographic and Health Survey (DHS). These discrepancies are difficult to interpret due to differences in study design and timing. One possible explanation is the COVID-19 pandemic, which may have temporarily encouraged breastfeeding due to increased time at home and heightened attention to infant health, though this remains speculative in the absence of robust evidence.

A major barrier to exclusive breastfeeding remains the early introduction of water, tea, and herbal infusions. These practices are deeply rooted in cultural beliefs and are perceived as essential for infant survival, particularly to prevent or

treat dehydration. Some mothers also view water as a suitable complement or substitute for breast milk. At T2, 22% of mothers of infants under six months reported giving water "*to satisfy my baby when I don't have enough breast milk*" and 10% said they gave water because "*it is a good alternative when I'm away*." Similar responses were recorded at T3 (18% and 11%, respectively).

These findings reflect a widespread and well-documented practice across sub-Saharan Africa [13]. The provision of water to breastfed infants is often seen as vital, yet it poses significant risks: it can reduce breastfeeding frequency, lower milk production, and increase the risk of diarrhea, malnutrition, and early weaning. Campaigns such as Stronger with Breastmilk Only, led by UNICEF and Alive & Thrive, aim to challenge these perceptions [14]. While occasional ritual use of water may not interfere with breastfeeding, regular consumption before six months can have harmful consequences for infant health and nutrition [15].

Moreover, our findings indicate that, at wave 3, 50% of infants were breastfed while also receiving water, other non-milk liquids or regular milk, and 26% were exclusively breastfed. If the provision of non-nutritive liquids (including regular milk) were eliminated, the theoretical rate of exclusive breastfeeding could reach 76%. Similarly, incorporating the proportion of breastfed infants who received early complementary foods yields a potential exclusive breastfeeding rate of 85%. These estimations underscore the significant impact of early introduction of water and complementary feeding on reducing exclusive breastfeeding prevalence. As such, these practices represent critical targets for public health interventions and awareness campaigns aimed at promoting optimal infant feeding practices [16].

As for continued breastfeeding, a large proportion of mothers reported breastfeeding up to 13 - 18 months (63% at T1, 69% at T2, and 61% at T3). However, many expressed the need to introduce alternatives as the child grew. This trend is consistent with findings across sub-Saharan Africa, where exclusive and continued breastfeeding are often constrained by economic, professional, and social pressures. Early return to work, often under precarious conditions and without supportive infrastructure, limits the feasibility of sustained breastfeeding. These structural challenges are compounded by concerns related to marital dynamics and body image. In increasingly couple-centered households, some women perceive prolonged postpartum abstinence and physical changes from breastfeeding as threats to conjugal harmony. Consequently, early introduction of complementary foods is often seen as a pragmatic strategy to balance maternal, professional, and relational responsibilities.

Aside from the temporary increase in infant formula use before six months at T2, overall formula consumption remained stable across survey waves and age groups. The decline in family milk consumption observed at T3 may reflect the impact of awareness campaigns promoting breast milk or age-appropriate formula.

This study presents several strengths. It enabled the monitoring of behavioral trends over time, offering valuable insights into population-level responses to public

policy interventions such as the decree. Its flexible design allowed for the adaptation of questionnaires and the inclusion of new variables without compromising individual tracking. Moreover, the approach minimized test-retest bias, enhancing the reliability of responses. As a result, it provided a cost-effective and context-sensitive alternative to traditional longitudinal studies.

However, the study also has limitations. Sample variability may have introduced differences unrelated to actual behavioral changes, complicating the attribution of observed trends. Slight imbalances in key demographic characteristics (e.g., age, socioeconomic status, geographic location) across waves were due to fieldwork constraints and non-random participant availability. These factors may have affected comparability. Additionally, the absence of individual follow-up precludes causal inference, limiting the analysis to associations. The statistical power to detect trends was also reduced by the lack of repeated measures on the same individuals. Finally, external contextual factors, such as policy changes, economic shifts, or social events, may have influenced the results, further complicating interpretation.

Additionally, the face-to-face nature of data collection may have introduced social desirability bias, whereby respondents, particularly mothers, could have provided answers they perceived as socially acceptable, especially concerning breastfeeding practices and the timing of complementary food introduction. Although interviewers were trained to foster a neutral and non-judgmental environment, the potential influence of such bias cannot be entirely ruled out.

This study also collected a comprehensive set of exploratory data on infant feeding practices and maternal motivations, extending beyond its primary objective of assessing the impact of the decree. While only partially analyzed in the present article, these data offer valuable contextual insights into infant feeding behaviors in Côte d'Ivoire. They also provide a robust foundation for future research, particularly through more granular analyses leveraging the study's stratified design, including variables such as socioeconomic status and urban–rural residence.

5. Conclusions

The implementation of Ministerial Decree No. 689/MSHPCMU/MCI, enacted on August 2, 2021, to regulate the marketing of infant formula, does not appear to have had a substantial impact on breastfeeding practices or on the use of infant formula and non-adapted foods and beverages before six months of age in Côte d'Ivoire between 2022 and 2024. While a few isolated changes were observed, the overall influence of the decree on infant feeding behaviors remains limited at this stage. Although breastfeeding is deeply embedded in Ivorian cultural norms and mothers express pride in breastfeeding, this study highlights the persistence of practices, such as the early introduction of water, that continue to hinder exclusive breastfeeding. These findings underscore the need for breastfeeding support policies that are more context-sensitive, taking into account cultural beliefs, women's living conditions, and the diversity of their identities and experiences.

Efforts to promote and sustain breastfeeding should go beyond regulatory measures and focus on community-based strategies that foster supportive environments. This includes culturally appropriate counseling and education aimed at families and communities, with the goal of encouraging prolonged breastfeeding and discouraging the use of inappropriate substitutes such as family milk and sweetened beverages.

Conflicts of Interest

Fanny Krumholz and Pauline Moehlinger are employees of Danone Nutricia Africa & Overseas. Professor ASSE Kouadio Vincent has no conflict of interests to declare.

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