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Comparing Iraqi Regional Differences on Infant Feeding through Breastfeeding and Formula

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Abstract: ***Research tends to focus on the health implications of breastfeeding, but understanding associations that might drive maternal choice in infant feeding practice is also very important. To understand the relationship between women's feeding strategies for their children and the context in which they live in Iraq, mixed methods are deployed through analysis of surveys and interviews. Using data from the 2000 and 2011 Multiple Indicator Cluster Survey, trends are quantitatively examined in breastfeeding and infant formula use for Iraq using linear probability models. Interviews are qualitatively analyzed that were collected from women in Sulaimani governorate in the Kurdish region of Iraq to begin understanding the reasons why Iraqi women initiate breastfeeding and formula use. Being urban, wealthier, and more educated increases the probability of a mother using infant formula, while only increasing wealth and increasing education are associated with increasing the probability of breastfeeding. In 2000, governorates significantly differ in the probability of mothers using infant formula (e.g. Karbala = 24.32 percentage points lower probability of using infant formula relative to Sulaimani, (p<0.0001), but differences in breastfeeding seem to be between the southern and northern governorates (e.g. Karbala = 6.78 percentage points higher probability of breastfeeding relative to Sulaimani, (p<0.01). Over the ensuing decade, the probability of breastfeeding decreases, and the probability of infant formula use increases across most governorates. Interviews provide narratives that help explain these trends such as mothers continuing to breastfeed during stressful times but using infant formula when working outside of the home. Between governorate differences could be driven by differences in conflict over the decade. This study contributes to a more nuanced perspective on infant feeding practices in Iraq at the governorate level, suggesting that future maternal-child nutrition studies need to account for the effects of where a mother lives within Iraq.***

Keywords: breastfeeding, formula, Iraq, maternal-child nutrition, infant feeding practices.

1. INTRODUCTION

Infant feeding practices focus on breastfeeding and its substitutions, including formula use or animals' milk. Breastfeeding is preferred by healthcare providers and nutrition researchers [1], while infant formula holds the promise of buffering the children of poorly nourished mothers who cannot produce enough milk. Both strategies carry certain challenges, such as breastfeeding's stigma regarding feeding in public, limiting maternal mobility, while infant formula is typically associated with a higher cost and higher risk of infant death in unsanitary conditions [2].

Breastfeeding builds an infant's immune system, provides a sterile source of food, and contains a balanced source of nutrition for the infant. However, infant formula has retained its popularity through the efforts of companies with alluring advertisements [2], hospital distribution of formula upon discharge [3], and local country norms and aid organization responses to formula use during crises [4]. While the consensus that breastfeeding is healthier for children's long-term health has been established, debate still exists on best practices when maternal malnutrition is high, such as during war and other situations where mothers are severely malnourished [5].

Associations have been shown between the likelihood of mothers breastfeeding and their increasing education level in high-income countries, but these same trends are reversed for middle- and low-income countries with breastfeeding incidence and duration associated with a decrease in urbanization, wealth, and education [6]. Breastfeeding often faces additional cross-cultural challenges in a context of increased exposure to maternal malnutrition, violence, displacement, and war. A study in Iraq recently showed that an increase in casualties from conflict, higher household income, and higher supplementation were associated with a reduction in the incidence and duration of breastfeeding [7].

This paper contributes to the literature on infant feeding in Iraq through a mixed methods approach. I quantitatively examine trends in breastfeeding and infant formula use for Iraq in 2000, before the U.S. invasion, and in 2011, after the country stabilized as they relate to the location of women's residence, their education level, their income, and their child's age and health. I also qualitatively analyze interviews collected from women in Slemani governorate, Iraqi Kurdistan to begin understanding the reasons why Iraqi women initiate breastfeeding and formula use. Being urban, wealthier, and more educated increases the probability of a woman using infant formula, while only increasing wealth and

increasing education are associated with increasing the probability of breastfeeding. In 2000, governorates only significantly differ on their probability of infant formula use, where most governorates have a lower probability relative to Slemani governorate. Over the ensuing decade, the probability of breastfeeding decreases, and the probability of infant formula use increases across most governorates. Interviews provide potential mechanisms to explain these trends, such as sharing narratives that help explain these trends in education and wealth such as mothers continuing to breastfeed during stressful times but using infant formula when working outside of the home.

2. LITERATURE REVIEW

In the 1990s, bombing during the war, subsequent economic sanctions, and a U.S. trade embargo dismantled Iraq's previously effective public health system and caused a public health crisis [8-11]. Before the Iraq War began in 2003, the health of Iraqi women and children was already degraded due to the harsh economic sanctions levied against the country in the 1990s [12, 13]. The Public Distribution System (PDS) was created and sustained under the regime of Saddam Hussein during the late 1980s and 1990s in response to the humanitarian chaos at the end of the Iran-Iraq War, but the food distributed through the program from the mid-1990s through the early 2000s came from the United Nations' Oil for Food program [14]. Eligibility applied to every Iraqi citizen and foreign resident in Iraq, and for 250 Iraqi dinars (~$0.08), a PDS food basket could be received, which included wheat flour, rice, sugar, tea, vegetable oil, and sometimes dried whole milk, dried beans, salt, soap, and detergent [14]. Families with children under the age of one were also eligible to receive 2.7kg of infant formula, 0.9 kg of cereal, 0.25kg of soap, and 0.35kg of detergent [14]. While the PDS buffered Iraqis from experiencing food insecurity for decades it also normalized infant formula. Receiving infant formula through PDS has performed positive functions like buffering food insecure families to protect basic child health [14]. Receiving formula from the government through PDS made using infant formula a more financially and physically accessible option for families to consider. infant feeding

Infant feeding practices among Iraqi women have been studied since the 1990s, with a range of studies at the national and local levels. A national study conducted from 1992 to 1994 found that wasting was more frequent among children fed with formula rather than breastfed (49.3% vs 28.9%, $p < .01$), using this information as a reason to recommend breastfeeding-promotion programs to Iraqi women [15]. More recently, a 2008 national study of 3,413 Iraqi mothers and their adult relatives showed that the majority of women (73.1%) initiated breastfeeding early after delivery [16]. Rural women with less education knew less about breastfeeding than more educated urban women, but more rural women also continued breastfeeding for longer [16].

Many recent studies have examined breastfeeding practices and programs in more localized contexts across the northern and southern regions of Iraq. Differences in regional stability and infrastructure provide useful points of comparison that should be kept in mind when studying this literature. Local studies are also useful when conflict makes a nationally representative study difficult. In the Kurdish region, a recent study assesses the impact of the Baby-Friendly Hospital Initiative on breastfeeding indicators in Shaqlawa district and reports low early initiation of breastfeeding (38.1%) and exclusive breastfeeding (15.4%) [17]. Though a significant relationship is found between delivery at the Baby Friendly accredited hospital and early initiation of breastfeeding, the other breastfeeding indicators are not significantly associated with the program [17]. These results differ from a study in the southern area of Basra in 1998, where 91% of women exclusively breast-feed at one week of age, and through one year, 52% of children receive breast milk [18]. However, these regional differences could be due to differences in income or other factors between the north and the south. Challenges to breastfeeding have been examined in southern Iraq, and sociocultural beliefs about pre-lacteal feeding as well as education level and socioeconomic status influence feeding practices [19]. Recent evidence from south-eastern Iraq also suggests that the cost of feeding infant formula is burdensome to families and less cost-effective than breastfeeding [20]. However, many of these studies assume that breastfeeding is always the best option and that women will breastfeed if only they have education and other such resources. This study contributes to the literature by combining the statistical power of national level Multiple Indicator Cluster Survey data with qualitative interviews with Iraqi Kurdish women to begin understanding how women negotiate between these different feeding practices.

Research Questions**:** *What factors explain an Iraqi woman's response to questions about breastfeeding and formula? Did those responses change before and after the Iraq War? How have women characterized their experiences with breastfeeding and infant formula in Slemani governorate?*

3. METHODS

Quantitative: MICS Dataset and Statistical Analysis

Multiple Indicator Cluster Survey (MICS) was developed by the United Nations Children's Fund (UNICEF), and then the surveys were collected by the Central Organization for Statistics and Information Technology and the Kurdistan Regional Statistics Office via collaboration with the Ministry of Health [7]. MICS data have been collected around the globe since 1995 and 1996 with 60 initial countries. The sixth wave of data collection began in 2016. UNICEF's project aims to provide information about the status of women and children across different countries, and the survey includes sections for individual women and children under five years old as well as the household at large. The Multiple Indicator Cluster Surveys (MICS) from 2000 and 2011 in Iraq are being used for these analyses. The 2000 survey includes 99,478 people of which 22,997 are women. The 2011 survey includes 238,327 people of which 56,445 women.

The outcomes of interest are "currently breastfeeding" and "currently using infant formula". Each variable is a

yes or no response on the child's questionnaire. The independent variables of interest are the governorates which are classified as follows: Dohuk, Ninevah, Sulaimani, Kirkuk, Erbil, Diyala, Anbar, Baghdad, Babil, Karbala, Wasit, Salahadin, Najaf, Qadisiya, Muthanna, Thi-Qar, Maysan, and Basrah. Location is categorized as either urban or rural. Wealth is collected as a score first and then is divided into quintiles. Maternal level of education is rated from 0 to 3 representing no education, primary education, secondary education, non-standard education. Child age ranges from 0 to 4 completed years because of age constraints on child eligibility. Child weight is measured in kilograms, while child height is measured in centimeters. Child weight for height is expressed as a z-score.

A linear probability model is used to estimate the effect of location on breastfeeding and infant formula consumption over time [21]. More specifically, in the 2000 and 2011 surveys, the breastfeeding outcome of interest is "currently breastfeed" with a yes or no response. The measure for formula consumption changes slightly between 2000 and 2011. In the 2000 survey, the formula outcome of interest asks if a bottle with a nipple/teat is given to the child, yes or no. In the 2011 survey, the formula outcome of interest asks if the child drank infant formula yesterday, yes or no. The primary independent variables of interest are which governorate the woman resided in. The year of the survey is included as a dummy variable with 2000 omitted as a reference group. To allow for changes in the effect of governorates on the outcomes of interest over time, each governorate dummy variable is also interacted with the year dummy variable in the final model. Additional dummy variables for urban, wealth quintile, and maternal education level, as well as continuous variables for child age, child weight, child height, and child weight by height z-score are also included in the model.

Qualitative Data Collection and Analysis

This was an exploratory pilot study conducted in 2017 that sought to compile qualitative data about the life histories of older women in Sulaimani governorate, Iraqi Kurdistan. Qualitative data were gathered among women across class and ethnicity. Life history interviews were conducted with 18 women. Snowball sampling for the life history interviews included internally displaced and host women from both the Arab and Kurdish communities. Participants were drawn from the urban center of Slemani, the smaller city of Chamchamal one hour south of Slemani, a village 40 minutes south of Chamchamal, and an internally displaced people camp 20 minutes south of Sulaimani. Snowball sampling was utilized among this population in particular due to currently low levels of social trust caused by the war in Iraq. During the life history interviews which ranged from 30 minutes to three hours, women were guided through questions about their childhoods and current adulthood focusing on topics related to nutrition, such as the relationship between income and food purchasing and preparation, infant feeding through breastfeeding and formula, and her access to education.

Interviews were translated from audio recordings Kurdish and Arabic directly to English through the research assistants approved under Emory University's Institution Review Board. The transcripts were de-identified and transferred to the qualitative data software MAXQDA. In MAXQDA, these data were coded and organized along thematic lines.

4. RESULTS

Quantitative Data

Descriptive statistics are presented in Table 1 below. Of the respondents to the survey who discuss breastfeeding and infant formula use (N_{2000} = 13,521; N_{2011} = 32,829), 29.45% of respondents were currently breastfeeding in 2000 which decreased slightly to 27.58% by 2011, while 13.30% of respondents were currently bottle-feeding in 2000 which increased to 18.17% by 2011. Generally, the samples for 2000 and 2011 contain equal numbers of people from each governorate and from urban and rural areas. The data from both 2000 and 2011 contain a majority of women who only have a primary education (41.20% in 2000, 50.32% in 2011). There were an approximately equal number of children aged <1 year, 1 year, 2 years, 3 years, and 4 years in completed years. Children are marginally taller and weighed slightly more on average in the 2011 sample. Finally, the children's average weight for height z-score is slightly lower than the mean in 2000 (WHZ = -0.11) and slightly higher than the mean in 2011 (WHZ = 0.11).

Table 1: Descriptive statistics

	2000 (N=13,521)		2011 (N=32,829)	
	N	%	N	%
Currently breastfeeding				
Yes	3,982	29.45	9,055	27.58
No	9,539	70.55	23,774	72.42
Currently using Infant formula				
Yes	1,798	13.30	5,966	18.17
No	11,728	86.70	26,863	81.83
Governorate				
Duhok	713	5.27	2,081	6.34
Ninewa	910	6.73	2,472	7.53
Sulaimani	452	3.34	2,328	7.09
Kirkuk	644	4.76	1,267	3.86
Erbil	527	3.90	1,719	5.24
Diyala	595	4.40	1,455	4.43
Anbar	1,039	7.68	2,553	7.78
Baghdad	689	5.10	2,115	6.44
Babylon/Babil	860	6.36	1,250	3.81
Kerbela	871	6.44	926	2.82
Wasit	666	4.93	1,713	5.22
Salahaddin	838	6.20	2,537	7.73
Al-Najaf	759	5.61	938	2.86
Al-Qadisiya	842	6.23	1,467	4.47
Al-Muthanna	755	5.58	1,531	4.66
Thi-Qar	808	5.98	1,802	5.49
Maysan	805	5.95	2,274	6.93
Basrah	748	5.53	2,401	7.31
Area				
Rural	6,350	46.96	15,280	46.54
Urban	7,171	53.04	17,549	53.46
Mother's Education Level				
None	4,960	36.68	8,254	25.14
Primary	5,570	41.20	16,519	50.32
Secondary	2,991	22.12	8,056	24.54
Wealth Index Quintiles				
Poorest	4,502	33.30	11,336	34.53
Second	2,792	20.65	7,910	24.09
Middle	2,621	19.38	6,033	18.38
Fourth	1,878	13.89	4,420	13.46
Richest	1,728	12.78	3,130	9.53
Child Age				

<1 years	2,908	21.51	6,949	21.17
1 year	2,759	20.40	6,698	20.40
2 years	2,519	18.63	6,649	20.25
3 years	2,948	21.80	6,540	19.92
4 years	2,388	17.66	5,993	18.26
Child Anthropometrics	**Mean**	**SD**	**Mean**	**SD**
Child Weight (kg)	11.39	3.45	12.05	3.88
Child Height (cm)	83.39	13.88	84.72	14.63
Child Weight for Height Z-score	-0.11	1.80	0.11	1.44

Results from the linear probability models are presented in Table 2 below. Time alone does not have a statistically significant effect on the probability of breastfeeding or using infant formula. The effect of living in urban versus rural areas is negligible for breastfeeding, while in Model 2 the probability of infant formula consumption is 2.49 percentage points higher for mothers in urban areas relative to rural residents. Generally, changes in wealth produce more significant differences in infant formula use than breastfeeding practice. Holding all else equal, the probability of breastfeeding is 0.96 percentage points lower for mothers at the median wealth level relative to the poorest mothers and is marginally significant. Increasing wealth quintiles are associated with statistically significant increases in infant formula consumption, where the probability of infant formula use increases by 6.61 percentage points for the richest wealth quintile relative to the poorest quintile, holding all else equal.

Additionally, as the level of maternal education increases, the probability of breastfeeding decreases, and the probability of infant formula use increases. For example, compared to mothers with no formal education, women who complete secondary school see a statistically significant 2.93 percentage point decrease in probability of breastfeeding, while the probability of infant formula consumption for mothers with secondary education statistically significantly increases by 4.51 percentage points, holding all else equal.

Among child anthropometric measures, the probability of breastfeeding and the probability of infant formula use both significantly decrease as height increases, while increasing child weight non-significantly increases the probability of breastfeeding and significantly increases the probability of infant formula use. Finally, as child age increases, the probability of both breastfeeding and infant formula use decrease. The probability of breastfeeding a child aged less than 1 year old statistically significantly increases by 59.15 percentage points relative to the probability of breastfeeding a 4 year old child, while the probability of infant formula use for a child less than 1 year old increases by 37.21 percentage points relative to a 4 year old.

In 2000, the probability of breastfeeding in most governorates is not statistically different from Sulaimani, a northern Kurdish governorate where the interviews are based. Meanwhile, the probability of infant formula use significantly decreases by 12-24 percentage points in most middle and southern governorates relative to Slemani. In other Kurdish areas during 2000, being a mother living in Erbil significantly increases the probability of infant formula use by 6.61 percentage points relative to Sulaimani. Living in Duhok significantly decreases the probability of infant formula use by 1.77 percentage points, which is a small decrease relative to middle and southern governorates. The change in the difference in the relative probability of a woman breastfeeding in another governorate relative to Sulaimani over 2000 to 2011 is generally negative, while the same change for a woman using infant formula is generally positive. For example, the probability of breastfeeding among mothers in Erbil is 3.24 percentage points lower than mothers in Sulaimani in 2000 and 1.79 percentage points lower than mothers in Sulaimani in 2011. Thus, while the probability of breastfeeding increases in Erbil from 2000 to 2011, it still remains below that of the Sulaimani governate. Contrastingly, the probability of infant formula use among mothers living in Erbil relative to Sulaimani significantly decreases over time from a probability of infant formula use that is 6.01 percentage points higher than Sulaimani in 2000 and 1.43 percentage points higher than Sulaimani in 2011.

Table 2: Linear probability models for current breastfeeding and current infant formula use.

Variables	**Model 1** ***Breastfeeding***	**Model 2** ***Infant Formula***
Rural	Ref.	Ref.
Urban	-0.0029 (0.0036)	0.0249 (0.0038) ****
Survey 2000	Ref.	Ref.
Survey 2011	0.0127 (0.0160)	0.0087 (0.0172)
Child WHZ^{+}	-0.0098 (0.0020) ****	-0.075 (0.0022) ***
Child Age (4 yrs)	Ref.	Ref.
Child Age (3 yrs)	-0.0301 (0.0049) ****	0.0203 (0.0053) ****
Child Age (2yrs)	-0.0211 (0.0058) ***	0.0795 (0.0062) ****
Child Age (1yr)	0.2793 (0.0072) ****	0.2412 (0.0077) ****
Child Age (0yrs)	0.5915 (0.0098) ****	0.3721 (0.0105) ****
Child Weight	0.0012 (0.0019)	0.0061 (0.0020) **
Child Height	-0.0065 (0.0005) ****	-0.0015 (0.0006) *
Maternal Ed (0)	Ref.	Ref.
Maternal Ed (1)	-0.0124 (0.0036) ***	0.0068 (0.0039)
Maternal Ed (2)	-0.0293 (0.0046) ****	0.0451 (0.0049) ****
Wealth (Poor)	Ref.	Ref.
Wealth (2nd)	0.0001(0.0043)	0.0132 (0.0046) **
Wealth (Mid)	-0.0096 (0.0048) *	0.0280 (0.0052) ****
Wealth (4th)	-0.0069 (0.0056)	0.0394 (0.0060) ****
Wealth (Rich)	-0.0144 (0.0062) *	0.0661 (0.0066) ****
Sulaimani	Ref	Ref.
Erbil	-0.0324 (0.0199)	0.0601 (0.0214) **
Duhok	-0.0509 (0.0187) **	-0.0177 (0.0201) ****
Ninewa	0.0083 (0.0179)	-0.1778 (0.0193) ****
Kirkuk	0.0250 (0.0192)	-0.1292 (0.0206) ****
Diyala	-0.0030 (0.0195)	-0.2147 (0.0210) ****
Salahaddin	-0.0207 (0.0182)	-0.1406 (0.0196) ****
Wasit	0.0231 (0.0191)	-0.2338 (0.0205) ****
Karbala	0.0678 (0.0181) ***	-0.2432 (0.0195) ****
Babil	0.0520 (0.0182) **	-0.1927 (0.0196) ****
Baghdad	0.0217 (0.0190)	-0.1620 (0.0205) ****
Anbar	-0.0022 (0.0177)	-0.1548 (0.0190) ****
Basrah	0.0431 (0.0187) *	-0.1978 (0.0201) ****
Maysan	0.0229 (0.0184)	-0.2276 (0.0198) ****
Thi-Qar	0.0545 (0.0184) **	-0.2243 (0.0198) ****
Muthanna	0.0379 (0.0186) *	-0.2011 (0.0200) ****
Qadisiyah	0.0428 (0.0183) *	-0.2095 (0.0196) ****
Najaf	0.0529 (0.0187) **	-0.1907 (0.0201) ****
2011 x Sulaimani	Ref.	Ref.
2011 x Erbil	0.0145 (0.0223)	-0.0461 (0.0239)
2011 x Duhok	0.0222 (0.0209)	0.0199 (0.0225)
2011 x Ninewa	-0.0169 (0.0200)	-0.0125 (0.0215)
2011 x Kirkuk	-0.0818 (0.0220) ***	-0.0297 (0.0237)
2011 x Diyala	-0.0338 (0.0221)	0.1066 (0.0237) ****
2011 x Salahaddin	-0.0094 (0.0202)	0.0160 (0.0218)
2011 x Wasit	0.0020 (0.0215)	0.0390 (0.0231)
2011 x Karbala	-0.0499 (0.0217) *	0.0245 (0.0234)
2011 x Babil	-0.0406 (0.0211)	-0.0143 (0.0227)
2011 x Baghdad	-0.0041 (0.0211)	0.0413 (0.0227)

2011 x Anbar	0.0241 (0.0197)	0.0853 (0.0212) ****
2011 x Basrah	-0.0369 (0.0207)	0.0070 (0.0223)
2011 x Maysan	-0.0142 (0.0206)	0.0503 (0.0221) *
2011 x Thi-Qar	-0.0079 (0.0208)	0.0318 (0.0223)
2011 x Muthanna	0.0100 (0.0212)	0.0560 (0.0228) *
2011 x Qadisiyah	-0.0166 (0.0210)	0.0604 (0.0225) **
2011 x Najaf	-0.0523 (0.0222) *	0.0008 (0.0238)
Constants	0.6471 (0.0339) ****	0.1543 (0.0364) ****
Observations	46,350	46,350
R^2 (adjusted)	0.5224	0.2005
F-statistic	1035.82****	238.24****

*P<0.05, **P<0.01; ***P<0.001; ****P<0.0001

[+] Weight for Height Z-score

Qualitative Data

Preliminary themes from the interviews conducted help illustrate potential mechanisms behind the patterns described in the quantitative data above. Mothers describe the choice of breastfeeding or infant formula use within the context of (1) stress during times when they had small children, (2) situations where the mother worked outside the home, (3) situations when siblings performed the functions of parents, and (4) situations when the children were close in age.

Stress

Women recount nursing children through becoming widows, being impoverished, giving birth on the street, and other jarring scenarios. However, stress does not appear to be cited as a reason for lack of breastfeeding or a substitution for infant formula. A woman from Chamchamal describes, "…when we had the exodus (in 1991), their father passed away, their father…You know what? I had a little daughter, who was two months old but still breastfeeding, so thanks be to God for helping me see my children grow up." Meanwhile, a displaced woman from the south shares that, "all of my children were breastfed, even though one time I gave birth on the street."

Mother working outside home and food aid

When women are describing their own childhoods, mothers needing to work outside of the house to provide an income for their family are often cited as a reason that bottle-feeding and infant formula became a viable, necessary option for them or their siblings. When a displaced woman from the south is asked why her younger sister was bottle-fed, she describes how "My mother was working outside of the house. I bought formula milk from my own money. It was not expensive because of the PDS aid program…It was normal." A wealthy professional woman also mentions the assistance of the PDS program in feeding her child, saying "I am in management now….and later when my daughter was born, she was born in 97, the PDS was introduced, and I did not have much problem."

Siblings as parents

Situations where mothers are working outside the house or have many children prompted descriptions of women taking over as mothers for their younger siblings, necessitating the use of infant formula and milk as a way to feed their siblings until their mothers returned home. A woman from Chamchamal describes staying with her younger sister and "feeding her with milk in bottles…because mother worked outside." Meanwhile, a woman from Sulaimani talks of taking care of a younger brother through giving him milk and "always holding him" in her arms.

Children close in age

When women have children close together in age, this can create a physical stress on their body, leaving them unable to provide breastmilk for two nursing children. Typically, exclusive breastfeeding can buffer against additional pregnancy, but introducing supplementation or halting breastfeeding can allow mothers to quickly become pregnant again [22] The reason behind having those children close together is not discussed during the interview, but low income is often cited as a reason for why taking care of multiple young children was so challenging. A woman from Sulaimani describes how "me and my other sister, we have a two-year age difference between us, and my mother didn't know which one of us should be breastfed. There were times when my sister drank canned milk, but I did not. Or vice versa." Meanwhile, another woman from Chamchamal speaks of the struggle of feeding the many children she had, saying "I had many children in need because I was giving birth to them one after another, and there was nothing… I breastfed my eldest son, and that's it. The rest of my children were bottle-fed. I was also trying to breastfeed them too, but there wasn't enough milk in my breast."

5. DISCUSSION

To understand the relationship between Iraqi Kurdish and Arab women's feeding strategies for their children and the context in which they live, mixed methods are deployed that emphasize the relevance of wealth, maternal education, child's current health, rural and urban differences, differences across time between 2000 and 2011, and differences between governorates. Formula and breastmilk are both meant to provide a nutritious food source for infants, but formula is a commercial product, whereas breastmilk is produced by the mother's body [23]. Thus, many arguments in favor of breastmilk take the complementary approach of showing that formula is more expensive, while breastmilk protects children against disease [20]. These arguments are complicated in Iraq by PDS and the provisioning of infant formula during the 1990s as well as issues of birth spacing and maternal work [14].

Increasing wealth is statistically significantly associated with decreases in breastfeeding and increases in infant formula use. Wealth and education are often coupled in the literature on maternal feeding practices, and maternal education similarly shows that as maternal education level increases, breastfeeding decreases, and infant formula use increases. This trend agrees with the regional literature. A Saudi Arabian cross-sectional study shows an association between low-income, less-educated women and the likelihood they will exclusively breastfeed their infants [24], while a Jordanian cross-sectional study suggests that women working are less likely to exclusively breastfeed [25]. Interviewees' narratives help explain these trends in education and wealth such as mothers continuing to breastfeed during stressful times but using infant formula when working outside of the home. Interviewees' stories included the continuity of breastfeeding during stressful periods of their life. However, both poor and wealthy

women describe working outside of the house. Women with higher education levels seem to be more likely to work outside of the house professionally and be wealthier, while poor women use outside work as an economic buffer. The interviews further suggest a possible mechanism by which poorer families need to use formula –siblings parenting their younger siblings because mothers work outside for needed additional income. However, more research is needed on potential reasons why wealthy women use infant formula. Both income levels also described benefiting from the presence of infant formula in the PDS system. The affordability of infant formula around the 1990s and early 2000s seems to remove the main deterrent often emphasized in discussions of infant formula, perceived cost. A cross-sectional study in southern Iraq finds that the mean cost of formula consumed per day is over 2,000 IQD by 6 months old [20], but this study concludes that this amoutn is a financial burden without qualitatively interviewing families to understand their opinion. Some existing work suggests that infant formula was coupled it to a narrative of modernization in aggressive marketing campaigns, wielding symbolic power in low- and middle-income contexts that might make its use appealing [26]. Additional research is also needed to understand how working mothers can be better supported to make healthy decisions about infant feeding practices that make sense for their lives.

While socio-demographic variables like wealth and maternal education have been heavily addressed in the literature on breastfeeding in the Middle East, there is a dearth of engagement on location. Often location is reduced to a rural/urban dichotomy [24]. The MICS data show that living in an urban location does not affect the probability of breastfeeding but does significantly increase the probability of infant formula use. Urban areas likely have increased access to infant formula. Additionally, interviewees in rural and urban areas discuss the challenges of having multiple children close in age, while urban residents might have more access to infant formula to nutritionally buffer children in those situations. Short intervals for spacing births can tax the mother's physical resources to produce breastmilk, making complementary or mixed feeding necessary to protect the health of both offspring [22, 27] . The reasons for this distinction between rural and urban areas needs further investigation through interviews to understand whether location is simply a proxy for income and education or if other factors are at work.

Iraq as a country has experienced political, social, cultural, and economic upheaval over the past 20 years, so using the MICS data for 2000 and 2011 allows for the examination of the effect of time on women's responses to breastfeeding and infant formula practices. Breastfeeding generally decreases between 2000 and 2011 across other governorates relative to Slemani, while infant formula use generally increases across governorates over the same time period relative to Sulaimani. Sulaimani is not only the governorate from which the interviews came but also the governorate with one of the lowest poverty rates, making it a useful benchmark for comparison [28]. In 2000, the probability of breastfeeding is not statistically different between Sulaimani and the other governorates, while infant formula use is statistically lower in most governorates compared to Sulaimani, except Erbil, where it is higher. This trend could be due to issues of maternal access or preference regarding formula, or maternal health knowledge. Within research conducted in the Kurdish region of Iraq, mothers who are giving birth for the first time at the Maternity Teaching Hospital in Erbil are shown to have some knowledge about the health and economic benefits exclusive breastfeeding in over 40% of the survey population, but maternal age and occupation (housewife, employee, or student) are shown to be associated with the level of the new mother's knowledge [29]. Beyond the mother herself, there are regional differences in women's engagement in the labor force, which might also impact the use of formula.

By 2011, the Hussein regime had toppled, and the ensuing Iraq War perpetuated violence in specific areas of the country throughout the 2000s [7]. Increased exposure to violence has been shown to decrease breastfeeding in Iraq, which could also affect infant formula use [7]. For example, in Kirkuk, a disputed area between the Kurdish region and the rest of Iraq, violence has been a recurrent problem [7], and the probability of breastfeeding significantly decreases between 2000 and 2011 relative to Sulaimani. The probability of infant formula use also decreases in Kirkuk relative to Slemani between 2000 and 2011, which suggests potential issues with formula supply and resources that would also be an expected consequence of increased violence. Diyala governorate had the highest casualty rate in 2007 from the Iraq War that began in 2003 [7], and looking at Diyala's patterns over time, the probability of breastfeeding as a mother in Diyala in 2000 is slightly lower than Sulaimani, decreasing even further in 2011 to 3.68 percentage points lower relative to Sulaimani. However, the probability of infant formula use has statistically significantly increased over time in Diyala by 10 percentage points from a probability that 21.47 percentage points lower than Sulaimani in 2000 to 10.81 percentage points lower relative to Sulaimani in 2011. Thus, mothers in Diyala might have been able to use infant formula when breastfeeding was a less favorable infant feeding strategy during times of violence. Baghdad and Najaf, two governorates that saw many battles during the Iraq War [7] show similar trends in a decreasing probability of breastfeeding over time that remains higher relative to Sulaimani. Even interviewees from governorates that experienced less direct war remember periods of exposure to violence while having young children, such as the mother who fled in the 1991 mass exodus from the Kurdish region with her two-month old. Thus, more research into the lived experiences of violence and infant feeding in Iraq would be helpful to understand maternal choice.

There is an already established precedent for differences across the country regarding health and breastfeeding. Between the Kurdish region in the north and the south/central areas of Iraq, communities already interact with health systems and ideas of healing differently [30]. Studies of breastfeeding suggest that the south breastfeeds more than the northern governorates in the Kurdish region, with some variation in beliefs associated with breastfeeding [17, 18], although the interpretation from these studies is limited by a large time difference between the two cross-sectional surveys. Thus, the significant

differences shown by the linear probability models cohere with existing literature. More work is needed to understand how geographical differences in politics, economics, society, and culture might contribute to these differences in breastfeeding and infant formula use. Previous research conducted in the Middle East regarding infant feeding practices has generally focused on what mothers know about exclusive breastfeeding and examining breastfeeding practices. Much less work has been done regarding infant formula use, and most literature takes a critical stance towards infant formula use without presenting the mother's perspective on why she makes her choices between breastfeeding and infant formula use. This study contributes to a more nuanced perspective on infant feeding practices in Iraq at the governorate level and shows that when accounting for time, location, wealth, maternal education, and child anthropometrics, governorate differences in breastfeeding and infant formula practice exist, suggesting that future maternal-child nutrition studies need to account for the effects of where a mother lives within Iraq.

Limitations and Future Research

The limitations of this research include the slight differences in MICS questions across years, and the geographical and numerical limitations of the qualitative data. Questions for infant formula were not exactly the same across the two years (giving a bottle (2000), and child had formula yesterday (2011) (MICS). However, bottle-feeding and infant formula likely refer to the same feeding strategy, so the two were combined. Breastmilk would not have been included in bottle feeding, since pumps were not available, but animal's milk could have been used in the bottle. Qualitative and quantitative research is needed to more extensively understand the common practice of mixed and complementary feeding strategies. Among mothers surveyed in a cross-sectional study conducted in primary health care centers in Erbil, the majority of them used a mixed feeding strategy that is efficient but does not emphasize exclusive breastfeeding as recommended by the WHO [31]. Mixed feeding was not addressed in the quantitative or qualitative methods of this study. To carry this research forward in the future, more extensive qualitative research needs to be done to understand what local realities obstruct or facilitate breastfeeding and infant formula use across the country. Additionally, more research needs to be done on the differences in the use of infant formula and milk, which interviewees mentioned.

4. CONCLUSION

This study contributes information on the heterogeneity of infant feeding practices across Iraq at the governorate level, suggesting that future research into maternal-child nutrition needs to better account for the effects of where a mother lives within Iraq. Additionally, by taking a mixed methods approach, researchers can begin to understand why Iraqi mothers are choosing to breastfeed and use infant formula, which can lead to more locally-appropriate and culturally-informed public health programs in the future.

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