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Exploring the impact of exclusive bottle feeding on infant serum calcium and vitamin D_3 levels in Diyala governorate, Iraq: A comprehensive study with implications for optimizing pediatric oncology and radiotherapy care

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ABSTRACT

Background: The infant receives just formula milk and no other foods when exclusively bottle fed. The newborn receives just breast milk without any additional nutrients during exclusive breastfeeding. Infants that receive a combined feeding receive breast milk, bottle milk, and other meals. Since formula feeding does not contain all of the essential nutrients needed for an infant's physiological development and growth during the first six months of life, it serves as an incomplete source of nutrient.

Objectives: The goal of this research is to ascertain the impact of feeding type on the incidence of hypocalcaemia and blood vitamin D_3 levels.

Patients and methods: Fifty patients were enrolled in this study. We collected the sample from the patients that attend Al-Batool teaching hospital in the period from twenty of October 2022 to twenty of April 2023.

Results: Fifty patients were enrolled in this study. They were 27 male and 23 females with age ranged from less than one month to two years. There was significant association between type of feeding and risk of hypocalcaemia and decrease level of vitamin D_3 in blood.

Conclusion: We concluded that there is a strong association between type of feeding and risk of hypocalcaemia and decrease level of vitamin D_3.

Keywords: Type of feeding; Serum calcium; Serum vitamin D_3; Oncology care; Radiotherapy care

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INTRODUCTION

The infant receive just formula milk and no other foods when exclusively bottle fed. To the initial six months of an infant's in existence, bottle feeding provides a portion of their nutrition. The use of formula feed fails to give the essential vitamins and minerals that are required for an infant's physiological growth and development. Because they contain necessary proteins and fatty acids, nutrients that are essential have significance for children's development of cognition and infant brain growth [1,2]. Compared to bottle milks, breast milk provides better nutritional and health benefits [3]. By breastfeeding exclusively for the first four months of life and longer, it is possible to reduce the risk of disorders such atopic dermatitis, asthma, and maybe allergic rhinitis in children up to two years old [4]. Colostrum, the term for the initial milk that mom produces, is rich in amino acids and immunoglobulin, which is crucial for protecting infants while their immune systems are still developing. The prevent jaundice by inhibit bilirubin build up and protection gastrointestinal tract by colostrum when act as laxative [5]. Infants are protected from diarrhea and acute respiratory illnesses during their first six months of life by exclusively or primarily breastfeeding [6]. Breast feeding has helpful effects for mothers like decrease danger for hyperlipidemia hypertension, defends them against ovarian, breast cancers and type 2 diabetes mellitus [7,8]. Due to their higher rates of breastfeeding and lower rates of bottle feeding, white women in the USA have a lower rate of breast cancer than black women [9]. The purpose of this study was to ascertain the effects of exclusive bottle feeding on infants' serum calcium and serum vitamin D_3, compare it to other forms of feeding such as exclusively breastfeeding for the first six months, formula feeding, or mixed feeding, and identify the percentage of mothers who were funded for this study who used bottles exclusively.

MATERIALS AND METHODS

This research was done in Iraq's Diyala governorate. In this study, fifty healthy, full-term infants were included in it. All infants had to regularly attend Al-Battol teaching hospital for medical care and follow-up at any age in order to be accepted into this study. Mothers of infants were questioned about if they only breastfed, only bottle-fed, or mixed-fed their infants during their initial 24 months of life. Infants who are exclusively breastfed only receive breast milk, infants who are solely bottle-fed only receive bottle milk, not breast milk, and infants who are mixed-fed only receive both breast milk and bottle milk. Data gathering techniques between the twenty of October 2022 and the twenty of April 2023, healthy infants were registered. At the time of the a child's visit to Al-Battol teaching hospital, the newborns' serum calcium and vitamin D_3 values were measured. The serum vitamin D_3 levels of infants were evaluated using a quick quantitative test for vitamin D. Calcium ions

react with 5-nitro-5-methyl-1,2-Bis (2-Aminophenoxy) ethane Tetraacetic Acid (NM BAPTA) in an alkaline environment to generate a complex, which allows for the measurement of infant blood calcium. In the subsequent stage, this compound interacts with Ethylene Diamine Tetraacetic Acid (EDTA). When measured photometrically, the change in absorbance is directly proportional to the calcium content. This test done by Roche cobas integra 400 Germany.

Statistical analysis

For collection and statistical analysis, information was entered into SPSS version 26 (Statistical Package for Social Sciences). One-way ANOVA was used to test the differences, and a P value of 0.05 or less was considered significant.

RESULTS

The samples

The study sample consisted of:

- The first group consist of (19) patients with breast feeding of both gender, 11 were males and 8 were females.
- The second group consist of (23) patients with bottle feeding of both gender, 11 were males and 12 were females.
- The third group consist of (8) patients with mixed feeding of both gender, 5 were males and 3 were females (Table 1).

Tab. 1. Age and gender distribution of the samples.

Age (months)	M		F		Total	
	n	%	n	%	n	%
<1 month	4	8%	5	10%	9	18%
1-6 months	10	20%	4	8%	14	28%
7-12 months	6	12%	5	10%	11	22%
>12 months	7	14%	9	18%	16	32%

Serum Calcium (S. Ca)

The (S. Ca) showed increase level in breast feeding group with mean (9.21) as compared to bottle feeding with mean (8.93) and mixed feeding with mean (8.97).

On the other hand, bottle feeding group shows a decreased level of (S. Ca) as compared to breast feeding and mixed feeding, as showed in Tables 2-4.

Tab. 2. Descriptive statistics (Mean ±) of the studied (S. calcium) in different samples (breast feeding, bottle feeding and mixed feeding).

Groups		S. Ca
Breast feeding	No.	19
	Mean	9.21
	Std. deviation	1.033814
Bottle feeding	No.	23
	Mean	8.93
	Std. deviation	0.978605
Mixed feeding	No.	8
	Mean	8.97
	Std. deviation	0.749762

Tab. 3. Descriptive statistics (Mean ± SD) with std. error of the studied (S. calcium) in different samples (breast feeding, bottle feeding and mixed feeding) distributed in gender.

Groups		Gender	N	Mean	Standard deviation
Breast feeding	S. Ca	Male	11	8.81	1.089787
		Female	8	9.75	0.690755
Bottle feeding	S. Ca	Male	11	9	1.136182
		Female	12	8.85	0.854356
Mixed feeding	S. Ca	Male	5	9.28	0.697854
		Female	3	8.46	0.61101

Tab. 4. Analysis of variance testing (equality of means) by least sig. difference method for the studied (S. calcium) among different groups.

Dependent variable	Groups	Groups
S. calcium	Breast feeding	Bottle feeding
		Mixed feeding
	Bottle feeding	Mixed feeding

Note: (**) Highly sig. at P<0.01; (*) Sig. at P<0.05; NS: Non Sig. at P ≥ 0.05

Serum Vitamin D_3 (S. Vit D_3)

As shows in Table 5, level of (S. Vit D_3) in breast feeding group with mean (37.77) was increase as compared with bottle feeding with mean (27.87) and mixed feeding groups mean (23.95).

In contrast, the mixed feeding group has a lower level of (S. Vit D_3) than the breast and bottle feeding groups, as seen in Tables 6-7 and Figure 1.

Tab. 5. Descriptive statistics (Mean ± SD) of the studied (S. Vitamin D_3) in different samples (breast feeding, bottle feeding and mixed feeding).

Groups		S. D_3
Breast feeding	No.	19
	Mean	37.77
	Std. deviation	15.04935
Bottle feeding	No.	23
	Mean	27.87
	Std. deviation	13.14569
Mixed feeding	No.	8
	Mean	23.95
	Std. deviation	12.87754

Tab. 6. Descriptive statistics (Mean ± SD) with std. error of the studied (S. vitamin D_3) in different samples (breast feeding, bottle feeding and mixed feeding) distributed in gender.

Groups		Gender	N	Mean	Standard deviation
Breast feeding	S. Vit D_3	Male	11	31.6	12.87098
		Female	8	46.27	14.256
Bottle feeding	S. Vit D_3	Male	11	33.49	16.15569
		Female	12	22.72	6.914954
Mixed feeding	S. Vit D_3	Male	5	28.98	13.30083
		Female	3	15.59	7.648418

Tab. 7: Analysis of variance testing (equality of means) by least sig. difference method for the studied (S. vitamin D_3) among different groups.

Dependent variable	Groups	Groups
S. vitamin D_3	Breast feeding	Bottle feeding
		Mixed feeding
	Bottle feeding	Mixed feeding

Note: (**) Highly sig. at P< 0.01; (*) Sig. at P<0.05; NS: Non Sig. at P≥ 0.05

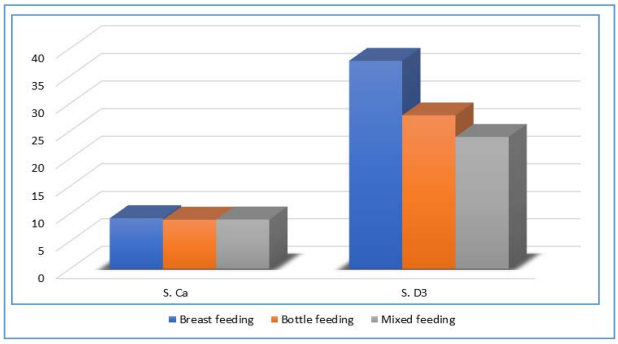

Fig. 1. Bar-charts of the studied mean's values of (S. calcium and S. vit. D_3) in different samples (breast feeding, bottle feeding and mixed feeding).

DISCUSSION

The current study examined the effects of various infant feeding practices, including Exclusive Formula Feeding (EFF), mixed feeding, and Exclusive Breast Feeding (EBF), on infants' serum calcium and vitamin D amounts through their initial two years in the Diyala governorate. Participation rates for EBF, mixed feeding, and EFF were 38%, 16%, and 46%, respectively. These rates roughly correspond to research done in Bagdad. The rates of EBF, mixed feeding, and EFF had been found to be 48%, 41%, and 11%, respectively [10].

The study sample consisted of three groups the first group consist of 19 patients with breast feeding of both gender, 11 were males and 8 were females.

The second group consists of 23 patients with bottle feeding of both gender, 11 were males and 12 were females. The third group consists of 8 patients with mixed feeding of both gender, 5 were males and 3 were females.

The serum calcium showed increase level in breast feeding group compared to bottle feeding and mixed feeding were also reported by Dorea JG and Dror DK [11,12]. On the other hand, bottle feeding group shows a decreased level of serum calcium as compared to breast feeding and mixed feeding were also reported by Challa, A et al. [13]. However, some other researchers said the study's findings showed greater calcium absorption from breast milk than the Figure 1 of 61.23% previously reported for older (4-7 month old), mixed-fed infants [14]. Other researchers concur with this study that children's seizures are typically caused by hypocalcaemia. Compared to exclusively breastfed newborns, artificially fed infants are more likely to develop hypocalcaemia. Lack of breastfeeding and improper artificial feeding are two prominent causes of hypocalcaemia in infants. Recent reports in the UK indicate an increased incidence of hypocalcaemia and vitamin D insufficiency in children and newborns without radiological signs of rickets. Recent reports from the UK indicate that children and newborns without radiological signs of rickets are increasingly experiencing hypocalcaemia and vitamin D insufficiency [15].

If the serum 25(OH) vitamin D_3 level was less than 10 ng/mL, a vitamin D deficit was determined. The serum vitamin D_3 level in the breast-feeding group was higher than that in the bottle-feeding and mixed feeding groups [16]. According to Basile, LA, et al., high-dose vitamin D was effective in raising 25(OH) D levels in breastfeeding moms to their highest levels without any evidence of harm. These other researchers disagree with this study. During the first four months, the breast milk's vitamin D_3 and calcium levels declined independently of the mother's vitamin D intake and grade. The mother's vitamin D condition improved, while the baby's calcium level remained normal [17]. Observations from a different study from the United States have led to the approval of vitamin D medication for all exclusively breastfed newborns at the first few months of age and continuation of treatment for the duration of breastfeeding [18]. The purely bottle-fed group exhibits a lower level of (S. vitamin D_3), which is contrary to some other researchers who concur with this study, like Choi et al. If a newborn is formula-fed, it cannot be assumed that the infant is receiving an adequate amount of vitamin D. The amount of formula you consume each day should be taken into account [19]. According to some other researchers who disagree with this study, including Hollis BW, Wagner CL, et al., healthy lactating women's milk typically isn't considered sufficient to prevent vitamin D deficiency in infants who are exclusively breastfed if sunlight exposure is insufficient. Recent studies have also demonstrated that healthy lactating mothers who take vitamin D supplements of 4000 IU per day and 6400 IU per day can increase the vitamin D concentration in milk to a level that provides an adequate amount of vitamin D for the breastfed infant, even though neither the mother nor the child received enough sunlight exposure [20]. Some other researchers, such as Wagner CL and Greer FR, disagree with this study, since the majority of studies on the vitamin D concentration in human milk were published in North America and Europe more than two decades ago.

The biological activity values of the vitamin D metabolite (25(OH) D) and the vitamin D in human milk were used to communicate the vitamin D content in the milk as Ant Rachitic Activity (ARA) [14,20]. In average, the mean ARA of human milk in healthy nursing mothers ranges from 10 to 80 IU/L with or without supplementing the existing recommended vitamin D intake. If human milk is the only source of vitamin D, these data point to poor vitamin D consumption in breast-fed infants compared to bottle-fed infants with the recommended intake of 400 IU/d of vitamin D [21].

The main limitations for the study was the small size of the sample, and that we collected the data from only Al-Batool teaching hospital.

CONSLUSION

According to our findings we concluded that there is strong association between type of feeding and serum calcium, serum vitamin D_3 levels.

We recommend conducting more studies about this topic an especially on the breast feeding and serum calcium, serum vitamin D_3 levels in Diyala governorate.

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