

Assessment of the Indications and Practices of Medical Formula Use in Infants Less Than One Year in Tikrit City in Iraq

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Abstract: Background: Infant feeding is one of the most critical factors in growth, development and health in the first year of life. While breast feeding is the ideal choice for infant nutrition, some medical situations require specialized medical formulas when infant nutritional needs are unique, or when medical problems make it difficult to breast feed. The correct selection, preparation, administration, and handling of medical formulas are thus significant factors in infant's health and nutrition. Objectives: The aim of this study was to identify the indications and practices of the use of medical formulas by babies under one year in Tikrit City, Iraq. Design: The convenience sampling method was used to select the participants. Data was gathered by direct questioning of mothers using a structure of a questionnaire with mainly closed questions. The data collected comprised infant demographic characteristics, maternal characteristics, indications for medical formula use, bottle sterilization methods, formula preparation practices, formula type and length of use, allergic reactions and clinical response. Results: Females made up 52.9% of the study population and 57% of the infants were urban dwellers. The majority of mothers was literate (71.5%) and without a job (78.5%). About 74.2% of infants received immunizations as per the Iraqi immunization schedule. Medical advice, most commonly, was the primary reason for starting medical formula use (57%). The most common method of sterilization bottle (71%) and 97.1% of mothers used one scoop of formula powder per ounce of water. The most common indications for medical formula use were prematurity or immature infants (31%) and acute or chronic diarrhea (29%). The most common type of formulas used was lactose-free (44%). Eighty-six percent of the infants were reported to improve clinically after using formula. Conclusions: Maternal and infant related factors, such as maternal education, attitudes, place of residence and medical advice were influential in the use and preparation of medical formulas among infants. Some of the feeding practices were found suitable, but ongoing education about the safe preparation of medical formulas and their use is still relevant.

Keywords: Infant feeding; Medical formula; Bottle feeding; Infant nutrition; Feeding practices.

Introduction

Infancy is a time of accelerated growth, brain maturation and nutritional susceptibility. Good nutrition in the first one year of life is critical to support normal growth, immune function and long-term health outcomes. While breastfeeding is the preferred method of infant feeding, there are situations in which certain babies may need other or special nutritional support due to certain medical or nutritional issues [1], [2], [3], [4], [5].

Commercial infant formulas are manufactured and marketed as a supplement to human milk when human milk is not available, inadequate, or contraindicated. Under certain conditions, special medical formulas may be needed to provide adequate nutrition for babies who have specific medical issues, such as

gastrointestinal disorders, food intolerance, metabolic disorders and other medical conditions [6], [7], [8].

Infant formulas have also experienced significant evolution in recent decades, introducing several nutrients in order to enhance infant formulas and make them more like the nutritional profile of breast milk. The ingredients are compounds that can contain iron, nucleotides, modified fat blends, arachidonic acid and docosahexaenoic acid. Infancy is a sensitive developmental stage and the safety and suitability of new foods introduced should be carefully considered, however [9], [10], [11], [12], [13].

Correct preparation and administration of infant formula is critical for the nutritional and microbiological safety of the infant formula. The cleaning and handling of feeding bottles may not be sufficient and may cause contamination and gastrointestinal infections. Previous studies have shown that poor bottle hygiene and higher incidence of infant diarrheal illness [14], [15], [16], [17].

A source of water for preparing the formula and the consistency of the formula dilution are also important. Inappropriate preparation of powdered formulas can change the nutritional content and could have a negative impact on infant health [18], [19]. Caregivers should thus adhere to recommended preparation procedures and instructions by healthcare professionals or manufacturers.

Factors such as maternal knowledge, education, attitude, socioeconomic status, and health services utilization could have a significant impact on infant feeding practices. Maternal education and family characteristics have been found to be significant factors affecting child health and feeding practices in previous studies [20], [21], [22], [23]. Healthcare professionals also have an important role to play in helping mothers to make decisions about feeding practices and the use of specialized nutrition products. While most babies are breast-fed, in some clinical condition's formula is indicated. Specific nutritional changes are necessary for gastrointestinal disorders, chronic diarrhea, lactose deficiency, cow's milk protein allergy, prematurity and some metabolic conditions [24], [25], [26], [27]. Therefore, the correct use of medical formulas should depend on the clinical condition of the infant and their nutritional needs. Factors that influence the use of formula and maternal practices around preparation and feeding of formula could be used to identify areas of knowledge gaps and to encourage safer infant feeding practices. Although the use of the appropriate medical formula is of clinical importance, there is little information available about the indications and practices of using special formula among babies in the local community. The present study was carried out to evaluate the indications and practices regarding the use of medical formulas by infants less than 1 year in Tikrit city, Iraq.

Materials and Methods

Study Design and Setting

A descriptive cross-sectional study was conducted among infants younger than one year of age who were admitted to Salahaldin General Hospital, Salahaldin Governorate, Iraq.

Study Period

The study was conducted from November 12, 2024, to July 5, 2025.

Study Population and Sample Size

The study included 70 infants younger than one year of age who were using medical formulas. The study population consisted of 33 male infants and 37 female infants.

Sampling Technique

Participants were selected using a convenience sampling method according to the availability of eligible infants during the study period.

Data Collection

The data was gathered by conducting a face-to-face interview with the mothers of medical formula-fed babies. A well-constructed questionnaire was created to gather information pertinent to the study's aims. The questionnaire was a mainly closed type with some open-ended questions as appropriate.

The information collected involved infant's demographic characteristics, maternal education and employment status, place of residence, the mother's mode of preparation for medical formula, the concentration of medical formula, clinical indications for using medical formula, types and duration of medical formula use, the occurrence of allergic reactions and response to medical formula after administration.

Data Management and Analysis

The collected data were organized, summarized, and presented using tables and figures. Descriptive statistics, including frequencies and percentages, were used to describe the characteristics of the study population and the reported practices related to medical formula use.

Ethical Considerations

All mothers who participated in this study were briefed on the purpose and objectives of this study before the data collection. Parents' consent was sought and obtained verbally prior to the interviews and participation was voluntary. All data was kept confidential during the study.

Results

Demographic and Maternal Characteristics of the Study Population

70 infants under the age of one year were included in the study. Females infants comprised a slightly larger proportion of the study population than did male infants. The majority of babies were urban residents. Most mothers were uneducated and not working. About three-fourths of the babies received immunizations following the standard Iraqi immunization program. The results showed that 52.9% were female and 47.1% were male. The population was divided between those living in cities and those living in rural areas, with 57% of the population being urban. The majority of the mothers (71.5%) could read and write while majority were not employed (78.5%). Furthermore, 74.2% infants were immunized in line with the Iraqi immunization schedule (Table 1).

Table 1. Demographic, Maternal, and Clinical Characteristics of Infants Using Medical Formula

Variable	Category	Frequency/Percentage
Sex	Female	52.9%
	Male	47.1%
Residence	Urban	57.0%
	Rural	43.0%
Maternal education	Literate	71.5%
	Illiterate	28.5%
Maternal employment	Unemployed	78.5%
	Employed	21.5%
Vaccination status	Vaccinated	74.2%
	Unvaccinated	25.8%
Water source	Filtered water	76.0%
	Tap water	24.0%
Growth parameters	Normal	70.0%
	Abnormal	30.0%

Reasons for Using Medical Formula

The most frequent indication of the use of medical formulas among the infants participating in this study was medical advice. It was less common for relatives to provide advice and for the participants to choose between the options. Physician's recommendation (57%) and relatives' recommendation (27%) were the most common reasons for using medical formula, with personal choice accounting for 16% of formula use (Fig. 1)

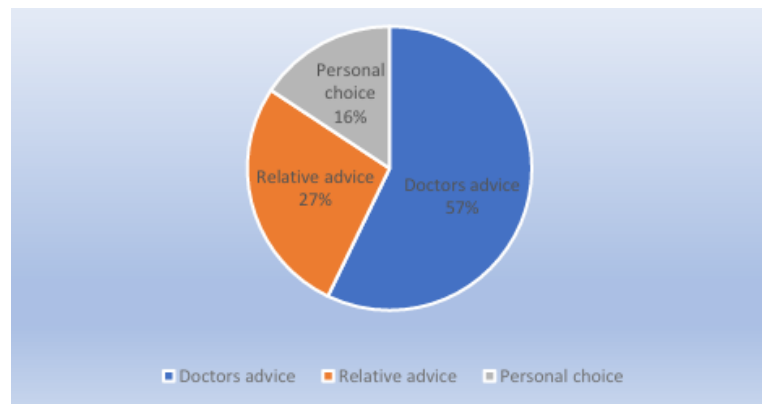


Figure 1. Reasons for Using Medical Formula

Methods of Bottle Sterilization

Different methods of cleaning and sterilizing feeding bottles were reported by the mothers. Boiling was the most frequently used method. Boiling was used by 71% of mothers as the primary method of bottle sterilization. Brushing was reported by 16%, whereas washing alone was reported by 13% (Fig. 2).

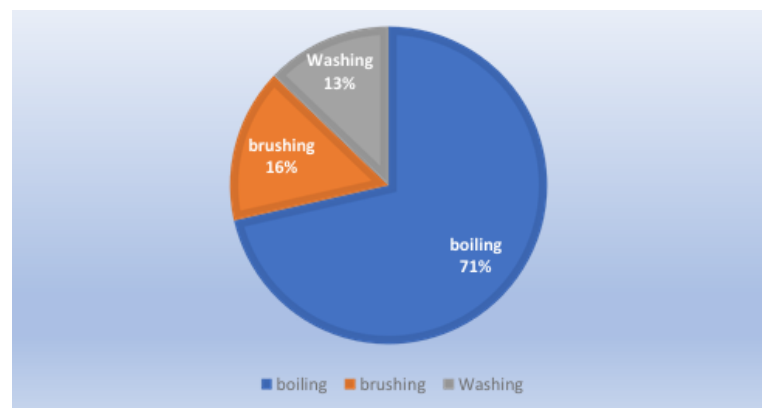


Figure 2. Methods of Bottle Sterilization

Formula Preparation Practices

The majority of mothers prepared the formula using one scoop of formula powder per ounce of water. Almost all mothers (97.1%) reported using one scoop of formula powder for each ounce of water. Only 2.9% reported using two scoops per ounce, while none reported using half a scoop (Fig. 3).

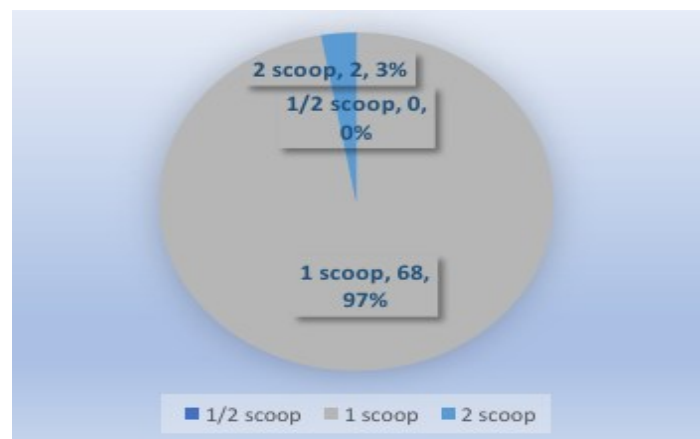


Figure 3. Number of Scoops Mixed With Each Ounce of Water

Medical Indications for Formula Use

Several clinical indications were treated with medical formulas. The most frequently reported indication was "prematurity or immature infants. The clinical indications with which medical formula has been used

are shown in the figure 4. The most prevalent was prematurity or immaturity (31%) and the next most common was acute or chronic diarrhea (29%). Gastroenteritis (21%), cow's milk protein intolerance (11%) and other condition (around 7%) accounted for 21%, 11% and 7% respectively.

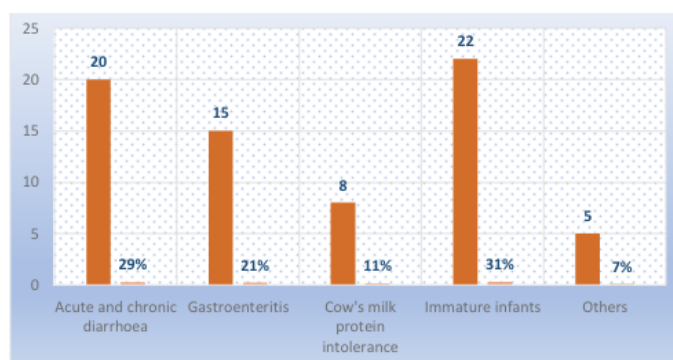


Figure 4. Medical Conditions Indicating the Use of Medical Formula

Types of Medical Formula Used

The infant participants were given different special formulas based on their nutritional and medical needs. The frequency of the various types of medical formulas used by the study population are shown in figure 5. Lactose-free formula was the most common type of formula (44%), followed by metabolic formulas (36%). Other special formulations such as extensively hydrolyzed and soya were also utilized.

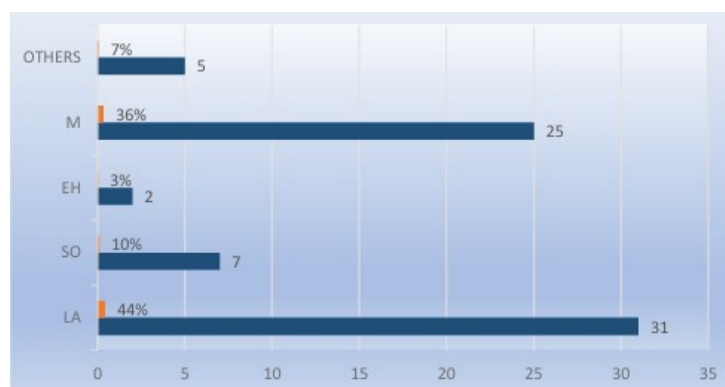


Figure 5. Types of Medical Formula Used by Infants. M: metabolic formula; EH: extensive hydrolyzed formula; SO: soya-based formula; LA: lactose free formula

Duration of Medical Formula Use

The amount of time infants used medical formula was variable. Figure 6 shows that the infant's formula use distribution of durations. The most common period of use was 25–30 days (36%). 20–25 days and 15–20 days were the most commonly reported durations, each accounting for 19%, while 5–10 days was the least commonly reported, at 10%.

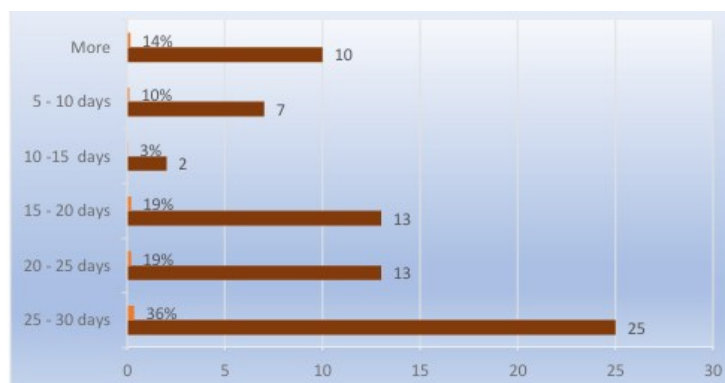


Figure 6. Duration of Medical Formula Use

Allergy to Medical Formula

Allergic reactions reported for the use of medical formula were evaluated in the infants involved in the study. Figure 7 shows the allergic reaction(s) experienced and not experienced in relation to medical formula use. No more than 7.1% (most infants, 92.9%) of them had an allergic reaction to the medical formula.

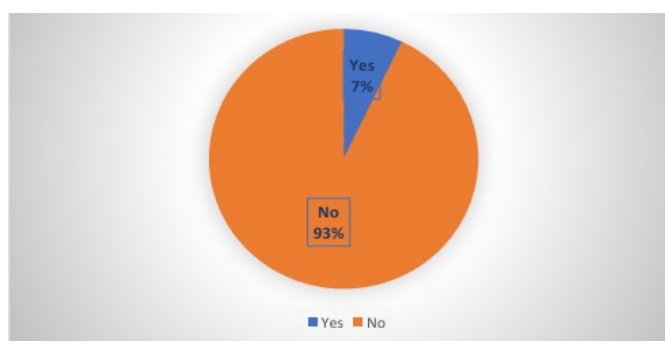


Figure 7. Frequency of Allergy to Medical Formula

Clinical Response to Medical Formula

Medical formulas reported clinical improvement in most of the infants. The figure 8 illustrates the clinical response of infants after the use of medical formulas. About 86% of infants improved and 14% did not improve.

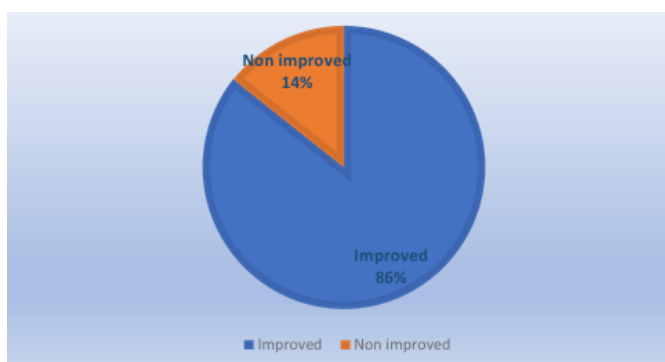


Figure 8. Clinical Response to Medical Formula Use

Disease Recurrence After Discontinuation of Medical Formula

The rate of recurrence of the underlying condition after stopping medical formula was also assessed. In figure (9) that show the frequency of recurrence of diseases after stop usage of medical formula Infant who did not have any complication were (48) while those who had complications are (22).

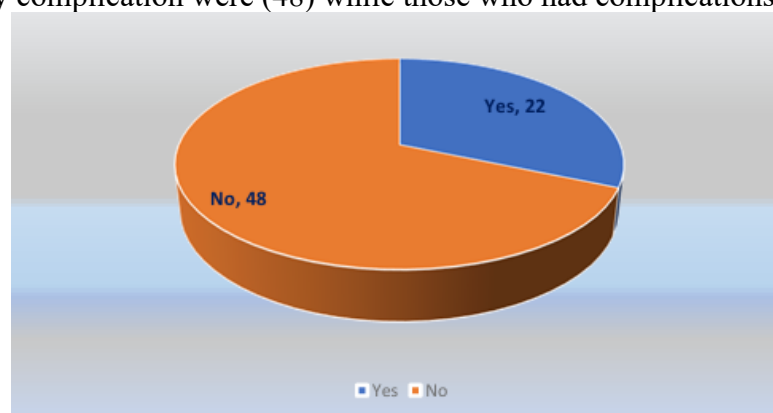


Figure 9. Disease Recurrence After Stopping Medical Formula

Discussion

The current study aimed to examine the indications and practices of the use of medical formula among infants under the age of one year in Tikrit City. Results showed that a number of maternal, demographic

and clinical variables were linked to the use of special formulas. In the current study, there were slightly more female infants than male infants (52.9% female and 47.1% male). The original study made comparisons with previously reported population data, however sampling characteristics and population size from which the participants were recruited may have affected the sex distribution [28], [29].

The vast majority of the infants in the present study resided in an urban area. A person's place of residence can impact the person's ability to access health care, commercial products, and health-related information. Child health and nutrition practices can also be influenced by urban and rural differences in the environment and social conditions [30]. A relatively high level of education was observed among the study participants in that 71.5% of mothers were considered to be literate. Numerous studies have found that maternal education plays a key role in the health and health-related behavior of children. Educated mothers may be better informed about health information, and be provided with more opportunities to receive professional advice on safe infant feeding practices [31], [32], [33], [34], [35], [36].

The majority of mothers in the present study were unemployed. Working status of the mother might affect infant feeding decisions due to the fact that employment status and family responsibilities can impact time available for infant feeding and infant care. The use of medical formulas should, however, be in the first place to cater to medical indications and not simply for social convenience. Around three-fourths of infants participating in the study were immunized on schedule with regular immunizations in Iraq. This is likely an acceptable level of engagement in preventive healthcare services. Comparable immunization rates for children have been reported in other developing countries, highlighting the significance of national and international immunization programmer [37], [38], [39], [40].

Medical advice was most often cited as the reason for initiating formula. This is particularly important because the underlying medical/nutritional state of the baby should determine the type of infant formula to be given. It is important to health professionals to know when to use them and how to use them safely, as well as knowing when to give them a second thought [41], [42]. Sterilization of bottles in the present study was most commonly reported to be achieved by boiling. Cleaning and sterilization of feeding equipment are important to minimize the risk of microbial contamination. The previous studies have focused on the association of feeding bottle hygiene and gastrointestinal disease in infants [43], [44].

The majority of mothers said they used 1 ounce of water for every 1 scoop of formula powder. Correct formula preparation is important, as using the incorrect dilution can affect the nutritional content of the prepared feed. Recommendations from around the world stress the need for proper feeding and formula preparation to keep infants safe and well fed [34]. In the present study, the most common clinical signs associated with medical formula use were premature or immature, acute or chronic diarrhea, and gastroenteritis. Nutritional modifications may be necessary based on the condition, tolerance, and nutritional status of infants with gastrointestinal disorders. Inadequate nutritional status is a potential cause of poor growth and clinical outcomes during diarrheal diseases and appropriate feeding practices are especially important during these illnesses [6], [15], [20].

In the present study, lactose-free formulas were the most commonly reported specialized formula used. If the lactose intolerance or any other food-related disorder is present, then adjustments in dietary intake may be necessary, but the type of formula should be chosen based on a clinical evaluation that is suitable [38], [39], [40]. The medical formula did not trigger an allergic response in most infants and clinical improvement was seen by most after using the medical formula. These results might indicate that the formulas were mostly suitable for the conditions under which they were applied. However, factors such as the underlying disease, concurrent medical treatment, and other factors that might affect recovery should be taken into account in interpreting the clinical response. More babies were not at risk of recurrence or complications when they stopped medical formula. The nutritional management is a critical aspect during and after illness, as poor nutritional practices can negatively impact on nutritional outcomes and complications.

Conclusion and Recommendations

The present study showed that there are several maternal, social and clinical factors that were related to the use of medical formulas among infants under one year. There seemed to be significant differences in the use of the specialized formulas as a function of maternal education, occupation, and medical advice, especially. Most mothers reported on several appropriate practices of medical formula preparation and

equipment cleanliness of feeding equipment. Bottle sterilization was the most common practice, with most mothers reporting the use of the recommended amount of formula powder when preparing a bottle. The most prevalent reason for starting formula was medical advice.

Medical formula use was primarily seen for clinical indications of prematurity, diarrhea, gastrointestinal disorders. Some of the formulas used were lactose free and metabolic. Clinical improvement was seen in most infants and allergic reactions were relatively rare. The results of this study indicate that constant health education and expert guidance are needed to encourage the right use, selection, and preparation of medical formulas for infants.

Recommendations

1. Mothers should be educated on the correct indications for medical formula use.
2. Healthcare professionals should give clear instructions on how to prepare, store and give medical formulas.
3. Mothers should be encouraged to practice recommended bottle cleaning and sterilisation practices.
4. Use manufacturer's instructions when preparing formula to prevent from being made too dilute.
5. Medical formulas should be used preferably with the guidance of qualified health care professionals.
6. Further research is suggested in the form of larger studies that will be conducted in other healthcare institutions and larger populations to further explore the practices of feeding infants with medical formula.

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