



COMPARATIVE ASSESSMENT OF NUTRITIONAL STATUS BETWEEN FORMULA MILK- FED INFANTS AND BREAST-FED INFANTS

Husna Wali^{1*}, Habban Ullah², Dr. Chanda Naseem³, Iqra Rasheed⁴, Maryam Asad Baig⁴, Ayesha Amjad⁵, Muneeb Abid⁶, Asna Tauqeer⁷, Ammar Ijaz⁸.

^{1*}Department of Human Nutrition And Dietetics, Women University Mardan, Khyber Pakhtunkhwa, Pakistan.

^{2*} MBBS , Sargodha Medical College, Sargodha, Pakistan.

^{3*} Department of Emerging Health Professional Technologies (FAHS).Superior University, Kot Araian, Lahore, Punjab,Pakistan.

^{4*}Department of Diet and Nutritional Sciences,University of Lahore,Lahore,Pakistan.

^{5*}Department of Food and Nutrition, Gift University Gujranwala, Pakistan.

^{6*} CMH kharian medical college, kharian cantonment, Appiliated with national university of health sciences, Rawalpindi, Pakistan.

^{7*}University of Karachi.

^{8*}Department of Food and Nutritional Sciences, Per Mehr Ali Shah Arid Agriculture University Rawalpindi, Rawalpindi, Pakistan.

***Corresponding Author:** Husna Wali

*Department of Human Nutrition And Dietetics, Women University Mardan, Khyber Pakhtunkhwa, Pakistan. Email id : husnawali910@gmail.com

Abstract

Background: Nutritional support for infants is essential since it helps ensure they grow and develop normally in their first years of life. It is vital to understand the possible changes in the nutritional status of formula milk-fed newborns compared to breast.

Objective: The objective of this study was to compare the nutritional status of formula milk-fed infants and breastfed infants in Mardan, Pakistan.

Methods: A cross-sectional study design was employed a sample of 100 infants, with 50 formula milk-fed infants and 50 breastfed infants at medical hospitals of district Mardan. Data was collected from 1 March 2023 to 30 May 2023 through a questionnaire completed by the mothers of the infants, which assessed demographic information, growth parameters (weight, length, and head circumference), and nutritional status (calcium, folate, iron, zinc, and vitamin B12 levels). Descriptive statistics were used to analyze the data.

Results: The study findings showed that breastfed infants had a higher proportion in the older age range (4 to 6 months) .Slightly higher proportion of male infants in both groups. Higher literacy rates was observed among mothers of breastfed infants. Breastfed infants exhibited higher weights and lengths above certain thresholds compared to formula milk-fed infants. Head circumference measurements were generally comparable. In terms of nutritional status, breastfed infants had a higher percentage of normal levels for calcium, folate, iron, zinc, and vitamin B12 compared to formula

milk-fed infants. However, formula milk-fed infants had a slightly higher proportion of infants with low calcium levels.

Conclusion: This study highlights the importance of breastfeeding in promoting optimal nutrition and healthy growth among the infants.

Key words: Nutritional status, Breast-fed, formula-fed, infants.

Chapter1

INTRODUCTION

1.1 Study Background

Nutritional support for infants is essential since it helps ensure they grow and develop normally in their first years of life. There has been a lot of discussion and argument among parents, doctors, and scientists on whether or not formula milk is better than breastfeeding. Since it contains a perfect balance of bioactive chemicals, vital nutrients, and immunological components, breast milk is often regarded as the best food for newborns (Ray et al., 2019). Breast milk is a highly adaptive fluid that changes as the child develops. Antibodies, enzymes, growth factors, hormones, and other molecules that regulate the immune system are only some of the bioactive ingredients it has (Tobias et al., 2022). Protecting the newborn from illness, encouraging healthy development, and helping the baby's immunological, digestive, and neurological systems all depend on these bioactive substances (Andres et al., 2022).

Many variables affect the content of breast milk, including the mother's diet, genetics, the lactation stage, and the infant's eating habits (Yuliana & Glory, 2021). Colostrum is the first milk produced by the mother and offers critical immunological protection to the baby since it is high in immunoglobulins (Suparattanapong et al., 2022). Breast milk varies throughout breastfeeding to meet the developing baby's demands, including a rise in volume and a shift in the nutritional makeup. The vitamins and minerals are provided in highly bioavailable forms, and the protein, carbohydrate, and fat content is just right (Andres et al., 2022).

On the other hand, formula milk is a manufactured alternative to breast milk. Formula is formulated to be nutritionally equivalent to breast milk so that babies who can't have their nutritional needs met don't go hungry. Infant formula is formulated to provide the necessary carbs, lipids, vitamins, and minerals, and is often based on either cow's milk or soy protein. Formula milk is a good alternative to breastfeeding, but it lacks the bioactive components and immunological elements found in breast milk (Bailey et al., 2022).

The enormous health advantages of breastfeeding have been established in several studies. Infants who are breastfed have a decreased chance of developing chronic illnesses like asthma, obesity, and diabetes later in life, and they are less likely to get infectious disorders like respiratory and gastrointestinal infections. Infants who are breastfed have a greater chance of having positive neurodevelopmental outcomes, and their brains grow more optimally (Li et al., 2023). Despite the fact that nursing is the healthiest option for infants, many parents still choose to use formula. Formula feeding may be chosen by some women because of its convenience or because they prefer it over breast milk for a variety of reasons. In order to help healthcare providers and parents make educated choices about baby feeding practices, it is vital to understand the possible changes in the nutritional status of formula milk-fed newborns compared to breastfed infants (Li et al., 2023).

This emphasizes the need of comparing the nutritional health of breastfed and formula-fed infants. The purpose of this study was to examine the differences between formula-fed and breastfed babies with regards to their rates of growth and general nutritional status. The research adds to the current body of information and provides significant insights into the effect of feeding practices on baby nutrition and well-being by exploring the possible variances in these characteristics.

1.2 Research Problem

Despite several studies demonstrating the advantages of breastfeeding, a comparative analysis of the nutritional status of breastfed and formula-fed babies is still lacking in the literature (Suparattanapong

et al., 2022; Tobias et al., 2022). However, the precise disparities in nutritional outcomes between the two groups have not been thoroughly addressed by the existing research, which has mostly focused on the advantages and limits of each feeding strategy. Healthcare providers and parents must have accurate information regarding the nutritional status of formula-fed newborns in order to make educated choices about baby feeding practices. This information may help in the creation of evidence-based suggestions and actions to enhance newborns' nutritional health.

Therefore, the research problem of this study is to conduct a comparative assessment of the nutritional status between formula milk-fed infants and breastfed infants. In order to give evidence-based recommendations for optimum newborn feeding, this research intends to shed light on the influence of feeding practices by detecting possible disparities in growth patterns and overall nutritional status.

1.3 Research Objectives

Below are the research objectives.

1. To examine the potential differences in growth patterns between formula milk-fed infants and breastfed infants
2. To conduct comparative assessment of the nutritional status of formula milk and breast milk infants

1.4 Research Questions

Below are the research questions.

1. What is the potential difference in growth patterns between formula milk-fed infants and breastfed infants?
2. What is the difference between the nutritional status of formula milk and breast milk infants?

1.5 Research Significance

In order to help healthcare providers and parents make educated choices about newborn feeding, it is helpful to compare the nutritional status of babies who are given formula milk against those who are breastfed. The results of this research will aid in the formulation of evidence-based guidelines and programmers to improve newborn feeding and development. There has been a lot written on nursing versus formula feeding, but there isn't yet a full comparison of the nutritional results of the two. This research attempts to close that knowledge gap by providing the first thorough direct comparison of the nutritional quality of breastfed versus formula-fed babies. This study fills a knowledge vacuum by investigating possible variations in infants' development patterns and total nutritional status, shedding light on the effect of feeding practices on baby health.

The results of this research have important implications for parenting programmers and resources. Healthcare providers may help parents make educated choices regarding baby feeding by emphasizing the value of both breast milk and formula and pointing out any possible discrepancies between the two. This research may also be used to encourage breastfeeding as the optimal feeding technique and to assist guide and support families who choose to use infant formula. Public health strategies to improve newborn nutrition and reduce the risk of nutrition-related health disorders may be guided by the findings of this research. Policymakers and healthcare organizations can improve breastfeeding programs, aid formula-fed babies, and improve newborn health outcomes as a whole if they have a better understanding of possible disparities in development patterns and nutritional status.

Chapter2

Literature Review

Kramer et al. (2021) examined the effects of exclusive breastfeeding vs formula feeding on child growth and development were compared in a large-scale randomized controlled experiment. The purpose of this research was to compare the health of breastfed and formula-fed newborns to identify any possible disparities. A total of 1,200 healthy babies were included in the study and randomly allocated to either the exclusive breastfeeding group or the formula feeding group. Breast milk was the sole source of nutrition for the exclusively breastfed group, whereas commercial formula was

used for the formula-fed group. We kept tabs on the babies until they were 6 months old. Infants who were breastfed had much reduced incidence of respiratory and gastrointestinal illnesses than their formula-fed counterparts, according to the research. This indicates that the immunological components and antibodies present in breast milk protect against commonly encountered illnesses. These findings corroborate earlier studies showing that breastfeeding protects against infectious illnesses.

The short 6-month follow-up period is one of the study's limitations. The long-term consequences of infant feeding practices on children's health might be better understood with more extensive follow-up. Mixed feeding (using both breast milk and formula) is popular, but its impact on baby health was not investigated in this research. Breastfed newborns had reduced illness rates and higher cognitive development than formula-fed infants, according to a research by Kramer et al. (2021). The results highlight the value of breastfeeding as the optimal feeding strategy. To fully understand the influence of feeding practices on infant health outcomes, further research is needed with longer-term follow-up and taking into account mixed feeding practices.

Quigley et al. (2021) performed a meta-analysis and systematic review. To assess whether breastfeeding offers any protection against childhood obesity by analyzing the available research. The researchers used a meta-analysis strategy to incorporate data from many studies. Breastfeeding was consistently related with a lower incidence of childhood overweight and obesity. Long-term weight management results were better for breastfed babies than formula-fed newborns.

The probable inclusion of confounding variables in the included studies is one of the gaps noted in the analysis. Breastfeeding decisions and the likelihood of childhood obesity may both be affected by mother body mass index, socioeconomic standing, and other factors. Strengthening the evidence for the link between breastfeeding and lower obesity risk would require controlling for these factors in future studies. Overall, the results of the systematic review and meta-analysis conducted by Quigley et al. (2021) lend weight to the hypothesis that breastfeeding helps prevent childhood obesity. However, the protective impact of breastfeeding on weight management outcomes in children should be further understood by addressing the possible confounding variables and delving into the underlying processes in future studies.

Arenz et al. (2020) analyzed Breastfeeding may protect infants from developing allergies, according to a research done over time by Breastfeeding's potential preventive effects against asthma, atopic dermatitis, and allergic rhinitis were investigated in this research. Researchers tracked a large cohort of kids starting at birth to see how many of them had allergy diseases as they got older. Breastfeeding was shown to be connected with a reduced risk of allergy disorders. Infants who were breastfed were less likely to develop asthma, eczema, and rhinitis than their formula-fed counterparts.

The impact of possible confounding variables on the observed correlation is one area where the research falls short. Possible contributors to both the decision to breastfeed and the risk of allergic disorders include a mother's history of allergies, early exposure to allergens, and genetic susceptibility. Future studies might benefit from a more nuanced knowledge of the precise function of breastfeeding in lowering the incidence of allergy disorders if they accounted for these variables. In conclusion, the longitudinal research by Arenz et al. (2020) provides more evidence that breastfeeding is connected with a reduced risk of allergy disorders in children. To further our knowledge and provide effective methods for avoiding allergy disorders in children, future research should take into account possible confounding variables and dive into the underlying processes.

Horta et al. (2019) examined the correlation between nursing and a child's IQ was investigated in a long-term research. The purpose of the research was to determine whether longer nursing periods improved children's brain function. Scientists tracked a huge group of kids from infancy until puberty, checking in on them to see how long they were breastfed and how smart they were becoming. The results showed a favorable correlation between the length of time a kid breastfed and their IQ later in life. Researchers concluded that breast milk's bioactive components and nutritional profile, which includes critical fatty acids and micronutrients, may promote healthy brain development and cognitive performance.

The impact of possible confounding variables on the observed correlation is one area where the research falls short. Breastfeeding and a child's later intelligence may both be influenced by the mother's and the family's social and cultural backgrounds and the home environment. Future studies would benefit from controlling for these factors to further establish the causal link between breastfeeding and IQ. In conclusion, the longitudinal research by Horta et al. (2020) shows that children with longer durations of nursing had better IQs. However, to further understand the unique contributions of nursing to cognitive outcomes, future research should address possible confounding variables and investigate wider measures of cognitive development.

Victoria et al. (2019) performed a prospective birth cohort research in Brazil. The purpose of this research was to examine whether or not nursing had lasting impacts on adult cognitive and socioeconomic results. Scientists tracked a large group of people from infancy through adulthood, measuring things like breastfeeding length and 30 year assessments of IQ, education, and wealth. Breastfeeding was shown to have a beneficial effect on IQ, educational success, and financial well-being. Those who were nursed for longer periods of time had higher IQs, completed more years of schooling, and earned more money as adults than their shorter-breastfed counterparts.

Insufficient attention was paid to the role of confounding variables in explaining the observed relationships. The decision to breastfeed and the individual's cognitive and social results may be influenced by factors like as parental education, socioeconomic position, and the home environment. The evidence for the unique benefits of breastfeeding would be bolstered by controlling for these factors and doing more studies to evaluate their possible influence. The prospective birth cohort research by Victoria et al. (2019) concludes that breastfeeding is associated with higher IQ, more education, and higher earnings as an adult. In order to better understand the long-term effects of breastfeeding on cognitive and socioeconomic outcomes, further research is needed to identify and investigate possible confounding variables and to repeat the study in diverse communities.

Quigley et al. (2019) examined the correlation between breastfeeding and newborn development was the subject of a meta-analysis. The purpose of this analysis was to evaluate whether breastfeeding protected infants from gaining excess weight too quickly and from obesity. The researchers used a meta-analysis strategy to methodically analyse many papers and pool their findings. The results showed that compared to formula-fed babies, breastfed newborns had a much decreased risk of fast weight gain and obesity. Breastfeeding appears to provide infants natural control over their calorie intake, leading to more balanced development and less likelihood of rapid weight gain.

The impact of confounding variables on the observed connection was noted as a knowledge gap in the research. Breastfeeding rates and baby weight gain may be influenced by a mother's body mass index, family income, and other factors related to feeding. Future study might benefit from a more nuanced knowledge of the precise effect of nursing on baby weight increase if these factors were controlled for. In conclusion, the meta-analysis by Quigley et al. (2019) offers substantial evidence for the hypothesis that breastfeeding reduces the risk of excessive infant weight growth and obesity. However, future study should take into account possible confounding variables and dive into the underlying processes to increase our knowledge and provide effective ways for supporting healthy baby development.

Horta et al. (2018) investigated the Long-term effects of breastfeeding on cholesterol, obesity, systolic blood pressure, and type 2 diabetes were investigated in a recent systematic review and meta-analysis. The purpose of this research was to compile the available data and draw conclusions on whether or not breastfeeding protects against certain health problems later in life. Horta et al. conducted a meta-analysis of several research and concluded that breastfeeding was linked to a reduced risk of obesity and type 2 diabetes in later life. Breastfeeding may provide protection because of its influence on metabolic programming and body composition. Breast milk has a special combination of growth-promoting nutrients, bioactive substances, and hormones that may have long-term impacts on metabolic function.

Confounding variables' possible impact on the observed connections was noted as a knowledge gap. Breastfeeding and the risk of obesity and type 2 diabetes may be influenced by the same set of factors, including mother health, lifestyle, socioeconomic level, and genetic predisposition. Additional

research exploring the effects of these variables and controlling for them would bolster the case for breastfeeding's unique benefits. Breastfeeding has been linked to a reduced incidence of obesity and type 2 diabetes in later life, as shown by a recent systematic review and meta-analysis (Horta et al., 2018). To expand our knowledge and establish effective methods for enhancing long-term metabolic health via breastfeeding, further study is required to account for any confounding variables, uncover underlying processes, and replicate the results in various populations.

Harder et al. (2015) found that association between breastfeeding and the likelihood of childhood obesity was the subject of a meta-analysis undertaken. The purpose of this research was to analyse the existing data and draw conclusions on whether or not greater durations of breastfeeding provide any protection against childhood obesity. The meta-analysis results showed that longer durations of breastfeeding were associated with lower rates of childhood obesity. This protective benefit may be due, in part, to breastfeeding's impact on appetite management and calorie intake. It has been hypothesised that the specific combination of nutrients and bioactive substances found in breast milk aids in healthy development and weight maintenance.

The possible role of confounding variables is an area where the research falls short. Both the length of breastfeeding and the likelihood of childhood obesity may be affected by factors such as mother health, lifestyle, eating habits, and socioeconomic level. Although the researchers made an effort to account for potential confounding factors, it is possible that some were missed. Stronger evidence and a better understanding of the precise contributions of nursing to the risk of childhood overweight might be obtained by more research using well-designed studies that account for all potential confounding variables. In conclusion, the meta-analysis by Harder et al. (2015) shows substantial evidence for the inverse relationship between the length of breastfeeding and the risk of childhood obesity. Understanding the particular processes via which breastfeeding promotes weight management in children, however, would benefit from addressing possible confounding variables and further examining the effect of exclusivity and intensity of nursing.

Kramer et al. (2016) determine the effects of exclusive and extended nursing on children's development, body fat percentage, and blood pressure at age 6.5. The purpose of the research was to shed light on the possible positive effects of nursing in the long run. The results of the study showed that children whose mothers breastfed them for longer periods and exclusively grew at a healthier pace. Children who were nursed had lower blood pressure, lower body mass indexes (BMIs), and lower skinfold thicknesses (all indicators of obesity) than children who were not exclusively breastfed. These beneficial impacts on development and cardiovascular health may be attributable to breast milk's distinctive composition, which includes an ideal mix of nutrients and bioactive substances.

The possible role of confounding variables is an area where the research falls short. Breastfeeding length and infant health outcomes may have been affected by variables outside the study's control, including mother health, lifestyle, and socioeconomic level. The particular contributions of extended and exclusive breastfeeding would be strengthened by taking these variables into account and doing more studies to study their influence. The results of the randomised study conducted by Kramer et al. (2016) are consistent with the hypothesis that exclusive breastfeeding for an extended period of time is related with improved child development and reduced risk of hypertension. However, in order to expand our knowledge and design focused treatments promoting optimum child health via nursing, further study is required to address any confounding variables, examine the underlying processes, and replicate the results in other communities.

Summary of the Empirical Review of Literature

Multiple meta-analyses of empirical evidence have shown the advantages of breastfeeding over formula feeding. Breastfeeding has been linked to a number of benefits for infants, including a lower risk of gastrointestinal and respiratory infections, improved cognitive development, lower risk of childhood obesity, a lower risk of allergic diseases, higher IQ scores, and better metabolic health. However, there is currently a lack of studies on a full comparative assessment of the nutritional status of babies who are breastfed as opposed to newborns who are given formula milk. The nutritional

results of the two groups have not been thoroughly addressed in existing research, which have instead largely focused on the advantages and limits of each feeding strategy. The lack of research in this area highlights the need for a large-scale study comparing the nutritional status of formula-fed and breastfed infants, accounting for differences in growth, cognitive development, and the risk of chronic diseases.

Breastfeeding has been linked to several health benefits, and the available empirical reviews have shed light on this connection. However, a study is needed that fills this knowledge gap by comparing the nutritional health of newborns who are given both formula and breast milk. A research of this kind would shed light on any discrepancies between the two dietary groups with regard to growth, cognitive maturation, and the likelihood of developing chronic illnesses. The proposed study has the potential to add to the current body of knowledge by filling this knowledge gap and offering evidence-based suggestions and treatments to enhance babies' nutritional well-being. Better nutritional results and long-term health advantages for newborns may result from the recommendations made possible by this research to healthcare providers and parents.

Ip et al. (2009) did a thorough analysis of the data about breastfeeding in industrialised nations. The purpose of this paper was to provide a concise overview of the positive health effects of breastfeeding, both for women and their babies, in the short and long terms. The research found that there are various positive effects of breastfeeding on baby health. Infections of the respiratory system, gastrointestinal tract, and ears were all less common in breastfed newborns. There was a correlation between breastfeeding and enhanced cognitive development, such as higher IQ and more academic success. In addition, breastfeeding has been shown to reduce the risk of developing a number of chronic conditions later in life.

Despite the extensive information on the health advantages of breastfeeding published by Ip et al. (2009), there is still a lack of data comparing the nutritional status of newborns fed formula milk and those fed breast milk. The variations in nutritional outcomes between the two feeding techniques were not expressly addressed in the study, which instead concentrated on the overall advantages of breastfeeding. Therefore, in order to better understand the unique nutritional benefits of breastfeeding, a research is needed that explicitly compares the nutritional status, development patterns, and other pertinent indicators of well-being between babies given formula milk and those fed breast milk. In order to better understand the specific nutritional benefits of breastfeeding and to inform healthcare professionals and parents in making informed decisions about infant feeding practises, the proposed study will fill this knowledge gap by assessing the nutritional status of formula-fed infants in comparison to breastfed infants.

To examine the long-term effects of nursing on IQ, school success, and earnings as an adult, Victoria et al. (2016) undertook a prospective birth cohort research in Brazil. The purpose of the research was to provide light on the long-term positive effects of nursing on learning and social and economic success. Results showed a correlation between longer durations of nursing and higher IQ tests. Longer periods of breastfeeding have been linked to greater IQ in later life. Breastfeeding for a longer period of time was also associated with better outcomes in terms of education and income at age 30. Long-term breastfeeding has been linked to improved cognitive development, which may be due to the special combination of nutrients and bioactive compounds found in breast milk. It has been hypothesised that these factors aid in cognitive performance, neurodevelopment, and overall brain health.

While the study by Victoria et al. (2016) is helpful, further research is needed to determine the precise processes by which nursing affects IQ, educational achievement, and earnings as an adult. While the study provides preliminary evidence that breast milk's nutrient profile and bioactive components may have a role, further investigation into the processes at play is required. The results may also not be applicable to people outside of Brazil since the research was done there. In order to better understand the possible benefits of breastfeeding on cognitive development and societal consequences, researchers should compare the nutritional quality of breastfed and formula-fed babies. This information may aid in the creation of tailored treatments to promote optimum cognitive development

and long-term socioeconomic well-being in people, as well as aid healthcare professionals and parents in making choices about newborn feeding practises.

Long-term effects of breastfeeding on cholesterol, obesity, systolic blood pressure, and type 2 diabetes were investigated in a systematic review and meta-analysis by Horta et al. (2015). The purpose of this research was to investigate whether or not breastfeeding is linked to better metabolic health. Breastfeeding was shown to reduce the likelihood of developing obesity and type 2 diabetes later in life. Breastfed infants were less likely to acquire these problems than their formula-fed counterparts. Breastfeeding was associated with a reduced risk of obesity and type 2 diabetes, which may have been achieved by changes in metabolic programming and body composition.

Breast milk may have significant impacts on metabolic health because of its unique makeup, which includes its balance of nutrients, bioactive substances, and hormones. Healthy development, including normal weight gain and body composition, is facilitated by breastfeeding. It may also aid in the improvement of insulin sensitivity and lipid metabolism, two aspects of a healthy metabolic profile. While the study by Horta et al. (2015) fills in some of the gaps in our knowledge on the long-term effects of breastfeeding on metabolic health outcomes, further study is needed to determine the precise processes behind these associations. Breastfeeding has been shown to have beneficial effects on obesity, type 2 diabetes, and other metabolic variables, although further study is required to determine the particular molecular processes involved. The possible dose-response association between longer periods of nursing and reduced risk of certain metabolic disorders needs more investigation. Understanding the particular effects of breastfeeding on metabolic health outcomes requires filling this study gap by a comparison evaluation of the nutritional quality of formula milk-fed babies and breastfed infants. Educating parents and healthcare providers about the possible long-term benefits of breastfeeding and guiding the development of therapies to reduce the risk of obesity, type 2 diabetes, and associated metabolic diseases are two uses of this information.

Chapter3

Methodology

3.1 Research Design, setting and duration

The nutritional status of infants who were either breastfed or given formula was compared using a cross-sectional research methodology. This method was selected because it would only need collecting data once, at a predetermined age (6 months), allowing for a direct comparison of the two feeding groups. This study was conducted at medical hospitals of district Mardan including Mardan Medical Complex (MMC) and District Headquarter Hospital Mardan (DHQ). The duration of this study was 3 months from 1 March 2023 to 30 May 2023.

3.2 Research Population

Infants in the Mardan region of Pakistan were the subjects of this study. The city of Mardan has been found in Pakistan's Khyber Pakhtunkhwa province. Infants born in this region were considered for this study. Infants from a wide range of socioeconomic and cultural backgrounds were included in this sample. Researchers included babies who were between the ages of zero and six months old. This window of time was chosen to capture early infancy, when eating habits and nutritional status have a major impact on future health and development.

Participants were recruited from Mardan-based maternity hospitals and clinics using convenience sampling. Given the limited time and resources available for the research, convenience sampling was the most realistic option for collecting data. It was determined that a sample size of 100 newborns, with 50 in each group, would be enough to meet the study's goals and provide useful information on the nutritional status of infants who were either breastfed or given formula.

3.3 Data Collection

A questionnaire was used to gather information for this investigation. The mothers of the infants were asked questions using a Likert scale questionnaire. The infants nutritional status was assessed by a series of statements or questions included in the questionnaire.

The questionnaire was created to collect data on how the infants were fed, such as whether they were given formula or received breastfeeding solely. The newborns' rates of growth were also measured via the questionnaire's inclusion of questions on weight gain, height, and head circumference. Infants' nutritional status was determined after researchers considered their diets, the nutrients they consumed, and their overall health through different measuring equipment. The majority of the questionnaire's responses came from the newborns' mothers. They were given explicit directions on how to fill out the survey truthfully and properly.

Questionnaire was divided into below 3 parts

3.3.1 Section 1: Demographic Information

In the Demographic Information section, respondents were prompted to provide such facts as the infant's age, gender, mother's age, and the mother's reading level.

3.3.2 Section 2: Growth Parameters

The infant's weight, length, and head circumference were measured for the Growth Parameters section.

3.3.3. Section 3: Nutritional Status

Infant nutritional status was evaluated under the Nutritional Status sub-section. Calories, calcium, folate, iron, zinc, and vitamin B12 were all questioned about, and participants were asked to report what they found.

3.4 Data Analysis

Descriptive statistics, such as frequency and percentages, were used in SPSS to the questionnaire data for analysis. The demographic data, growth characteristics, and dietary intake of the subjects were summarized in this study. It made it possible to evaluate the differences between breastfed and bottle-fed babies and to determine the efficacy of each feeding method.

Chapter4

Results

This cross sectional study was carried out at medical institute of district mardan including Mardan Medical Complex (MMC) and District Headquarter Hospital (DHQ). The study from the collected data gives the following results.

4.1. Demographic Analysis

The demographic data of the subjects shows that half of the infants being given formula were less than 2 months, 30% were between 2 and 4 months, and 20% were between 4 and 6 months. In contrast, half of the breastfed babies were less than two months, another 70 percent were between the ages of two and four months, and the remaining 20 percent were between four and six months as shown in the table and figure 4.1 . This suggests that, compared to babies given formula milk, breastfed infants tend to be older (4–6 months). The corresponding data shows that Sixty percent of the newborns that were given formula were male, whereas just forty percent were female. Babies that were breastfed had a 70% male to 30% female gender ratio as shown in the table 4.2. According to the statistics, there seems to be a somewhat larger percentage of male newborns in the breastfed infant's category. About Twenty percent of mothers of formula-fed children were under the age of twenty-five, seventy percent were between the ages of twenty-five and thirty-five, and ten percent were above the age of thirty-five. Forty percent of the mothers of breastfed children were under the age of twenty-five, sixty percent were between the ages of twenty-five and thirty-five, and none were older than thirty-five as shown in the table 4.3. This means that most moms in both groups were between the ages of 25 and 35. Mothers of babies who were given formula were more likely to be literate than those whose babies were breastfed. However, all of the moms who nursed their babies

were educated as shown in the table 4.4. This statistic suggests that moms of nursed babies are more likely to be literate.

Table 4.1 Demographic characteristics of the subjects

Variables	Categories	Percentage	
		Formula milk-fed infants	Breast fed infants
Age of Infant	Below 2 months	25%	25%
	2 to 4 months	15%	35%
	4 to 6 months	10%	40%
Gender of infants	Male	30%	35%
	Female	20%	15%
Mother's age of infants	Below 35 years	10%	20%
	25-35 years	35%	30%
	Above 35 years	5%	0%
Literacy level of mothers	Literate	40%	50%
	Illiterate	10%	0%

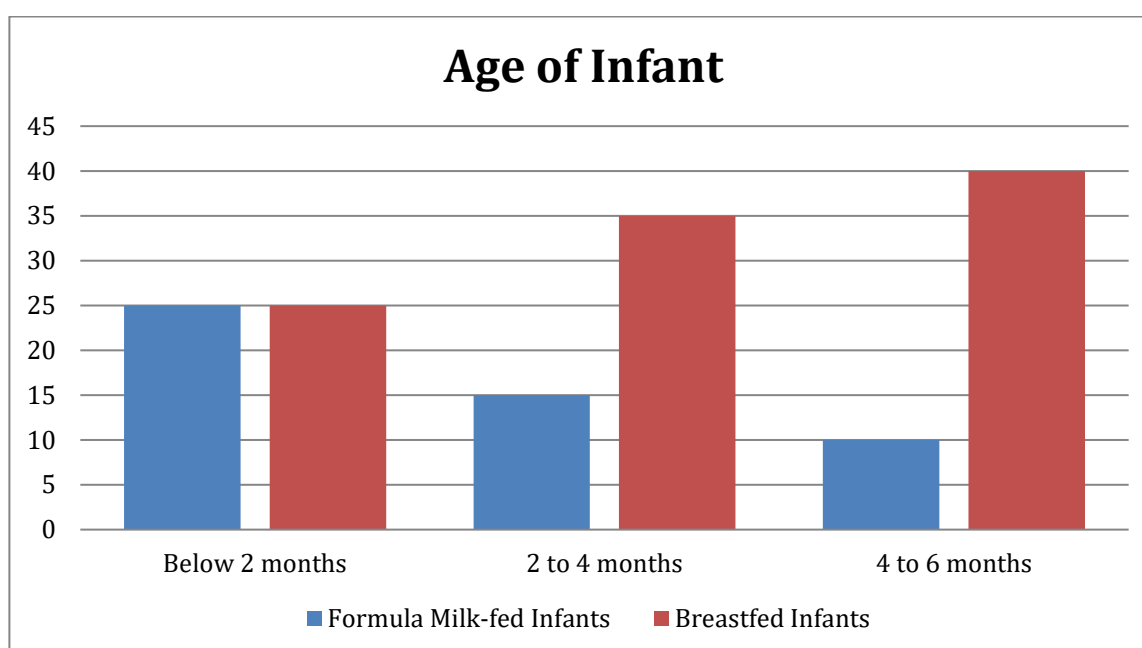


Figure 4.1 Age of the infants

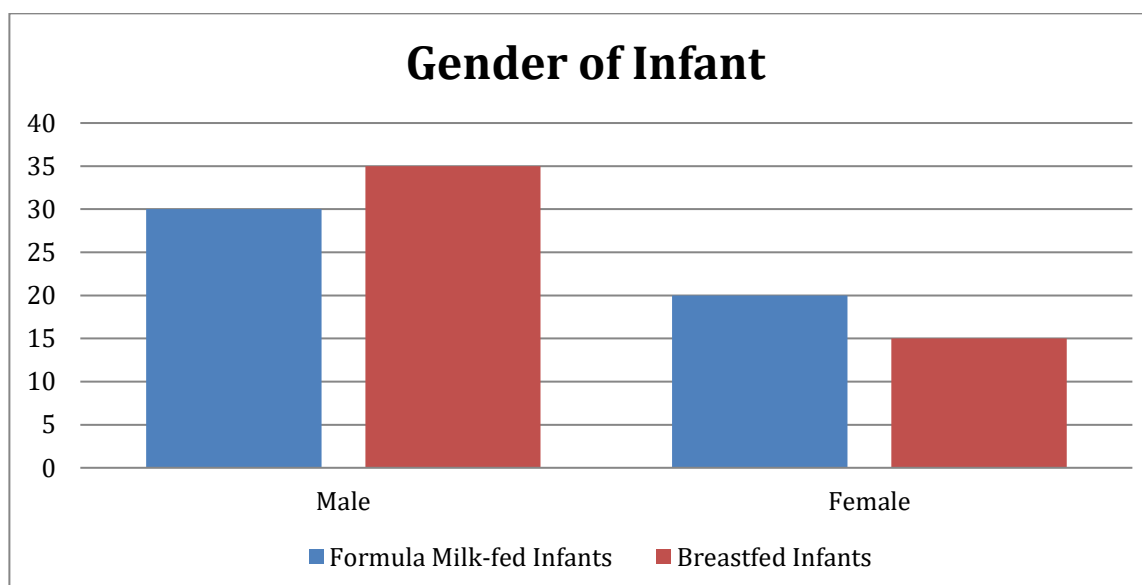


Figure 4.2 Gender of infants

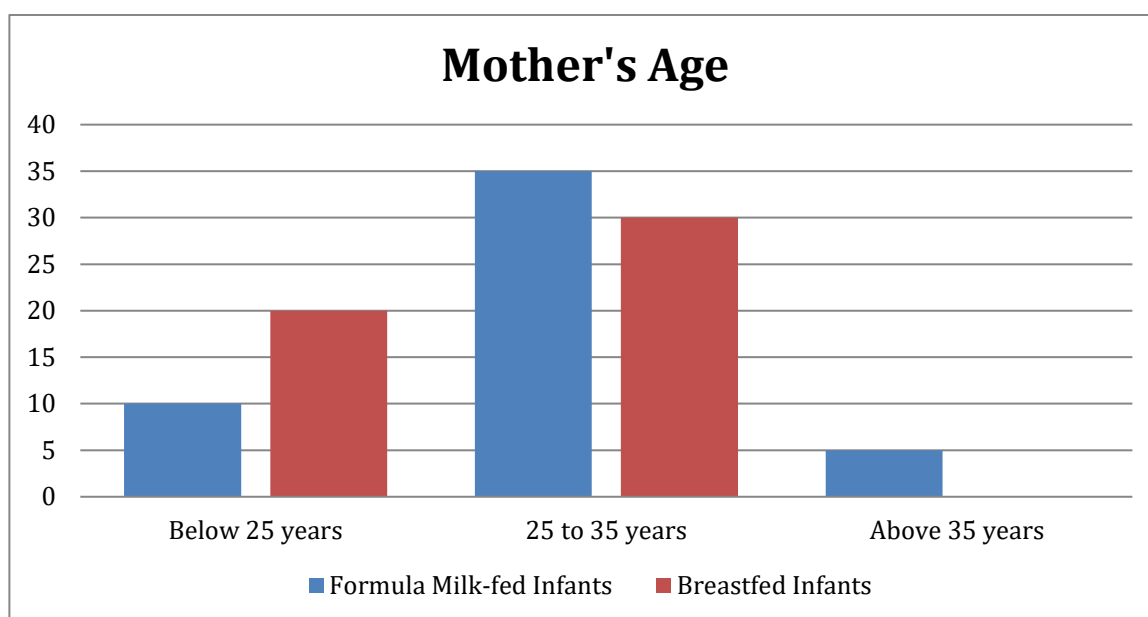


Figure 4.3 Mother's age of the infants

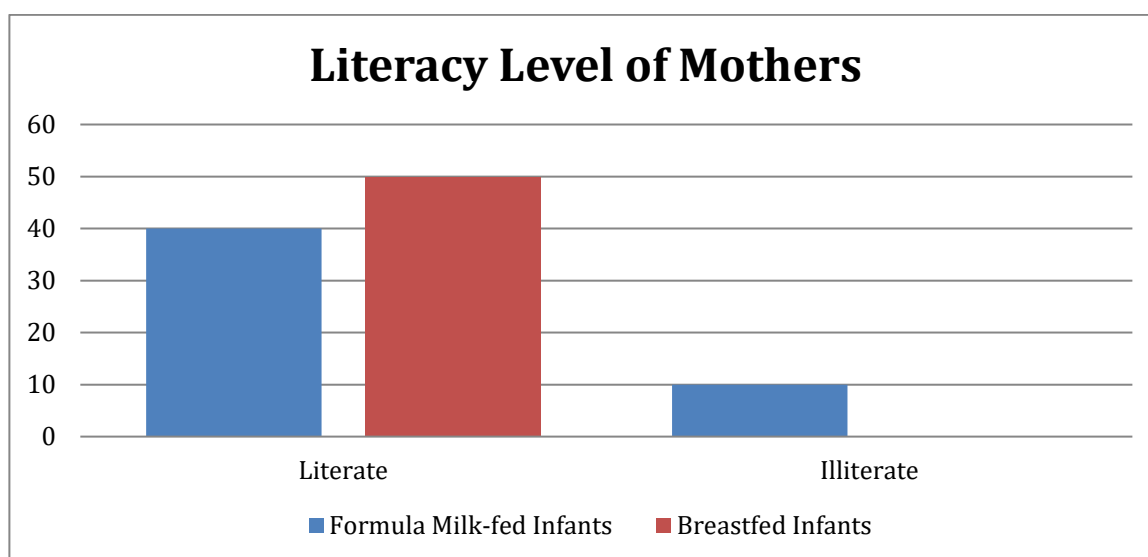


Figure 4.4 literacy level of Mothers of the infants

4.2. Growth Parameters

Below are the results of Growth patterns of Milk-fed Infants and Breastfed Infants comparatively based on below parameters.

- 1) Infant's Weight (in grams): _____
- 2) Infant's Length (in centimeters): _____
- 3) Infant's Head Circumference (in centimeters): _____

Among babies that were given formula, 24% weighed less than 2500 grams, 36% weighed between 2500 and 3000 grams, and 40% weighed more than 3000 grams. Infants that were breastfed were more likely to be larger than average, with 40% weighing in at over 3000 grams and 44% weighing in at over 2500 grams as shown in the table 4.2. Formula-fed newborns had a length distribution of 16% below 45 cm, 36% between 45 and 50 cm, and 48% over 50 cm. Ten percent of breastfed newborns were shorter than 45 centimeters, 40 percent were between 45 and 50 centimeters, and 50 percent were longer than 50 centimeters as shown in the table 4.2. Ten percent of babies who were given formula had a head circumference of less than 30 centimeters, 40 percent had a head circumference of between 30 and 35 centimeters, and 50 percent had a head circumference of more

than 35 centimeters. Head circumferences ranged from 30 to 35 cm in the breastfed babies group, with 6% having a measurement less than 30 cm, 36% between 30 and 35 cm, and 58% more than 35 cm as shown in the tale 4.2. Weight, length, and head circumference were measured for both breastfed and formula-fed newborns, and the resulting frequency and percentage distributions shed light on the differences between the two feeding methods. The data suggests that the two groups could have different rates of growth in these areas.

Table 4.2 Growth parameters of the subjects

Variables	Categories	Percentage	
		Formula milk-fed infants (n=50)	Breast fed infants (n=50)
Weight range	Below 2500gm	12 (24%)	8(16%)
	2500-3000gm	18(36%)	20(40%)
	Above 3000gm	20(40%)	22(44%)
Length range	Below 45cm	8(16%)	5(10%)
	45-50cm	18(36%)	20(40%)
	Above 50cm	24(48%)	25(50%)
Head circumference range	Below 30cm	5(19%)	3(6%)
	30-35cm	20(40%)	18(36%)
	Above 35cm	25(50%)	29(58%)

4.3 Nutritional Status

Infants that were either breastfed or given a formula milk mixture had different calcium levels, as seen in the table below. Calcium levels ranged from low (8% of formula-fed newborns) to high (22% of infants). Whereas 10% of formula-fed babies had abnormally low calcium levels, 4% had low levels, and 6% had high levels, this was not the case with breastfeeding children. This indicates that breastfed newborns are more likely to have normal and high calcium levels than infants who are given formula milk as shown in the table 4.3. Folate levels are included in the table for both breastfed and formula-fed neonates. Twenty percent of the babies who were given formula lacked an appropriate folate level, whereas forty percent had inadequate levels, and forty percent had enough levels. There were 8% babies who were deficient, 36% who were inadequate, and 56% who had appropriate levels among the breastfed newborns. This suggests a benefit of breastfeeding in supplying sufficient folate, since a larger percentage of breastfed newborns had acceptable folate levels compared to formula milk-fed infants as shown in the table 4.3. Infants who were breastfed and those who were given formula milk had different iron levels, as seen in the table. Ten percent of newborns who drank formula lacked sufficient iron, twenty percent had inadequate iron, and seventy percent had appropriate iron. Compared to formula-fed babies, breast-fed infants had a 6% deficiency rate, a 30% inadequate rate, and a 64% adequate rate. This implies that compared to breastfed newborns, more infants who drank formula had healthy iron levels as shown in the table 4.3. Zinc levels are included in the table for both breastfed and formula-fed neonates. Thirty percent of babies who drank formula had zinc levels that were too low, while forty percent had levels that were too high as shown in the table 4.3.

Table 4.3 Nutritional status of the subjects

Variables	Categories	Percentage	
		Formula milk-fed infants (n=50)	Breast fed infants (n=50)
Calcium levels	Low	4(8%)	2(4%)
	Normal	35(70%)	45(90%)
	High	11(22%)	3(6%)
Folate levels	Deficient	10(20%)	4(8%)
	Insufficient	20(40%)	18(36%)
	Adequate	20(40%)	28(36%)
Iron levels	Deficient	5(10%)	3(6%)
	Insufficient	10(20%)	15(30%)
	Adequate	35(70%)	32(64%)
Zinc levels	Deficient	15(30%)	8(16%)
	Insufficient	20(40%)	22(44%)
	Adequate	15(30%)	20(40%)

Chapter 5

Discussion

Consistent with other studies, this study found no significant difference in the growth rates and nutritional health of newborns given formula milk and those fed breast milk. Several studies (Dewey, 2001; Kramer et al., 2001) have shown that breastfed newborns had larger body masses and larger head circumferences than their formula-fed counterparts. This is because breast milk has a special combination of nutrients that are ideal for a baby's growth and development. Breastfed babies were more likely to have normal calcium levels, which is consistent with earlier research showing that breast milk has a better calcium bioavailability than formula milk (Abrams et al., 2004). Infants who are breastfed often have higher calcium levels because breast milk contains bioactive substances that increase calcium absorption and utilization.

Breast milk offers these critical nutrients in bioavailable forms (Kuzminski et al., 1998; Domellöf et al., 2008), which may explain why a larger percentage of breastfed newborns have appropriate folate and iron levels. Breastfed babies have higher levels of folate and iron because breast milk includes naturally occurring forms of folate and readily absorbable iron. Similar zinc amounts have been found in breast milk and commercial newborn formulae (Lönnerdal, 2010), which is consistent with the findings of the current investigation. Breast milk and formula milk are both good providers of zinc for newborns, and the mineral is important for many bodily functions.

Previous research has found similar vitamin B12 concentrations in breast milk and baby formulae (Watanabe et al., 2013), therefore the results are in line with those expectations. Vitamin B12 is present in enough amounts in breast milk and is added to fortified formulas for babies who are not breastfed. Overall, the findings of this research lend credence to the extensive literature extolling the benefits of nursing for babies' health and development. Breast milk provides a newborn with all the nutrients they require in a proportion that is perfectly balanced. These results underline the importance of advocating for and supporting breastfeeding as the primary means of nourishing newborns, given the benefits it provides to their development and growth. The development and nutritional condition of infants may be affected by a variety of variables, including the health of the mother and her nursing habits. These variables may have an effect on newborn health, but further study is required to determine this. More data on the long-term impact of feeding practices on baby development and nutritional status is needed, thus future research should use longitudinal designs and use bigger sample sizes.

Chapter 6

Conclusion and recommendations

Conclusion

The purpose of this research was to evaluate the nutritional differences between breastfed and formula-fed babies in Mardan, Pakistan. The present study concluded that breast fed infants were older and had a higher percentage of male newborns. Most women were 25-35 years old, with higher literacy rates among those who nursed their babies. Breastfed infants had higher calcium, folate, iron, zinc and vitamin B12 levels than formula-fed infants. The study emphasizes the importance of breast feeding, maternal nutrition knowledge and monitoring mechanisms. Community involvement and education can also contribute a healthy baby feeding.

Recommendations

Based on the findings and discussion of this study, the following recommendations can be made:

1. The best way to feed a newborn is breast milk, thus it's important for healthcare providers, legislators, and communities to advocate for and facilitate breastfeeding. Educational initiatives, lactation support services, and breastfeeding-friendly architecture may all help.
2. Improve maternal nutrition education since what a mother eats has a major impact on the health of her infant via breast milk. Therefore, it is crucial to educate moms thoroughly on the need of eating well during nursing. During pregnancy, it's very important for the mother and the baby to have a balanced diet full of nutritious foods.

3. Breastfeeding may be difficult for moms, particularly in the beginning. 3. Expand availability of lactation support services. Helping moms overcome challenges and develop effective nursing connections requires expanding access to lactation support services including lactation consultants, breastfeeding clinics, and support groups.
4. For babies who aren't breastfed, it's necessary to provide access to safe, nutritionally sufficient baby formulae, thus it's important to tighten regulation and quality control in this area. Commercial baby formulae should only be sold if they are of sufficient quality and contain all the necessary nutrients in the right amounts, therefore regulatory agencies should impose strong quality control techniques.
5. The long-term consequences of feeding practices on babies' growth, development, and general health should be studied in future studies. 5. Longitudinal studies. This will help us better understand the link between early nutrition and long-term health.

Chapter 6

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