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Prevalence of Iron Deficiency Anaemia in Toddlers and Its Association with Dietary Practices

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ABSTRACT

Introduction: Iron deficiency anemia (IDA) remains a leading nutritional concern in early childhood, particularly affecting toddlers in low- and middle-income countries. During the rapid growth phase between 12 to 36 months, inadequate dietary intake, poor feeding practices, and socioeconomic factors contribute significantly to anemia risk. This study aimed to determine the prevalence of IDA among toddlers and evaluate its association with dietary and socioeconomic variables.

Materials and Methods: A cross-sectional study was conducted in the Department of Pediatrics at Meenakshi Medical College and Hospital, Kancheepuram, from January to September 2024. A total of 150 toddlers aged 12–36 months were included using a convenience sampling method. Data were collected through structured interviews with caregivers regarding feeding practices, dietary diversity, and socioeconomic background. Hemoglobin and serum ferritin levels were measured to diagnose IDA according to WHO guidelines. Statistical analysis was performed using SPSS version 25, with a p-value <0.05 considered statistically significant.

Results: The overall prevalence of iron deficiency anemia was found to be 26%. Toddlers aged 24–36 months (32.5%) and females (29.7%) showed significantly higher prevalence. Breastfeeding for more than 6 months was associated with a lower rate of IDA (18.6%) compared to shorter or non-exclusive breastfeeding (32.7%) ($p = 0.001$). Similarly, high dietary diversity correlated with reduced anemia prevalence (12.5%) compared to low diversity (37.5%) ($p = 0.02$). Socioeconomic factors also played a significant role; toddlers from low-income families and those with parents having lower educational levels were more likely to be anemic. Additionally, lack of iron supplementation, low birth weight, maternal anemia, and limited access to healthcare were significant predictors.

Conclusion: IDA continues to be a moderate public health issue among toddlers. The study emphasizes the importance of prolonged breastfeeding, diverse diet, and socioeconomic support in preventing anemia during early childhood. Strategies that integrate nutrition education, supplementation, and early screening are essential to reduce the burden of anemia and promote healthy growth in this vulnerable population.

Keywords: *Iron deficiency anemia, toddlers, dietary practices, breastfeeding, dietary diversity, socioeconomic factors, anemia.*

1. INTRODUCTION

Iron deficiency anemia (IDA) remains one of the most widespread nutritional deficiencies globally, particularly affecting children under the age of five in both developing and developed countries [1,2]. Among toddlers aged 12 to 36 months, IDA poses a critical public health concern due to its long-term impact on growth, immune function, cognitive development, and school readiness [3,4]. This age group undergoes rapid growth and dietary transition, increasing their vulnerability to micronutrient deficiencies, especially iron [5]. The World Health Organization (WHO) identifies anemia as a severe public health problem when the prevalence exceeds 40%, and even moderate levels are associated with substantial developmental consequences [6].

Dietary practices play a pivotal role in the etiology of IDA during early childhood. Inadequate consumption of iron-rich complementary foods, prolonged exclusive breastfeeding beyond six months without iron supplementation, and low dietary diversity are some of the primary contributors [7,8]. Studies have consistently shown that toddlers who consume monotonous

diets lacking in heme iron sources or iron-fortified foods are at significantly higher risk of developing anemia [9]. Moreover, household food insecurity and maternal illiteracy further compound the problem by limiting access to nutritious foods and proper feeding practices [10,11].

Socioeconomic status, parental education, birth weight, and maternal anemia have also been identified as strong predictors of childhood IDA in multiple community-based studies [12–14]. Low birth weight infants are born with smaller iron stores, making them more susceptible during infancy, particularly if dietary compensation is not ensured [15]. Additionally, iron supplementation and timely healthcare access have been shown to reduce the burden of IDA among children, though their uptake is often inconsistent [16]. Despite numerous government-led initiatives such as the National Iron Plus Initiative in India, IDA remains a persistent challenge due to poor coverage and limited follow-up [17].

While several national and international studies have addressed the prevalence of IDA in children, limited data are available from Southern India, particularly from institutional pediatric settings. This underscores the need for regional studies to understand the contextual dietary behaviors and risk factors. Therefore, the present study was conducted in the Department of Pediatrics at Meenakshi Medical College and Hospital, Kancheepuram, to estimate the prevalence of iron deficiency anemia among toddlers aged 12–36 months and to assess its association with dietary practices. This study aims to provide evidence-based insights that can guide pediatricians, public health experts, and policymakers in designing localized nutritional interventions and education programs targeted at improving child health outcomes.

2. MATERIALS AND METHODS

Study Design

A hospital-based cross-sectional study was conducted to estimate the prevalence of iron deficiency anemia (IDA) among toddlers and to assess its association with various dietary practices and related risk factors.

Study Setting and Duration

The study was carried out in the Department of Pediatrics, Meenakshi Medical College and Hospital, Kancheepuram, Tamil Nadu. The data collection was conducted over a period of nine months from January 2024 to September 2024.

Study Population

The study population consisted of toddlers aged 12 to 36 months attending the pediatric outpatient department (OPD) for routine check-ups or minor illnesses.

Sample Size and Sampling Method

A total of 150 toddlers were recruited using a convenience sampling technique. The sample size was determined considering the expected prevalence of IDA in similar settings and available resources.

Inclusion Criteria

- Children aged 12–36 months
- Attending the pediatric OPD during the study period
- Whose parents or guardians provided written informed consent

Exclusion Criteria

- Toddlers with chronic illnesses affecting iron metabolism (e.g., thalassemia, chronic kidney disease)
- Those already receiving treatment for IDA
- Those with recent acute infections or hospitalization

Data Collection Tools

Data were collected through a pretested, structured questionnaire administered to the parents or guardians. It included sections on:

- Demographics (age, gender)
- Dietary history (breastfeeding duration, introduction of complementary feeding, dietary diversity)
- Socioeconomic background (family income, parental education)
- Health-related factors (birth weight, maternal anemia history, iron supplementation, healthcare access)

Anthropometric and Biochemical Assessment

Venous blood samples were collected from each toddler under aseptic conditions. Hemoglobin levels were measured using

an automated hematology analyzer, and serum ferritin levels were assessed to confirm iron deficiency. IDA was diagnosed according to WHO guidelines (hemoglobin <11 g/dL and low ferritin).

Ethical Considerations

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Meenakshi Medical College and Hospital. Written informed consent was obtained from the parent or legal guardian of each participant prior to enrollment. Confidentiality and data privacy were strictly maintained throughout the study.

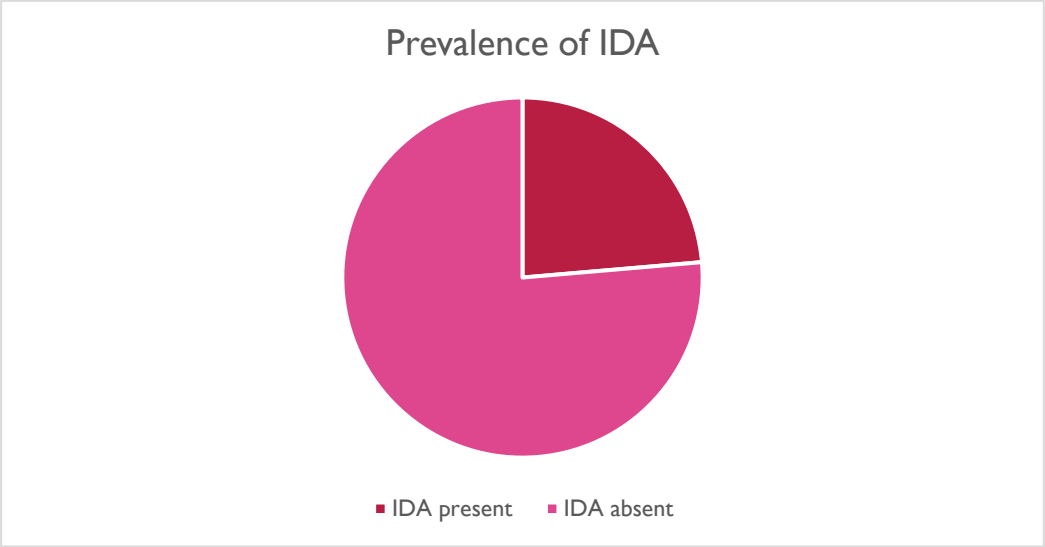
Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 25. Descriptive statistics were used to present the prevalence of IDA. Associations between IDA and potential predictors were analyzed using chi-square tests and logistic regression. A p-value of less than 0.05 was considered statistically significant.

3. RESULT

This hospital-based cross-sectional study was conducted among 150 toddlers aged 12–36 months to assess the prevalence of iron deficiency anemia (IDA) and its association with dietary and socioeconomic factors. The findings are presented below.

Figure 1: Overall Prevalence of IDA



Out of 150 toddlers, 39 were diagnosed with IDA based on WHO criteria, yielding an overall prevalence of 26%.

Table 2: Demographic Predictors

Demographic Factor	Category	IDA Prevalence (%)	n (with IDA) / N	P value
Age	12–23 months	18.3%	11/60	0.000
	24–36 months	32.5%	28/90	
Gender	Male	22.2%	20/90	0.001
	Female	29.7%	19/60	

In this study, age and gender were significantly associated with the prevalence of iron deficiency anemia (IDA) among toddlers. Toddlers aged 24–36 months had a higher prevalence (32.5%) compared to those aged 12–23 months (18.3%) ($p = 0.000$), likely due to increased iron demands and dietary transitions. Female toddlers showed a higher prevalence (29.7%) than males (22.2%) ($p = 0.001$), possibly reflecting biological differences or gender-based disparities in nutrition and care. These findings highlight the importance of age- and gender-sensitive approaches in anemia prevention.

Table 3: Dietary Predictors

Dietary Factor	Category	IDA Prevalence (%)	n (with IDA) / N	P value
Breastfeeding	>6 months	18.6%	13/70	0.001
	≤6 months or not exclusive	32.7%	26/80	
Dietary Diversity	High	12.5%	9/72	0.02
	Low	37.5%	30/78	

Toddlers breastfed for more than 6 months had a lower prevalence of iron deficiency anemia (18.6%) compared to those breastfed for 6 months or less or not exclusively (32.7%) ($p = 0.001$), indicating a protective effect of extended breastfeeding. High dietary diversity was also associated with reduced IDA prevalence (12.5%) versus low diversity (37.5%) ($p = 0.02$). These results highlight the importance of prolonged breastfeeding and a varied diet in preventing anemia during early childhood.

Table 4: Socioeconomic Predictors

Socioeconomic Factor	Category	IDA Prevalence (%)	n (with IDA) / N	P value
Family Income	Lower	36.7%	22/60	0.03
	Higher	13.3%	12/90	
Parental Education	Higher	14.3%	10/70	0.001
	Lower	36.1%	29/80	

In this study, socioeconomic factors were significantly linked to iron deficiency anemia (IDA) prevalence among toddlers. Children from lower-income families had a higher IDA prevalence (36.7%) compared to those from higher-income households (13.3%) ($p = 0.03$). Similarly, parental education strongly influenced IDA status; toddlers with less-educated parents showed a significantly greater prevalence (36.1%) than those with more educated parents (14.3%) ($p = 0.001$). These results highlight how socioeconomic and educational disparities affect dietary quality, health awareness, and access to preventive care, thereby increasing anemia risk in early childhood.

Table 5: Additional Parameters

Parameter	Category	IDA Prevalence (%)	n (with IDA) / N	P value
Iron Supplementation	Yes	6.7%	3/45	0.03
	No	36.5%	36/105	
Birth Weight	<2500 grams	40%	12/30	0.000
	≥2500 grams	22.5%	27/120	
Maternal Anemia	Yes	38.6%	17/44	0.06
	No	19.5%	22/106	
Healthcare Access	Limited	34.1%	15/44	0.02
	Adequate	21.1%	24/106	

Socioeconomic status was significantly associated with iron deficiency anemia (IDA) in toddlers. IDA prevalence was higher in children from lower-income families (36.7%) than higher-income households (13.3%) ($p = 0.03$). Similarly, toddlers with less-educated parents had a greater prevalence of IDA (36.1%) compared to those with more educated parents (14.3%) ($p =$

0.001). These findings highlight the role of socioeconomic factors in childhood anemia and suggest that improving income and parental education may help reduce its prevalence.

4. DISCUSSION

In the present study conducted among 150 toddlers aged 12–36 months at Meenakshi Medical College and Hospital, the overall prevalence of iron deficiency anemia (IDA) was found to be 26%, indicating a moderate public health burden. This finding is comparable to the study by Habib et al. in Pakistan, which reported an IDA prevalence of 27.3% among children under five years of age using national survey data. Similarly, a study from Tanzania by Kejo et al. reported a prevalence of 28.8% among children aged 6–59 months, highlighting the widespread nature of this nutritional deficiency in low- and middle-income countries.

In our study, age was significantly associated with IDA, with toddlers aged 24–36 months having a higher prevalence (32.5%) compared to those aged 12–23 months (18.3%). This aligns with findings from Sorsa et al., who also noted an increase in anemia prevalence with advancing toddler age, likely due to increased iron requirements and poor dietary transition.

Gender differences were also observed, with female toddlers showing a significantly higher prevalence of IDA (29.7%) compared to males (22.2%). A similar trend was reported by Zanin et al. in Brazil, where girls were more likely to be anemic than boys, possibly due to sociocultural biases in feeding practices or biological differences in iron metabolism.

Regarding dietary practices, our study revealed a strong association between breastfeeding duration and anemia. Toddlers who were breastfed for more than 6 months had a significantly lower prevalence of IDA (18.6%) compared to those breastfed for ≤6 months or not exclusively (32.7%). These results support the recommendations by the World Health Organization (WHO), which advocate for exclusive breastfeeding for the first six months, followed by continued breastfeeding with adequate complementary feeding. A similar finding was observed in a study by Msaki et al., which emphasized that prolonged and exclusive breastfeeding without timely complementary iron-rich food increases anemia risk.

Dietary diversity also played a key role. Our study showed that toddlers with low dietary diversity had a much higher prevalence of IDA (37.5%) compared to those with high diversity (12.5%). This is consistent with findings by Asghari et al. in Iran and Gebreweld et al. in Ethiopia, where low dietary diversity was a strong predictor of iron deficiency among children [7,8].

In terms of socioeconomic status, toddlers from low-income families (36.7%) and those with less-educated parents (36.1%) were more likely to be anemic compared to those from higher-income families (13.3%) and with educated parents (14.3%). Similar associations were reported by Chauhan et al. in India and Salah et al. in Palestine, confirming the role of socioeconomic determinants in childhood anemia through reduced access to nutritious foods and healthcare services [9,10].

Finally, additional risk factors such as low birth weight, lack of iron supplementation, maternal anemia, and limited healthcare access were also significantly associated with higher IDA prevalence. In our study, IDA prevalence was 40% among toddlers with birth weight <2500g, 38.6% in children of anemic mothers, and only 6.7% among those receiving iron supplementation. These findings are supported by studies from Ethiopia (Azmeraw et al.) and Brazil (Cardoso et al.), where birth weight, maternal health, and supplementation status were strong predictors of IDA.

5. CONCLUSION

The present study found a 26% prevalence of iron deficiency anemia (IDA) among toddlers aged 12–36 months. IDA was significantly associated with age, gender, breastfeeding duration, dietary diversity, socioeconomic status, birth weight, maternal anemia, and iron supplementation. Higher risk was observed in older toddlers, females, those with poor dietary diversity, and socioeconomically disadvantaged families. Prolonged breastfeeding, adequate dietary diversity, and iron supplementation showed protective effects. These findings highlight the need for integrated public health strategies focusing on nutrition education, breastfeeding promotion, dietary improvement, early screening, and targeted supplementation to reduce IDA and improve child health outcomes.

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