Original Article

Infant and Child Feeding Index and nutritional status of children aged 6 to 24 months in a Metropolitan city

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Abstract

Background: The nutritional status of children is influenced by feeding practices. Infant and Child Feeding Index (ICFI) is an age-specific composite index to assess the feeding practices of children. **Objectives:** To determine the association between ICFI and the nutritional status of children aged 6 to 24 months. To find whether ICFI has value as a tool for detecting poor nutritional status. To determine the association of ICFI and nutritional status with sociodemographic and other factors. **Methods:** A cross-sectional study was conducted in the urban field practice area of a tertiary care institute among 149 children aged 6 to 24 months and their mothers. Data on feeding practices were obtained and ICFI scores were calculated. The weight and length of the children were measured and Z scores (WAZ, LAZ, and WLZ) were calculated. A Chi-square test was used to find the association between the categorical variables. **Results:** We found no association between ICFI and any of the three nutritional indicators such as WAZ, LAZ, and WLZ. The sensitivity of the ICFI was low for detecting underweight (10.0%), stunting (29.4%), and wasting (11.1%). ICFI was significantly associated with the growth monitoring of children and mothers' education. WAZ was significantly associated with mother's education and socioeconomic class. **Conclusions:** There is no association between ICFI and the nutritional status of children. ICFI has limited value in detecting the poor nutritional status of children in this urban setting. Maternal education and growth monitoring of children play an important role in infant and child feeding practices.

Keywords: Feeding index, feeding practices, infant and child feeding, nutritional status, underweight

Introduction

Globally, undernutrition is associated with 45% of child deaths.[1] Infant and young child feeding practices directly affect the nutritional status of children. For children, 6 to 24 months of age is a very vulnerable period and poor feeding practices during this period result in malnutrition that leads to impaired cognitive development, poor school performance, and reduced productivity in life.[2,3] In India, according to the National and Family Health Survey 4, only 9.6% of children aged 6 to 23 months receive adequate diet and in the district of the study area, only 6.4% receive an adequate diet.[4,5]

The availability of simple, valid, and reliable indicators is important to assess the feeding practices and monitor the programs designed to improve the nutritional status of children.[6,7] In the National and Family Health Survey of India, the World Health Organization (WHO) Infant and Young Child Feeding (IYCF) indicators are being used.[4,7] Studies reported in Myanmar, Bhutan, and Cambodia found no association of WHO IYCF indicators with the nutritional status of children.[8-10] A study in India reported that IYCF indicators were not associated with the nutritional status of children except minimum dietary diversity.[11]

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Ruel and Menon constructed an Infant and Child Feeding Index (ICFI), and in 2002, Ruel and Arimond revised it using Ethiopian DHS data.[12] The ICFI constructed by Ruel and Arimond was modified and its association with the nutritional status was studied in some countries.[13-20] In India, only a few studies tried to find the association between the feeding index and nutritional status of children.

We aimed to assess the association between the ICFI and nutritional status of children aged 6 to 24 months and to find whether the ICFI has value as a tool for detecting poor nutritional status. We also studied the association of ICFI and nutritional status with sociodemographic and other characteristics.

Materials and Methods

Setting and study participants

A community-based cross-sectional study was conducted in the urban field practice area of a tertiary care institute in a metropolitan city from November 2019 to January 2020.

Study subjects were children aged 6 to 24 months and their mothers. Children who are severely ill and those with congenital anomalies and any chronic disease that could affect feeding behavior were excluded.

Sample size and sampling method

Considering the proportion of children (p) with ICFI scores of less than 66 percentile (high score) from the previous study[21] and the number of children (N) aged 6 to 24 months in the study area as 525 (data from Health post), a relative precision of 10%, and a 95% confidence interval, the sample size was calculated as 149 using the OpenEpi software.

Children were selected by a systematic random sampling method. From the list of children aged 6 to 24 months obtained from Health post, every third child (524/149 = 3.5) was selected. The first child was selected randomly from the first three children. If the child was not fulfilling the inclusion criteria or the mother did not give consent for the study, the next child was selected.

Data collection

Mothers were interviewed in their houses using the interview schedule. The sociodemographic data collected include the age and sex of the child, mother's education, and socioeconomic class calculated using the modified Kuppuswamy socioeconomic scale.[22] Other data collected include the last two-week history of morbidity and whether growth monitoring was done in the last three months. Acute respiratory infection was defined as cough and nasal discharge with or without fever. Diarrhea was defined as three or more soft watery stools per day.

The weight of children was measured using a digital weighing scale with a precision of 100 g. The length of the children was measured using an infantometer to the nearest 0.1 centimeters and the length and weight were measured following the standard procedures.[23]

Infant and child feeding index

ICFI that was described by Arimond and Ruel and Moursi *et al.* was used in the study.[12-14] The components of the index scoring system are given in Table 1.[13]

For calculating the ICFI score, the following data were collected

- Is the mother currently breastfeeding the child?
- Whether bottle-feeding was done in the past 24 hours?
- Frequency of feeding solids and semisolids (meals and snacks) in the past 24 hours.
- Whether the child took selected food groups in the past 24 hours?
- In the past seven days, how many days the selected food groups were given?.

Scores of all the five components were added which gave a score ranging from 0 to 9. The scores were divided into three categories as follows: Low = 0 to 5, Medium = 6 to 7, and High = 8 to 9.[13,14]

Statistical analysis

Data were analyzed using the SPSS software (version 25.0). Z scores were calculated for the weight for age (WAZ), length for age (LAZ), and weight for length (WLZ) using the WHO Anthro software (2009). The children were grouped depending on the Z scores based on the WHO criteria.[24] The Chi-square test was used to analyze the association between categorical variables. The sensitivity of ICFI was defined as the ability to correctly detect a child as underweight (WAZ <-2SD), stunted (LAZ <-2SD), and wasted (WLZ <-2SD) when the ICFI score was ≤ 5 and specificity was defined as the ability of ICFI to identify children as normal (WAZ, LAZ, and WLZ ≥-2SD) when ICFI ≥6.[14]

Ethics

The study was reviewed and approved by the Institutional Ethics Committee of Seth G S Medical College and KEM Hospital, Mumbai. The approval was obtained on 04-11-2019. Informed consent was obtained from mothers.

Results

Table 2 shows the characteristics of the study participants. Among 149 children who participated in the study, 58.5% (87/149) were of age 12 to 23 months and almost half (51%, 77/149) of the children were boys. Nearly half (47%, 70/149) of children were from the upper-middle class. For 69% (103/149) of children, growth monitoring had been done in the last three months.

ICFI score

As shown in Figure 1, 18% (27/149) of children had low ICFI scores. Only half (52.3%, 78/149) of the children had high dietary diversity score.

Table 1: Infant and Child Feeding Index components and scoring

Components of ICFI	Age of children		
	6-8 months	9 months-11 months	12 months-24 months
Breastfeeding	Yes=2 No=0	Yes=2 No=0	Yes=1 No=0
Bottle feeding	Yes=0 No=1	Yes=0 No=1	Yes=0 No=1
Dietary Diversity (past 24 H)*	0-1 food group=0 2 food groups=1 3 or more food groups=2	0-2 food groups=0 3 food groups=1 4 or more food groups=2	0-2 food groups=0 3 food groups=1 4 or more food groups=2
Food group frequency score*† (past 7 Days)	0-2=0 3-4=1 5 or more=2	0-3=0 4=1 5 or more=2	0-3=0 4-5=1 6 or more=2
Frequency of feeding solids or semi solids	0 or 1 time=0 2 times=1 3 or more times=2	0 to 2 times=0 3 times=1 4 or more times=2	0 to 2 times=0 3 times=1 4 times=2 5 or more times=3

*Food groups are 1. Grains/roots/tubers 2. Legumes/nuts 3. Dairy (other than breastmilk) 4. Flesh food 5. Eggs 6. Vitamin A rich fruits and vegetables 7. Other fruits and vegetables †Each food group will be given score of 0 if not given for past 7 days, score of 1 if given for 1 to 3 days and score of 2 if 4 days or more. This will give total score ranging from 0 to 14. Based on this, food group frequency score is given

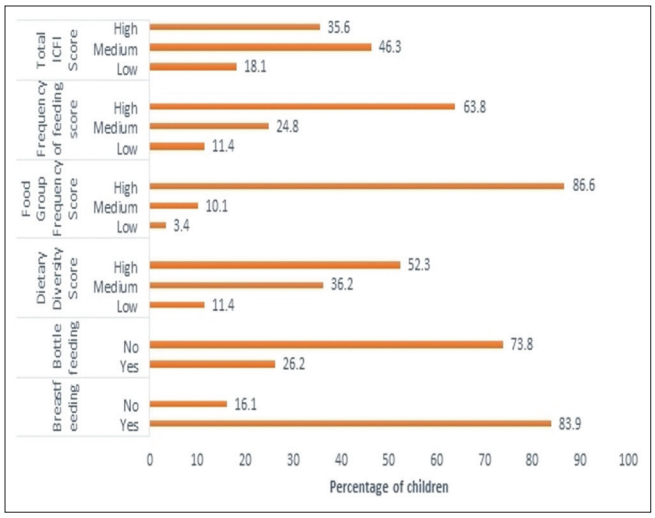

Figure 1: Proportion of children with total ICFI score and scores of components of ICFI .ICFI- Infant and Child Feeding Index

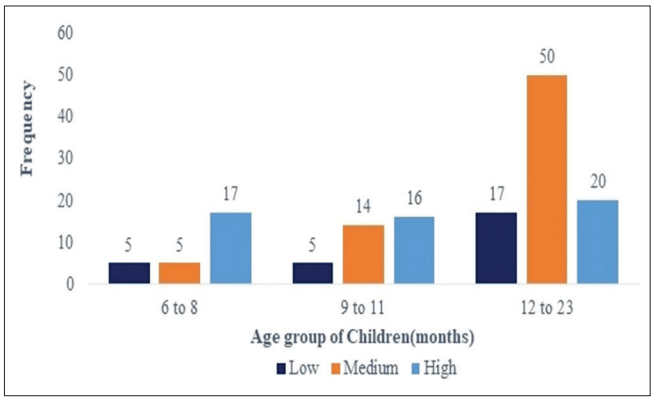

Figure 2: Distribution of ICFI score among children of three age groups ICFI- Infant and Child Feeding Index

We found that the proportion of high ICFI score was more among children of age 6–8 months (62.9%, 17/27) followed by 9–11 months (45.7%16/35) and 12–23 months (22.9%, 20/87) [Figure 2].

Nutritional status of children

The proportion of underweight, stunting, and wasting among children was 14%, 11%, and 12%, respectively. In the 6- to 8-month and 9- to 11-month age group, the proportion of wasted children was high compared to the stunted and underweight children and among children aged 12 to 23 months, the proportion of underweight children was high (17%, 15/87).

Association of nutritional status with ICFI

Table 3 shows that there was no statistically significant association between the three categories of the ICFI score and any of the three nutritional indicators such as WAZ, LAZ, and WLZ. There was no statistically significant association between the individual components of ICFI and any of the three nutritional indicators.

Association of sociodemographic and other characteristics with ICFI

The proportion of low ICFI scores was more in children whose mothers' education was below higher secondary ($P = 0.003$) and among children whose growth monitoring was not done ($P = 0.018$). The proportion of children with high ICFI scores decreased with age ($P = 0.001$). There was no statistically significant association of ICFI score with the sex of the child, socioeconomic class, birth order, working status of mother, and history of morbidity in the last two weeks.

Association of sociodemographic and other characteristics of children with the nutritional status of children

We found that the proportion of underweight was more among children whose mother's education was below higher secondary ($P = 0.031$) and those belonged to lower socioeconomic class ($P = 0.029$). The proportion of stunting was more among

Table 2: Descriptive characteristics of study participants (*n*=149)

Characteristics	Frequency	Percentage
Age group (months)		
6-8	27	18.1
9-11	35	23.5
12-23	87	58.4
Sex		
Boys	77	51.7
Girls	72	48.3
Birth order		
First	75	50.3
Second and above	74	49.7
History of diarrhea/fever/ ARI* in the last 2 weeks		
Yes	63	42.3
No	86	57.7
Mother's education		
Secondary and below	51	34.3
Higher Secondary/Diploma	37	24.8
Graduation & above	61	40.9
Working mother		
Yes	32	21.5
No	117	78.5
Socioeconomic class		
Upper lower	28	18.8
Lower middle	51	34.2
Upper middle	70	47.0
Growth monitoring in the last 3 months		
Yes	103	69.1
No	46	30.9

* ARI- Acute Respiratory infection

children whose birth order was second and above ($P = 0.019$). There was no statistically significant association of wasting in children with age and sex of the child, birth order, mother's education and working status, socioeconomic class, history of morbidity in the last two weeks, and history of growth monitoring performed in the last three months.

Sensitivity and specificity

We found that the sensitivity of ICFI for finding underweight, stunted, and wasted was low. But the specificity of ICFI was around 80% for all the three nutritional indicators. The sensitivity and specificity of ICFI were high for LAZ when compared to the other two nutritional indicators WAZ and WLZ [Table 4].

Discussion

We conducted the study in the urban field practice area of a tertiary care institute in which half of the children aged 6 to 24 months belonged to the upper-middle class and 69% of children had a history of growth monitoring done. In this context, we found no association between ICFI and the nutritional status of children. The sensitivity of ICFI was low for detecting poor nutritional status. The association of maternal education with feeding practices and underweight children suggests the importance of the mothers' knowledge on the feeding practices and nutritional status of children. Wasting in children was not associated with any of the child and maternal characteristics studied and feeding practices.

In our study, we found no association between ICFI and any of the nutritional indicators. A study conducted in the urban slums of Mumbai shows no significant difference between the mean Z scores of the three nutritional indicators in the low, medium, and high categories of ICFI.[14] A study conducted in urban Vadodara reported that ICFI was not associated with any of the three nutritional indicators; however, ICFI used in this study included the time of initiation of complementary foods, psychosocial feeding, and hygiene aspects.[25] A study conducted in urban Madagascar also reports no significant association between ICFI and LAZ after the adjustment of other characteristics.[13] Arimond and Ruel also found no association between LAZ and ICFI in their analysis of urban area data only.[12] In a study conducted in an urban hospital in Bangladesh, a positive correlation between ICFI and LAZ was found among children of age 6 to 8 months and 12 to 23 months but among 9- to 11-month-old children.[21] A study conducted in urban slums of Ahmedabad shows a significant association between all three nutritional indicators and ICFI and they used an index in which four of the seven components were related to breastfeeding only.[20]

Our finding of no association between ICFI and nutritional status is similar to the findings of other studies conducted in urban areas. The studies conducted in rural Senegal, rural Burkina Faso, rural Western China, and rural areas of Uttar Pradesh in India show the association between ICFI and LAZ.[16-19]

In studies conducted in rural areas of Uttar Pradesh, rural Senegal, and Urban Madagascar, dietary diversity was associated with LAZ.[13,18,19] Ruel and Arimond also found that dietary diversity was associated with height for age Z score (HAZ) in a study using the DHS data of 11 countries.[26] However, in our study, we found no association between dietary diversity and the nutritional status of children.

A study conducted in urban slums of Mumbai also shows that the sensitivity of ICFI was low for detecting the poor nutritional status similar to our study.[14]

While the proportion of children with high ICFI scores decreased with age in our study, studies conducted in Vadodara and rural Uttar Pradesh report that ICFI increased with age.[25] Similar to our study, a study conducted in the Maldives shows that mean ICFI scores were better for children of age 6 to 8 months than those for other age groups.[27] In our study, we found that higher maternal education was associated with a high ICFI score in children. This finding is consistent with the findings of other studies conducted in Vadodara and urban slums of Mumbai and Ahmedabad.[14,20,25] A study conducted using DHS data in India and a hospital-based study in Bhopal show that maternal education was associated with feeding practices.[28,29] Studies in Mangalore in India, Northwest Ethiopia, Nepal, Southwest

Table 3: Association of ICFI score with the nutritional status of children

ICFI score	Nutritional Indicators (*n*=149)					
	WAZ Frequency (%)		LAZ Frequency (%)		WLZ Frequency (%)	
	Normal	Underweight	Normal	Stunted	Normal	Wasted
Total score						
Low (*n*=27)	25 (92.6)	2 (7.4)	22 (81.5)	5 (18.5)	25 (92.6)	2 (7.4)
Medium (*n*=69)	55 (79.7)	14 (20.3)	62 (89.9)	7 (10.1)	60 (87.0)	9 (13.0)
High (*n*=53)	49 (92.5)	4 (7.5)	48 (90.6)	5 (9.4)	46 (86.8)	7 (13.2)
P	0.074		0.435		0.712	
Breast-feeding						
Yes (*n*=125)	108 (86.4)	17 (13.6)	109 (87.2)	16 (12.8)	110 (88.0)	15 (12.0)
No (*n*=24)	21 (87.5)	3 (12.5)	23 (95.8)	1 (4.2)	21 (87.5)	3 (12.5)
P	1.000		0.310		1.000	
Bottle-feeding						
No (*n*=110)	94 (85.5)	16 (14.5)	96 (87.3)	14 (12.7)	98 (89.1)	12 (10.9)
Yes (*n*=39)	35 (89.7)	4 (10.3)	36 (92.3)	3 (7.7)	33 (84.6)	6 (15.4)
P	0.500		0.561		0.567	
Dietary diversity score						
Low (*n*=17)	15 (88.2)	2 (11.8)	14 (82.4)	3 (17.6)	16 (94.1)	1 (5.9)
Medium (*n*=54)	48 (88.9)	6 (11.1)	49 (90.7)	5 (9.3)	49 (90.7)	5 (9.3)
High (*n*=78)	66 (84.6)	12 (15.4)	69 (88.5)	9 (11.5)	66 (84.6)	12 (15.4)
P	0.761		0.637		0.402	
Food group frequency score						
Low and medium (*n*=20)	19 (95.0)	1 (5.0)	17 (85.0)	3 (15.0)	19 (95.0)	1 (5.0)
High (*n*=129)	110 (85.3)	19 (14.7)	115 (89.1)	14 (10.9)	112 (86.8)	17 (13.2)
P	0.313		0.713		0.469	
Feeding frequency score						
Low and medium (*n*=54)	46 (85.2)	8 (14.8)	46 (85.2)	8 (14.8)	49 (90.7)	5 (9.3)
High (*n*=95)	83 (87.4)	12 (12.6)	86 (90.5)	9 (9.5)	82 (86.3)	13 (13.7)
P	0.707		0.324		0.426	

Table 4: Sensitivity and specificity of ICFI

	Sensitivity‡ (%) (95% CI)	Specificity† (%) (95%CI)
WAZ	10 (1.8, 33.1)	80.6 (72.5, 86.8)
LAZ	29.4 (11.3, 55.9)	83.3 (75.6, 89.0)
WLZ	11.1 (1.9, 36.1)	80.9 (72.9, 87.0)

†Ability of ICFI to identify children as underweight, stunted or wasted when ICFI score ≤5. ‡Ability of ICFI to identify children as normal when ICFI score ≥6

Nigeria, and the rural setting of Islamabad also show similar findings.[30-34] In a feasibility study conducted among Bangladeshi mothers of children aged 6 to 24 months living in London, there was no significant correlation between ICFI categories and maternal education but this finding may be due to the small sample size.[35] Similar to our study, a study conducted in Nepal among children aged 6 to 23 months shows that growth monitoring of children was associated with the minimum acceptable diet.[36] This may be due to the fact that growth monitoring of children provides an opportunity for educating mothers regarding good feeding practices.

In our study, we found that higher maternal education was associated with a low proportion of underweight children. This finding is similar to the findings of other studies in Mumbai, rural Uttar Pradesh, Pakistan, and a study conducted using the DHS data of Malawi, Zimbabwe, and Tanzania.[19,37-39]

We found that stunting is associated only with birth order but not with feeding practices and other maternal and child characteristics studied. Other factors that affect child growth in the antenatal period and early infancy which we did not investigate may be associated with stunting in the study area.

As primary care physicians provide the first contact and continuing care and are also involved in preventive care, counseling mothers regarding feeding practices whenever they come in contact with them helps in improving mothers' knowledge, thereby improving the feeding practices of children. This study shows the association of the growth monitoring of children with ICFI scores. Growth monitoring of children during all child visits needs to be adopted by primary care physicians.

In India, studies to find the association of feeding index and nutritional status were done in rural areas and urban slums, pediatric clinics. To our knowledge, this is the first community-based study conducted in a non-slum urban area to find the association between feeding index and nutritional status in India. This study is one of the few studies which assessed the sensitivity and specificity of ICFI.

This study has some limitations. The findings of the study cannot be generalized and are applicable to this study area or

similar settings only. The other limitation is recall bias. The cross-sectional nature of the study is also a limitation as we could not find the time–trend relationship. The index did not include other components like responsive feeding, time of initiation of complementary feeding, etc.

Conclusion

There is no association between ICFI and the nutritional status of children. ICFI has limited value in detecting the poor nutritional status of children in this urban setting. There is a need for more research in constructing and testing an Infant and Child Feeding Index which reflects the nutritional status of children aged 6 to 24 months in both rural and urban areas and there is a need for a study of time–trend relationship. Improving female literacy and regular growth monitoring of children are recommended for improving the infant and child feeding practices that in the long run improve the nutritional status of children.

Key Messages

- ICFI has limited value in detecting the poor nutritional status of children in the study area.
- Feeding practices were better among children aged 6 to 8 months compared with children aged 9 to 24 months.
- Maternal education and growth monitoring of children play important roles in improving the feeding practices and nutritional status of children.

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Conflicts of interest

There are no conflicts of interest.

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