Influence of Childcare Practices on Nutritional Status of Children in India: An Analysis of National Family Health Survey-4

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Abstract

Appropriate childcare practices (CCPs) play a crucial role in achieving optimal health outcomes in early childhood as well as in later life. However, poor childcare practices can lead to stunted growth, immune dysfunction, delayed mental development and significantly increased risk of infectious diseases. In countries like India, the problems of undernutrition are always considered in terms of household food security without recognizing the importance of CCPs, which play a vital role in influencing the nutritional status of children. Therefore, using data from the National Family Health Survey (NFHS-4), this study assesses the effect of CCP on the nutritional status of children aged 6-36 months in India. The principal component analysis was used to create CCP index and generalized linear model was used to assess the association of nutritional indices with CCPs. The results showed a positive association between CCPs and child nutritional indices such as height-for-age Z-scores (HAZ), weight-for-height Z-score (WHZ) and weight-for-age Z-score (WAZ), after controlling for potential confounding factors. Therefore, promoting CCPs that not only include feeding practices but also health services like immunization could improve child health and nutrition in India.

Keywords: Childcare practices, nutritional status, undernutrition, stunting, wasting, India

I. Introduction

Adequate nutrition during childhood is essential for the development of each child's full human potential, but globally it remains unmet for many under-five children. Despite international and national efforts to improve child health and the availability of nutritional interventions, undernutrition continues to be a major problem in numerous countries. In most developing countries, undernutrition continues to be a significant cause of infant and child mortality as well as low nutritional status during childhood (Black et al., 2008; Victora et al., 2008). According to the United Nations Children's Fund (UNICEF) data, nearly half of all deaths of under-five children are attributed to undernutrition (UNICEF, 2020). The first five years of a child's life are critical for optimal growth, health, and behavioural development. Therefore, the nutritional status of children under the age of five is critical since it may be used as a proxy indicator for measuring the overall health of a community as well as a key predictor of child survival.

Southern Asia is the only region with a high wasting prevalence as more than 50 per cent of the world's children impacted by wasting live in South Asia (UNICEF, 2018). Despite continuing attempts to fight it, undernutrition remains a public health concern in India. It has the world's second-largest estimated number of malnourished individuals (Yadavar, 2018). Further, according to a UNICEF report, India is one of the three nations that account for over half of the world's stunted children (UNICEF, 2018). In addition, as per the National Family Health Survey- 4 (NFHS-4) (2015-16) report, 38.4 per cent of children aged less than five years in India are stunted, 35.8 per cent are underweight and 21 per cent are wasted (IIPS, 2017). All these are signs of chronic undernutrition.

Acceptable CCPs are vital for improving the nutritional status and health of children. CCPs refer to child-rearing practices for the wellbeing of children below five years of age. Such practices include breastfeeding, complementary feeding and health-seeking behaviour (Kaibua, 2014). The impact of CCPs on the health of children has gained recognition during recent years. Breastfeeding

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is more hygienic, more nutritious and cheaper than bottle feeding. In addition, it boosts the immunity of the infant. Therefore, UNICEF has made the promotion of breastfeeding as one of the major components of its strategy of improving child survival. When breast milk alone is no longer adequate to satisfy the nutritional needs of infants, the process of complementary feeding begins. As a result, in addition to breast milk, other foods and drinks are given (Abeshu et al., 2016). Child feeding practices in the form of complementary feeding constitute a significant component of CCPs, apart from demographic, socio-cultural and economic factors (Kumar et al., 2006; Sreedhara et al., 2016). The impact of complementary feeding in the form of optimal timing, quantity and quality of food on nutritional status is the subject of study in many researches. The time between the introduction of complementary feeding and the period when the child is wholly weaned to the adult diet is the most vulnerable duration for children and the rates of undernutrition peak in this particular period (Shrimpton et al., 2001; Shamim et al., 2006). Therefore, weaning practices and care of children during this period are critical determinants of child nutrition in a population (Range et al., 1997; Ijarotimi, 2013; Zeleke et al., 2017). Appropriate CCPs, therefore, play a crucial role in achieving optimal health outcomes in early childhood as well as in later life. However, poor CCPs can lead to stunted growth, immune dysfunction, delayed mental development and significantly increased risk of infectious diseases (Hediger et al., 2000; Chirande et al., 2015; Bourke et al., 2016). Therefore, the significance of CCPs in improving the nutritional status of children has gained importance and has been documented repeatedly (Nakahara et al., 2006; Bolajoko & Ogundahunsi, 2012; Ramji, 2009).

Basic needs of children are the same in every culture; however, resources and care practices vary greatly not only among cultures, but also among different groups within cultures. Therefore, widespread changes in society require adaptation in CCPs and understanding its importance would help in encouraging acceptable practices and correcting the deficient practices. Even though the quality of CCPs has a demonstrated role in alleviating child undernutrition in a resource-constrained country like India, there has been no study that could examine the role of CCPs concerning the nutritional status of children in the country. Despite the literature having reported various causes of undernutrition, only a little has been published about the associations between CCPs and the nutritional status of under-five children in India. Therefore, this study aims to examine the influence of CCPs on the nutritional status of young children. It is essential in designing an appropriate intervention for addressing undernutrition.

II. Materials and methods

Data source

This study utilized data from the NFHS-4 conducted under the stewardship of the Union Ministry of Health and Family Welfare (MoHFW) (IIPS, 2017). The fundamental objective of this survey was to obtain fertility, maternal and child health, family planning services, reproductive health, nutrition, women's autonomy, domestic violence, etc. It is a large-scale multi-round survey conducted in a nationally representative sample of households. A stratified two-stage sampling was adopted to provide statistics about various indicators for all 640 districts and 35 states and Union Territories (UTs) as per the 2011 Indian Census classification of districts. International Institute for Population Sciences (IIPS), Mumbai, being the nodal agency, was responsible for obtaining ethical approval for conducting and disseminating the data for the survey.

In NFHS-4, anthropometric evaluation included measurement of height, weight and blood specimens. Data was reported at the district level for women aged 15–49 years and children aged 0-59 months. Children born in the last five years who were listed in the household questionnaire were measured for height and weight. Weight was measured using Seca 874 digital scale, while height of children aged 24-59 months was measured using Seca 213 stadiometer. Moreover, Seca 417 infantometer was used to measure the recumbent length of children under 24 months or less than 85 cm. These anthropometric measurements were recorded by trained field investigators and medical staff using standardized procedures. NFHS-4 provided information on height/length-for-age, weight-

for-age and weight-for-height of concerned children. Based on these indicators, nutritional status was determined observing WHO (2006) reference standards and standard deviation z-scores were calculated. The analysis included 79,008 children aged 6-36 months.

Outcome variables

For the present study, improvement in the nutritional status of children was a matter of interest. Therefore, the outcome variables were height-for-age Z-scores (HAZ), weight-for-height Z-score (WHZ) and weight-for-age Z-score (WAZ).

Construction of childcare practices (CCP) index

The CCP index was created using feeding practices variables and preventive health services variables available in the NFHS data set. All these variables were extracted from a woman's questionnaire. The feeding practices variables included in the CCP index were as follows: (1) tinned, powdered or fresh milk; (2) baby formula; (3) cheese, yoghurt and other milk products; (4) fortified baby food (cereals, etc.); (5) chicken, duck or other birds; (6) bread, noodles, others made from grains; (7) potatoes, cassava or other tubers; (8) eggs; (9) pumpkin, carrots and squash (yellow or orange inside); (10) dark green leafy vegetables; (11) mangoes, papayas, other vitamins-A fruits; (12) any other fruit; (13) liver, heart, other organs; (14) fish or shellfish; (15) food made from beans, peas, lentils, nuts; (16) any other meat. However, other feeding practices variables were also included such as (1) breastfeeding status and (2) frequency of feeding solid, semi-solid or soft food (more than twice). The preventive health service variables included: (1) BCG vaccination, (2) DPT vaccination, (3) hepatitis-b vaccination, (4) vitamin A1, (5) polio vaccination, (6) measles vaccination and (7) use of any drug for intestinal parasites.

All the variables mentioned above were binary, i.e., yes = received the care, and no = did not receive the care. The principal component analysis was used to create an index for child care practices. First, seven principal components with eigenvalues > 1 were extracted that explained nearly 92 per cent of the total variation in the data (Supplementary file - Table S3). Oblique factor rotation procedure was applied to review the correlations between variables and components. The first principal component explains 57 per cent of the variation in the data, and this component was used to create the index. Further, the index was divided into three categories: poor childcare practices, average childcare practices and good childcare practices.

Covariates

The study aimed to identify the effect of CCPs on the nutritional status of children in India. Therefore, it was crucial to incorporate all the available and feasible individual and household level indicators of socio-economic status in the study. The covariates used in the analysis were as follows: age of child (6-11 months, 12-23 months, 24-36 months); sex of child (male/female); any morbidity history of the child in last two weeks (yes/no); birth order (one, two, three, four or more); birth size of the child (large, average, small); maternal age (15-24 years, 25-29 years, 30-34 years, 35-39 years, 40-49 years); maternal education (no education, primary, secondary, higher); mass media exposure of the mother (no, low, medium, high); and maternal body mass index (BMI) (underweight, normal, overweight, obese); religion (Hindu, Muslim, others); place of residence (urban/rural); wealth index (poorest, poorer, middle, richer, richest); disposal of children's stools (inappropriate/ appropriate disposal practice).

Statistical analysis

The statistical analysis was performed in two stages using STATA (version 15.0). The first stage was descriptive statistics to provide general information on the characteristics of the study sample. Then in the second stage, a generalized linear model (GLM) was used to assess the association of three outcome variables, i.e., HAZ, WHZ, and WAZ score with CCP and other selected

covariates. Regression coefficient with 95 per cent confidence interval was calculated to assess the strength of the association between covariates and outcome variables. All the estimates provided in this study were derived by applying appropriate sampling weights provided by NFHS-4.

III. Results

Characteristics of the study sample

Table 1 presents the descriptive statistics of the variables used in creating the CCP index for children aged 6-36 months. Among feeding practices variables, about 60.3 per cent of the children were given bread and other foods made from grains. Likewise, 27.1 per cent of them were given green leafy vegetables and 22.5 per cent vitamin-A containing fruits. However, only a small percentage of them aged 6-36 months were given chicken or any other meat-containing foods. Nevertheless, in this study sample, the percentage of breastfeeding practice was 80.4 per cent, and more than 50 per cent children (51.4%) were fed with solid and semi-solid foods more than twice a day. About 92.1 per cent of them had received BCG vaccine. Likewise, the children who had received the vaccination for DPT, Hepatitis-B, polio and measles were 88.9 per cent, 64.7 per cent, 79 per cent and 66.7 per cent respectively.

Table 1: Characteristics of variables used in creating the child care practices index for children aged 6-36 months

Variables	Weighted %	Frequency
Feeding practices variables		
Tinned, powdered or fresh milk	38.90	29,820
Baby formula	9.80	7,179
Cheese, yogurt, other milk products	8.80	7,466
Fortified baby food (cereals, etc.)	14.50	10,907
Chicken, duck or other birds	4.60	4,627
Bread, noodles, others made from grains	60.30	48,144
Potatoes, cassava or other tubers	20.30	16,785
Eggs	13.50	10,629
Pumpkin, carrots, squash (yellow or orange inside)	18.70	15,210
Dark green leafy vegetables	27.10	22,182
Mangoes, papayas, other vitamin A fruits	17.40	13,841
Any other fruit	22.50	17,771
Liver, heart, other organs	4.90	4,459
Fish or shellfish	4.50	4,048
Food made from beans, peas, lentils, nuts	12.50	10,571
Any other meat	3.70	3,701
Other feeding practices variables		
Ever breastfeed	80.40	63,521
Frequency of feeding solid, semi-solid or soft food (more than twice)	51.40	41,971
Preventive health service variables		
BCG vaccination	92.10	71,752
DPT vaccination	88.90	69,409
Hepatitis-B vaccination	64.70	48,885
Vitamin A1	69.10	52,248
Polio vaccination	79.00	59,471
Measles vaccination	66.70	51,338
Any drugs for intestinal parasites	27.30	19,713

Note: Food types consumed by the children over last 24-hour period.

The descriptive statistics of the study sample have been presented in Table 2. A greater number of children in the sample belonged to the age group of 12-23 months (57.4%). Further, the sample consists of a slightly higher number of male children (50.9%) than female children (49.1%). About 46 per cent mothers were in the age group of 15-24 years. Only 10.8 per cent of them were highly

educated. A high proportion of mothers (74.2%) used inappropriate ways to dispose of the child's stool.

Table 2: Characteristics of the study sample (N=79,008)

Background characteristics	Weighted %	N
Maternal and child basic factors		
Age of child		
6-11 months	29.1	22,968
12-23 months	57.4	45,260
24-36 months	13.6	10,780
Sex of child		
Male	50.9	40,156
Female	49.1	38,852
Maternal age (in yrs.)		
15-24	46.2	34,151
25-29	35.5	28,111
30-34	13.1	11,677
35-39	4.1	3,934
40-49	1.1	1,135
Any morbidity in last two weeks		
No	75.8	60,120
Yes	24.2	18,888
Birth order		
One	40.6	31,019
Two	32.0	24,391
Three	14.6	12,108
Four or more	12.8	11,490
Birth size of child		
Large	19.4	13,483
Average	67.5	54,637
Small	13.1	10,888
Maternal resources		
Maternal education		
No education	28.2	22,961
Primary	13.9	11,281
Secondary	47.1	36,964
Higher	10.8	7,802
Mothers mass media exposure		
No	35.1	29,389
Low	45.0	34,466
Medium	16.9	12,921
High	3.1	2,232
Maternal BMI		
Underweight	28.6	21,394
Normal	59.1	48,443
Overweight	9.5	7,218
Obese	2.4	1,665
Contexture factors		
Place of residence		
Urban	26.7	18,126
Rural	73.3	60,882
Religion		
Hindu	78.7	57,259
Muslim	16.7	12,541
Others	4.6	9,208

…..contd.

Table 2: Characteristics of the study sample (N=79,008) *.....continued.*

Background characteristics	Weighted %	N
Household resources		
Wealth index		
Poorest	25.2	20,457
Poorer	22.3	18,722
Middle	20.6	16,198
Richer	18.2	13,296
Richest	13.7	10,335
Disposal of child's stool		
Inappropriate disposal practices	74.2	58,119
Appropriate disposal practices	25.8	20,889

Differential in childcare practices by background characteristics

Table 3 reveals that 38.7 per cent children aged 12-23 months received good childcare practices, which were twice as compared with the children aged 24-36 months (19.1%). Male children were at an advantage in receiving good childcare, as the percentage of children who received good care was slightly higher in their case (36.3%) than in the case of female children (35.1%). Moreover, the percentage of good childcare practices decreased with the increase in birth order, which indicated that the higher the birth order of a child, the lesser the chance of receiving good care. In relation to the maternal age, the analysis showed a great variation in the childcare practices. Mothers in the age group of 25-29 years were taking better care of their children as compared with the mothers of other age groups. Furthermore, the results showed that the higher the mass media exposure and educational level of the mother, the greater the percentage of giving better childcare. Children from urban areas (71.1%) were more likely to get better care as compared with children from rural areas (22.8%). Likewise, the percentage of children who received good childcare was greater among children who belonged to the higher wealth quintile than the children from lower wealth quintile.

Results from bivariate analysis showed a strong association between childcare practices and children's nutritional status (Figure 1). The prevalence of wasting and underweight was significantly lower among those children who were in the highest tercile of the CCP index, indicating a lower risk of undernutrition among children receiving good care. The magnitude of the difference in the prevalence of underweight between the 1st and 3rd CCP index terciles, i.e., between good and poor CCP, was almost 24 per cent. However, in the case of wasting and stunting, the differences were 8.6 per cent and 5.9 per cent respectively.

*Results from regression analysis*

Table 4 shows the result of generalized linear regression model which was carried out to examine the influence of CCPs on the nutritional status of children after controlling other covariates. The results showed a significant association between CCPs and the indicators of nutritional status (HAZ, WHZ, and WAZ). In Model A, the children who received good care practices had a 0.14 unit increase in HAZ score (coefficient=0.138; CI: 0.046-0.229) as compared with those who received poor care. Similarly, in Model B (WHZ) and Model C (WAZ), children with higher CCP scores had a 0.10 unit (coefficient=0.103; CI: 0.03-0.177) and a 0.15-unit (coefficient=0.152; CI: 0.09-0.214) increase in WHZ score and WAZ score respectively as compared with those with lower CCP scores. In addition, factors like age, anaemic status, morbidity history, birth order and birth size of the child were negatively associated with HAZ and WAZ. Likewise, in the case of WHZ, the anaemic status of the child, morbidity history, birth order and birth size were shown to have negative associations. Further, maternal and household factors including maternal education, maternal BMI, mass media exposure, wealth index, etc., were positively associated with HAZ, WHZ, and WAZ. Place of residence and religion were also shown to have positive associations.

Table 3: Child care practices by background characteristics of study sample

Background characteristics	Child care practice index		
	Bad	Average	Good
Age of child			
6-11 months	27.93	46.95	25.12
12-23 months	37.68	23.66	38.66
24-36 months	29.47	51.47	19.07
Sex of child			
Male	30.92	32.75	36.33
Female	32.21	32.66	35.13
Maternal age (in yrs.)			
15-24	29.53	37.00	33.47
25-29	30.12	30.94	38.93
30-34	35.27	26.46	38.27
35-39	46.61	23.23	30.17
40-49	62.67	19.01	18.33
Any morbidity in last two weeks			
No	31.39	32.47	36.13
Yes	32.06	33.43	34.51
Birth order			
One	23.40	32.92	43.68
Two	27.37	33.50	39.14
Three	40.79	33.94	25.27
Four or more	57.40	28.63	13.97
Birth size of child			
Large	27.25	34.28	38.48
Average	31.52	32.28	36.20
Small	38.10	32.56	29.34
Maternal education			
No education	61.17	28.48	10.35
Primary	39.60	39.78	20.62
Secondary	17.96	37.22	44.82
Higher	3.19	14.97	81.83
Mothers mass media exposure			
No	65.81	27.28	6.91
Low	15.31	41.77	42.92
Medium	7.79	21.95	70.26
High	7.81	21.07	71.13
Maternal BMI			
Underweight	34.98	34.37	30.65
Normal	33.66	34.92	31.42
Overweight	31.01	30.61	38.38
Obese	30.75	27.84	41.41
Place of residence			
Urban	6.47	22.44	71.09
Rural	40.71	36.45	22.84
Religion			
Hindu	32.73	33.18	34.08
Muslim	29.39	31.72	38.89
Others	19.34	28.09	52.57
Wealth index			
Poorest	34.88	38.41	26.71
Poorer	34.23	35.07	30.70
Middle	33.12	33.30	33.58
Richer	32.04	31.25	36.70
Richest	34.00	30.33	35.68
Disposal of youngest child's stool			
Inappropriate disposal practices	39.67	36.42	23.91
Appropriate disposal practices	8.24	22.03	69.73

Childcare practices and child nutritional status

Figure 1: The childcare practices (terciles) and undernutrition prevalence among children aged 6-36 months
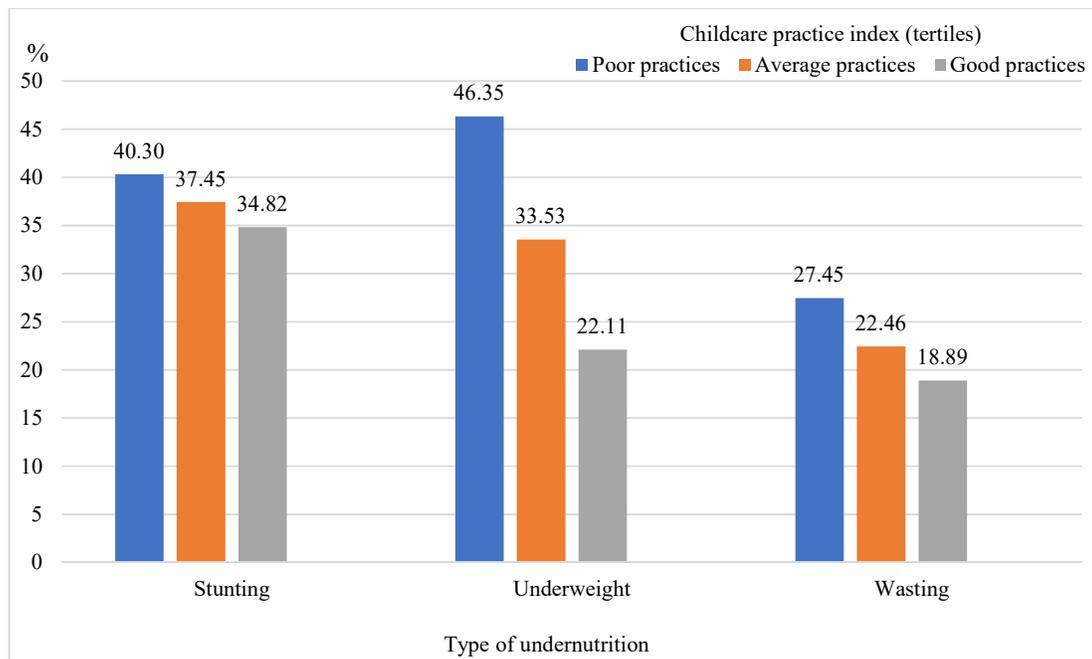
IV. Discussion & conclusion

In a country like India, the problems of undernutrition are always considered in terms of household food security without recognizing the importance of childcare that plays a vital role in influencing the nutritional status of children. It is mainly due to lack of adequate knowledge of their relevance and usefulness in promoting nutritional wellbeing. Although childcare practice has been identified as a major influencing factor for nutritional status, primarily for the vulnerable group, not a single study has been done to examine the association between CCPs and the nutritional status of children in India. Therefore, the current study aimed to assess the influence of CCPs on HAZ, WHZ and WAZ among children aged 6-36 months in India, controlling for potential confounding factors at the child, maternal and household levels.

The study revealed a positive and significant association between the CCP index and child nutritional indices such as HAZ, WHZ, and WAZ. This result is in line with various other studies from Ghana, Tanzania, Nigeria and Latin America (Amugsi et al., 2014; Nti & Lartey, 2008; Mtoi & Nyaruhucha, 2019; Amosu et al., 2011; Ruel & Menon, 2002). It also posits the fact that the growth of a child is not only determined by adequate nutritional food but also good care practices and access to health services are equally important (Amugsi et al., 2014). Therefore, strategies for optimal growth and improving the health outcomes of children should not be limited only to nutritious food or feeding practices. However, they should also include access to health services like immunization etc.

The analysis also revealed a significant association of some maternal and household factors with the nutritional status of children. From the findings, it is observed that maternal education and mass media exposure were significant determinants of children's nutritional status. It is consistent with the results of other studies (Mtoi & Nyaruhucha, 2019; Abuya et al., 2012; Kulwa et al., 2006).

Table 4: Multivariate analysis of the determinants of nutritional status of children aged 6–36 months, NFHS-4, India

Background characteristics	Model A (HAZ)		Model B (WHZ)		Model C (WAZ)	
	Coefficients	95% CI	Coefficients	95% CI	Coefficients	95% CI
Maternal and child basic factors						
Age of child						
6-11 months ®						
12-23 months	-0.805***	-0.834, -0.777	0.058***	0.035, 0.081	-0.211***	-0.23, -0.191
24-35 months	-0.992***	-1.033, -0.951	0.144***	0.11, 0.177	-0.32***	-0.348, -0.292
Sex						
Male ®						
Female	0.204***	0.179, 0.228	0.058***	0.039, 0.078	0.116***	0.099, 0.133
Anaemic status						
No ®						
Yes	-0.199***	-0.226, -0.172	-0.088***	-0.109, -0.066	-0.168***	-0.187, -0.15
Maternal age (in yrs.)						
15-24 ®						
25-29	0.093***	0.063, 0.123	0.04***	0.016, 0.064	0.081***	0.06, 0.101
30-34	0.171***	0.128, 0.213	0.052***	0.017, 0.086	0.13***	0.101, 0.159
35-39	0.156***	0.091, 0.22	0.096***	0.044, 0.148	0.154***	0.11, 0.198
40-49	0.148***	0.039, 0.257	0.06***	-0.028, 0.147	0.119***	0.045, 0.193
Any morbidity in the last two weeks						
No ®						
Yes	-0.021	-0.05, 0.008	-0.083***	-0.107, -0.06	-0.068***	-0.087, -0.048
Birth order						
One ®						
Two	-0.118***	-0.149, -0.087	-0.039***	-0.064, -0.014	-0.094***	-0.115, -0.073
Three	-0.199***	-0.24, -0.158	-0.092***	-0.125, -0.059	-0.178***	-0.206, -0.15
Four or more	-0.32***	-0.368, -0.272	-0.145***	-0.184, -0.106	-0.279***	-0.312, -0.246
Birth size of child						
Large ®						
Average	-0.112***	-0.145, -0.078	-0.042***	-0.069, -0.016	-0.086***	-0.109, -0.064
Small	-0.358***	-0.402, -0.313	-0.217***	-0.253, -0.181	-0.345***	-0.376, -0.315
Maternal resources						
Maternal education						
No education ®						
Primary	0.062***	0.021, 0.102	0.047***	0.014, 0.08	0.073***	0.045, 0.1
Secondary	0.197***	0.163, 0.232	0.076***	0.048, 0.103	0.165***	0.141, 0.188
Higher	0.334***	0.278, 0.391	0.168***	0.122, 0.213	0.300***	0.261, 0.338
Mothers mass media exposure						
No ®						
Low	0.066***	0.033, 0.099	0.012***	-0.014, 0.039	0.047***	0.025, 0.07
Medium	0.103***	0.057, 0.148	0.060***	0.023, 0.096	0.101***	0.07, 0.132
High	0.173***	0.092, 0.255	0.088***	0.022, 0.154	0.155	0.099, 0.21
Maternal BMI						
Underweight ®						
Normal	0.212***	0.183, 0.24	0.321***	0.298, 0.344	0.341***	0.321, 0.36
Overweight	0.275***	0.225, 0.324	0.579***	0.539, 0.619	0.565***	0.531, 0.598
Obese	0.424***	0.335, 0.514	0.658***	0.585, 0.73	0.695***	0.633, 0.756
Contexture factors						
Place of residence						
Urban ®						
Rural	0.052***	0.019, 0.085	0.1***	0.073, 0.127	0.099***	0.077, 0.122
Religion						
Hindu ®						
Muslim	0.052***	0.017, 0.088	0.121***	0.093, 0.15	0.117***	0.093, 0.141
Others	0.171***	0.131, 0.212	0.389***	0.356, 0.421	0.376***	0.348, 0.403

……contd

Table 4: Multivariate analysis of the determinants of nutritional status of children aged 6–36 months, NFHS-4, India……continued

Background characteristics	Model A (HAZ)		Model B (WHZ)		Model C (WAZ)	
	Coefficients	95% CI	Coefficients	95% CI	Coefficients	95% CI
Household resources						
Wealth index						
Poorest ®						
Poorer	0.098***	0.045, 0.151	0.09***	0.048, 0.133	0.116***	0.08, 0.152
Middle	0.199***	0.13, 0.268	0.102***	0.047, 0.158	0.176***	0.129, 0.223
Richer	0.23***	0.129, 0.33	0.15***	0.069, 0.231	0.228***	0.16, 0.297
Richest	0.371***	0.267, 0.476	0.171***	0.086, 0.255	0.315***	0.244, 0.387
Disposal of child's stools						
Inappropriate disposal practices ®						
Appropriate disposal practices	0.108***	0.076, 0.14	0.09***	0.064, 0.115	0.121***	0.099, 0.142
Child care practices						
CCP index						
Low ®						
Average	0.043***	-0.013, 0.098	0.076***	0.031, 0.12	0.083***	0.045, 0.121
Good	0.138***	0.046, 0.229	0.103***	0.03, 0.177	0.152***	0.09, 0.214

Note: ®: reference category; *, **, *** refers to $p < 0.05$, $p < 0.01$, $p < 0.001$ level of significance; CI - Confidence Interval.

Further, in contrast to a previous study by Armar-Klemesu et al. (2000), our study showed a strong association between household wealth inequality and childhood undernutrition. Therefore, reducing poverty and making health services more available and accessible to the poor is important for improving the health and nutritional status of children in India. Hong et al. (2006) and Hong & Mishra (2006) have also documented a similar kind of result in their respective studies. Poor hygiene and sanitation can have a negative impact on health. Several studies have also reported that personal and household hygiene practices are significantly correlated to positive nutritional and health outcomes (Armar-Klemesu et al., 2000; Nti & Lartey, 2008). Likewise, in this study, appropriate disposal practice has shown to have a significant association with nutritional indices.

As this study has used nationally representative data from a large-scale health survey in India to explore the relationship between childcare practices and the nutritional status of children, one of its major strengths is the wider relevance of its results. Another strength of the study is the use of modern and up-to-date statistical methods for the calculation of the CCP index. The limitation of this study is the inability to find out the potential causal relationship between variables due to the use of cross-sectional data.

In conclusion, the study has confirmed the notion that better childcare practices that include not only breastfeeding and complementary feeding practices but also immunization could promote growth and nutrition of young children. Therefore, promoting these care practices could lead to improvements in child health and nutrition in India. Further, an increase in maternal knowledge of childcare contributes significantly to the nutritional status of children. Thus, it is important to focus on health education among women, especially mothers, on the nutritional requirements of the child at a specific age.

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Supplementary Tables

Table S1: Result of Bartlett's test for sphericity

Bartlett's test for sphericity	
Chi-square	4.53e+05
Degrees of freedom	351
p-value	0.000
Bartlett test is significant. This indicates that there are sufficient inter-correlations to conduct the principal component analysis.	
Result of Kaiser-Meyer-Olkin Measure	KMO = 0.863
Large values for the KMO measure indicate that principal component analysis of the variables is a good idea.	

Table S2: Result of Cronbach's alpha test

Item	Item-test correlation	Item-rest correlation	Average interitem correlation	Alpha
Gave child tinned, powdered or fresh milk	0.27	0.18	0.15	0.82
Gave child baby formula	0.32	0.23	0.15	0.82
Gave child cheese, yogurt, other milk products	0.53	0.46	0.14	0.81
Gave child fortified baby food (cerelac, etc)	0.34	0.25	0.15	0.82
Gave child any chicken, duck or other birds	0.54	0.47	0.14	0.81
Gave child bread, noodles, other made from grains	0.45	0.38	0.15	0.82
Gave child potatoes, cassava, or other tubers	0.52	0.45	0.14	0.81
Gave child eggs	0.56	0.5	0.14	0.81
Gave child pumpkin, carrots, squash (yellow or orange inside)	0.55	0.48	0.14	0.81
Gave child any dark green leafy vegetables	0.57	0.51	0.14	0.81
Gave child mangoes, papayas, other vitamin-A fruits	0.56	0.5	0.14	0.81
Gave child any other fruits	0.59	0.53	0.14	0.81
Gave child liver, heart, other organs	0.54	0.48	0.14	0.81
Gave child fish or shellfish	0.49	0.42	0.14	0.81
Gave child food made from beans, peas, lentils, nuts	0.53	0.46	0.14	0.81
Gave child any other meat	0.51	0.44	0.14	0.81
Child received BCG vaccination	0.31	0.22	0.15	0.82
Child received DPT vaccination	0.32	0.24	0.15	0.82
Child received hepatitis-b	0.3	0.21	0.15	0.82
Child received vitamin A1	0.35	0.27	0.15	0.82
Child received polio	0.3	0.21	0.15	0.82
Child received measles	0.39	0.31	0.15	0.82
Child received any drugs for intestinal parasites	0.27	0.18	0.15	0.82
Currently breastfeeding	0.09	0	0.16	0.83
More than two times child ate solid, semi-solid or soft food yesterday	0.38	0.3	0.15	0.82
Test scale			0.15	0.82

Table S3: Principal component analysis for self-medication index (First seven principal components were displayed which has eigenvalues greater than 1)

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp 1	5.412	2.435	0.567	0.567
Comp 2	2.977	1.225	0.110	0.678
Comp 3	1.752	0.448	0.065	0.743
Comp 4	1.304	0.125	0.048	0.791
Comp 5	1.179	0.103	0.044	0.835
Comp 6	1.076	0.058	0.040	0.874
Comp 7	1.018	0.059	0.038	0.912