Inadequate feeding of infant and young children in India: lack of nutritional information or food affordability?

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Faculty of Arts, University of British Columbia, 997–1873 East Mall, Vancouver, British Columbia, Canada, V6T 1Z1

Abstract

Objective: Despite a rapidly growing economy and rising income levels in India, improvements in child malnutrition have lagged. Data from the most recent National Family Health Survey reveal that the infant and young child feeding (IYCF) practices recommended by the WHO and the Indian Government, including the timely introduction of solid food, are not being followed by a majority of mothers in India. It is puzzling that even among rich households children are not being fed adequately. The present study analyses the socio-economic factors that contribute to this phenomenon, including the role of nutritional information.

Design: IYCF practices from the latest National Family Health Survey (2005–2006) were analysed. Multivariate logistic regression analyses were performed to establish the determinants of poor feeding practices. The indicators recommended by the WHO were used to assess the IYCF practices.

Setting: India.

Subjects: Children (*n* 9241) aged 6–18 months.

Results: Wealth was shown to have only a small effect on feeding practices. For children aged 6–8 months, the mother's wealth status was not found to be a significant determinant of sound feeding practices. Strikingly, nutritional advice on infant feeding practices provided by health professionals (including anganwadi workers) was strongly correlated with improved practices across all age groups. Exposure to the media was also found to be a significant determinant.

Conclusions: Providing appropriate information may be a crucial determinant of sound feeding practices. Efforts to eradicate malnutrition should include the broader goals of improving knowledge related to childhood nutrition and IYCF practices.

In India, an alarming 43% of children less than 3 years of age are stunted, 48% are underweight and 17% are wasted, according to the latest National Family Health Survey (NFHS; 2005–2006)[1]. It is well known that poor anthropometric indices of children have serious consequences for their survival. Nutritional intake in the early years of life can also have long-term health consequences in adulthood. Lower nutritional intake is positively associated with an increased risk of CHD, lower intellectual and poor reproductive performance[2–6]. Malnutrition in childhood can also have intergenerational impacts. A mother's poor nutritional intake and growth during her infancy is associated with lower birth weight and lower risk of survival for her offspring[3,7–10].

A balanced diet rich in both macro- and micronutrients is fundamental to an infant's growth and development[11]. According to current WHO recommendations on infant and young child feeding (IYCF), an appropriate diet is breast-feeding for the first 6 months of life, followed by adequate and nutritionally balanced solid food to complement breast milk[12]. The introduction of solid or semi-solid food at around 6 months of age is crucial, since breast milk alone would no longer be sufficient for maintaining a child's optimal growth[13–16]. Generally, there is a clustering effect of nutritional deficiency, so that a few nutrients cannot be singled out, and a well-balanced diet is vital for children. Diversity in an infant's diet has been linked to improved nutritional status and anthropometric measures in childhood[17,18].

Food requirements vary across breast-feeding status. According to the guidelines[19], a child in the age range 6–23 months should be fed from four or more different food groups in addition to breast milk. Further, a child who does not receive any breast milk should be fed from four or more food groups and should also receive milk or milk products on a daily basis. In its indicators for assessing IYCF

Corresponding author: Email nishamalhot@gmail.com

practices in population-based surveys, the WHO classifies seven food groups: (i) Milk and Milk Products; (ii) Eggs; (iii) Flesh Foods (Meat, Fish, etc.); (iv) Vitamin-A Rich Fruits and Vegetables; (v) Other Fruits and Vegetables; (vi) Grains; (vii) Nuts and Legumes. The Indian National Guidelines on IYCF (based on WHO's guiding principles) also recommend that after the first 6 months of age children should no longer be exclusively breast-fed, and should be given complementary solid and semi-solid food[20,21].

Breast-feeding is nearly universal in India where 96 % of children younger than 5 years of age are breast-fed; the mean duration of breast-feeding is 24·7 months[9]. Nevertheless, there are prolonged delays in the introduction of complementary food, with only 55·8 % of children aged 6–9 months receiving such food. Further, it is during this time of delay that the incidence of childhood malnutrition rises in the population[9,22,23]. This is also true of other developing countries; malnutrition rates rise during 6–8 months of age, coinciding with complementary feeding[24].

Much of the research on this issue has emphasized poverty as a leading cause of malnutrition[25–28]. Income is a binding constraint to proper nutrition; however, income is only one of the many determinants of poor feeding practices. Maternal characteristics like formal schooling, wealth and employment are also found to be important in mothers' timely introduction of complementary food[29–31].

The present study uses data from the NFHS (2005–2006), which provides useful information on IYCF practices at the national level, to evaluate the extent to which various factors previously found to be important determinants of poor feeding practices apply to the case of India. The study also highlights the role of nutrition information, in comparison to formal education and wealth, as an important determinant of infant diet. This work contributes by separating and quantifying the contribution of nutritional information and informal education to the prevalence of inadequate feeding practices.

Methods

Data

NFHS (2005–2006) data are used for the present analysis[32]; NFHS is the Indian component of the Measure Demographic and Health Survey project. NHFS provides a cross-sectional data set. The survey was nationally representative and collected information from 124 385 eligible women aged 15–49 years in all of India's twenty-eight states. The survey collected information on their children born in the three years preceding the survey. Survey data include demographic and health parameters as well as information on food consumed by these children.

Outcome measure: complementary feeding

All children aged 6–18 months were included in the analysis. Data on children's dietary intake were obtained from mothers, using the conventional 24 h recall method. Mothers were also asked about the daily frequency of feeds (number of feeds in 24 h) and the various food groups offered in the meal. Inadequate feeding here is defined as falling short of the WHO guidelines, as evident by the late introduction of complementary food, low meal frequency, or insufficient food groups or quantity of complementary food. The IYCF indicators as suggested in the WHO guidelines for population-based surveys[19] are used. These indicators reflect three aspects of IYCF practices: timely introduction of solid/semi-solid foods, minimum dietary diversity and minimum meal frequency. For children in the age group 6 to 8 months, the WHO indicators are: complementary food (child was offered any solid/semi-solid food); child was fed two or more times daily; and child was offered food from four or more food groups. Given that only 3 % of the sample was offered food from four or more food groups, another variable was introduced for this age range: child was offered food from at least three food groups. For young children in the age group 9–18 months the WHO indicators are: child was fed three or more times daily; child was offered food from three or more food groups; and child was offered food from four or more food groups.

Food groups were based on a 24 h recall of different food products fed to the child. Food group categories are comparable to those used in previous literature[12,13] and are: milk, cheese, yoghurt or other milk products; bread, noodles or other food made from grains; oil, fats, butter or products made from them; mangoes, papaya or other vitamin-A-rich fruits; beans, legumes/lentils and nuts; other fruits and vegetables (including green leafy vegetables); and eggs, meat, poultry, fish and shellfish (and organ meats).

Exposure measures: nutritional information and other socio-economic variables

Information variables were created using questions related to the mother's contact with health professionals and exposure to media. Information regarding nutrition and IYCF practices was considered separately from formal education. The NFHS survey asked questions on whether nutritional advice was provided during meetings with health professionals (in the previous three months) or during antenatal care visits. More specifically, the survey asked: 'In the last three months, have you met with an anganwadi worker or other community health worker?' and 'Did you see anyone for antenatal care for this (recent) pregnancy?'. Mothers were then asked about the different matters addressed in the meeting. Responses were divided into eighteen categories, one of which was 'Nutrition/Health Education and Nutrition Advice'. The anganwadi health professionals are the workers at anganwadi centres set up by the Indian Government under the Integrated Child Development Services to take care of the health needs of children and mothers[20].

Frequency of media exposure, i.e. how often a mother, in total, read newspapers, listened to the radio and watched television, was also included in the analysis. Values ranged from not at all (0), less than once a week (1), at least once a week (2) to almost every day (3). Mothers' formal education was categorized by the highest level attained: no education (the reference group), less than primary, primary, middle school and completed high school.

A number of other socio-economic variables were included in this analysis. Two binary variables pertaining to the mother's work situation were included, as these can affect the time she has available to feed a child and also reflects that she might obtain information in the workplace. First, if a mother currently worked (in a paid labour force, either at home or away from home), the variable took the value 1, and 0 otherwise. A mother who is formally employed could either be working away from home (leaves the house to work outside) or could be working from home. The second variable pertains to the location of the mother's workplace; if a working mother (as defined above) had been working away from home, the variable took the value of 1, and 0 if she worked from home. The NFHS data do not contain information on individual or household incomes, but do provide a wealth index, which is used in the present analysis. The wealth index was based on asset ownership and housing characteristics of each household (e.g. type of flooring; material of exterior walls; type of roofing; cooking fuel; house ownership; ownership of a bicycle, a motorcycle or scooter, an animal-drawn cart, a car, etc.). Principal component analysis was used to assign weights to each asset (housing characteristics), which was then standardized. For each household, asset scores were summed and individuals were ranked according to the household score. The wealth index was divided into quintiles for the whole sample: poorest (the reference group), poorer, middle, richer and richest.

The following variables were used to account for any gender bias or lack of experience in feeding practices: number of siblings the child has aged less than 3 years, gender (equals 1 if the child is male), first child (equals 1 if the child is first born) and rural (equals 1 if the household resides in a rural area).

Statistical methods

In total, six regression models were used to test for the relationship between various indicators of IYCF practices, as recommended by the WHO, and socio-economic variables (including nutritional information). The same covariates were used for all models and the differences across the models are based on the outcome measures: different indicators of IYCF practices. All these models were tested using logistic multivariate regression analysis. The odds ratio, adjusted for all the covariates, and 95 % confidence interval are reported for all regressions.

Three regression models were used for infants in the age group 6–8 months (Models 1 to 3) and these covered three binary outcome measures: complementary feeding, fed two or more times daily, and fed from three or more food groups. Three regression models (Models 4, 5 and 6) were used for children in the age group 9–18 months, and these covered three indicators measured as binary variables: complementary feeding, fed three or more times daily, and fed from four or more food groups. The STATA statistical software package version SE 11·1 was used for all statistical analyses and regressions.

Results

Baseline statistics

Table 1 lists the baseline characteristics of the survey participants included in the study, stratified by age group (6–8 months (Gp1) and 9–18 months (Gp2)). In Gp1 (Gp2), 99 % (98 %) of mothers had an antenatal check-up and 35 % (32 %) had met with a health-care worker in the three months preceding the survey. For both groups, 56 % of mothers discussed nutrition during antenatal check-ups, whereas only 1·5 % of mothers in Gp1 and 1·8 % of mothers in Gp2 discussed nutrition during other meetings with health-care workers. Among exposures to the media, television exposure was the highest, followed by radio and print media; this was true for both groups. Both groups were also comparable in terms of wealth index.

Table 2 reports descriptive statistics on feeding practices. In the sample, only 63 % of children between the ages of 6 and 8 months were given any solid/semi-solid food; this rose to 84 % of children between the ages of 9 and 11 months. Although 92 % of children between the ages of 12 and 18 months in the sample received complementary food, only 17 % of them were fed adequately from four or more food groups, and only 54 % of them were fed three or more times daily.

Multivariate regression

The results of multivariate logistic regressions in Tables 3 and 4 provide evidence of a strong association between nutritional information and adequate IYCF practices.

Table 3 presents adjusted odds ratios and 95 % confidence intervals from the multivariate logistic regression analysis for children in the age group 6–8 months. For children aged 6–8 months, mothers were more likely to give complementary food to their child, offer food at least twice daily and from three or more food groups, if they had received nutritional advice during antenatal check-ups than if they had not (OR = 1·48, 1·29 and 1·55, respectively). This was true even for mothers who discussed nutrition during other meetings (non-antenatal) with health professionals: they were more likely to give complementary food (OR = 3·76). Exposure to radio increased meal frequency and diversity, and the likelihood of mothers offering

Table 1 Descriptive statistics of the study population

	Age group					
	6–8 months			9–18 months		
Variable	n	%	SD	n	%	SD
Mother's exposure to health-care professionals						
Had antenatal check up	2202	99·46	0·07	6869	97·61	0·15
Advised on nutrition (antenatal)	1241	56·05	0·50	3971	56·43	0·50
Met health-care worker in the last 3 months	772	34·87	0·48	2211	31·42	0·46
Discussed nutrition in last 3 months	32	1·45	0·12	125	1·78	0·13
Exposure to media (ever)						
Watched television	1463	66·08	0·48	4627	65·75	0·47
Listened to radio	988	44·63	0·50	2994	42·55	0·49
Read newspaper or magazine	816	36·86	0·48	2467	35·06	0·48
Wealth index*						
Poorest	379	17·12	0·38	1193	16·95	0·38
Poorer	399	18·02	0·38	1299	18·46	0·39
Middle	453	20·46	0·40	1428	20·29	0·40
Richer	513	23·17	0·42	1623	23·06	0·42
Richest	470	21·23	0·41	1494	21·23	0·41
Mother's education						
No education	826	37·31	0·48	2640	37·52	0·48
Less than primary	148	6·68	0·25	500	7·11	0·26
Primary school	152	6·87	0·25	498	7·08	0·26
Middle school	749	33·83	0·47	2436	34·62	0·48
High school and above	339	15·31	0·36	963	13·68	0·34
Mother's employment†						
Currently working	626	28·27	0·45	2285	32·47	0·47
Work: from home	124	5·60	0·23	481	6·84	0·25
Work: away from home	500	22·58	0·42	1798	25·55	0·44
Other variables						
Male child	1143	51·63	0·50	3645	51·80	0·50
Had diarrhoea recently	411	18·56	0·39	1133	16·10	0·37
No. of siblings aged <3 years	587	26·51	0·46	1205	17·12	0·39
First child	744	33·60	0·47	2343	33·30	0·47
Low birth weight – subjective	138	6·23	0·24	444	6·31	0·24
Total	2214			7037		

Frequency, percentage and standard deviation of explanatory variables considered for the multivariate regression models, stratified by age group, from the 2005–2006 Indian National Family Health Survey.
*Wealth index was based on asset ownership and housing characteristics of the household; the five categories were based on wealth quintiles of the whole sample of households (whereas, in the present analysis, we only consider households with children ≤18 months of age).
†Formal paid employment.

Table 2 Details on feeding practices

	Age group								
	6–8 months			9–11 months			12–18 months		
Variable	n	%	SD	n	%	SD	n	%	SD
Complementary feeding	1395	63	0·48	1682	84	0·37	4632	92	0·26
Meal frequency									
Two or more feeds daily	1129	51	0·50	1381	69	0·46	4330	86	0·35
Three or more feeds daily	554	25	0·43	781	39	0·49	2719	54	0·50
Dietary diversity									
Three or more food groups	155	7	0·26	400	20	0·40	1762	35	0·48
Four or more food groups	66	3	0·18	180	9	0·28	856	17	0·37
	n	Mean	SD	n	Mean	SD	n	Mean	SD
No. of feeds/d	2214	1·54	1·53	2002	2·18	1·54	5035	2·72	1·45
No. of food groups/d	2214	0·78	1·05	2002	1·49	1·33	5035	2·13	1·47

Frequency, percentage, mean and standard deviation of feeding practices, as per the WHO feeding guidelines, stratified by age group of the child, from the 2005–06 Indian National Family Health Survey.

complementary food in that age group, food at least twice daily and from at least three out of the seven food groups (OR = 1·08, 1·12 and 1·19 respectively; food groups: milk and milk products; food made from grains; oil, fats, butter or products made from them; vitamin-A-rich fruits; beans, legumes/lentils and nuts; other fruits and vegetables

Table 3 Information and adequate feeding practices (6–8 months)

	Complementary feeding (yes)		Two or more times daily		Three or more food groups	
	Model 1		Model 2		Model 3	
	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's exposure to health-care professionals						
Had antenatal check up						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	2·00	0·54, 7·42	0·05*	0·01, 0·44	0·43	0·05, 3·71
Advised on nutrition (antenatal)						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·48*	1·21, 1·82	1·29†	1·06, 1·58	1·55†	1·03, 2·33
Met with health-care worker in last 3 months						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·95	0·78, 1·15	0·88	0·73, 1·06	0·94	0·66, 1·34
Discussed nutrition and health						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	3·76†	1·27, 11·13	1·88	0·87, 4·08	0·70	0·16, 3·08
Exposure to media						
Watched television	1·07	0·97, 1·17	1·04	0·95, 1·14	1·08	0·91, 1·29
Listened to radio	1·08‡	0·99, 1·17	1·12*	1·03, 1·21	1·19†	1·04, 1·37
Read newspaper or magazine	1·30*	1·13, 1·50	1·21*	1·06, 1·37	1·18‡	0·97, 1·44
Wealth index						
Poorest	1·00	Ref.	1·00	Ref.	1·00	Ref.
Poorer	0·75‡	0·56, 1·00	0·77‡	0·57, 1·03	0·83	0·41, 1·65
Middle	0·88	0·65, 1·20	0·90	0·66, 1·23	0·84	0·42, 1·68
Richer	1·14	0·81, 1·62	1·16	0·83, 1·64	1·45	0·72, 2·94
Richest	1·28	0·83, 1·98	1·13	0·75, 1·71	1·49	0·67, 3·31
Mother's education						
No education	1·00	Ref.	1·00	Ref.	1·00	Ref.
Less than primary	1·21	0·83, 1·75	1·32	0·91, 1·90	1·24	0·59, 2·60
Primary	0·99	0·68, 1·44	1·04	0·71, 1·51	0·43	0·15, 1·27
Middle school	1·16	0·89, 1·53	1·34†	1·03, 1·75	1·23	0·72, 2·09
High school and above	1·25	0·80, 1·95	1·19	0·80, 1·78	0·99	0·49, 2·02
Mother's employment						
Currently working						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·93	0·69, 1·26	0·84	0·63, 1·14	0·77	0·42, 1·39
Works away from home						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·33‡	0·98, 1·81	1·24	0·91, 1·67	1·45	0·80, 2·64
Other variables						
Gender						
Female	1·00	Ref.	1·00	Ref.	1·00	Ref.
Male	1·02	0·85, 1·23	0·96	0·81, 1·15	1·14	0·82, 1·57
Had diarrhoea in last week						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·03	0·81, 1·30	0·82‡	0·65, 1·03	0·64‡	0·40, 1·01
No. of siblings aged <3 years	0·79†	0·64, 0·98	0·78†	0·63, 0·97	0·62†	0·40, 0·95
Child was first-born						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·09	0·87, 1·36	0·94	0·76, 1·15	0·70‡	0·48, 1·01
Low birth weight – subjective						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·93	0·64, 1·35	0·82	0·57, 1·17	1·18	0·59, 2·36
Rural area						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·85	0·67, 1·07	0·83‡	0·67, 1·04	1·07	0·73, 1·57
Observations	2209		2210		2210	

Ref., reference category.
Odds ratio with 95 % confidence interval from the multivariate logistic regression models, stratified by WHO feeding guidelines, conditional on socio-economic variables.
All the covariates listed in the table were included for each model.
*Significant at 1 % level.
†Significant at 5 % level.
‡Significant at 10 % level.

(including green leafy vegetables); eggs, meat, poultry, fish and shellfish (and organ meats)). Frequency of reading newspapers and magazines increased the likelihood that mothers gave complementary food and offered it at least twice daily and from at least three food groups (OR = 1·30, 1·21 and 1·18, respectively).

Table 4 Information and adequate feeding practices (9–18 months)

	Complementary feeding (yes)		Three or more times daily		Four or more food groups	
	Model 4		Model 5		Model 6	
	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's exposure to health-care professionals						
Had antenatal check up						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	18·82*	12·24, 28·95	0·03*	0·01, 0·07	1·89‡	0·92, 3·92
Advised on nutrition (antenatal)						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·10	0·91, 1·33	1·03	0·92, 1·15	1·49*	1·25, 1·78
Met with health-care worker in last 3 months						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·20‡	1·00, 1·45	1·01	0·91, 1·12	1·13	0·97, 1·32
Discussed nutrition and health						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·91	0·47, 1·78	2·34*	1·58, 3·47	1·88*	1·20, 2·94
Exposure to media						
Watched television	1·17*	1·07, 1·27	1·02	0·98, 1·08	1·01	0·94, 1·09
Listened to radio	1·11†	1·02, 1·21	1·13*	1·09, 1·19	1·12*	1·05, 1·19
Read newspaper or magazine	1·04	0·91, 1·20	1·07‡	1·00, 1·14	1·12*	1·03, 1·21
Wealth index						
Poorest	1·00	Ref.	1·00	Ref.	1·00	Ref.
Poorer	0·97	0·76, 1·24	0·94	0·80, 1·11	1·49†	1·06, 2·07
Middle	1·01	0·77, 1·32	1·00	0·85, 1·19	2·00*	1·45, 2·77
Richer	0·86	0·63, 1·18	0·93	0·77, 1·12	2·49*	1·77, 3·49
Richest	1·00	0·66, 1·52	1·08	0·86, 1·36	2·71*	1·86, 3·96
Mother's education						
No education	1·00	Ref.	1·00	Ref.	1·00	Ref.
Less than primary	1·35*	0·98, 1·87	1·25‡	1·02, 1·52	1·50‡	1·08, 2·07
Primary	1·08	0·78, 1·49	0·90	0·73, 1·11	1·63†	1·19, 2·22
Middle school	1·74†	1·35, 2·25	1·35†	1·17, 1·56	1·61†	1·28, 2·03
High school and above	2·69†	1·67, 4·34	1·44†	1·16, 1·80	2·06†	1·52, 2·79
Mother's employment						
Currently working						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·42*	0·98, 2·06	1·44†	1·19, 1·74	1·51†	1·17, 1·94
Works away from home						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·84	0·57, 1·25	0·84	0·68, 1·04	0·64†	0·48, 0·85
Other variables						
Gender						
Female	1·00	Ref.	1·00	Ref.	1·00	Ref.
Male	0·98	0·83, 1·16	1·05	0·96, 1·16	0·98	0·85, 1·12
Had diarrhoea in last week						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·77‡	0·62, 0·95	0·94	0·83, 1·08	0·92	0·75, 1·12
No. of siblings aged <3 years	0·48†	11·92	0·48†	11·92	0·66†	2·80
Child was first born						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·89	0·73, 1·09	0·94	0·84, 1·05	0·90	0·77, 1·05
Low birth weight – subjective						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	1·32	0·91, 1·89	0·94	0·77, 1·14	1·45†	1·11, 1·91
Rural area						
No	1·00	Ref.	1·00	Ref.	1·00	Ref.
Yes	0·69†	0·55, 0·86	0·94	0·83, 1·06	1·24‡	1·05, 1·47
Observations	7027		7027		7027	

Ref., reference category.
Odds ratio with 95 % confidence interval from the multivariate logistic regression models, stratified by WHO feeding guidelines, conditional on socio-economic variables.
All the covariates listed in the table were included for each model.
*Significant at 10 % level.
†Significant at 1 % level.
‡Significant at 5 % level.

Wealth and formal education were not found to be significant determinants of adequate feeding practices for infants in the age group 6–8 months (Table 3). Number of siblings younger than 3 years of age was found to be significant, and decreased the likelihood of timely introduction of complementary food, minimum meal

frequency, as well as food diversity (OR = 0·79, 0·78 and 0·62, respectively).

Even for children in the age group 9–18 months, nutritional information received from health professionals was a significant and important determinant of sound feeding practices. As shown in Table 4, mothers were more likely to offer food from four or more food groups if they had received nutritional advice during antenatal check-ups (OR = 1·49) than if they had not. Mothers who discussed nutrition during their meetings with a health professional were more likely to offer food at least three times daily and from four or more food groups (OR = 2·34 and 1·88, respectively) than were mothers who did not discuss nutrition. As in the 6–8 months age group, frequency of listening to the radio was the most important contact with a media source for obtaining information; it increased the likelihood of mothers offering complementary food, offering food at least three times daily and from four or more food groups (OR = 1·11, 1·13 and 1·12, respectively).

For children in the age group 9–18 months, unlike for the younger infants, mothers' formal education and wealth index were positively associated with sound feeding practices, and the magnitude of the effect increased with an increase in education level and wealth index (Table 4). Compared with mothers from the poorest households, mothers from poorer, middle, richer and richest households were more likely to offer their children food from four or more food groups (OR = 1·49, 2·00, 2·49 and 2·71, respectively). Compared with mothers with no education, mothers with less than primary, primary, middle school and high school education were more likely to offer food from four or more food groups (OR = 1·50, 1·63, 1·61 and 2·06, respectively). Compared with mothers with no education, mothers with less than primary, middle school and high school education were also more likely to offer food three or more times daily (OR = 1·25, 1·35 and 1·44, respectively).

The other important factors of sound feeding practices were the mother's work status, the number of siblings and if the child was the first-born (Table 4). Working mothers were more likely to follow good feeding practices compared with mothers without formal employment. However, mothers who worked outside the home were less likely to offer their child food from four or more food groups (OR = 0·64) compared with mothers who worked from home. As expected, more siblings less than 3 years of age lowered the likelihood that a child would be offered complementary food, be fed three times or more daily and from four or more food groups (OR = 0·48, 0·48 and 0·66, respectively). Recent diarrhoeal episode reduced the likelihood of mothers offering complementary food in this age group (OR = 0·77). Mothers in rural areas were less likely to introduce complementary food on time (OR = 0·69), but more likely to offer food from four or more food groups (OR = 1·24).

Discussion and conclusion

The current work demonstrates that a lack of nutritional information is a major barrier to the following of sound nutritional practices in India. Across all wealth classes, mothers who had discussed nutrition with their health workers were more likely to follow IYCF guidelines while feeding their child. Nutritional information and advice offered by anganwadi workers and other health professionals significantly improved the feeding practices.

These results also highlight the success of anganwadi centres (set up by the Indian Government under the Integrated Child Development Services) in achieving one of their major goals: nutritional and health education for women in the age group of 15–49 years. Anganwadis are the primary instrument against child malnutrition, with the main aim of educating mothers and caregivers in following appropriate feeding practices. They give nutritional advice on appropriate and adequate complementary feeding practices like introducing complementary food at the age of 6 months, and also give guidance on appropriate preparation of local foods for children[20]. In the current study, nutritional advice from anganwadi workers was shown to significantly change the behaviour of mothers in following the IYCF guidelines.

Media, especially frequency of listening to the radio, was positively related to sound feeding practices; this is not surprising as mass media is an important channel for the Ministry of Women and Child Development (Government of India) to dispense nutrition information. Major steps were taken in 2006 with the launch of advertising campaigns on nutritional issues: a thirty-episode sponsored radio programme broadcast in twenty regional languages and wall calendars on nutrition were widely distributed all across the country[33].

It is not wealth that seems to determine whether a child in the age group 6–8 months is offered complementary solid or semi-solid food, but information on nutrition that plays a significant role; the same holds true for whether a child in the age group 6–8 months is offered food at least two times daily and from three or more food groups. This emphasizes the need to counsel and educate mothers about children's nutritional needs and appropriate feeding practices as per the Indian National Guidelines on IYCF. Wealth was found to be significantly important in determining how many times the child is fed in a day and whether the child is offered food from four or more food groups for children in the age group 9–18 months; however, even after controlling for wealth and formal education, nutritional information was found to be a significant determinant also for this age group.

In a developing country like India, the mother plays the central role in childrearing. Thus, the mother's employment was found to be a significant determinant. A working mother was more likely to follow good feeding practices than a mother who does not have formal

employment. Since the mother's education is already controlled for, the result suggests that a working mother might be more aware because of her social interactions or might be more proactive in obtaining information. However, if a mother had to leave home to work outside, the child was less likely to be offered appropriate food compared with when a mother worked from home; this might be the direct result of having less time to feed the child and might also reflect the inadequacy of the people substituting for the mother in childrearing while she is at work[34].

There is empirical evidence of the impact of health information in other health contexts related to hygiene, oral rehydration therapy and other spheres of health care on the health status of people[35–38]. The present study shows that the same is true of nutritional information in Indian child feeding practices. Among mothers who met with health professionals, those who received nutritional advice were more likely to follow better IYCF practices when compared with those who met them but did not receive advice. Some earlier studies have failed to show a significant improvement in IYCF practices following nutritional education due to a small sample size, the content of the education or the design of the intervention[39–41]. Other nutritional intervention studies that coupled nutritional education with provision of complementary food, fortification of complementary food or food supplements have found nutritional education to be effective in improving feeding practices[41,42].

In India, child malnutrition is widespread and affects up to 75 million children under the age of 3 years. The present work demonstrates that poverty is an implied contributor, but it is not the sole reason for this situation. Even among the wealthiest category (top quintile) of households in the survey, only 40 % of children received adequate food as per the WHO guidelines. If information about childhood feeding practices is a key obstacle to improved nutrition, then the prognosis is hopeful; it is easier to resolve the problem of scarce information than to resolve the problem of acute poverty. Ultimately, extensive intervention is needed to educate families about proper infant feeding practices. Traditional and cultural beliefs related to early childhood feeding are also a strong barrier to eradicating malnutrition[40,43,44] that needs to be addressed at the local level. Advice and counselling by health workers should not only educate mothers about their child's nutritional needs, but also address the restricted traditional beliefs that might be acting as a barrier to sound feeding practices. This should be done at multiple levels, and nutrition education should also be made an integral part of primary and secondary education.

Since nutritional advice during antenatal check-ups had the biggest impact on feeding practices, early childhood nutrition advice should be made available at every public health facility, not only for mothers and pregnant women, but also for women of childbearing age as well as other caregivers.

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