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Original Article

Determinants of inappropriate complementary feeding practices in young children in Nepal: secondary data analysis of Demographic and Health Survey 2006

Nira Joshi*, Kingsley E. Agho†, Michael J. Dibley‡, Upul Senarath§ and Kalpana Tiwari¶

*NewERA: Development Research and Training for Change, Kathmandu, Nepal, and †School of Medicine, University of Western Sydney, Penrith DC, New South Wales, Australia, and ‡Sydney School of Public Health, University of Sydney, New South Wales, Australia, and §Department of Community Medicine, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka, and ¶Nepal Technical Assistance Group, Kathmandu, Nepal

Abstract

Inappropriate complementary feeding increases the risk of undernutrition, illness and mortality in infants and children. This study uses a subsample of 1428 children of 6–23 months from Nepal Demographic and Health Survey (NDHS), 2006. The 2006 NDHS was a multistage cluster sample survey. The complementary feeding indicators were estimated according to the 2008 World Health Organization recommendations. The rate of introduction of solid, semi-solid or soft foods to infants aged 6–8 months was 70%. Minimum meal frequency and minimum dietary diversity rates were 82% and 34%, respectively, and minimum acceptable diet for breastfed infants was 32%. Multivariate analysis indicated that working mothers and mothers with primary or no education were significantly less likely to give complementary foods, to meet dietary diversity, minimum meal frequency and minimum acceptable diet. Children living in poor households were significantly less likely to meet minimum dietary diversity and minimum acceptable diet. Mothers who had adequate exposure to media, i.e. who watch television and who listen to radio almost every day, were significantly more likely to meet minimum dietary diversity and meal frequency. Infants aged 6–11 months were significantly less likely to meet minimum acceptable diet [adjusted odds ratio (OR) = 3.13, confidence interval (CI) = 2.16–4.53] and to meet minimum meal frequency (adjusted OR = 4.46, CI = 2.67–7.46). In conclusion, complementary feeding rates in Nepal are inadequate except for minimum meal frequency. Planning and promotion activities to improve appropriate complementary feeding practices should focus on illiterate mothers, those living in poor households, and those not exposed to media.

Keywords: complementary feeding, Infant and Young Child Feeding, dietary diversity, meal frequency, acceptable diet, South Asia.

Correspondence: Nira Joshi, NewERA: Development Research and Training for Change, PO Box 722, Kathmandu, Nepal. E-mail: nirajoshi@newera.wlink.com.np

Introduction

Adequate nutrition through appropriate Infant and Young Child Feeding (IYCF) during infancy and early childhood is fundamental to the development of each child (Pan American Health Organization & World Health Organization 2003). Feeding practices during infancy are critical for the growth, development and health of a child and of importance for the early prevention of chronic degenerative diseases (Black *et al*. 2008). It has been estimated that exclusive breastfeeding (BF) for the first 6 months of life could reduce infant deaths by 13% and optimal complementary feeding practice could reduce 6% of all under 5 deaths (United Nations Standing Committee on Nutrition 2003). Insufficient nutrient intake,

which results from suboptimal care and feeding practices, and inadequate access to nutrient rich foods, as well as frequent infections are the primary causes of undernutrition among children under 2 years of age (Shrimpton *et al*. 2001). Current World Health Organization (WHO) recommendations for IYCF include initiation of breast milk within the first hour of birth, exclusive BF of infants less than 6 months of age, and thereafter giving nutritionally adequate and safe complementary foods while BF continues for up to 2 years of age or beyond (World Health Organization 2008; Daelmans *et al*. 2009).

Child health and nutrition are found to be particularly dire in Nepal with high rates of undernutrition that demand a more comprehensive response. Current research indicates that child undernutrition still poses a serious public health problem to infant and young children with nearly 50% of children below 5 years in Nepal being stunted (low height for age), 39% being underweight (low weight for age) and 48% being anaemic, although vitamin A deficiency is decreasing (Ministry of Health & Population 2006). Besides these anthropometric indicators, the 2006 Nepal Demographic and Health Survey (NDHS) shows that only 35% of mothers initiated BF within an hour of delivery, 53% exclusively BF their child under 6 months, and 60% of children 6–12 months received ≥4 food groups over 24 h (Ministry of Health & Population 2006). In view of these nutritional challenges and opportunities, it becomes clear that targeted interventions to improve infant and child feeding practices, including the promotion of exclusive BF and appropriate complementary feeding, are essential to bring down the high rates of undernutrition across the country.

Although NDHS 2006 have identified the problem, there is a gap in information about the factors leading to inappropriate complementary feeding practices in the country and the information required to develop sustainable and effective community level interventions to improve IYCF practices. Further, there are no reports that have examined factors associated with complementary feeding using the WHO recommended indicators for IYCF. Hence, the purpose of the present study was to describe new complementary feeding indicators, namely introduction of solid, semi-solid or soft foods; minimum dietary diversity; meal frequency; and minimum acceptable diet using existing representative survey data from Nepal, and to identify factors associated with these four complementary feeding indicators. The results obtained from this study have the potential to provide the evidence needed to establish strategies and programs for appropriate complementary feeding interventions in Nepal.

Materials and methods

Data source

The data source for the study was the 2006 NDHS, which was conducted by the Department of Health Services, Ministry of Health and Population, in collaboration with New ERA (Ministry of Health &

Key messages

- The rate of minimum dietary diversity and minimum acceptable diet was low among children aged 6–23 months. However, rate of timely introduction of solid, semi-solid or soft food, and minimum meal frequency for both breastfed and not-breastfed children were satisfactory.
- Lower maternal education was consistently associated with inappropriate complementary feeding practices: delay in introducing solid/semi-solid or soft food; and inadequate dietary diversity, meal frequency and acceptable diet.
- Complementary feeding practices were significantly poor among children in lower household wealth quintiles and from urban areas.
- Inappropriate complementary feeding practices were significantly associated with mother's working status and limited exposure to media.
- Effective communication to change mother's behaviour should be the prime objective for ensuring appropriate complementary feeding in Nepal.

Population 2006). The 2006 NDHS sample was selected in two stages and it is a nationally representative sample of households. The 2006 NDHS used the sampling frame from the 2001 Population Census (Central Bureau of Statistics 2001). Each of the 75 districts in Nepal is subdivided into Village Development Committees (VDCs) and each VDC into wards. The primary sampling unit (PSU) for the survey was ward, subward, or group of wards in rural areas, and subward in urban areas. At the first stage of sampling, 260 PSUs (82 in urban areas and 178 in rural areas) were selected using systematic sampling with probability proportional to size. A complete household listing was carried out in all the selected PSUs to provide sampling frame from the second stage. At the second stage of sampling, systematic samples of about 30 households per PSU on average in urban areas and about 36 households per PSU on average in rural areas were selected in all the regions. From the sampled households, 8600 women aged 15–49 years (response rate 98.4%) were interviewed using a questionnaire to collect data regarding the respondent's background, maternal and childcare practices including infant feeding, reproduction and contraception. Another questionnaire was used to collect socio-demographic information for all persons usually residing in each household, as well as an inventory of household facilities and assets. Our analysis was restricted to the youngest living children aged 6–23 months, living with the respondent (ever marred women of 15–49 years). The total weighted sample size was 1428. The comprehensive details of sampling design and survey methodology have been described in NDHS 2006 report (Ministry of Health & Population 2006).

Complementary feeding indicators and explanatory factors

Complementary feeding practices were assessed according to the key indicators recommended by WHO (World Health Organization 2008). Analyses were confined to children 6–23 months of age. The definitions of complementary feeding indicators used in this paper are as follows:

Introduction of solid, semi-solid or soft foods

Proportion of infants 6–8 months of age who receive solid, semi-solid or soft foods.

Minimum dietary diversity

Proportion of children 6–23 months of age who receive foods from four or more food groups during the previous day. The seven food groups used for tabulation of this indicator were: grains, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables.

Minimum meal frequency

Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid or soft foods the minimum number of times or more (minimum is defined as: two times for breastfed infants 6–8 months; three times for breastfed children 9–23 months; and four times for non-breastfed children 6–23 months) in the previous day.

Minimum acceptable diet

Proportion of breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day, and non-breastfed children 6–23 months of age who received at least two milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day. Since 2006, NDHS did not ask about the frequency of other milk feeding, the results presented here for this indicator pertain only to breastfed children.

The independent variables were selected based on previous evidence regarding factors associated with timely complementary feeding in Nepal and other South Asian countries (Dibley *et al*. 2010; Pandey *et al*. 2010). The independent variables were grouped as characteristics of the child, maternal, family/household, health care services and the community

considering the feasibility of targeting these categories. The child characteristics included sex, age, birth order and having common childhood illnesses, and the maternal characteristics included age and education of mother, and her working status. The household wealth index and exposure to media were considered as key household characteristics whereas the nature of residence (urban or rural) and geopolitical regions were considered as community level variables. Antenatal visits, place of delivery and timing of post-natal care were included as health service characteristics. The principal components method was used to determine the wealth index and this has been described in detail in the NDHS report (Ministry of Health & Population 2006).

Statistical analysis

Complementary feeding indicators (introduction of complementary foods, minimum dietary diversity, minimum meal frequency and minimum acceptable diet) were expressed as a dichotomous variable with category 0 for meeting the four key complementary feeding indicators and category 1 for not meeting those key indicators. Data analysis was performed using Stata version 10.0 (Stata-Corp, College Station, TX, USA). The Taylor series linearization method was used in the analysis when estimating confidence intervals (CIs) around prevalence estimates using the survey 'Svy' commands to allow for adjustments for the cluster sample design and sampling weights. Chi-squared tests were used to test the statistical significance for categorical variables. Univariate associations were examined by unadjusted odds ratios (ORs) for the above mentioned four indicators of complementary feeding. Multiple logistic regression analyses were used in a stepwise backward regression model to estimate the adjusted ORs and 95% CIs. To avoid any statistical bias, we double-checked our backward elimination method by using the following procedures: (1) entered only variables with P-value < 0.20 in the backward elimination process; (2) tested the backward elimination by also including all variables (all potential confounders); and (3) tested and reported variables that are highly correlated in a logistic regression model.

Results

Characteristics of the sample

Table 1 reports the individual, household and community level characteristics of the 1428 children aged 6–23 months. The majority of the children's mothers were working (70%); more than half were illiterate while one-fourth had completed secondary or higher education. Half of the mothers were less than 25 years of age, and approximately 70% had more than one child with 55% having a preceding birth interval of more than 24 months. Of the total births, 81% were home deliveries, and only 21% had received assistance by a trained health professional for the birth. Three-fourths of the mothers (76%) had made at least one antenatal clinic visit. Approximately one-fourth (27%) of the mothers were underweight (body mass index ≤ 18.5 kg/m^2).

Types of food given to child by age

Table 2 explains the types of food given during the day preceding the interview according to the age of the child. More than 90% of the children had received foods from grains and tubers/roots while relatively fewer had received vitamin A-rich foods (48%), fruits and vegetables (25%), flesh foods (17%) and eggs (6%). Different food groups offered during the past 24 h are uniformly lower among children aged 6–8 months; however, with increasing age, an increasing trend in offering food is observed in all food groups.

Complementary feeding indicators

Table 3 shows that 70% of the children aged 6–8 months were given solid, semi-solid or soft foods. One-third (34%) of the children aged 6–23 months had received foods from four or more food groups meeting the minimum dietary diversity criteria. Around eight in 10 infants (82%) aged 6–23 months had received food two to four times or more on the day preceding the survey. The minimum acceptable diet rate in breastfed infants aged 6–23 months was only 32% indicating that a large proportion of infants did not meet either the recommended dietary diversity or the minimum meal frequency.

Table 1. Individual, parental, household, health care and community level characteristics of children aged 6–23 months, Nepal 2006 ($n = 1428$)

Characteristic	*n*	%	Characteristic	*n*	%
Child characteristics			Maternal BMI (kg m^{-2}) ($n = 1421$)		
Sex of baby			Less than or equal to 18.5 kg m^{-2}	380	26.7
Male	741	51.9	More than 18.5 kg m^{-2}	1041	73.3
Female	687	48.1	*Family/Household characteristics*		
Age of child (month)			Father's education ($n = 1422$)		
6–11	490	34.3	No education	307	21.6
12–17	472	33.0	Primary	991	69.7
18–23	466	32.7	Secondary and above	123	8.7
Birth order			Father's occupation		
Firstborn	448	31.3	Non-agricultural	806	56.4
Second to fourth	745	52.1	Agricultural	567	39.7
Five or more	236	16.5	Other	56	3.9
Size of baby			Source of drinking water		
Small	258	18.1	Improved	1097	76.8
Average	860	60.2	Not improved	332	23.2
Large	311	21.8	Household wealth index		
Diarrhoea			Poorest	366	25.6
No	1132	79.3	Poorer	301	21.1
Yes	296	20.7	Middle	294	20.6
ARI			Richer	253	17.7
No	184	12.9	Richest	215	15.1
Yes	176	12.3	*Health care characteristics*		
Missing/don't know	1068	74.7	Preceding birth interval ($n = 1425$)		
Maternal characteristics			No previous birth	448	31.4
Mother's age (year)			<24 months	201	14.1
15–24	746	52.2	>24 months	777	54.5
25–34	547	38.3	Mother's age at child's birth		
35–49	136	9.5	Less than 20	281	19.7
Mother's education			20–29	902	63.1
No education	802	56.2	30–39	216	15.1
Primary	275	19.2	More than 40	30	2.1
Secondary and above	351	24.6	Antenatal clinic visits		
Mother's literacy			None	349	24.4
Cannot read at all	713	49.9	1–3	643	45.0
Able to read only part of sentence	121	8.5	4+	437	30.6
Able to read whole sentence	594	41.6	Mode of delivery		
Mother's religion			Non-Caesarean	1384	96.9
Hindu	1209	84.7	Caesarean	45	3.1
Other	219	15.3	Place of delivery		
Mother's working status			Home	1160	81.3
Non-working	422	29.6	Health facility	268	18.7
Working (past 12 months)	1006	70.4	Type of delivery assistance ($n = 1340$)		
Marital status			Health professional	276	20.6
Currently married	1415	99.0	Traditional birth attendant.	48	3.6
Formerly married (divorced/separated/widowed)	14	1.0	Other untrained	1017	75.9
Reads newspaper or magazine			Timing of post-natal check-up		
Not at all	1075	75.3	Missing/don't know	1199	84.0
Less than once a week	271	19.0	0–2 days	130	9.1
At least once a week	58	4.1	3–6 days	59	4.1
Almost every day	24	1.7	Seventh day or later	41	2.9
Listens to radio			*Community level factors*		
Not at all	136	9.5	Residence		
Less than once a week	536	37.5	Urban	173	12.1
At least once a week	331	23.1	Rural	1255	87.9
Almost every day	426	29.8	Geographical region		
Watches television			Eastern	305	21.4
Not at all	500	35.0	Central	441	30.9
Less than once a week	499	34.9	Western	283	19.8
At least once a week	141	9.9	Midwest	181	12.7
Almost every day	289	20.2	Far west	218	15.3

ARI, acute respiratory infection; BMI, body mass index. Weighted total was 1428 otherwise stated within brackets.

Table 2. Types of food groups given to children aged 6–23 months by age group, Nepal 2006

Food groups	Age of child									
	6–8 months		9–11 months		12–17 months		18–23 months		6–23 months	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Grains, roots and tubers	64.6	(57.6, 70.8)	91.9	(86.5, 95.3)	96.9	(94.7, 98.2)	99.6	(98.6, 99.9)	91.2	(89.2, 92.9)
Legumes and nuts	26.7	(20.8, 33.7)	50.0	(40.9, 59.1)	63.6	(57.7, 69.2)	55.6	(48.5, 62.5)	52.2	(47.1, 57.3)
Dairy products	44.9	(37.3, 52.9)	51.8	(42.9, 60.5)	53.1	(47.3, 58.8)	51.6	(45.9, 57.3)	50.9	(46.7, 55.2)
Flesh foods	7.9	(4.5, 13.3)	11.2	(7.3, 16.6)	20.0	(15.9, 24.7)	22.8	(18.1, 28.2)	17.3	(14.8, 20.1)
Eggs	2.9	(1.3, 6.2)	1.8	(0.8, 3.9)	8.9	(6.3, 12.6)	8.0	(5.4, 11.7)	6.4	(4.8, 8.4)
Vitamin A-rich fruits and vegetables	17.2	(12.4, 23.5)	36.5	(29.5, 44.3)	57.4	(51.7, 62.9)	59.8	(53.7, 65.5)	47.6	(44.1, 51.1)
Other fruits and vegetables	11.5	(6.9, 18.5)	16.5	(11.9, 22.3)	29.4	(23.7, 37.7)	31.7	(25.0, 39.2)	24.8	(20.9, 29.2)
Total number of children (*n*)	254		236		472		466		1428	

CI, confidence interval.

Table 3. Complementary feeding indicators among children aged 6–23 months by age group, Nepal 2006 (*n* = 1428)

Indicator	Sample size (weighted)	*n* (weighted)	Rate (%)	(95% CI)
Introduction of solid, semi-solid or soft foods rate (6–8 months)	254	177	69.7	(62.4, 76.2)
Minimum dietary diversity rate				
Minimum dietary diversity rate for breastfed children (6–11 months)	487	89	18.3	(14.3, 23.1)
Minimum dietary diversity rate for non-breastfed children (6–11 months)	0	0	0.0	(–′, –′)
Minimum dietary diversity rate for all children (6–11 months)	490	89	18.2	(14.2, 22.9)
Minimum dietary diversity rate for breastfed children (12–17 months)	456	191	42.0	(36.4, 47.8)
Minimum dietary diversity rate for non-breastfed children (12–17 months)	16	15	98.9	(89.9 99.9)
Minimum dietary diversity rate for all children (12–17 months)	472	206	43.8	(38.2, 49.6)
Minimum dietary diversity rate for breastfed children (18–23 months)	450	186	41.2	(35.7, 46.9)
Minimum dietary diversity rate for non-breastfed children (18–23 months)	16	6	40.0	(18.5 66.3)
Minimum dietary diversity rate for all children (18–23 months)	466	192	41.2	(35.9, 46.7)
Minimum dietary diversity rate for breastfed children (6–23 months)	1393	446	33.4	(29.9, 37.2)
Minimum dietary diversity rate for non-breastfed children (6–23 months)	35	22	62.7	(41.3, 80.0)
Minimum dietary diversity rate for all children (6–23 months)	1428	489	34.2	(30.7, 37.8)
Minimum meal frequency rate				
Minimum meal frequency rate for breastfed children (6–11 months)	487	337	69.1	(63.3, 74.4)
Minimum meal frequency rate for non-breastfed children (6–11 months)	3	1	45.1	(–′, –′)
Minimum meal frequency rate for all children (6–11 months)	490	338	69.0	(63.2, 74.2)
Minimum meal frequency rate for breastfed children (12–17 months)	456	391	85.8	(81.2, 89.4)
Minimum meal frequency rate for non-breastfed children (12–17 months)	16	14	88.9	(62.3, 97.5)
Minimum meal frequency rate for all children (12–17 months)	472	405	85.9	(81.4, 89.4)
Minimum meal frequency rate for breastfed children (18–23 months)	450	420	93.4	(89.6, 95.8)
Minimum meal frequency rate for non-breastfed children (18–23 months)	16	7	45.1	(20.9, 71.8)
Minimum meal frequency rate for all children (18–23 months)	466	428	91.7	(87.8, 94.4)
Minimum meal frequency rate for breastfed children (6–23 months)	1393	1148	82.4	(79.3, 85.1)
Minimum meal frequency rate for non-breastfed children (6–23 months)	35	23	64.6	(43.3, 81.4)
Minimum meal frequency rate for all children (6–23 months)	1428	1171	82.0	(78.9, 84.7)
Minimum acceptable diet rate for breastfed children				
Minimum acceptable diet rate for breastfed children (6–11 months)	487	83	17.1	(13.3, 21.7)
Minimum acceptable diet rate for breastfed children (12–17 months)	456	179	39.2	(34.0, 44.8)
Minimum acceptable diet rate for breastfed children (18–23 months)	450	181	40.3	(34.9, 45.9)
Minimum acceptable diet rate for breastfed children (6–23 months)	1393	444	31.8	(28.5, 35.4)

CI, confidence interval.

Differentials of complementary feeding indicators

Table 4 presents the complementary feeding indicators according to various characteristics. A relatively high proportion of working mothers, and mothers with secondary and above education, had introduced complementary foods to their infants by 6–8 months of age. A significantly lower proportion of younger mothers had introduced complementary foods at 6–8 months than mothers aged 35–49 years.

The minimum dietary diversity rate was significantly higher among infants whose mothers had completed secondary or higher education and among infants whose mothers read newspapers and/or whose mothers watched television almost every day. Mothers who had four or more antenatal clinic visits had a significantly higher minimum dietary diversity rate than did mothers with no antenatal clinic visits at all. The dietary diversity rate was higher among children born at health facilities than those born at home. The families in the highest wealth quintile and families residing in the urban areas reported significantly higher dietary diversity rate than those from the poorest wealth quintile and from rural areas.

The minimum meal frequency rate was higher for mothers who were working, mothers who had secondary or higher level of education, who read newspapers/magazines, or who listened to radio and watched television. The minimum meal frequency rate was higher among infants who were born in health facilities and whose mothers made at least four antenatal care visits.

The minimum acceptable diet rate was low in mothers having no education, who delivered at home or who had no antenatal visits. Infants from the poorest household wealth index group and those from rural areas were also less likely to receive a minimum acceptable diet.

Determinants of inappropriate complementary feeding indicators

Unadjusted and adjusted ORs were calculated to estimate the strength of association between the independent variables and the four key complementary feeding outcomes: not being introduced to solid, semi-solid or soft foods at 6–8 months of age; not meeting minimum dietary diversity; not meeting minimum meal frequency; and not meeting minimum acceptable diet.

Table 5 shows that non-working mothers, mothers having secondary or above level of education and mothers aged 35–49 years were more likely to introduce complementary foods by 6–8 months. When maternal education was replaced by the closely related variable of maternal literacy, mothers who were unable to read were significantly associated with an increased odds of delayed introduction of complementary feeds at 6–8 months (adjusted OR = 4.51, CI = 2.09–9.74, $P < 0.001$) compared to literate mothers. Again, when maternal education was replaced by father's education, fathers with primary or with no education were significantly associated with an increased odds of delayed introduction of complementary feeds at 6–8 months (adjusted OR = 10.28, CI = 1.92–55.02, $P < 0.05$) compared to fathers with secondary education or higher. Increasing age of the children and young age of mothers were significantly associated with delay in introducing the complementary foods.

Table 6 shows that infants of mothers who listened to radio almost every day and infants of mothers who had four or more antenatal visits had significantly higher dietary diversity compared to the infants whose mothers had limited exposure to media and had less or no antenatal clinic visits. Compared with mothers with higher level of education, those who had primary level of education or who were illiterate reported risk for poor dietary diversity. The risk for inadequate dietary diversity was gradually increasing with lowering wealth index quintiles.

Adequate meal frequency was more likely among non-working mothers, educated mothers and mothers who watched television almost every day (Table 7). The mothers from urban areas, however, were less likely to give the recommended minimum frequency of solid, semi-solid or soft foods. The child's age was significantly associated with complementary feeding practices and lower ages showed alarmingly inadequate meal frequency. When maternal education was replaced by maternal literacy, mothers who were

Table 4. Introduction of complementary food, minimum dietary diversity, minimum meal frequency and minimum acceptable diet according to characteristics, Nepal 2006

Characteristic	Introduction of solid, semi-solid or soft foods rate			Minimum dietary diversity rate			Minimum meal frequency rate			Minimum acceptable diet rate		
	%	(95% CI)	*P*	%	(95% CI)	*P*	%	(95% CI)	*P*	%	(95% CI)	*P*
Child characteristics												
Sex of baby												
Male	73.5	(63.3, 81.7)		35.6	(31.3, 40.1)		83.1	(78.9, 86.6)		32.6	(28.4, 37.1)	
Female	65.5	(55.6, 74.2)	0.217	32.6	(28.5, 37.1)	0.243	80.7	(77.0, 84.0)	0.324	29.4	(25.4, 33.8)	0.233
Age of child (month)												
6–11				18.2	(14.2, 22.9)		69.0	(63.2, 74.2)		17.0	(13.2, 21.6)	
12–17				43.8	(38.2, 49.6)		85.9	(81.4, 89.4)		38.0	(32.8, 43.4)	
18–23				41.2	(35.9, 46.7)	0.000	91.7	(87.8, 94.4)	0.000	38.9	(33.6, 44.5)	0.000
Birth order												
Firstborn	76.5	(64.8, 85.3)		40.3	(34.4, 46.6)		82.7	(77.7, 86.8)		36.8	(31.3, 42.6)	
Second to fourth	63.0	(52.5, 72.3)		32.8	(28.5, 37.3)		82.2	(78.7, 85.2)		29.9	(25.7, 34.4)	
Five or more	75.4	(58.0, 87.2)	0.131	26.9	(19.8, 35.6)	0.020	79.9	(73.1, 85.3)	0.691	24.1	(17.4, 32.2)	0.023
Size of baby												
Small	70.2	(49.4, 85.1)		32.2	(25.9, 39.1)		82.1	(76.2, 86.8)		29.2	(23.2, 36.1)	
Average	68.9	(59.1, 77.3)		34.0	(29.8, 38.5)		82.1	(78.5, 85.2)		31.2	(27.2, 35.4)	
Large	71.7	(58.2, 82.2)	0.939	36.2	(28.5, 44.8)	0.718	81.5	(75.2, 86.6)	0.981	32.3	(24.8, 40.9)	0.822
Diarrhoea												
No	66.5	(58.6, 73.6)		35.1	(31.3, 39.1)		81.6	(78.3, 84.6)		31.3	(27.8, 35.1)	
Yes	80.4	(64.0, 90.4)	0.098	30.5	(24.3, 37.5)	0.215	83.2	(77.3, 87.8)	0.583	30.0	(23.9, 37.1)	0.715
ARI												
No	78.4	(59.3, 90.0)		39.6	(30.9, 49.0)		84.6	(77.9, 89.6)		35.4	(26.7, 45.2)	
Yes	74.6	(54.2, 88.0)	0.562	35.3	(28.3, 42.9)		79.5	(71.1, 85.9)		33.8	(27.2, 41.1)	
Missing	67.0	(58.3, 74.7)		33.0	(29.1, 37.2)	0.316	81.9	(78.5, 84.9)	0.537	29.9	(26.3, 33.6)	0.308
Maternal characteristics												
Mother's age (year)												
15–24	67.0	(57.5, 75.3)		34.7	(30.3, 39.2)		81.4	(77.0, 85.2)		31.9	(27.5, 36.7)	
25–34	69.8	(56.8, 80.2)		34.2	(29.2, 39.6)		82.0	(77.6, 85.6)		31.1	(26.5, 36.0)	
35–49	91.0	(69.0, 97.9)	0.139	31.2	(23.3, 40.3)	0.779	85.0	(76.8, 90.6)	0.706	26.2	(18.6, 35.7)	0.519
Mother's education												
No education	62.0	(51.4, 71.5)		25.1	(21.5, 29.1)		78.0	(73.9, 81.7)		22.5	(19.1, 26.2)	
Primary	66.8	(51.5, 79.3)		35.1	(28.6, 42.2)		81.8	(75.7, 86.7)		31.7	(25.5, 38.6)	
Secondary and above	93.2	(83.4, 97.4)	0.001	54.1	(47.4, 60.7)	0.000	91.1	(86.6, 94.3)	0.000	50.2	(44.1, 56.3)	0.000
Mother's literacy												
Cannot read at all	63.5	(52.7, 73.1)		24.2	(20.2, 28.6)		76.8	(72.1, 80.9)		21.1	(17.5, 25.2)	
Able to read only part of sentence	54.7	(30.1, 77.1)		31.1	(22.4, 41.4)		80.5	(71.4, 87.3)		28.8	(20.4, 39.1)	
Able to read whole sentence	82.5	(71.3, 89.9)	0.019	46.8	(42.1, 51.6)	0.000	88.5	(84.4, 91.6)	0.000	43.5	(39.1, 48.0)	0.000
Mother's religion												
Hindu	69.9	(62.3, 76.5)		33.9	(30.1, 38.0)		82.3	(79.1, 85.1)		31.5	(27.9, 35.4)	
Other	68.9	(44.1, 86.2)	0.933	35.5	(27.4, 44.5)	0.750	80.2	(72.9, 86.0)	0.532	28.4	(20.1, 38.5)	0.556

Mother's working status												
Non-working	60.0	(47.1, 71.6)		34.0	(28.0, 40.5)		75.5	(69.7, 80.6)		29.3	(23.2, 36.2)	
Working (past 12 months)	76.0	(68.5, 82.3)	0.016	34.2	(30.4, 38.3)	0.933	84.7	(81.6, 87.3)	0.001	31.8	(28.1, 35.7)	0.493
Marital status												
Currently married	69.7	(62.3, 76.1)		34.3	(30.8, 38.0)		81.9	(78.9, 84.6)		31.2	(27.8, 34.8)	
Formerly married (divorced/separated/widowed)	69.7	(62.4, 76.2)	0.513	16.9	(2.7, 59.9)	0.336	86.4	(59.6, 96.5)	0.647	16.9	(2.7, 59.9)	0.418
Reads newspaper or magazine												
Not at all	64.8	(56.2, 72.6)		27.6	(24.2, 31.3)		79.1	(75.4, 82.3)		25.1	(21.8, 28.8)	
Less than once a week	82.1	(60.8, 93.2)		50.3	(43.4, 57.2)		90.9	(86.0, 94.2)		45.6	(38.7, 52.7)	
At least once a week	97.9	(85.5, 99.7)		67.5	(53.6, 78.9)		93.3	(84.2, 97.3)		65.0	(52.1, 76.0)	
Almost every day			0.021	65.2	39.6, 84.2)	0.000	86.0	(62.2, 95.9)	0.000	50.4	(32.1, 68.5)	0.000
Listens to radio												
Not at all	49.6	(29.8, 69.5)		15.5	(9.3, 24.8)		59.5	(49.2, 69.1)		11.4	(6.6, 18.8)	
Less than once a week	69.5	(57.9, 79.0)		29.1	(24.2, 34.6)		82.1	(78.1, 85.5)		25.6	(21.2, 30.4)	
At least once a week	73.2	(56.3, 85.3)		38.9	(32.8, 45.4)		88.0	(83.2, 91.5)		37.3	(31.3, 43.6)	
Almost every day	73.0	(59.4, 83.3)	0.303	42.8	(37.2, 48.5)	0.000	84.3	(79.3, 88.3)	0.000	39.4	(34.0, 45.2)	0.000
Watches television												
Not at all	63.6	(52.0, 73.7)		25.0	(20.7, 29.7)		75.8	(70.5, 80.5)		22.9	(18.9, 27.5)	
Less than once a week	74.1	(62.9, 82.9)		32.7	(28.1, 37.6)		83.4	(79.0, 87.0)		28.6	(24.1, 33.6)	
At least once a week	71.9	(48.9, 87.2)		35.3	(25.7, 46.4)		89.2	(81.9, 93.8)		34.1	(24.6, 45.0)	
Almost every day	70.9	(51.0, 85.1)	0.618	52.1	(45.7, 58.4)	0.000	86.6	(79.2, 91.6)	0.005	48.0	(42.1, 53.9)	0.000
Mother's BMI (kg m^{-2})												
≤18.5	70.8	(58.1, 80.9)		32.9	(27.4, 38.9)		83.1	(78.5, 86.9)		30.3	(24.8, 36.4)	
>18.5	70.0	(61.1, 77.6)	0.240	34.7	(30.6, 39.0)	0.783	81.8	(78.1, 84.9)	0.195	31.4	(27.5, 35.5)	0.902
Family/Household characteristics												
Father's education												
No education	64.6	(50.2, 76.7)		21.4	(16.6, 27.3)		75.8	(69.1, 81.4)		19.1	(14.6, 24.6)	
Primary	69.1	(59.8, 77.1)		35.1	(31.3, 39.2)		82.9	(79.5, 85.8)		32.3	(28.6, 36.3)	
Secondary and above	92.5	(78.4, 97.6)	0.039	58.9	(47.2, 69.7)	0.000	90.0	(83.3, 94.2)	0.008	52.1	(41.8, 62.3)	0.000
Father's occupation												
Non-agricultural	63.6	(52.2, 73.7)		36.7	(32.2, 41.3)		80.2	(75.9, 83.8)		32.8	(28.6, 37.3)	
Agricultural	75.0	(65.1, 82.8)		28.4	(23.6, 33.6)		83.6	(79.6, 86.9)		26.3	(21.9, 31.3)	
Not working	93.2	(71.1, 98.7)	0.048	57.0	(40.5, 72.1)	0.001	91.7	(82.1, 96.4)	0.065	54.2	(38.2, 69.4)	0.001
Source of drinking water												
Not Protected	67.0	(52.2, 79.1)		36.2	(29.9, 43.0)		83.4	(77.9, 87.8)		32.4	(26.4, 39.1)	
Protected	70.5	(61.9, 77.9)	0.660	33.5	(29.5, 37.8)	0.490	81.5	(77.9, 84.7)	0.529	30.6	(26.8, 34.7)	0.630
Household wealth index												
Poorest	70.9	(59.0, 80.5)		25.3	(20.3, 31.0)		80.4	(75.4, 84.6)		24.0	(19.1, 29.6)	
Poorer	65.9	(51.5, 77.8)		27.0	(21.0, 34.0)		79.6	(73.5, 84.7)		24.4	(18.5, 31.3)	
Middle	69.0	(53.0, 81.5)		30.1	(23.7, 37.3)		81.6	(76.2, 85.9)		26.4	(20.2, 33.8)	
Richer	72.6	(55.6, 84.9)		37.7	(31.9, 43.9)		84.3	(78.1, 88.9)		33.9	(28.2, 40.2)	
Richest	72.5	(46.7, 88.8)	0.952	60.7	(51.0, 69.7)	0.000	85.8	(77.2, 91.5)	0.477	55.4	(46.5, 64.0)	0.000
Health care characteristics												
Preceding birth interval												
No previous birth	76.5	(64.8, 85.3)		40.3	(34.4, 46.6)		82.7	(77.7, 86.8)		36.8	(31.3, 42.6)	
<24 months	62.1	(40.4, 79.8)		35.5	(28.6, 43.0)		79.7	(73.0, 85.1)		31.1	(24.6, 38.4)	
>24 months	67.2	(57.2, 75.9)	0.313	30.2	(26.2, 34.4)	0.015	82.0	(78.2, 85.3)	0.769	27.7	(24.0, 31.6)	0.022

Table 4. Continued

Characteristic	Introduction of solid, semi-solid or soft foods rate			Minimum dietary diversity rate			Minimum meal frequency rate			Minimum acceptable diet rate		
	%	(95% CI)	*P*	%	(95% CI)	*P*	%	(95% CI)	*P*	%	(95% CI)	*P*
Mother's age at child's birth												
Less than 20	67.0	(50.7, 80.0)		38.6	(32.3, 45.4)		79.6	(73.7, 84.4)		35.2	(29.1, 41.8)	
20–29	68.7	(59.0, 77.0)		33.9	(29.6, 38.5)		83.0	(79.7, 82.8)		31.0	(26.9, 35.4)	
30–39	73.6	(55.0, 86.5)		31.1	(24.1, 39.1)		79.8	(72.5, 85.6)		27.6	(21.0, 35.2)	
More than 40	87.6	(45.2, 98.4)	0.699	20.4	(9.7, 38.1)	0.197	90.5	(77.5, 96.3)	0.269	19.3	(8.8, 37.1)	0.216
Antenatal clinic visits												
None	71.5	(53.8, 84.3)		24.1	(19.5, 29.5)		79.3	(74.4, 83.6)		22.0	(17.7, 27.0)	
1–3	68.6	(58.3, 77.4)		30.2	(25.7, 35.0)		79.6	(74.9, 83.5)		27.6	(23.3, 32.4)	
4+	70.7	(57.7, 81.1)	0.934	48.1	(42.8, 53.4)	0.000	87.6	(83.3, 91.0)	0.006	43.3	(38.4, 48.4)	0.000
Mode of delivery												
Non-Caesarean	51.5	(45.1, 57.9)		33.3	(29.8, 37.0)		82.1	(79.0, 84.8)		30.4	(27.0, 33.9)	
Caesarean	76.2	(35.9, 94.8)	0.198	60.4	(41.4, 76.6)	0.004	78.0	(59.8, 89.5)	0.570	53.0	(34.6, 70.7)	0.014
Place of delivery												
Home	66.3	(57.8, 73.9)		29.5	(26.0, 33.2)		80.9	(77.5, 83.8)		27.1	(23.7, 30.7)	
Health facility	83.1	(65.6, 92.7)	0.072	54.5	(47.4, 61.4)	0.000	86.8	(81.4, 90.8)	0.039	48.4	(42.0, 54.8)	0.000
Type of delivery assistance												
Health professional	84.5	(68.8, 93.1)		54.2	(47.5, 60.7)		87.9	(83.1, 91.5)		48.5	(42.5, 54.6)	
Traditional birth attendant.	84.9	(43.7, 97.6)		25.0	(11.6, 45.9)		81.0	(59.4, 92.6)		18.2	(8.6, 34.4)	
Other untrained	65.7	(56.7, 74.0)	0.130	29.7	(26.2, 33.6)	0.000	80.8	(77.3, 83.8)	0.112	27.4	(23.9, 31.2)	0.000
Timing of post-natal check-up												
No check-ups (including missing)	67.9	(59.8, 75.1)		29.8	(26.5, 33.4)		81.1	(77.8, 84.0)		27.5	(24.2, 31.0)	
0–2 days	77.8	(48.3, 92.9)		54.2	(43.3, 64.8)		80.9	(71.4, 87.9)		44.2	(34.0, 55.1)	
3–6 days	67.5	(39.9, 86.6)		60.5	(44.2, 74.7)		92.0	(77.0, 97.5)		55.7	(39.9, 70.4)	
Seventh day or later	0.0		0.342	60.4	41.7, 76.4)	0.000	97.0	(82.9, 99.5)	0.051	59.7	(41.2, 75.9)	0.000
Community level factors												
Residence												
Urban	58.8	(38.4, 76.7)		55.6	(44.6, 66.0)		79.1	(70.6, 85.5)		48.0	(38.1, 58.2)	
Rural	71.1	(63.3, 77.9)	0.232	31.2	(27.8, 34.9)	0.000	82.4	(79.1, 85.3)	0.398	28.7	(25.4, 32.3)	0.000
Geographical region												
Eastern	68.8	(54.1, 80.5)		30.6	(25.0, 36.7)		81.8	(75.2, 87.0)		27.6	(22.2, 33.6)	
Central	67.5	(52.9, 79.3)		36.5	(28.8, 44.9)		79.5	(72.5, 85.1)		31.3	(24.2, 39.4)	
Western	74.0	(52.6, 87.9)		39.5	(31.9, 47.7)		84.7	(78.4, 89.4)		37.1	(29.8, 45.0)	
Midwest	70.4	(54.2, 82.7)		27.9	(21.4, 35.4)		81.8	(75.8, 86.5)		26.5	(20.0, 34.2)	
Far west	73.2	(54.3, 86.3)	0.967	32.8	(24.8, 42.0)	0.259	83.7	(75.3, 89.6)	0.715	31.5	(23.6, 40.5)	0.330

ARI, acute respiratory infection; BMI, body mass index; CI, confidence interval.

Table 5. Determinants of not introducing complementary foods among children aged 6–8 months, Nepal 2006

Characteristic	Unadjusted			Adjusted		
	OR	(95% CI)	*P*	OR	(95% CI)	*P*
Mother's education						
Secondary and above	1.00			1.00		
Primary	8.78	(2.42, 31.82)	0.001	9.14	(2.50, 33.41)	0.001
No education	10.33	(3.24, 32.99)	<0.001	13.83	(4.22, 45.32)	<0.001
Mother's age (year)						
35–49	1.00			1.00		
25–34	3.15	(0.60, 16.47)	0.172	3.41	(0.63, 18.61)	0.155
15–24	4.07	(0.86, 19.30)	0.077	5.66	(1.16, 27.68)	0.032
Mother's working status						
Non-working	1.00			1.00		
Working (past 12 months)	2.36	(1.22, 4.56)	0.011	2.47	(1.21, 5.04)	0.013
Age of child (in months)	0.45	(0.29, 0.69)	<0.001	0.46	(0.29, 0.71)	0.001

CI, confidence interval; OR, odds ratio.

Table 6. Determinants of not meeting minimum dietary diversity among children aged 6–23 months, Nepal 2006

Characteristic	Unadjusted			Adjusted		
	OR	(95% CI)	*P*	OR	(95% CI)	*P*
Mother's education						
Secondary and above	1.00			1.00		
Primary	2.14	(1.41, 3.25)	<0.001	1.48	(0.95, 2.30)	0.085
No education	3.60	(2.55, 5.07)	<0.001	1.94	(1.31, 2.88)	0.001
Listens to radio						
Almost every day	1.00			1.00		
Not at all/Less than once a week/At least once a week	1.97	(1.5, 2.58)	<0.001	1.41	(1.02, 1.94)	0.036
Household wealth index						
Richest	1.00			1.00		
Richer	2.58	(1.55, 4.29)	<0.001	2.19	(1.28, 3.75)	0.005
Middle	3.68	(2.21, 6.10)	<0.001	2.63	(1.46, 4.72)	0.001
Poorer	4.48	(2.65, 7.58)	<0.001	2.94	(1.60, 5.43)	0.001
Poorest	4.70	(2.83, 7.80)	<0.001	2.91	(1.54, 5.47)	0.001
Antenatal clinic visit						
4+	1.00			1.00		
1–3	2.06	(1.57, 2.70)	<0.001	1.37	(1.01, 1.86)	0.041
None	3.07	(2.13, 4.43)	<0.001	1.66	(1.12, 2.46)	0.012
Mother's working status						
Non-working	1.00			1.00		
Working (past 12 months)	1.04	(0.76, 1.42)	0.813	1.48	(1.08, 2.01)	0.014

CI, confidence interval; OR, odds ratio.

unable to read were significantly associated with increased odds of not meeting minimum meal frequency (adjusted OR = 2.36, CI = 1.54–3.63, $P < 0.001$), and when maternal education was replaced again by father's education, the odds for not meeting minimum meal frequency was borderline significant among those infants whose fathers had no education (adjusted OR = 2.14, CI = 1.0–4.59, $P = 0.051$).

Table 8 shows that minimum acceptable diet rate was significantly higher among mothers who had completed secondary education and among mothers

Table 7. Determinants of not meeting minimum meal frequency among children aged 6–23 months, Nepal 2006

Characteristic	Unadjusted			Adjusted		
	OR	(95% CI)	*P*	OR	(95% CI)	*P*
Residence						
Rural	1.00			1.00		
Urban	1.30	(0.78, 2.17)	0.314	2.00	(1.23, 3.25)	0.005
Mother's working status						
Non-working	1.00			1.00		
Working (past 12 months)	1.83	(1.28, 2.61)	0.001	1.91	(1.35, 2.69)	<0.001
Watches television						
Almost every day	1.00			1.00		
Not at all/Less than once a week/At least once a week	1.82	(1.14, 2.89)	0.014	1.82	(1.14, 2.89)	<0.001
Mother's education						
Secondary and above	1.00			1.00		
Primary	2.25	(1.20, 4.23)	0.011	2.23	(1.13, 4.41)	0.021
No education	2.94	(1.76, 4.88)	<0.001	3.06	(1.67, 5.63)	<0.001
Child's age in category						
18–23	1.00			1.00		
12–17	1.71	(0.99, 2.97)	0.055	1.74	(1.02, 2.98)	0.041
6–11	4.53	(2.73, 7.50)	<0.001	4.46	(2.67, 7.46)	<0.001

CI, confidence interval; OR, odds ratio.

Table 8. Determinants of not meeting minimum acceptable diet among children aged 6–23 months, Nepal 2006

Characteristic	Unadjusted			Adjusted		
	OR	(95% CI)	*P*	OR	(95% CI)	*P*
Mother's education						
Secondary and above	1.00			1.00		
Primary	2.09	(1.39, 3.13)	<0.001	1.68	(1.08, 2.62)	0.021
No education	3.58	(2.59, 4.95)	<0.001	2.67	(1.84, 3.89)	<0.001
Child's age in category						
18–23	1.00			1.00		
12–17	1.06	(0.78, 1.45)	0.701	1.12	(0.82, 1.54)	0.474
6–11	2.99	(2.09, 4.27)	<0.001	3.13	(2.16, 4.53)	<0.001
Mother's working status						
Non-working	1.00			1.00		
Working (past 12 months)	1.14	(0.80, 1.63)	0.458	1.54	(1.11, 2.14)	0.01
Household wealth index						
Richest	1.00			1.00		
Richer	2.38	(1.47, 3.86)	<0.001	1.75	(1.04, 2.94)	0.037
Middle	3.49	(2.12, 5.73)	<0.001	2.17	(1.17, 4.04)	0.014
Poorer	4.16	(2.51, 6.89)	<0.001	2.42	(1.26, 4.67)	0.008
Poorest	4.06	(2.52, 6.54)	<0.001	2.32	(1.23, 4.36)	0.009

CI, confidence interval; OR, odds ratio.

who were not working. Compared with children from richest households, children from households with lower wealth quintiles were in higher risk of not meeting minimum acceptable diet.

Discussion

This study revealed that in Nepal minimum dietary diversity and minimum acceptable diet were low

among children aged 6–23 months despite a high rate of timely introduction of solid, semi-solid or soft food, and minimum meal frequency for both breastfed and not breastfed children. We found that low maternal education and younger maternal age were associated with delays in introducing complementary feeding at 6–8 months of age. Lower household wealth, low maternal education and limited exposure to media were predictors of inadequate dietary diversity. Lower child's age, mother's working status, limited exposure to television and low maternal education were risk factors for inadequate meal frequency. Lower household wealth, lower maternal education and working mother were determinants of not meeting the minimum acceptable diet.

This paper is the first to report analyses of complementary feeding indicators using the most recent nationally representative data from Nepal, and the new WHO indicators for the inappropriate complementary feeding practices. A selection of mainly BF indicators of IYCF practices have been described using new WHO indicators in the report of the 2006 NDHS (Ministry of Health & Population 2006). However, the risk factors for inappropriate complementary feeding practices have not been examined. The sampling method, appropriate adjustment for sampling design, including sampling weight, and a very high response rate (98.4%) to the survey interview are important strengths of the survey. The number of missing values was 105, and because the proportion with missing values was relatively small, this may not have a substantial impact on the final results. One of the major limitations of this study is the cross-sectional design as it only reports a 'snapshot' of the frequency of inappropriate complementary feeding (CF) and causal inferences about the factors associated with inappropriate complementary feeding cannot be made. Another limitation of this study is the failure to estimate the minimum acceptable diet for all children. Despite these limitations, the findings from this study contribute to our understanding of the factors associated with inappropriate CF in Nepal. The study also provides important insights regarding CF and that will help guide the development of appropriate programs to improve complementary feeding in Nepal.

Across the South Asian region, the complementary feeding indicators in Nepal were better than India, but somewhat lower than Bangladesh and Sri Lanka. It is interesting to note that the rate of minimum meal frequency in Nepal was high and similar to that of Sri Lanka, but the rates of minimum dietary diversity and acceptable diet were almost half of the Sri Lankan rates (Senarath *et al*. 2011). This could be due to the lack of affordability to a variety of food and poor knowledge about dietary diversity in Nepalese families. According to the country profiles compiled by the WHO, complementary feeding in many countries was not satisfactory and only a few developing countries have reported a minimum acceptable diet rate above 50% (WHO *et al*. 2010) which highlights the need to improve CF in order to reduce child undernutrition.

The rates of minimum dietary diversity, minimum meal frequency and minimum acceptable diet were generally high among mothers who had four or more antenatal visits, mothers who delivered at a health facility and mothers whose delivery was assisted by health professionals. Mothers who delivered their babies through Caesarean sections reported significantly higher prevalence of minimum acceptable diet and minimum dietary diversity than those mothers who delivered their babies through non-Caesarean. It was observed that visits to antenatal care (ANC) and institutional delivery were closely associated with complementary feeding. These findings are consistent with those reported for Bangladesh in this supplement (Iqbal *et al*. 2011). The fact that complementary feeding practice improved with exposure to health professionals could be due to the counselling they received from the health practitioner during the visit. However, in Nepal only 18% of births take place in health facilities and almost a quarter of the pregnant women do not attend antenatal care (Ministry of Health & Population 2006).

Infant mothers who are exposed to media, i.e. watched television, listened to radio and read newspapers or magazines every day or at least once a week, reported higher dietary diversity, meal frequency and acceptable diet than those infants of mothers who watched television, listened to radio and read newspapers or magazines less than once a week or not at all. A separate analysis of the same

subsample of data from the Nepal 2006 DHS (Pandey *et al*. 2010) showed that mothers who were able to read part or whole sentences had a higher rate of current BF. This may reflect broadly the influence of the media on infant feeding practices. Senarath *et al*. (2011) reported in this supplement that in Sri Lanka, the level of maternal education was high in general, but those who had lower level of education had significantly poor practices. There is recent evidence indicating that appropriate infant feeding practices in the community are strongly influenced by their knowledge about appropriate infant feeding practices (Roy *et al*. 2009). Effective communication to change mother's behaviour should be the prime objective for ensuring appropriate CF in Nepal.

Infants aged 6–11 months were significantly less likely to meet minimum acceptable diet and minimum meal frequency. This result indicates the relationship between different food groups by age group which implies that food groups decrease as the child age decreases. A recent study done by Adhikari also shows that the complementary food which is introduced to young children generally lacks variety and often based on rice and legumes only. Meat, fish or eggs are infrequently given to children because of the belief about pure and impure food. Some food items like green leafy vegetables are considered cold and are not given to children at early age (Adhikari 2010). Our findings suggest substantial improvement in CF among infants could be achieved with simple focused messages for child caregivers about appropriate CF, including the need to offer a range of foods given with sufficient frequency, as well as counselling and support as they introduce CF.

Multivariate analysis showed dietary diversity and acceptable diet have a declining pattern across wealth quintiles indicating linear relationship between wealth and feeding practices. This relationship reflects the food insecurity which could be a proxy determinant for inadequate feeding, undernutrition and child ill health. The reported high rate for those from richest households could be attributed to the fact that mothers from richest households were more likely to give their children good dietary quality foods compared to mothers from poor households who were more likely to focus on the quantity food. There is substantial evidence supporting wealth and undernutrition. As shown in six countries in South Asia by DHS, children in the top quintile present a sharp reduction in malnutrition compared to the four wealth groups (WHO *et al*. 2010).

Our analysis also indicated that mothers who lived in rural region reported lower rates of minimum dietary diversity and minimum acceptable diet compared to those mothers who lived in urban region. These low rates may be attributed to the challenges to good nutrition in children aged 6–23 months. Some of these underlining challenges are food beliefs, food insecurity and poor sanitation. The low rate of CF in rural region may, in part, be due to traditional beliefs and practices. For example, in the Nepalese rural communities, vegetables and fruits are considered dangerous to the health of the infant and young children because it is regarded as cold food for young children (Helen Keller International & USAID 2010). A widely shared misperception was that infants under 1 year of age cannot digest animal source foods (Gittelsohn *et al*. 1997; Siegel *et al*. 2006). Therefore, emphasis on the need for improved dietary quality of complementary foods and the inclusion of animal source foods, vegetables and fruits in the diet of children needs to be addressed.

The study revealed that maternal education level, wealth of household, children's age, maternal exposure to media and maternal working status are very important determinants of feeding practices of a child. Children from the poor households and illiterate mothers need special interventions to improve the IYCF practices in Nepal.

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Conflict of interest

The authors do not have any conflict of interest on the content of this manuscript.

Contributions

NJ designed the study, obtained data set, guided analysis, obtained literature, checked results, interpreted results and wrote the manuscript.
KA converted data files, conducted statistical analysis and compiled results.
MD conceptualized the research question, designed and guided the analysis, and revised and edited the manuscript.
US reviewed and revised the manuscript.
KT obtained literature.

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