

## RESEARCH PAPER

# Feeding practices of pre-school children and associated factors in Kathmandu, Nepal

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### Keywords

dietary knowledge, infants' diet, malnutrition, Nepalese mother, socio-economic status.

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### Introduction

Despite the approximately 50% drop in the global child mortality rate between 1990 and 2016, child malnutrition continues to be a global problem that must be eliminated<sup>(1)</sup>. Malnutrition includes undernutrition (wasting, stunting and being underweight), micronutrient deficiency (vitamins or minerals), being overweight and obesity<sup>(2)</sup>. Most overweight children live in developed countries<sup>(3,4)</sup>. Overweight-induced malnutrition leads to several diseases such as diabetes and various forms of coronary heart disorders. By contrast, children from developing countries

### Abstract

**Background:** In developing countries such as Nepal, many children aged below 3 years do not grow at a sufficiently high rate and are vulnerable to micronutrient deficiencies (e.g. vitamin A). Challenges to child nutrition can result from poverty, unhealthy traditional practices, inadequate caring and feeding practices. The present study aimed to assess the feeding practices of pre-school children and their associated factors.

**Methods:** A cross-sectional study was carried out in pre-schools located in Kathmandu district between February and March 2018. Three levels in terms of price range (lower, medium and higher level) of pre-schools were selected to reach the mothers of children aged  $\leq 3$  years. A structured questionnaire was administered to 145 mothers. Descriptive analyses were conducted to observe the characteristics of the population. Multinomial logistic regression analyses were performed to identify the association for the factors of mothers' perception of their current feeding practices.

**Results:** We found that *dal-bhat/jaulo* was a common complementary food irrespective of socio-economic background. Interestingly, mothers who had received a higher education were significantly less likely to change their feeding practices (odds ratio = 0.118, confidence interval = 0.01–0.94). The mothers that fed a higher quantity porridge to their children showed a high willingness to change the feeding practices.

**Conclusions:** Poor feeding practices are still an important public health problem in Nepal and were observed to be associated with low socio-economic status, unawareness and a lack of knowledge towards dietary diversity combined with strong beliefs related to social forces and cultures.

mainly suffer from being underweight and stunting, leading to other malnutrition-related health conditions such as diarrhoea and chronic obstructive pulmonary disease<sup>(1,5)</sup>. An inadequate micronutrient intake leads to one-third of child deaths in Africa<sup>(6)</sup> and similar challenges are faced in the south-east Asian countries such as Nepal. Nepal has 2.7 million children aged below 4 years<sup>(7)</sup> and 1.6 million children are estimated to suffer from chronic undernutrition and the severe long-term consequences associated with stunting<sup>(8)</sup>. Malnutrition is the persistent problem, with 35.8%, 27%, 1.2% and 9.7% of children under 5 years of age being stunted, underweight,

overweight and wasted, respectively (data based on the year 2016)<sup>(9)</sup>. The negative impact of being underweight, overweight or obese during childhood can lead to permanent and irreversible impairment and increases the risk of several chronic diseases because the first 5 years of life are fundamental for the development of organs and bones<sup>(10)</sup>.

Inappropriate feeding practices among infants are one of the major causes of malnutrition in Nepal<sup>(11)</sup>. An awareness of the need to feed various types of foods by mothers or caretakers has a significant influence on the health and nutrition of the children<sup>(8)</sup>. For example, Karkee *et al.*<sup>(12)</sup> identified that Nepalese mothers were breastfeeding more (98.0%) and feeding lower (13.4%) levels of infant complementary foods at the age of 22 weeks. This resulted in poor feeding practices at the critical stage (6–24 months), resulting in malnutrition in many children at a vulnerable stage of their growth. It is recommended that children aged 6–23 months must be fed from four or more out of seven food groups daily: [(i) grains, roots, tubers; (ii) legumes and nuts; (iii) dairy foods; (iv) fruits and vegetables; (v) green leafy vegetables and other fruits; (vi) meat, poultry and fish; and (vii) eggs<sup>(13)</sup>. In Nepal, 53% of children aged between 6 and 23 months do not reach the minimum dietary diversity, and only 36% consume a minimum recommended diet<sup>(9)</sup>. Traditionally, complementary feeding practices start after the 'Annaprashan' (rice feeding) ceremony. The ritual is normally held in the fifth month of a girl's and the sixth month of a boy's life<sup>(14)</sup>. Even though the time of initiation of complementary foods in the Nepalese

context is in accordance with the recommendations on complementary feeding, the feeding practices and dietary diversity are still falling behind recommendations<sup>(15)</sup>. According to previous studies<sup>(13–15)</sup>, several factors have been identified to explain the mother's decision with respect to poor feeding practices. The major factors were stated as a mother's education and dietary knowledge, socio-economic conditions, socio-cultural and physiological aspects, family pressure on continuing the traditional feeding practices, and a lack of social support. In the case of developing countries such as Nepal, a key factor affecting all underlying determinants is poverty<sup>(16)</sup>. A low economic background limits access to a good education and health system. Additionally, it reduces the range of affordable products, as well as their quality and quantity. This leads to poor feeding practices and consequently causes child malnutrition. The cultural context, especially at the local level, is also an influential determinant directly affecting the feeding practices<sup>(17)</sup>. Because Nepal is a culturally diversified country, feeding practices might vary according to the geographical region, ethnic groups and cultural taboos<sup>(15)</sup>.

Several local infant food formulas, their constituents and method of preparation are presented in Table 1<sup>(18)</sup>. Generally, 'dal-bhat' (pulse-rice) is the primary weaning food, where fruits and vegetables are rarely fed<sup>(19)</sup>. The other supplementary foods given are cow, buffalo and goat milk. Types of semi-solid foods are *jaulo* (rice, turmeric and salt), *chapatti* (home-made breads), *lito* (roasted rice flour; occasionally maize or millet), *ghee* (clarified butter and sugar), *sarbottam pitho* (local market

**Table 1** Description of local diet intake of children, their constituents and method of preparation

Serial Number	Local food name	Constituents	Method of preparation
1.	<i>Dal-bhat/jaulo</i>	<i>Dal-bhat</i> : made from a mixture of rice and lentils soup <i>Jaulo</i> : made from rice and turmeric or rice and salt	Rice and lentils are cooked to a semi-solid consistency
2.	<i>Lito</i>	Made from roasted rice flour (occasionally maize or millet), <i>ghee</i> (clarified butter) and sugar	All mixture is stirred into boiling water or milk and cook for a short time
3.	<i>Sarbottam pitho</i>	Two parts pulse – soybeans, small beans, grams and peas (any one of these can be used) One-part whole-grain cereal – maize or rice One part another whole-grain cereal – wheat, millet or buckwheat *All pulses and grains are roasted well (separately) and ground into fine flour and then stored in an airtight container	All mixture (flour) is stirred into boiling water or milk and cook for a short time
4.	Commercial baby foods	Nestle cerelac baby foods – rice, soya bean, sugar, skimmed milk powder (cow's milk), vegetable oils, apple powder (glucose, apple juice concentrate), minerals (calcium carbonate, sodium phosphate, ferric pyrophosphate, zinc sulphate, potassium iodide), contains emulsifier as permitted food conditioner. Contains permitted flavouring. All additives are of plant or synthetic origin	Cerelac is mixed with boiled water
5.	Routine foods	Daily food routine – rice, bread, lentil, pulses, fruits and vegetables, meat, eggs	Only spices are avoided in the baby's food

\*is used to emphasise the roasting process of all pulses and grains.

porridge), vegetables, *dal* (pulse soup), eggs and meat<sup>(20)</sup>. The National Planning Commission, World Food Program, World Bank, AusAID and UNICEF (2013)<sup>(21)</sup> reported that diets comprising starchy staples lack essential micronutrients (vitamins, iron, zinc, magnesium, etc.), therefore contributing to malnutrition.

Despite the existence of many nutritional studies on Nepal, little is known about the feeding practices of pre-school children (6–36 months) located in Kathmandu district. Furthermore, most of the previous studies were conducted in hospital settings. Pre-schools could be a good platform to reach mothers of a mixed socio-economic background and encourage them to vary their feeding practices. The present study therefore intended to assess the feeding practices of mothers and identify the associated factors that can be used as a vital indicator of the overall nutrition and healthy development of pre-school children.

## Materials and methods

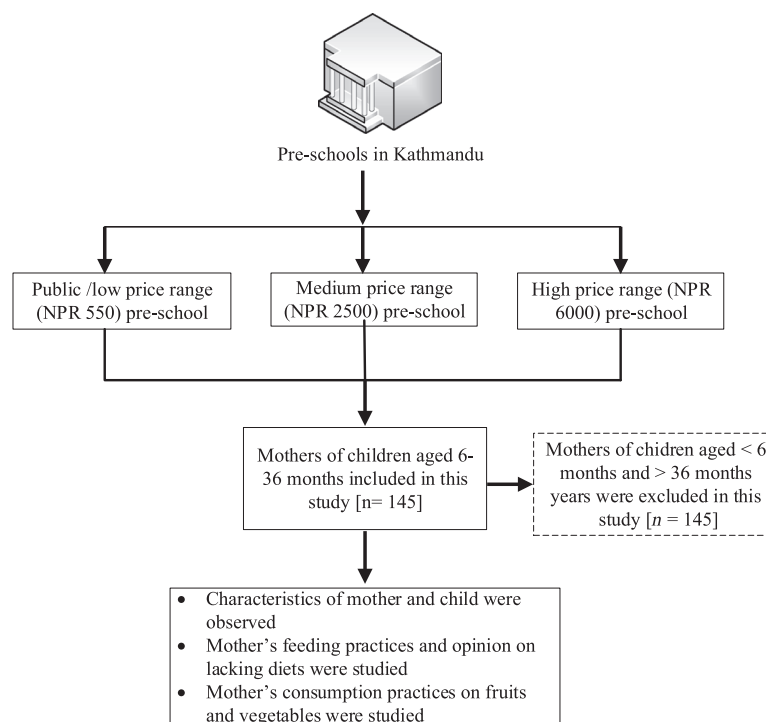
### Study design and setting

In the present study, a cross-sectional survey was conducted between February and March 2018 in Kathmandu valley, Nepal. This design was chosen because it is appropriate for a short period of data collection and to assess the relationship between the selected variables<sup>(22)</sup>.

Nepal has a population of approximately 29 million and is divided into 75 administrative districts. Amongst

these, Kathmandu valley has a total population of 2.8 million (i.e. almost 10% of the overall population). Kathmandu valley is comprised of five Metropolitan cities: Kathmandu Metropolitan City, Lalitpur Metropolitan City, Bhaktapur Municipality, Kirtipur Municipality and Madhyapur Thimi Municipality. Kathmandu Metropolitan City, which has approximately 1 million residents<sup>(23)</sup>, was chosen for the present study. Based on the National Population and Housing Census 2011, there are 763 Early Childhood Development and Pre-primary classes available in the Kathmandu valley<sup>(24)</sup>. This number was not used to calculate the sample size because it lacks information only for early childhood development.

In the present study, 27 different pre-schools located in Kathmandu Metropolitan City were sampled to recruit mothers from a range of socio-economic backgrounds. Currently, the trend of the pre-schooling education is increasing in the three Kathmandu subdistricts but is still not profoundly activated in other districts of Nepal. Furthermore, different levels of pre-schools are available in Kathmandu: low price range pre-schools charge NRs 550 (\$5), medium price range pre-schools charge NRs 2500 (\$22) and high price range pre-schools (expensive) charge NRs 6000 (\$53) per month on average. The survey plan as split by of pre-schools is presented in Fig. 1. Selecting mothers from pre-schools of all price ranges was relevant with respect to reaching different income group families and gaining a perspective towards differences in feeding practices, their own (healthy) consumption habits and the



**Figure 1** Study setting and design.

influences of social bonding towards their feeding practices.

### Sample size and sampling procedure

Mothers with children of an age between 6 and 36 months who had lived in the Kathmandu district for at least 6 months were eligible for the study. Study participants were selected through a random sampling method of the pre-schools available (i.e. who gave permission to use their pre-school premises to take an interview with mothers). With the consent of the chief or head leader of the pre-schools, mothers were pre-informed and invited to participate in the research. Only those who had an interest and the time to participate in the study volunteered. Mothers of children aged more than 36 months were excluded from the study. The final sample comprised of 145 mothers excluding those ( $n = 8$ ) who refused to participate (Fig. 1). The refusal of a mother who was approached was generally because of a lack of interest, a lack of time and the fact that they could not manage the infants during the interview ( $n = 8$ ). The age range of 6–36 months was selected for design reasons relating to feeding practices that are of nutritionally paramount importance for promoting the optimal development and growth of the child.

### Data collection tools and procedures

The structured questionnaires were used to collect data; a copy of the questionnaire is provided in the Supporting information (Data S1). Feeding practices were assessed according to the key indicators recommended by World Health Organization<sup>(25)</sup>. Outcome variables such as type of complementary feeding adopted by mothers were assessed. Data collectors created a conducive environment by keeping mothers apart and making them comfortable during the data collection to minimise the social desirability bias. A structured interview schedule was used as tool to gather information on factors associated with feeding practices. The questionnaires mainly comprised details regarding household profiles such as age, sex, education level and occupation of household members and household size. Specifically, the factors considered were:

- 1 Characteristics of mothers (age, occupation, residence, number of children, etc.)
- 2 The pattern of complementary foods and the mother's perspective towards lacking diets
- 3 Association between different levels of social life and socio-economic background of the mother
- 4 Association of changing the feeding practices with several factors such as socio-demographic characteristics

### 5 Mother's fruit and vegetable consumption habits

Quantitative data were designed continuously with the help of a 1–9 scaling score<sup>(26)</sup>. An objective rescaling distance was created when performing the analysis (e.g. a 1–3 scaling score).

A pre-tested questionnaire initially developed in English and then translated in the local language (Nepali) was used for data collection. A facilitator and a student assistant who had a background in social work study were involved to conduct all interviews. Prior to data collection, the research assistants (data collectors and supervisors) were trained for 2 days on interview techniques. The questionnaire was pre-tested on 10 subjects in two pre-schools in the study area. The clarity, acceptability and applicability of the procedures were evaluated during the pre-test and used to make any necessary corrections to the questionnaire and the mode of question delivery to the subjects.

### Study variables

The dependent variable in the present study is considered to be feeding practices. The tendency of mothers to change their feeding practices was taken as the source to determine the likelihood of adapting appropriate feeding practices. These are indicated by feeding foods in a diversified way, such as animal and plant-based food products. The independent variables were mainly related to the mothers' socio-demographic and economic characteristics [age, education, employment, religion, household size and marital status, child characteristics (age, sex), maternal consumption habits (mother's fruits and vegetable consumption patterns) and health conditions of the children]. The selection of pre-school was organised based on a mother's capability to afford that price level and is a representation of the socio-economic background of the Nepalese population. Each of the variables was measured using a single question.

### Statistical analysis

Data were checked for completeness and inconsistencies and then collated using EXCEL (Microsoft Corp., Redmond, WA, USA) before analysis. All data were analysed using SPSS, version 22.0 (IBM Corp., Armonk, NY, USA). Socio-demographic characteristics and the prevalence of complementary feeding practices were analysed using descriptive statistics, with the results being presented as the frequency. Multinomial logistic regression analysis was used to determine the associations of feeding practices and their different factors, such as socio-economic characteristics of mothers and child status. Associations were examined by odds ratios (ORs) for the above-

mentioned indicators to determine the likelihood of changing the feeding practices. The backward elimination method was used, aiming to avoid any statistical bias, by double-checking and following procedures: (i) entering only variables with  $P < 0.05$ ; (ii) testing the backward elimination by also including all potential confounders; and (iii) testing and reporting variables that are highly corrected in a logistic regression model.

## Results

### Characteristics of mothers and their children

Table 2 provides the characteristics of mothers and their children. All 145 respondents were married. Remarkably, 60% of the mothers were of university-level education followed by a higher secondary degree (37.2%). Some 89% of the mothers were residing in an urban area. The reasons for living in the urban area were cited as marriage (40.8%), better opportunities (24.2%) and to achieve a higher education (21.7%). The extended family structure was found to be represented almost twice as often (60.7%) compared to a nuclear family structure (33.8%). Most mothers had a single child (66.9%) and 75.2% of the children were aged below 24 months. Noteworthy, most mothers selected medium-priced range pre-schools compared to high and low-priced range.

### Complementary food practices and mother's perspective towards lacking diets

In Nepal, it is very common practice to introduce complementary food after the rice feeding ceremony. Nevertheless, complementary feeding practices differ greatly between the mothers (Fig. 2a). The findings in the present study indicate staple food (*dal-bhat/jaulo*) to be the most commonly used complementary food (36.10%) among the children. A strong negative correlation was found between the willingness of the mother to change their feeding practices and current feeding by staple foods ( $P < 0.05$ ). Some 32% of the mothers fed their child with homemade porridge known as '*lito*'. It is remarkable that 15.10% of mothers fed their children with commercial food products such as cerelac and only less than half (6.40%) chose a diet based on local products such as *sar-bottam pitho*. Some 10.40% of the children were fed with routine foods (pulses-rice, roots and tubers, fruits and vegetables, meat products).

The food groups lacking the most, according to the mothers' perception, were pulses, fruits and vegetables (fresh and dried), and milk products (Fig. 2b). The participants with a higher education level emphasised the importance of consuming fruits and vegetables for a balanced diet. However, most of the mothers stated that fruit and

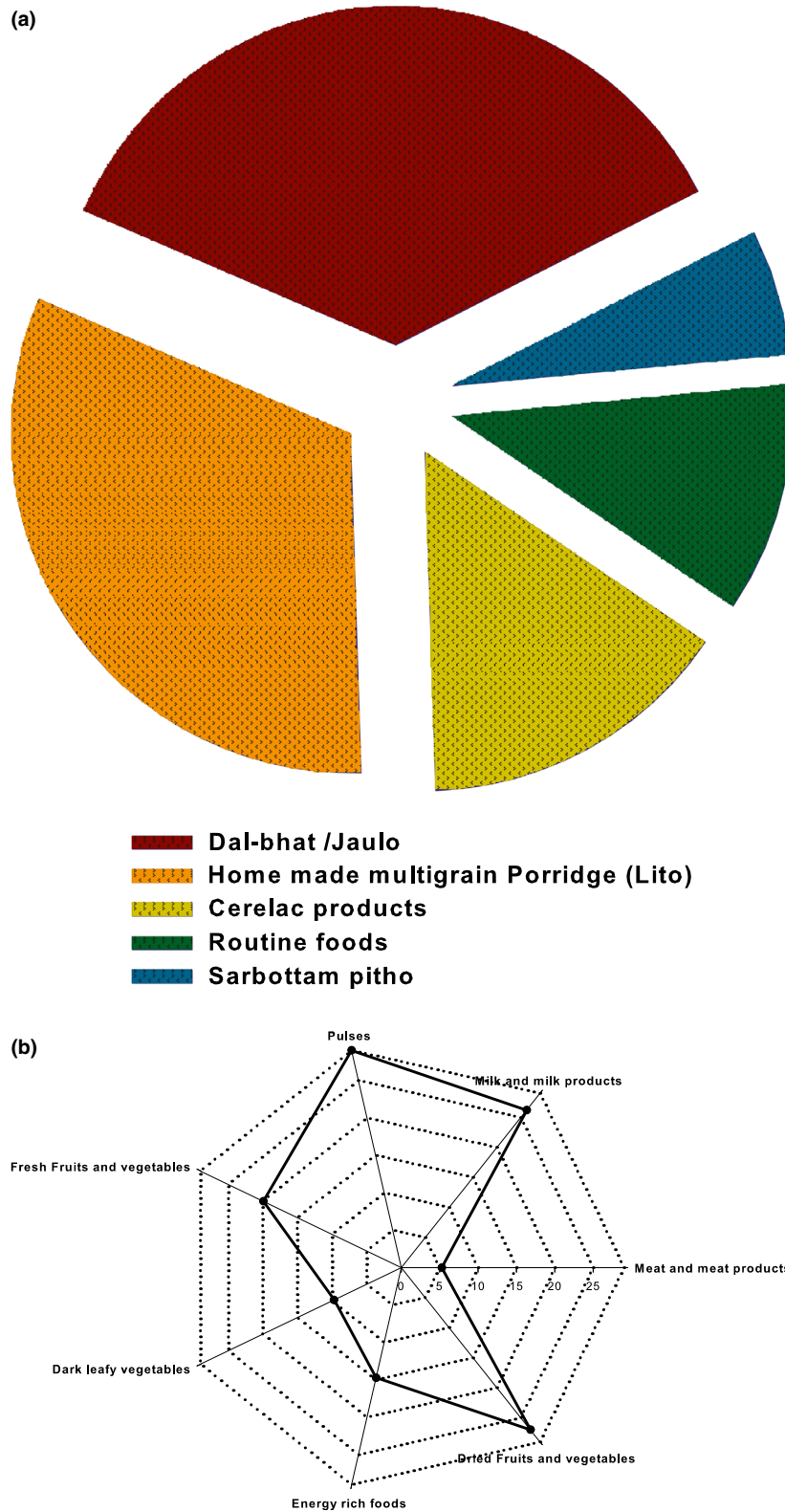
**Table 2** Mothers' and children's characteristics

Variables	Categories	Frequency (%)
Mothers' age	<21	2 (1.4)
	21–25	46 (33.7)
	26–30	55 (37.9)
	>30	42 (29.0)
Ethnicity	Chhetri	30 (20.7)
	Brahmin	32 (22.1)
	Magar	11 (7.6)
	Tharu	3 (2.1)
	Tamang	22 (15.2)
	Newar	27 (18.6)
	Others	20 (13.8)
Education level	Primary school	4 (2.8)
	Secondary school	54 (37.2)
	Academic/university	87 (60.0)
Origin of residence	Urban	36 (24.8)
	Peri-urban	47 (32.4)
	Rural	62 (42.8)
Current residence	Urban	129 (89.0)
	Peri-urban	16 (11.0)
Reason to migrate	Marriage	64 (40.8)
	Education	34 (21.7)
	Family	21 (13.4)
	More opportunities	38 (24.2)
Occupation	Housewife	70 (48.3)
	Informal sector	51 (35.2)
	Formal sector	14 (9.7)
	Self-employed	10 (6.9)
Number of children	1	97 (66.9)
	2	41 (28.3)
	3	7 (4.8)
Sex of child	Male	76 (52.4)
	Female	69 (47.6)
Child age group	6–12 months	12 (8.3)
	13–24 months	109 (75.2)
	25–36 months	24 (16.6)
Family structure	Own's parent	4 (2.8)
	Extended family	88 (60.7)
	Nuclear family	49 (33.8)
	Alone	4 (2.8)
Type of pre-school	High price range	42 (29)
	Medium price range	92 (63.4)
	Low price range	11 (7.6)

vegetable consumption was lacking in their daily routine. Only a few mothers (5%) considered there to be a lack of meat and meat products in their feeding practices.

### The association of level of social life with the economic status of mothers based upon the selection of pre-school

Table 3 shows the association of social bonding with the socio-economic ability of mothers. Other factors, such as education, age and the number of children, were not significantly associated with the different levels of social bonding and thus the results are not presented. In the



**Figure 2** (a) Complementary foods feeding pattern. (b) Food groups lacking in the feeding practices of the children age (6–36 months).

**Table 3** Association of social bonding with the mother's socio-economic background

	Not at all			Average			Very much		
	Coefficient	OR (95% CI)	P-value	Coefficient	OR (95% CI)	P-value	Coefficient f	OR (95% CI)	P-value
Type of Pre-school									
Lower	2.219	9.20 (2.065–40.99)	0.004	1.749	5.75 (0.832–39.740)	0.076	2.828	16.90 (0.74–385.47)	0.076
Higher	–.049	0.95 (0.336 –2.69)	0.926	0.733	2.08 (0.691–6.275)	0.193	2.971	19.50 (0.90–422.09)	0.058
Medium		1			1			1	

OR, odds ratio; CO, confidence interval.

present study, the mothers who sent their children to a highly priced pre-school (i.e. assuming the mothers from a higher socio-economic background) were less likely to be socially active (OR = 0.95; 95% CI = 0.33–2.69). However, there was no significant difference between

mothers selecting high- and medium-priced pre-schools. Mothers who are sending their children to a low-priced pre-school (i.e. assuming the mothers are from a low socio-economic background) were more likely to engage with the society and have a higher level of social bonding.

**Table 4** Mothers' association towards changing their feeding practices with several factors

Variables	Not important OR (95% CI)	Average OR (95% CI)	Very important OR (95% CI)
Education level			
Basic education	0.52 (0.04–6.09)	1.23 (0.10–14.64)	1.89 (0.16 –21.80)
Higher level education	0.83 (0.39–1.78)	1.13 (0.44–2.87)	1.19 (0.55–2.55)
Academic level education	1	1	1
Type of pre-school			
Lower	0.72 (0.12–4.21)	2.500 (0.60–10.29)	0.35 (0.05 –2.15)
Higher	2.04 (0.93–4.46)	0.118 (0.01–0.94)	0.72 (0.12–4.12)
Medium	1	1	1
Opinion on baby health status			
Not healthy	2.63 (0.62–11.16)	5.553 × 10 <sup>-9</sup> (5.553 × 10 <sup>-9</sup> to 5.553 × 10 <sup>-9</sup> )	0.36 (0.08–1.56)
Average	1.75 (0.56–5.45)	1.12 (0.25–4.87)	0.53 (0.172–1.68)
Healthy	1	1	1
Age of child (months)			
6–12	0.12 (0.04–1.59)	0.09 (0.01–1.22)	3.66 (0.73–18.33)
13–24	0.09 (0.01–1.41)	0.72 (0.18–2.79)	1.57 (0.57–4.29)
25–36			
Number of children			
1	0.12 (0.01–1.77)	0.148 (0.010–2.236)	3.79 (0.375–38.35)
2	0.09 (0.01–1.41)	0.11 (0.01–1.78)	5.32 (0.49–57.31)
3	1	1	
Routine feeding practices			
Homemade porridge (No)	1.61 (0.59–4.40)	3.47 (1.13–10.95)	0.62 (0.22–1.70)
Homemade porridge (Yes)	1	1	1
Locally available porridge (No)	1.69 (0.45–6.35)	11.66 (1.17–115.90)	0.59 (0.15–2.21)
Locally available porridge (Yes)	1	1	1
Breast milk and dairy foods (No)	0.99 (0.42–2.32)	0.27 (0.06–1.11)	1.01 (0.43–2.37)
Breast milk and dairy foods (Yes)	1	1	1
Commercial market product (No)	0.55 (0.23–1.27)	0.61 (0.19–1.88)	1.81 (0.78–4.20)
Breast milk and dairy foods (Yes)	1	1	1
All type of foods (No)	0.77 (0.289–2.09)	0.62 (0.19–2.03)	1.28 (0.47–3.45)
All type of foods (Yes)	1	1	1

OR, odds ratio; CO, confidence interval.

### The association of changing the feeding practices with several factors; fruits and vegetables consumption patterns of mothers

Table 4 shows the factors associated with mother in Kathmandu Metropolitan City changing their feeding practices. Mothers from a high socio-economic background have an average likeness (OR = 0.118; 95% CI = 0.01–0.94) to change their feeding practices. There is a significant difference ( $P < 0.05$ ) between the mothers who had the opinion that their children are healthy, average and not healthy. The mothers that fed more porridge to their children showed a significantly different ( $P < 0.05$ ) willingness to change their feeding practices compared to those that fed medium and low proportions of porridge. The ORs of other factors such as the age of children, number of children and education of mothers were not significantly associated with changing the feeding practices.

The consumption of fruits and vegetables per day by mother is presented in Fig. 3. Interestingly, 71% of mothers consumed at least one or two fresh fruits per day and 75.2% consumed three or four fresh vegetables per day. The consumption of dried fruits and vegetable juice was found to be negligible. However, the consumption of dried vegetables such as *gundruk*, *sinki*, dried broccoli and mushroom was very common.

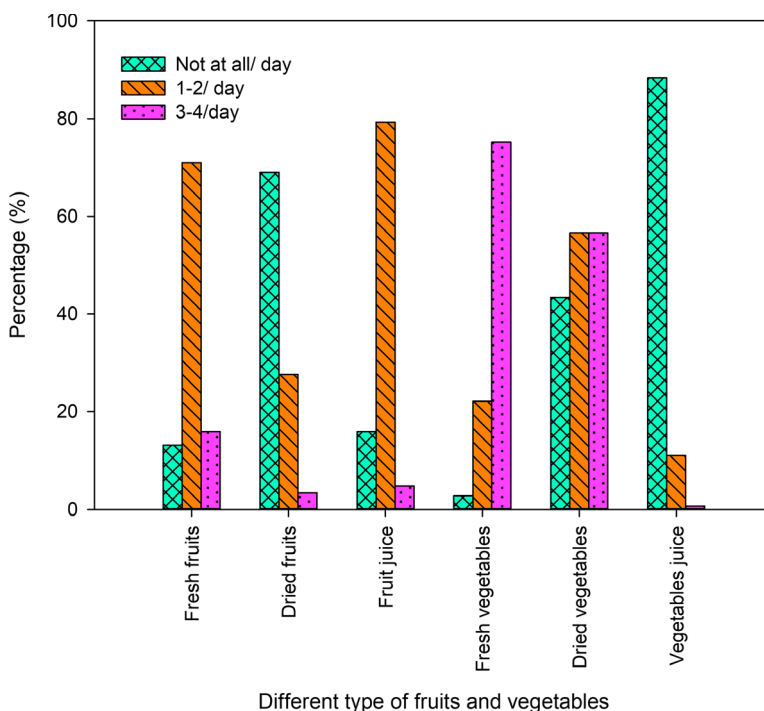
### Discussion

The present study reports the baseline information collected from mothers in Kathmandu Metropolitan City on

their feeding practices towards their children and associated factors. Most participants (60%) had an academic level (bachelor level or above) of education. This is in accordance with the study carried out by Cunningham *et al.* (27) which showed that the educational level in Nepal has substantially progressed during recent decades because the net enrolment rate in elementary education has increased from 66.3% in 1999 to 97% in 2016. Likewise, female participation in educational attainment has also increased dramatically (28). This phenomenon can be observed globally as the role of women has changed over the last decades (29). They are progressively coming closer to being granted equal rights to men regarding education and the range of opportunities.

Most mothers were assumed to be from a middle-class background because they sent their children to a medium price pre-school. In the present study, mothers were not open to answering how high the family income was. Thus, the price level of pre-schools was used as an indirect income indicator based on the assumption that it reflected the affordability.

Furthermore, the extended family structure still exists in large parts of Nepalese society and was found to have the greatest influence on child feeding practices. The children raised within this context were fed mostly staple foods (*dal-bhat/jaulo*). This might be a result of the influence of elders, traditional and religious rituals, and their consumption habits. Mothers from a low socio-economic background were significantly more socially bonded than mothers from a high socio-economic background This



**Figure 3** Fresh fruits and vegetable consumption of mothers.



might be why mothers from a low socio-economic background wanted to learn about improving their feeding practices. Moreover, being socially active encourages mothers modifying their feeding behaviour and improving the health status of infants.

Most mothers considered the current diets to be lacking fruits and vegetables (fresh and dried), as well as milk and milk products, rather than meat and meat products. This confirmed that dietary diversification is still lacking for infants among mothers' practices, which aligned well with the study carried out by Cunningham *et al.*<sup>(27)</sup>. Those mothers who fed their children with more home-made and locally available porridge were significantly interested in changing their feeding practices to improve the health status of their children. The willingness to change feeding practices increased with a high educational level of the mothers. Thus, it appears that mothers with a higher education have a better understanding of the necessity of balanced infant diets and are more aware of issues related to feeding practices.

The results of the present study show clearly that feeding practices in relation to fruits and vegetables and mothers' consumption were interrelated. Mothers who did not consume fruits themselves did not prioritise feeding fruits and vegetables to their children. These findings agree with the findings of Locks *et al.*<sup>(15)</sup> in that only some mothers fed their children fruits and vegetables alongside the porridge. This might also be a result of the influence of joint family structures, as well as changing living standards (i.e. moving from the county side to the city). However, education and social bonding were found to have the greatest impact on the mothers' willingness to improve feeding practices and could define what types of food are missing or lacking in infant nutrition. This might explain why the overall child nutrition status has not improved as much would be expected, irrespective of the education and social status of mothers.

Additionally, the respondents in the present study were self-decision makers and mostly willing to change feeding practices to upgrade the nutritional status of their children. The self-decision capability may be a result of the effect of the education level and social interaction motivations. Imdad, Yakoob & Bhutta<sup>(30)</sup> reported that educated mothers place high emphasis on feeding nutrient-rich animal source foods as a diet diversification. Obviously, this might vary again according to ethnicity, residence region and cultural aspects<sup>(31)</sup>.

## Conclusions

An important aspect of the present study was the assessment of primary associations of changing feeding practices with several influencing factors, such as education,

economic conditions and family structure. This helps to understand the mechanisms behind mothers' knowledge on feeding practices and the health status of their children in a real-world context. Mothers were well aware of the fact that the first years of the children's life are crucial for physical and mental development, with a lifelong impact. However, very few mothers had appropriate knowledge regarding the necessary modifications to the dietary intake of children, as well as how to analyse the results by observing health status. These findings reflect the importance of generating awareness of the current situation and the need for improving the knowledge of mothers about child feeding practices, which, in turn, will help to reduce the malnutrition problem in Nepal.

A clear limitation of the present study is that we analysed cross-sectional data; therefore, the findings could only be relevant to the study context and similar settings. The relationship between mothers' fruit and vegetable consumption and that of their children might be associated. To further clarify the cause and effect relationship, longitudinal analyses are needed. In addition, the present study was focused on the mothers and their feeding dietary and consumption patterns, which may evoke a desirability bias. This implies that the need for interventions to increase the dietary diversification patterns, rather than focusing on the traditional way of feeding, should be emphasised. Future studies could include other caregivers and entities, such as grandparents, fathers, schools and children's hospitals, to obtain a broader picture on child feeding practices by assessing the method of feeding, pre-lacteal feeds, colostrum, types of diet, age of complementary food and types of complementary food.

Another limitation was the small sample size, which was a result of the limited time boundary and resources. Hence, there could have been a recall bias. Because the results have been drawn from an urban population, this cannot be generalised to the rural population or other parts of Nepal. Nevertheless, the strength of the present study is that it has determined some important aspect regarding feeding practices and a lack of diversity of diets among Nepalese mothers at pre-schools located in Kathmandu Metropolitan City. Although some indicators identified in the present study provide baseline information, there is still a need to conduct further studies to increase awareness amongst mothers and improve the diets of children aged under 3 years of age.

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### Conflict of interests, source of funding and authorship

The authors declare that they have no conflicts of interest.

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LS, OH and BS conceived and designed the study. LS conducted the study, collected the data, constructed the database, analysed and interpreted the results, and wrote the manuscript, as supported by BS. BK helped to revise the questionnaire formatting and data analysis. AP read and reviewed all sections of the manuscript. All authors read and approved the final manuscript submitted for publication.

### Transparency declaration

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The reporting of this work is compliant with STROBE guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

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### Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Data S1.** Questionnaire for mothers of infants aged 6–36 months.