



## Socio-ecological Factors Associated with Snacking Behaviors of Basic School Students in Nepal

YADU R. UPRETI<sup>1\*</sup>, SHERI BASTIEN<sup>2,3</sup>,  
BIRGITTE BJONNESS<sup>4</sup> and BHIMSEN DEVKOTA<sup>5</sup>

<sup>1</sup>Central Department of Education, Tribhuvan University (TU), Kathmandu, Nepal.

<sup>2</sup>Department of Public Health Science, Norwegian University of Life Sciences (NMBU), As, Norway.

<sup>3</sup>Department of Community Health Sciences, Cumming School of Medicine,  
University of Calgary, Alberta, Canada.

<sup>4</sup>Faculty of Science and Technology, Norwegian University of Life Sciences (NMBU), As, Norway.

<sup>5</sup>Department of Health and Physical Education, Mahendra Ratna Campus,  
Tribhuvan University (TU), Kathmandu, Nepal.

### Abstract

Consumption of unhealthy snack foods among young children in low-and-middle-income countries is high and Nepal is no exception. A quantitative cross-sectional study was conducted among 259 students to investigate their snacking behaviors and examine factors that influence the behavior from a socio-ecological framework. The study used self-reported questionnaires, food recall diaries, and participant observation forms to collect data. Students' snacking behavior was the dependent variable where as age, sex, grade, parent's education, parent's sources of income, religion, ethnicity, family type, and living arrangements were the independent variables. Chi-square test and logistic regression were applied to analyze the results. The main findings of the study indicate that 89 percent of students consumed school snacks regularly, including unhealthy snacks, which were either commercially prepared junk foods bought from nearby vending shops and grocery stores or deep-oil-fried snacks food prepared at the school canteen. Bivariate analysis shows that age, grade, father's education, and the student's religion were significantly associated with snacking behaviors of students. The multivariate analysis indicates that grade (aOR= 0.259,  $P < .05$ ) and religion (aOR= 0.373,  $P < .05$ ) were the significant predictors. The snacking behaviors among basic level students are influenced by multilevel factors, which is consistent with the socio-ecological model. The study's findings further suggest that comprehensive and effective school-based nutrition education interventions are necessary to promote healthy snack consumption behaviors of students.



### Article History

Received: 14 September 2020

Accepted: 05 December 2020


### Keywords

Chitwan District of Nepal;  
Nutrition Education;  
School children;  
Snacking Behaviors;  
Socio-Ecological Model  
(Sem).

**CONTACT** Yadu R. Upreti ✉ [yaduram2014@gmail.com](mailto:yaduram2014@gmail.com) 📍 Central Department of Education, Tribhuvan University (TU), Kathmandu, Nepal.



© 2020 The Author(s). Published by Enviro Research Publishers.

This is an  Open Access article licensed under a Creative Commons license: Attribution 4.0 International (CC-BY).

Doi: 10.12944/CRNFSJ.8.3.10

## Introduction

In collaboration with the World Food Programme (WFP), the government of Nepal is implementing a day snack service known as school feeding in the selected districts that have had low human development indices since 2009.<sup>1</sup> This programme reached over 600,000 school children at the basic school education in 2017. In the year 2020/2021, the school feeding program was launched for all children studying from early child development (ECD) to grade five. This program played a crucial role in increasing children's academic and nutritional outcomes.<sup>1, 2</sup> However, this programme has yet to expand to the higher grades nationwide. The Ministry of Health and Population (MOHP) and the Ministry of Education and Sports (MOES) jointly endorsed the National School Health and Nutrition Strategy (NSHNS) in 2006. It aimed to improve school children's health and nutritional behavior through skill-based health education and nutrition services at schools, based on Focusing Resources on Effective School Health (FRESH) approach. The FRESH approach was the merged concepts of WHO's 'Health Promoting School' and UNICEF's 'Child-Friendly School'.<sup>3</sup> Recently, the Multi-sector Nutrition Plan (MSNP)-I and II<sup>4</sup> and the National Adolescent Development and Health Strategy<sup>5</sup> have also focused on improving snacking behavior of school adolescents by promoting healthy eating behaviors through consumption of locally available foods and by restricting commercially prepared junk foods on the school premises. The focus is to improve students' nutritional status through the school health and nutrition program, addressing both the individual and structural determinants of nutritional behaviors. This strategy is streamlined with the international commitments laid out in the Sustainable Development Goals (SDGs) particularly, SDG-2, 'end hunger, achieve food security, improve nutrition, and promote sustainable agriculture' and SDG-3, 'ensure healthy lives and promote well-being for all at all ages'.<sup>6</sup>

The meaning of 'snack' varies in terms of how it is defined worldwide,<sup>7</sup> however, in Nepal, it is commonly known as a light food or drink that is eaten in between two main meals. Snacks, popularly known as *Khaja*, form an integral part of children's diet.<sup>8</sup> These snacks contribute 15-20 percent of daily energy intake, 15-20 percent of mineral intake, and 13-17 percent of vitamin intake for a child.<sup>9</sup>

There is substantial evidence that school snacks contribute substantially towards meeting the daily nutritional requirements of school children.<sup>8, 10</sup> Serving school snacks is vital to provide children with extra energy and micro-nutrients, and prevent nutritional disorders.<sup>11, 12</sup> Moreover, the provision of school snack services is considered as the most effective intervention for improving the nutritional and educational outcomes of school children, especially in developing countries.<sup>13</sup>

Despite these facts, the consumption of unhealthy day snack foods among young children in low-and-middle-income countries is high<sup>14</sup> and Nepal is not exception where consumption of unhealthy school snacks is common among young children.<sup>15, 16</sup> A growing body of literature reveals that consuming commercially processed instant foods and beverages, which are widely known as junk foods, have become common place among school children in both the urban and rural areas of Nepal.<sup>16-20</sup> A cross-sectional study conducted in Chitwan, indicates that snacking on junk foods was common among the secondary level students,<sup>21</sup> yet further evidence is needed to fill the knowledge gap on snacking behavior among the school children at the basic education level.

This study aims to provide important information to address the critical knowledge gaps related to snacking behaviors among the students attending a community school. Snacking behaviors, in this study, refers to the consumption of particular types of foods by the students during school meal time. The study used a socio-ecological model (SEM) as a theoretical framework to investigate the factors influencing students' snacking behaviors.

The SEM, which states that behavior is affected by the interaction of multifaceted influences such as intra-personal, inter-personal, and environmental,<sup>22</sup> can help to gain more insights into the factors that influence the snacking behaviors of students. SEM states that various proximal and distal influences shape human behavior within the social setting where one lives.<sup>23</sup> Proximal influences (micro and meso systems) are those closest to the individual level, such as family, friends, and co-workers. Distal influences (Exo and macro systems) are inclined to a broader societal phenomenon, including public policies. SEM consists

of four significant levels, namely, microsystem, mesosystem, exosystem, and macrosystem.<sup>23</sup> The microsystem consists of biological and predisposing factors such as age, sex, knowledge, intention, and motivation. mesosystem includes interaction among the people who are closest to the individual, such as family, peers, relatives, and teachers. The exosystem is an organizational and community level construct, including home, school, health centers, clubs, markets, and other settings. The macrosystem is a socio-cultural construct that indirectly influences the behavior of people from the top level, such as religion, ethnicity, socio-economic status (SES), public policy and regulation, and public media.<sup>22-24</sup> This study investigates the interplay between these systemson the snacking behaviors of children.

## Materials and Methods

### Study Design

The study used a cross-sectional quantitative study to investigate students' snacking behaviors to examine multifaceted factors that influence the snacking behaviors. The study was conducted in a community school located in the Chitwan district of Nepal in January 2019.

### Sampling

The school was purposively selected considering the inclusion criteria developed by the NORAD supported NORHED Rupantaran, a participatory action research project which was developed and implemented in collaboration with the three partners; Tribhuvan University (TU), Kathmandu University (KU), and the Norwegian University of Life Sciences (NMBU). The inclusion criteria guiding the selection of the primary action research school was as follows: schools having multi-ethnic groups of students including indigenous and disadvantaged groups; motivated teachers willing to engage in action research; an active and functional school management committee, parent-teacher association and child clubs; right place for school gardening, and willingness to apply human urine as fertilizer on the school garden were the criteria used to select the school to implement the project interventions. Though there were 304 basic level students according to the Education Management and Information System (EMIS) record of the school in 2018/19, only 259 volunteered to participate in the study. Thus, 259 students were the total respondents for the study.

### Data Collection Tools

This study used multiple methods to collect data and triangulate the results. A self-administered structured questionnaire, self-reported food recall diary, and the participant observation form were used to collect the data. These tools were pretested, modified and only then employed among the respondents. Questionnaires were given to each student to complete with the grade teacher's assistance and the research team. In grades 1-5, teachers and researcher(s) facilitated the questionnaire's completion, while in grades 6-8, the students completed the questionnaire themselves. For keeping the record of snack consumption, a food recall diary was distributed to each student during the classes. The food recall diary was used from Sunday to Thursday after the snack break time each day. Students were clearly instructed how to complete the food diary with the name of foods they had recently consumed during the snacks break time. They completed the diary with the name of the snacks they had consumed each day. The teachers helped fill out the form for students (especially below-grade five) who could not complete the task themselves by asking them what they had consumed each day. The first author recorded the snack items prepared and served by the school canteen using a participant observation form.

### Measures

The snacking behavior of students was the dependent variable for this study. This variable was recoded into a dichotomous nominal scale indicating 0 for 'no' and 1 for 'yes.' Age, sex, grade, father's education, mother's education, father's source of income, mother's source of income, religion, ethnicity, family type, and living arrangements of the students were the independent variables. All independent variables were recoded into a categorical scale with two or three attributes. Further, they were categorized into four levels of SEM.<sup>22, 23</sup> Sex and age represent the intrapersonal (microsystem) level; family type, parental education, and living arrangements represent the interpersonal (mesosystem) level; the grade of students represent the setting (exosystem) level with finally, religion, ethnicity, and family source of income representing the socio-cultural level (macrosystem) of SEM.

### Statistical Analyses

Collected data were entered into SPSS software version 16.0, cleaned the missing and repeated variables by matching them with the initially completed questionnaire, and then edited for statistical analysis. Univariate analyses such as means, standard deviations, and percentages were performed. Chi-square tests from bivariate analysis and binominal logistic regression from the multivariate analysis were used to analyze the results at a 5% significance level using SPSS.

### Ethical Considerations

Before recruiting the students for the study, written consent was obtained from parents. For that, we had given a consent form to each student and asked them to get it completed with their parents' signature. In the case of students who could not return their consent form from parents, the final approval was confirmed from the school administration as a proxy for parental consent. Further, informed assent was also obtained from the students. Ethical approval for the study was obtained from the Nepal Health Research Council (NHRC).

### Results

Out of the total of 259 students, based on the results obtained from food diaries in table 1, close to 90 percent of students reported that they consumed school snacks regularly during a week at the time of the survey, while more than one in ten (11.4%) skipped their regular snacks. The students consumed various items as midday school snacks. As indicated in Table 1, based on food diaries, more than half (54.3%) of the students consumed canteen-made deep-oil-fried snack foods such as Samosa, Pakauda, Jeri, Chowmin, Doughnut, Aaluchap, and Nimki. One in five students consumed junk foods such as noodles, chips, crackers, popcorn, biscuits, cookies, bakery products, and sweetened beverages like juice, soda, cola, and confectionery. They spent an average of 20 rupees daily out of their pocket money for school snacks. Sixth to eighth-graders spent more pocket money than 1-5<sup>th</sup> graders. It was also found that 14.7 percent of the students consumed homemade foods as school snacks such as rice and curry, bread and curry, beaten rice and legumes, boiled eggs, boiled potato and yam, boiled and fried whole grains, and seasonal fruits.

**Table 1: Type of Snacks Consumed by Students at the School**

Types of school snacks <sup>a</sup>	Responses		
	No.	Percent	Case percent
Homemade snack foods	172	14.7	66.4
Junk foods	231	19.7	89.2
Canteen made snack foods	636	54.3	245.6
Students who did not consume snacks	133	11.4	51.4
Total	1172	100.0	452.5

a. Multiple responses

Table 2 summarizes the socio-ecological factors concerning the consumption of midday snacks by students. Bivariate analysis shows that age, grade, father's education, and the student's religion were significantly associated with snacking behavior. Findings indicate that a significantly higher percentage of first to third graders (91.8%) consumed snacks regularly over fourth to fifth (82.6%) and sixth

to eighth graders (67.1%). Similarly, a significant percentage (80.7%) of students who were 12 years and below consumed more snacks than students age 12 years and above (67.7%). The mean age of the students was 12.1 (SD±2.2) years. Significantly, a higher percentage of students (76.1%) with parents having formal school education consumed regular school snacks compared to the students

with parents having no formal education (72.5%). (78.6%) consumed regular school snacks than their counter parts(51.3%). Similarly, significant numbers of Hindu students

**Table 2: Socio-ecological Factors and Snack Consumption**

SEM levels and variables	Categories	Regular snack consumption at school			
		Yes		No	
		N	%	N	%
<b>Microsystem</b>					
Sex	Male	91	74.6	31	25.4
	Female	102	74.5	35	25.5
Age group (In years)** Mean 12.1(Sd±2.2)	Below mean	109	80.7	26	19.3
	Above mean	84	67.7	40	32.3
<b>Mesosystem</b>					
Family type	Single	56	71.8	22	28.2
	Joint	136	75.6	44	24.4
Living arrangements	Parents	187	75.4	61	24.6
	Relatives	6	54.5	5	45.5
Father's education**	No formal education	50	72.5	19	27.5
	School education or high	143	76.1	45	23.9
Mother's education	No formal education	85	75.2	28	24.8
	School education or high	107	74.8	36	25.2
<b>Exosystem</b>					
Grade***	Lower basic level (1-3)	45	91.8	4	8.2
	Middle basic level (4-5)	38	82.6	8	17.4
	Upper basic level (6-8)	110	67.1	54	32.9
<b>Macrosystem</b>					
Father's occupation	Service and business	104	80.0	26	20.0
	Agriculture-related works and daily wage-earning	88	70.4	37	29.6
Mother's occupation	Agriculture-related works and daily wage-earning	164	77.0	49	23.0
	Service and business	29	64.4	16	35.6
Religion***	Hindu	173	78.6	47	21.4
	Non-Hindu	20	51.3	19	48.7
Caste/ethnicity group	Chhetri and Brahmin	39	79.6	10	20.4
	Other than Chhetri and Brahmin	150	72.8	56	27.2

Note: Significant at \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 3 shows the likelihood of an association between snacking behaviors and socio-ecological factors. To determine the odds ratio between these variables, binominal logistic regression analysis was performed. All significant variables in the bivariate analysis, along with other non-significant variables,

were also considered as covariates (independent variables) for logistic regression. Regression analysis shows that the students' grades and religion appear to be strong predictors for regular snack consumption after controlling other variables. Results reveal that fourth to fifth (aOR= 0.604) and

sixth to eighth graders (aOR= 0.259\*) were less likely to consume snacks than those in first to third grades. Similarly, non-Hindu (aOR= 0.373\*) students were less likely to consume regular snacks than those who were Hindu.

**Table 3: Likelihood of Regular Snack Consumption**

SEM levels and variables	Categories	Adjusted OR	95% CI	
			Lower	Upper
<b>Microsystem</b>				
Sex	Male (Ref)	1		
	Female	1.140	0.597	2.175
Age group	Below mean age (Ref)	1		
	Above mean age	0.997	0.460	2.164
<b>Mesosystem</b>				
Family type	Single (Ref)	1		
	Joint	1.080	0.554	2.106
Living arrangements	Parents (Ref)	1		
	Relatives	0.522	0.110	2.470
Father's education	No formal education (Ref)	1		
	School education or higher	1.195	0.584	2.443
Mother's education	No formal education (Ref)	1		
	School education or higher	0.557	0.271	1.145
<b>Exosystem</b>				
Grade	Lower basic level (1-3) (Ref)	1		
	Middle basic level (4-5)	0.604	0.157	2.318
	Upper basic level (6-8)	0.259*	0.074	0.910
<b>Macrosystem</b>				
Father's occupation	Service and business (Ref)	1		
	Agriculture-related works and daily wage-earning	0.591	.312	1.120
Mother's occupation	Service and business (Ref)	1		
	Agriculture-related works and daily wage-earning	1.666	0.772	3.596
Religion	Hindu (Ref)	1		
	Non-Hindu	0.373*	0.169	0.825
Caste/ Ethnicity	Chhetri and Brahmin (Ref)	1		
	Other than Chhetri and Brahmin	0.736	0.318	1.701

Note: Significant at \* $p < 0.05$

### Discussion

The main finding revealed by this study relates to the high prevalence of unhealthy snacking behaviors. Multilevel factors influence these, as the SEM describes. The findings of this study indicate that snacking behaviors among students are complex and influenced by micro (intra-personal), meso

(inter-personal), exo (organizational), and macro (socio-cultural) level factors.<sup>23, 24</sup> Though close to 90 percent of students consumed school snacks regularly except Friday as it is a half-holiday. The school snacks consumed by most of the students were unhealthy as they consumed commercially prepared junk foods bought either



from the school's tuck shop, nearby vending shops or purchased deep-oil-fried foods from the canteen. This finding is corroborated by the studies conducted in Kathmandu,<sup>16, 17</sup> Lalitpur,<sup>25</sup> Chitwan,<sup>21</sup> and Parsa<sup>26</sup> districts of Nepal. The finding is also comparable to a study conducted in the Himanchal<sup>27</sup> and the Maharashtra provinces of India<sup>28</sup> and a study conducted in China.<sup>29</sup> The junk foods are often highly processed foods that tend to be higher in added fat, sugar, and salt<sup>30, 31</sup> and often lack the useful micro-nutrients in combating micro-nutrient deficiency disorders in children.<sup>11,31</sup> During a week-long observation of the school canteen, it was observed that the same oil was being repeatedly used while preparing stakeholders for students. Surprisingly, school stake holders (school management committee, administrative body, teachers, and parents) were unaware with this situation. According to the available evidence, if the oil is repeatedly used, it produces a hydrogenated toxic acid called 'trans-fat', resulting in life-threatening diseases among school-age children.<sup>32-34</sup>

The study also reveals that fourth to eighth graders were less likely to consume school snacks on a regular basis than those in first to third grades. The reasons are yet to be explored through a qualitative study, however the food recall diary showed that upper grade students felt uncomfortable in consuming homemade snacks in front of their classmates. Another reason could be that parents were more conscious of their younger children's dietary behavior than those of older. Further, the results of this study can be compared with a cross-sectional study conducted in India, which revealed that older age students (10<sup>th</sup> graders) skipped regular breakfast intake when compared with a younger age group (8<sup>th</sup> graders).<sup>35</sup> The finding of the study is also consistent with a growing body of literature from developed countries.<sup>36-38</sup> Similarly, the present study shows that the higher the grade of students the lower the chance of consuming school snacks regularly.

Regarding parental occupation, the study reveals that the students whose fathers were involved in agriculture and other work were less likely to regularly consume school snacks than those with parents involved in a service or business. Conversely, the children whose mothers were involved in agriculture and other occupations were more likely to consume snacks regularly. This result suggests that if

fathers had a better income, they would support their children with pocket money. Thus, they could regularly consume school snacks. However, this finding does not hold with the mother's occupation. In the contrary, if mothers were involved in agriculture or other works at home, they would help their children prepare homemade lunch boxes for school snacks. Thus, their children would consume healthy snacks regularly. A cross-sectional study conducted in Sri Lanka<sup>39</sup> and Bangladesh<sup>40</sup> revealed that children's dietary behaviors were positively associated with their parent's monthly income. Though bivariate analysis significantly proves the relationship between the parental source of income (father's only) and snack consumption, logistic regression analysis does not support it. Similarly, non-Hindu students were less likely to consume regular school snacks than students belonging to the Hindu religion. Further results indicate that a higher percentage of parents from the Hindu religion were involved in service and business-related work than non-Hindu parents.

In this study, one-fourth of total students skipped their regular school snacks at the survey time. According to the findings of this study, there could be many reasons behind; however, their parent's occupational status is a significant factor. The majority of students involved in the study come from farming and animal husbandry family background, it is followed by daily wage earners like working in brick kilns. Providing the children with homemade foods or pocket money for school snacks seemed beyond the capacity to those parents involved in farming, animal husbandry, and daily wage income. Moreover, they had to leave home early in the morning for their outdoor jobs and they backed at noon. Consequently, neither their children carried snack nor with pocket money for school snacks. These results are aligned with a published document by Nepal's government, which explained that many school students in Nepal comprise ethnic and low caste groups.<sup>41</sup> They are unable to consume school snacks regularly as they represent poor socio-economic families.<sup>1</sup> This result is also comparable with a study conducted in Delhi.<sup>35</sup> Another study conducted in southern India also reveals that a higher proportion of students with lower SES from government colleges had unhealthy snacking behavior.<sup>42</sup> Similarly, a scoping review study concluded that SES significantly influences the eating behavior among adolescents. Further, it also claimed that low SES is associated with

unhealthy snacking behavior in adolescents.<sup>43</sup> It can be argued that parents' poor SES is the impeding factor for students' school snacks skipping behavior. But, the multivariate analysis could not support this claim. Similarly, Feyzabadi, Mohammadi, Omidvar, Karimi-Shahanjarini, Nedjat and Rashidian<sup>44</sup> argued that students with higher SES frequently skipped school snacks and became accustomed to eating unhealthy snacks more so than those who represent the poor or middle class. However, the socio-cultural and geopolitical conditions of Nepal and Iran are different.

It is further discussed that not a single factor influences students' snack consumption behavior; rather, multiple socio-ecological factors interact to influence as the SEM asserted.<sup>24</sup> Individual influences like students' age representing the microsystem level significantly influenced their snacking behavior. Similarly, parental education (especially father's education) representing the mesosystem also influenced students' snacking behavior. The setting level influences such as the student's grade, the school canteen, and the vending shop representing the exosystem influenced the snacking behaviors. And the socio-cultural also influenced like religion and parental occupation representing the macrosystem level influenced the snacking behaviors. Therefore, the findings of the study is aligned with the main levels of the ecological model as Bronfenbrenner<sup>23</sup> and McLeroy, Bibeau, Steckler and Glanz<sup>22</sup> explained.

The present study had a few limitations that are important to consider. Firstly, the study was conducted in a small sample of students from purposively selected only one community school. It is thus the results of the study may not represent other public and private schools. Secondly, students' snacking behaviors were assessed based on self-reported responses, which are susceptible to both recall and social desirability bias. Another limitation is dissimilarity in the data collection method between students' groups, where students below grade five received assistance to complete the questionnaire and food recall diary. In contrast, students above grade five completed the questionnaire themselves without help. Lastly, this study's statistical analyses cannot establish cause and effect relationships between predictors and their outcomes since it is a cross-sectional descriptive study.

## Conclusion

The findings of the study suggest that many students consumed school snacks regularly; however, the snacks were predominately unhealthy and were either bought from the school canteen or nearby vending shops and grocery stores. The student's age (microsystem), parental education (mesosystem), student's grade (exosystem), and religion and parental occupation (macrosystem) remained the significant drivers that influence the snacking behaviors of students. This study claims that basic school students' snacking behaviors are influenced by multifaceted factors, extending from micro (individual) to macro (socio-cultural) level as asserted by the SEM.

This study's findings highlighted the need for a multilevel school-based intervention that addresses the need for increased availability and provision of healthy snacks at schools and behavior-change focused nutrition education to promote students' healthy nutritional behaviors. Furthermore, this study's findings suggest the need for future research focusing on longitudinal analytical studies considering representative samples from both public and private schools to investigate multilevel factors, which influence the snacking behaviors of students. This study also indicates a research gap requiring more qualitative inquiry to explore the underlying causes of consuming unhealthy school snacks among the students.

## Acknowledgements

We would like to extend our heartfelt thanks to all participants of the study. And authors also wish to acknowledge anonymous reviewers for their worthy comments.

## Funding

The NORAD-funded NORHED/Rupantaran Project (QZA0483, NPL-16/0014) has provided financial support for this study, which is jointly implemented in Nepal by Tribhuvan University (TU), Kathmandu University (KU), and the Norwegian University of Life Sciences (NMBU).

## Conflict of interest

The authors declare no conflict of interest.



## References

1. Education and Human Resource Development Center, Ministry of Education, Science and Technology. A Facilitation Booklet for Day Snack Regulation and Programme in Community School. 2019. <http://www.doe.gov.np/article/920>. Accessed February 23, 2020.
2. Global Child Nutrition Foundation. Global Survey of School Meal Programs: Country Report Nepal. 2019. <https://gcnf.org/wp-content/uploads/2018/10/GCNF>. Accessed March 15, 2020.
3. Ministry of Education and Sports, and Ministry of Health and Population. National School Health and Nutrition Strategy of Nepal. 2006. <http://www.nnfsp.gov.np/PortalContent.aspx?Doctype=Resources&ID=191>. Accessed June 12, 2019.
4. National Planning Commission. Multi-sector Nutrition Plan:2018-2022. 2017. <http://nnfsp.gov.np/PublicationFiles/b8aae359-15ea-40c4-aa13-b1076efb251b.pdf>. Accessed February 10, 2019.
5. Ministry of Health and Population. National Adolescent Development and Health Strategy. 2018. <https://www.nepalindata.com/resource/national-adolescent-health-&-development-strategy/>. Accessed May 22, 2020.
6. National Planning Commission. Nepal's Sustainable Development Goals Status and Roadmap: 2016-2030.2017. <http://sdg.npc.gov.np/resource/2659/>. Accessed December 12, 2019.
7. Chaplin K., Smith A.P. Definitions and perceptions of snacking. *Curr Top Nutraceut R.* 2011;9:53-60.
8. Oogarah-Pratap B., Heerah-Boo-luck B. Children's consumption of snacks at school in Mauritius. *Nutr Food Sci.* 2005;35:15-19.
9. Summerbell C., Moody R., Shanks J., Stock M., Geissler C. Sources of energy from meals versus snacks in 220 people in four age groups. *Eur J Clin Nutr.* 1995;49:33-41.
10. Pries A.M., Ferguson E.L., Sharma N., Upadhyay A., Filteau S. Exploratory analysis of nutritional quality and metrics of snack consumption among Nepali children during the complementary feeding period. *Nutrients.* 2019;11:2962.
11. Luoh J., Yang R., Mecozzi M., *et al.* Vegetables and Nutrition for Schools in Nepal. 2017. <https://worldveg.tind.io/record/66184/>. Accessed March 10, 2019.
12. Kotecha P., Patel S.V., Baxi R., *et al.* Dietary pattern of schoolgoing adolescents in urban Baroda, India. *J Health Popul Nutr.* 2013;31:490-96.
13. Ministry of Education, UNICEF and UNESCO. Global Initiative on Out of School Children – Nepal Country Study.2016. <https://www.unicef.org/nepal/reports/all-children-school-nepal-country-study-report>. Accessed March 9, 2020.
14. Huffman S.L., Piwoz E.G., Vosti S.A., Dewey K.G. Babies, soft drinks and snacks: a concern in low-and middle-income countries? *Matern Child Nutr.* 2014;10:562-574.
15. Pries A.M., Huffman S.L., Adhikary I., *et al.* High consumption of commercial food products among children less than 24 months of age and product promotion in Kathmandu Valley, Nepal. *Matern Child Nutr.* 2016;12:22-37.
16. Sharma N., Ferguson E.L., Upadhyay A., Zehner E., Filteau S., Pries A.M. Perceptions of commercial snack food and beverages for infant and young child feeding: A mixed-methods study among caregivers in Kathmandu Valley, Nepal. *Matern Child Nutr.* 2019;15:e12711.
17. Poudel B., Tiraphat S., Hong S.A. Factors associated with junk food consumption among urban school students in Kathmandu District of Nepal. *J Public Health Dev.* 2018;16:59-72.
18. Neupane D. Junk food and food insecurity in developing countries. *Health for All.* 2014;2(1):6-8.
19. Uprety A. Junk Food Epidemic. 2012. <http://nepalitimes.com/news.php?id=2409>. Accessed March 3, 2019.
20. Subedi Y.P., Marais D., Newlands D. Where is Nepal in the nutrition transition? *Asia Pac*

- J Clin Nutr.* 2017;26:358-367.
21. Sapkota S.D., Neupane S. Junk food consumption among secondary level students, Chitwan. *J Nep Paedtr Society.* 2017;37:147-152.
  22. McLeroy K.R., Bibeau D., Steckler A., Glanz K. An ecological perspective on health promotion programs. *Health Edu Quart.* 1988;15:351-377.
  23. Bronfenbrenner U. *The Ecology of Human Development.* Harvard University Press; 1979.
  24. Sallis J.F., Owen N., Fisher E. Ecological models of health behavior. In: Glanz K., Rimer B.K., Vishwanath K., eds. *Health behavior: Theory, research, and practice.* 4<sup>th</sup> ed. John Wiley & Sons, Inc; 2008:465-486.
  25. Karki A., Shrestha A., Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health.* 2019;19:1055.
  26. Poudel P. Junk food consumption and its association with body mass index among school adolescents. *Int J Nutr Food Sci.* 2018;7:90-93.
  27. Gupta A., Kapil U., Singh G. Consumption of junk foods by school-aged children in rural Himachal Pradesh, India. *Brief Research Article. Ind J Pub Health.* 2018;62:65-67.
  28. Antony M., Bhatti R. Junk food consumption and knowledge about its ill effects among teenagers: a descriptive study. *Int J Sci Res.* 2015;4:1133-1136.
  29. Xue H., Wu Y., Wang X., Wang Y. Time trends in fast food consumption and its association with obesity among children in China. *PLoS ONE* 2016;11:1-14.
  30. Piernas C., Popkin B.M. Trends in snacking among US children. *Health Aff.* 2010;29:398-404.
  31. Ashakiran D.R., Deepthi R. Fast foods and their impact on health. *J Krishna Inst Medical Sci Univ.* 2012;1:7-15.
  32. Bauer L.R., Waldrop J. Trans fat intake in children: risks and recommendations. *Pedtr Nurs.* 2009;35:367-368.
  33. Te Morenga L., Montez J.M.. Health effects of saturated and trans-fatty acid intake in children and adolescents: Systematic review and meta-analysis. *PLoS ONE.* 2017;12:e0186672.
  34. Milan J. There's a BIG Reason to Avoid Ultra-processed Food. <https://www.cookinglight.com/news/can-ultra-processed-foods-cause-cancer>. Accessed February 20, 2020.
  35. Arora M., Nazar G.P., Gupta V.K., Perry C.L., Reddy K.S., Stigler M.H.. Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: results of a cross-sectional study. *BMC Public Health.* 2012;12:881.
  36. Pérez A., Hoelscher D.M., Brown III H.S., Kelder S.H.. Differences in food consumption and meal patterns in Texas school children by grade. *Prev Chronic Dis.* 2007;4.
  37. De Marchi E., Cavaliere A., Nayga RM., Banterle A. Incentivizing vegetable consumption in school-aged children: Evidence from a field experiment. *J Consum Aff.* 2020; 54:261-285.
  38. Niven P., Scully M., Morley B., *et al.* What factors are associated with frequent unhealthy snack-food consumption among Australian secondary-school students? *Public Health Nutr.* 2015;18:2153-2160.
  39. Rathnayaka R.K.T., Wang Z-J. Influence of family status on the dietary patterns and nutritional levels of children. *Food Nutr Sci.* 2012;3:1055.
  40. Turin T.C., Rumana N., Shahana N. Dietary pattern and food intake habit of the underprivileged children residing in the urban slums. *Iran J Pediatr.* 2007;17:227-234.
  41. Ministry of Education. 2016. School Sector Development Plan, Nepal, 2016/17-2022/23. <https://www.moe.gov.np/article/772/ssdpfinaljuly-5-2017.pdf>. Accessed March 19, 2020.
  42. Mithra P., Unnikrishnan B., Thapar R., *et al.* Snacking behavior and its determinants among college-going students in Coastal South India. *J Nutr Metab.* 2018;2018.
  43. Williamson V.G., Dilip A., Dillard J.R., Morgan-Daniel J., Lee A.M., Cardel M.I.. The influence of socioeconomic status on snacking and weight among adolescents: A scoping review.

- Nutrients*. 2020;12(1):167.
44. Feyzabadi V.Y., Mohammadi N.K., Omidvar N., Karimi-Shahanjarini A., Nedjat S., Rashidian A. Factors associated with unhealthy snacks consumption among adolescents in Iran's schools. *Int J Health Policy Manag.* 2017;6(9):519.