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# Drivers of Food Choice among Children and Caregivers in Post-earthquake Nepal

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**ABSTRACT**

Food systems in many countries are experiencing a shift from traditional foods toward processed foods high in sugar, fat and salt, but low in dietary fiber and micronutrients. There is an urgent need to better understand drivers of changing food behavior, particularly for lower-income countries. This study analyzes drivers of food choice among children and parents in rural Nepal. It uses qualitative data collected through key informant interviews and focus group discussions with school children, parents and teachers. The study reveals substantial changes in food behavior during the past decade with increased consumption of rice, meat, and highly processed snack foods while an increased consumption of fruit and vegetables is not evident. It identifies cash availability is the main driver of increased rice, meat and snack food consumption. The second driver is the 2015 Nepal earthquake, which accelerated the transition from homegrown food to purchased food as people got habituated to eating more meat and snack foods while reconstruction tripled local wages and changed the food environment. This shows how humanitarian assistance in the wake of extreme shocks can unintentionally contribute to unhealthy eating habits. An integrated school and home garden intervention appears to contribute to healthier diets.

**KEYWORDS**

Diet; food behavior; food system; healthy eating; nutrition

## Introduction

Of the world's 7.5 billion people, approximately 3 billion have low quality diets – either consuming insufficient amounts of healthy foods, consuming excessive amounts of unhealthy foods, or doing both at the same time (Global

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Panel 2016). In a global study of dietary quality trends, Imamura et al. (2015) observed that the consumption of healthy and unhealthy food items both increase with rising income levels, meaning little improvement in average dietary quality as these opposing trends cancel each other out. Increased consumption of highly processed foods, with high quantities of sugars, salts, and edible oils, has been observed for high- and low-income countries alike (Dickerson et al. 2008; Popkin, Adair, and Ng 2012). On the other hand, vegetables are one category of healthy food that tends to be under-consumed (Afshin et al. 2019; Pushpamma, Mrudula Kalpalathika, and Rajyalakshmi 1984; Willett et al. 2019) and not necessarily increasing with growth in average income (Global Panel 2016). It is not well-understood why this is the case.

This lack of understanding of drivers of food choice, particularly among the poor in low- and middle-income countries, is one of the key challenges to design effective policies and interventions addressing malnutrition (Blake et al. 2021; Popkin 2014; Ruel and Alderman 2013). It is understood that changes in food consumption patterns are complex, reflecting changes in availability and affordability but also changes in tastes, lifestyles, convenience, nutritional awareness and policies (Blake et al. 2021; Constantinides et al. 2021; Finzer et al. 2013; Kearney 2010; Traill et al. 2014; Turner et al. 2018).

Nepal has made progress in reducing malnutrition, but child malnutrition remains a significant problem with 36% of children under five years of age affected by stunting (low height for age) and 10% affected by wasting (low weight for height) (Development Initiatives 2020). Overweight in children under five is not currently a large problem with only 1% affected (*ibid.*). Yet, food systems in Nepal, as in many other countries, are experiencing a rapid 'nutrition transition' in terms of a shift toward ultra-processed foods high in sugar, fat, salt, low in fiber and low in nutrients other than energy and fat. It has been reported that children under the age of two in Kathmandu Valley are getting a quarter of their calories from unhealthy snack foods and beverages (Pries et al. 2019), which is indicative of a wider problem of unhealthy eating habits. Another study reported that only 1.1% of the adult (>15 years) population in Nepal consumes at least 400 g of fruit and vegetables a day – the amount recommended by the World Health Organization (Frank et al. 2019).

Against this background, this study's objective is to analyze drivers of food choices in a low-income setting where people are potentially affected by multiple forms of malnutrition, including under-nutrition, over-nutrition, and micronutrient deficiencies.

## Materials and methods

Data were collected in Sindhupalchok District in Nepal in December 2018. The district has a size of 2,542 $km^2$ and is located between Kathmandu and the border with China. It is a mountainous area with altitudes ranging from 850 to

7,000 meters above sea level. Most of the population lives in the lower-lying hilly areas. The district was severely affected by the Nepal earthquake of April 25, 2015 and its largest aftershock on May 12, 2015, which had its epicenter at the district border. Government data estimate that 97% of all houses in the district were destroyed and 3,500 people lost their lives (Government of Nepal 2015).

The district is a 3–4 hours drive from Nepal's capital city, Kathmandu, but is nevertheless one of the poorest in the country with 25% of the population living below the national poverty line (World Bank 2011). The district had a population of about 290,000 people in 2011 (CBS 2018). The average household size is 4.3 persons (CBS 2018). Sindhupalchok is ethnically diverse including Tamang (34%), Chhetri (18%), Newar (11%), Brahmin (10%) and other ethnicities (26%) (Neupane and Rai 2018). Tamang are the largest ethnic group in Sindhupalchok, but only make up 6% of the population in the whole of Nepal. They are generally considered a marginalized group with poor socio-economic and educational status. Nepali is used as the first language by 53% of the population with others using Tamang (33%), Newari (6%) and other languages (6%) (CBS 2018).

Crop cultivation and livestock rearing are the main livelihood activities in Sindhupalchok District (Van der Geest and Schindler 2016). Overall, about 76% of households are engaged in agriculture (World Vision International Nepal 2017). However, the land is not very fertile and 50% of the households lack irrigation facilities (World Vision International Nepal 2017), which contributes to low average crop yields. Labor migration to foreign countries is a common and reportedly growing phenomenon (Van der Geest and Schindler 2016).

Data were collected from five schools that are part of the project "Nudging children toward healthier food choices: an experiment combining school and home gardens," which tests if a school garden program can nudge children aged 8–12 years toward healthier food choices if simultaneously increasing the availability of healthy food items in children's homes through home gardens (Schreinemachers et al. 2020). The five schools were purposely selected from 15 intervention schools included in this project. Project staff had monitored progress in the school garden implementation using a standard checklist and had labeled each school as doing well, doing average, or doing below average. We used these data to select two, one, and two schools from each category, respectively. This sample of schools may not be fully representative for schools in the whole district because the project had selected non-boarding government-run schools with access to a source of water for irrigation (Schreinemachers et al. 2020). Nevertheless, the issues studied are likely to apply equally to most other communities and schools in the district.

The gardens of each of these five schools were visited and the teacher in charge of the garden was asked to describe progress and challenges regarding the school garden, followed by a formal in-depth interview with the teacher and school principal. These persons were interviewed at the same time since they worked together to establish and maintain the school garden. Following this interview, two focus group discussions were scheduled in each school (ten in total). The first focus group was held with 4–6 parents involved in the project. Next, a focus group discussion was conducted with 4–6 school children, but not necessarily the children of the parents interviewed. Parents and children were selected by the teacher based on their interest in this subject and willingness to talk. Most parents selected for the study lived near the school, which could potentially introduce bias. However, the topics discussed are equally relevant to all parents and it is therefore unlikely that the results would have been different had parents been selected randomly. The researchers visited one or two home gardens near the school after the interviews at the school and conducted informal qualitative interviews with the women managing these gardens.

Semi-structured interview guides were used for the in-depth interviews and another set of guides were used for focus group discussions held for the parents and children. The questions focused on the perceptions of healthy and unhealthy eating, observed changes in caregivers' and children's food behavior, and the observed changes induced by the school and home garden project. Table 1 shows some sample questions.

**Table 1.** Sample questions used for the interviews with schoolchildren and parents.

| Main question/topic | Probing questions |
|---|---|
| (1) In your opinion, what is a "healthy meal"? | (a) Can you describe a dish that you consider as healthy?<br>(b) What makes a meal healthy? (e.g. ingredients or method of preparation)<br>(c) Do you regularly eat such meals?<br>(d) If not, why? |
| (2) Can you also give an example of an "unhealthy meal"? | (a) What makes a meal unhealthy?<br>(b) How often do you eat such meals?<br>(c) What is the difference between a healthy meal and an unhealthy meal?<br>(d) If you know that certain foods are unhealthy, why do you eat them?<br>(e) Do you feel that you have a choice in what you eat? |
| (3) Let's talk about snacks | (a) Please write some common snacks on pieces of paper. Can you separate them in healthy and unhealthy snacks?<br>(b) Why do you separate them like this (what makes some snacks healthy and others unhealthy?)<br>(c) If you could choose any of these snacks, which one would you choose, and why?<br>(d) Would most other children in your class choose the same? Why, or why not?<br>(e) Why do you think that many children buy snacks that are not so healthy?<br>(f) If you think that unhealthy snacks are a problem, then what do you suggest can be done about it? |

The second author conducted all interviews while the third author observed and wrote down the answers in English. Each interview took about one hour. Interviews were audio recorded, but we did not produce transcripts of every interview. Consistent responses were seen across interviews and focus groups at the five schools and data saturation was achieved. Field notes and interview guides are publicly available on Harvard Dataverse (Schreinemachers 2020).

School principals and caregivers signed written consent forms to participate in the study and to agree with the interviews being audio recorded. The study was approved by the Nepal Health Research Council (NHRC) Ethical Review Board on May 30, 2018 (Reg. No. 222/2018). It was also approved by the Institutional Biosafety and Research Ethics Committee of the World Vegetable Center (Approval No. 23). Participation in the project bore minimal risk for parents and children while the benefits in terms of improved nutrition as a result of the school garden program were potentially substantial.

We reviewed the interview notes and discussed the data extensively and through this process identified a large number of drivers of food choice using an inductive approach. Not all of these factors worked at the same level and we found it useful to create a hierarchy of drivers by separating them into underlying drivers (e.g., long-term trends and shocks), intermediate drivers (e.g., food environment), and direct drivers (e.g., preferences, cash). We then mapped these drivers in a diagram and identified the causal pathways and effects. Some drivers of food choice were mentioned prominently and repeatedly by many respondents across interviews and focus groups and were therefore considered as key drivers. We used these to structure our analysis into major themes. These themes include the increased availability of cash as an economic driver of food choice, the effects of the 2015 earthquake, snack foods, and the consumption of fruit and vegetables.

## Results

### *Common meal patterns*

To understand the context of people's food choices, we first describe common meal patterns as based on the interview data collected. Meal patterns in the study area, and in Nepal generally, are different from the concepts of breakfast, lunch and dinner common in many other countries. In Nepal, the first meal of the day consists of tea (sometimes milk tea) at around 6–7am and is referred to as "breakfast" (Table 2). During school days, from Sunday to Friday noon, children eat a full meal at around 8–9am, depending on how far away the school is. This meal, referred to as "lunch," usually consists of rice, *daal* (a soup made of stewed lentils or other legumes), vegetables or sometimes pickled vegetables. The

**Table 2.** Common meal schedule among school children, Sindhupalchok District, Nepal, 2018.

| Time | School schedule | Type of meal | Examples |
|---|---|---|---|
| 6–7am | | Breakfast | Tea or milk tea, sometimes with sugar and biscuits |
| 8–9am | | Lunch | Full meal: usually rice, daal, vegetables |
| 10am | School starts | | - |
| 1–2pm | Midday break | Khaja (mid-day snack) | Some schools provide a mid-day meal called a tiffin, or sometimes children bring a tiffin box from home. Other children may buy a snack locally or eat nothing. |
| 4pm | School ends | Khaja | Some children buy snacks. |
| 7–8pm | | Dinner | Full meal: usually rice, daal, vegetables, sometimes meat and/ or pickles |

The Nepali school week runs from Sunday through Friday noon. Saturday is a holiday.

responses from children and school teachers show that children generally walked between 30 minutes and 2 hours to school. School starts at 10am and there is a midday break from 1pm till 2pm.

Two schools in our sample serve a government-sponsored midday meal for children up to grade 5, called a *tiffin*, which is between a snack and a meal in terms of portion size (for details of this program see Shrestha et al. 2020). Younger children may bring a home-prepared *tiffin* box to school. However, children in many schools receive neither of these and either buy a snack from a street vendor or shop, share their friends' *tiffin* or snack, or eat nothing. School ends at 4pm and some children buy a snack from a local shop or eat what they can find at home. The second full meal of the day, dinner, is usually served around 7–8pm and includes rice, *daal*, some vegetables and sometimes meat and/or pickles and is very similar in composition to lunch. The length of time between two full meals can therefore be up to 11 hours while physical activity levels are high. This signifies the importance of snacking for children in the study area to satisfy their hunger. Rates of child overweight or obesity are near zero.

The focus group discussions with children and parents revealed that meals eaten at home are nearly always prepared by the mother or grandmother. Only in one case did a grandfather do the cooking: his leg was fractured in the 2015 earthquake and he took over the housework and kitchen gardening as he was no longer able to work in the field. Daughters are more likely to help with food preparation than sons. Children said that they can tell their mother to cook a particular dish and she will usually try to take this into account. Parents also confirmed this. Typically, the mother or grandmother doing cooking decides the meal and the content that goes into preparing it.

During one focus group discussion, parents described that the head of the household would traditionally eat first, followed by the children, while the daughter-in-law would eat last.[1] They explained that this sequence is no longer uniformly practiced. Nowadays, children usually eat first because they have to leave for school early, while parents often arrive home late as they do paid work outside the home. Still, the woman preparing the meal would set aside food for the household head, but not for herself, which shows that the traditional meal sequence is still adhered to, although it may be more for reasons of convenience than of tradition.

### *Economic drivers of food choice*

In our analysis of drivers of food choice, we separate between underlying, intermediate, and direct drivers as shown in Figure 1. The most important drivers, discussed at length by focus group participants in nearly every interview and highlighted in the figure, are described next.

The data clearly show that the increased availability of cash is, by far, the most important driver of recent changes in food behavior. This driver is itself the result of increased demand for construction labor and remittances from family members that have migrated. Increased cash availability is a trend that preceded the 2015 earthquake, but the earthquake accelerated the process as it raised wages and stimulated out-migration.

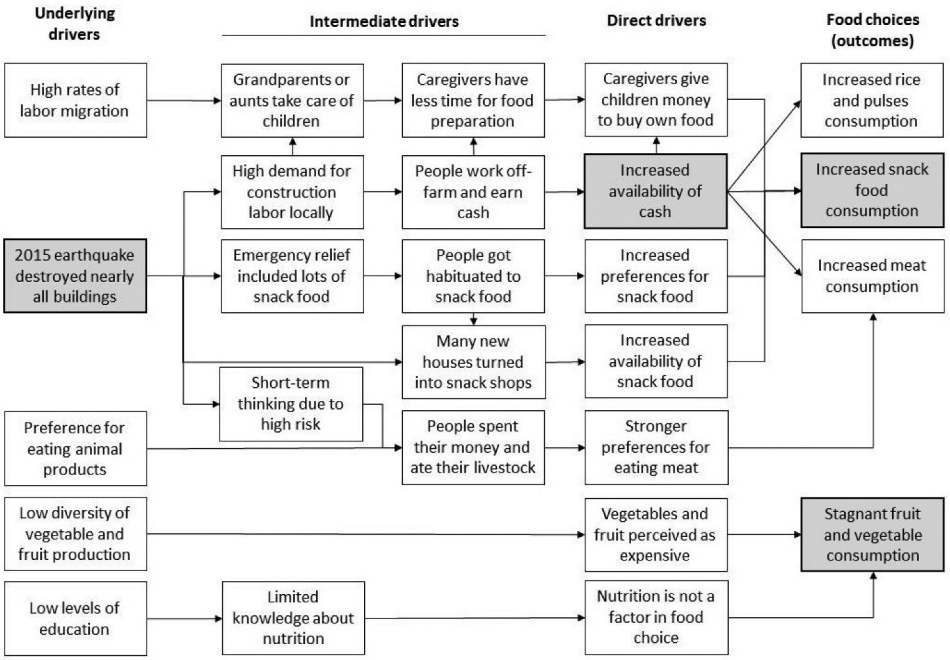


**Figure 1.** Systematized overview of the identified drivers of food choice.

The increased availability of cash provided people with better access to purchased food items. It increased the consumption of rice and pulses, thereby helping to reduce hunger. Cash also allowed people to eat meat more often. Parents indicated that they used to eat meat once or twice a month, but now eat meat more regularly (1–3 times a week). As one vice-principal explained:

> "Talking about the meat consumption, when we were kids, we used to eat meat only during festivals. We could not afford to eat it regularly. But these days, there are so many meat shops in this area and many people eat meat regularly. Everybody loves to eat meat more than vegetables. Even butchers are astonished with the rate of meat consumption". (Vice principal, KII-T-4)

The recent introduction of broiler chickens (*i.e.*, chickens bred for meat production) also contributed to the increased availability and affordability of meat. However, the most visible effect of increased cash availability is the wider availability and consumption of highly processed snack foods.

### *The 2015 earthquake as a driver of food choice*

The data from interviews with parents and teachers point to significant change in food behavior as a consequence of the 2015 earthquake. In the immediate aftermath of the earthquake, the district witnessed an acute scarcity of food and other basic needs. One of the interviewed parents indicated that her family ate a low-quality flour (usually meant for animal feeding) for a week before emergency food aid arrived. The food aid consisted mostly of instant dried foods that required minimal cooking such as flattened rice flakes (also called "beaten rice" or *chiura* in Nepali), instant noodles and packaged snacks. One school principal explained:

> "Food items stored for year-round consumption got buried and mixed up with rocks and mud. So, people could not eat the buried food (rice, grains etc.). Due to these reasons they had to rely on packaged goods." (School principal: KII-T-2)

Parents and teachers described that they solely ate such food for many months. Teachers said that people developed a taste for such snack foods, which were less common before the earthquake. As a result of this habituation, they continued to consume these items and their children also asked for these, as they liked the taste.

The earthquake and its aftermath created a sense of doom as people were not sure if they would survive the hardship as aftershocks continued for months. This experience led people to more heavily discount the future: parents and teachers described that people cared less about their health or savings, spent their money, and ate their farm animals. They described that alcohol consumption also increased, even "skyrocketed" according to some

respondents. This effect gradually weakened as reconstruction efforts started and people could see a brighter future again. However, school principals described that people had become habituated to a lifestyle of increased meat and alcohol consumption (among adults).

> "Many people died in Sindhupalchok due to the earthquake. People were therefore not sure whether they would live or die because there were many aftershocks of the earthquake. So, people started to consume meat and alcohol excessively with whatever little money they had." (Focal teacher, KII-T-2)

### *Snack food consumption*

A further effect of the earthquake on food choices relates to the reconstruction effort. When people rebuilt their homes, many allocated the ground floor to shop space for their own business or for renting out. The most common use of these shop spaces is the selling of snacks, including mostly packaged snacks of low nutritional value that need little or no preparation. This is, of course, a response to the increased demand for snacks, enabled by the increased availability of cash. It dramatically increased the availability of highly processed snack foods in the communities.

The increased consumption of highly processed snacks is the most evident sign of changing food behavior. The research team observed that every study village, however small, has several snack shops. Many of these are clustered around the school. Some are even situated inside the school premises. High snack food consumption was also evident from the large amounts of plastic wrappings that littered the school grounds and roadsides.

Table 3 shows a list of commonly available snack choices and their respective prices as collected from local vendors in one of the communities. Not all these snacks are unhealthy. Some traditional snacks such as *momo* (Tibetan-style steamed dumplings), *chatpate* (puffed rice mixed with onion, green peas, pulses and other vegetables, salt and spices), *panipuri* (deep-fried bread balls filled with onion, potato, coriander leaves, spices and diluted vinegar), *dalmoth* (mixture of fried pulses sometimes with nuts) and *chow mein* (Chinese-style stir-fried noodles with vegetables and sometimes meat) can be considered nutritious, although they contain much sodium. However, some of the highly processed snack foods such as instant noodles, biscuits, and candies have little nutritional value other than providing energy and are high in sugar, salt and fat. High sodium content is a problem with nearly all available snacks, except fruits. Bananas, oranges and apples – although commonly available at the time of the survey in local village markets and shops, were not considered as snack choices among children even though one banana costs the same as a *samosa* or bread bun.

**Table 3.** Generally available snack choices and prices, Sindhupalchok District, Nepal, 2018.

| Snack item | Price (NPR) | Price (USD) |
|---|---|---|
| Panipuri (deep-fried bread ball filled with onion, potato and diluted vinegar) (2 pieces) | 5 | 0.04 |
| Lollipop (1 piece) | 5 | 0.04 |
| Chewing gum (2 pieces) | 5 | 0.04 |
| Samosa (deep-fried dumpling with potato, onion and spices) (1 piece) | 10 | 0.09 |
| Bread bun (refined wheat flour with sugar) (1 piece) | 10 | 0.09 |
| Chatpate (puffed rice mixed with onion, peas and other vegetables and spices) (small portion) | 10 | 0.09 |
| Roti (1 piece) | 10 | 0.09 |
| Biscuits (1 package, 45 g) | 10 | 0.09 |
| Banana (1 fruit) | 10 | 0.09 |
| Instant noodles (1 package) | 20 | 0.18 |
| Cheese balls (1 bag, 50 g) | 20 | 0.18 |
| Dalmoth (mixture of fried pulses) (1 portion) | 20 | 0.18 |
| Orange (1 fruit) | 10–12 | 0.20 |
| Chow mein (Chinese-style stir-fried noodles with chopped vegetables) (1 portion) | 50 | 0.44 |
| Momo (steamed dumpling filled with meat and vegetables) (10 pieces) | 50–70 | 0.62 |

Parents said that they give their children about 10–20 rupees (about USD 0.09–0.18) two to three times a week for a midday snack, meaning that most snack choices are affordable. Some parents give a lot more with one parent saying that she gave her child 90 rupees on the day of the interview. The focus group discussions with parents and children clearly showed that children got habituated to receiving cash. One parent said that her son refused to go to school when she gave him only 10 rupees as he said that he needed 20 rupees or more. Giving cash is also convenient for parents and it makes their children happy. Parents reported that they give the same amount to sons and daughters. It was observed that younger children like to bring a homemade meal in a *tiffin* box to school while older children feel a bit embarrassed about this and prefer to buy their own snack.

Children confirmed that receiving cash is important to them. During one interview, school girls explained that pooling 10 rupees with three friends allows them to buy a larger portion of *chatpate*. When one student buys a snack, he or she shares it with friends in the expectation that they will share theirs next time. Such behavior appears to stimulate children's desire to have cash on hand to be part of the group and not be excluded.

### *Perceptions about healthy and unhealthy eating*

Parents are fully aware that their children buy snack food with the money they give. The concept of "junk food" is well understood by both children and parents. Parents in one school said that they stopped giving money to their children to prevent them from buying junk food, but the children contradicted this during their interview. The head teacher of this school had instructed parents not to give money to children, but to prepare a homemade midday

meal, yet the success varied. Some children also recognized the problem and suggested that their parents should perhaps stop giving them money. One teacher said "changing people's behavior is difficult."

Children listed their favorite snack choices during their focus groups, which generally included *panipuri, chatpate*, instant noodles, and cheese balls. Children are aware that junk food is not good for them. They associate instant noodles, in particular, with weakened bones and candies and chocolates with dental caries. These perceptions recurred in every interview with children, though such information had not been disseminated by the project. However, neither children nor parents were able to tell what substances in these junk foods cause these effects. For instance, no one mentioned sodium as a cause of potential health problems. Instead, one of the mothers, talking about potato chips, explained that:

> "Increased salt intake leads to thirst and the drinking of plenty of water, which is good for the body." (Mother, FGD-P-4)

A few of the parents mentioned the word "vitamins" but no one was able to describe the function of vitamins when prompted to elaborate.

Parents and children hold similar perceptions of unhealthy foods. They universally mentioned stale food and food with flies as examples of unhealthy food. This is understandable considering that no household has a refrigerator and staleness and flies are therefore an important source of foodborne disease. People are generally aware of this and other good hygiene practices such as hand washing with soap and the use of clean water as evidenced by this statement from a student:

> "Teachers taught us hand washing techniques and when to wash hands. We need to wash our hands before cooking and serving food, before and after eating, after playing with dirty things and after using the toilet." (Student, FGD-S-3)

Green leafy vegetables, pulses, squash, milk, cauliflower, curd and meat were mentioned as examples of healthy food by parents and children, yet the most frequent answer was "fresh food," which confirms the above observation. Some parents answered that no food is unhealthy, but excess amounts of any food is unhealthy. Parents mentioned that traditional snack foods such as *dhindo* (a thick porridge made of millet or maize), roasted maize and roasted soybean, sweet potatoes and yams are healthy and that the consumption of these used to be more common. Some respondents described that:

> "In the past, maize, soybean and wheat were roasted and consumed as snacks. Now kids don't even look at these." (Mother, FGD-P-5)

> "Types of food eaten for snacks are drastically different then and now. Then, it was very difficult for us to get money from our parents to buy snacks. We used to eat milk and dhindo for lunch. For snacks, we usually ate milk, yogurt, roasted maize and soybean, roti, etc." (School principal, KII-T-4)

### *Constraints to fruit and vegetable consumption*

At the time of data collection in December, it was observed that fruits (bananas, apples and oranges) are available in local shops, as are vegetables (broadleaf mustard, chayote, radish, cabbage, cauliflower). However, people do not regularly purchase these items as they find them expensive. The main types of vegetables consumed are broadleaf mustard and radish, which are grown by nearly every household in a kitchen garden. Less common are cabbage and cauliflower. Hence, the diversity of vegetables consumed is low.

Parents explained that in earlier times, people would bring fresh fruits or vegetables from their garden when visiting someone else's home. Yet, nowadays, people bring soft drinks for the adults and chocolate for the children. This may be indicative for a change in preferences for purchased foods over traditional or homegrown foods. Another example of this, as described by a teacher, is the reduced use of fermented vegetables – called *gundruk* in Nepali and made of sun-dried mustard, cauliflower or radish leaves, which is considered "a poor man's diet." Parents and teachers also confirmed that when people have money, they prefer to spend it on meat rather than fruit or vegetables. In the words of one school principal:

> "If family members visit from Kathmandu, they no longer bring apples, bananas, grapes, pomegranates, or sweet oranges with them, but they bring cheese balls or buy Coke, Fanta, biscuits, and noodles from nearby shops." (School principal, KII-T-1)

### *Effect of an integrated school and home garden intervention*

School gardens had been established around August in all five schools as part of the project activities. All schools had been provided with seed of ten vegetables for the winter season: broadleaf mustard, broccoli, carrot, cauliflower, coriander, fenugreek, garden peas, spinach, radish, and turnip. Schools had also received money from the project to build a plastic tunnel, buy a water tank, fencing materials, and fertilizer and hire labor for land preparation as required. The intervention builds on an earlier pilot of school gardens in Nepal by the same research team (Bhattarai, Subedi, and Schreinemachers 2016; Schreinemachers et al. 2017). Children from grades 4 and 5 were trained on gardening and nutrition using a 23-week curriculum that was often taught in the school garden. For a randomly selected group of 30 children, their parents were trained on gardening and nutrition by an outside expert. The parents

were provided with seeds of the same vegetables as used in the school garden and natural fertilizer. Each school had a focal teacher who was in charge of the school garden and who would visit the parents to provide advice on their home gardens.

School teachers, parents and children were enthusiastic about the school garden and three of the five gardens were productive, while one garden was planted too late and another suffered from slow growth due to a shaded location. The performance of parents' home gardens also varied, but parents were generally enthusiastic about them. The main benefit they described was the increased diversity of vegetables as they had not previously tried to grow carrots, cauliflower, fenugreek, garden peas, spinach, and turnips. They were excited to try other new vegetables next season. They also noted that the varieties of broadleaf mustard, radish and cauliflower supplied by the project performed much better than the ones they used to grow. However, many households had difficulties growing spinach and broccoli. Nearly all parents interviewed thought that the project helped to increase their household vegetable consumption.

Another benefit identified by teachers and parents was the better collaboration between school and parents. Parents felt honored that a teacher would visit their home and inspect their home garden while teachers were proud that the school garden, and sometimes their personal home garden, was a model for parents to copy. As one focal teacher explained:

> "One of the parents told that I went to monitor other peoples' kitchen gardens, and asked why I didn't come to hers for inspection" (Focal teacher, KII-T-3)

One of the five schools was preparing two additional school gardens for children in higher grades as they were convinced that gardens were useful.

Children explained that they enjoyed eating a greater diversity of vegetables such as carrot, cauliflower and garden peas, which they did not regularly eat before. They enjoyed sharing their knowledge with their parents and would occasionally help in the home garden doing small things like watering, weeding or harvesting. The results therefore show that positive changes in attitudes toward vegetable consumption were achieved in a relatively brief period of less than four months since the start of the project. These positive results were also confirmed by the project's randomized controlled trial, which showed an 15–26% increase in children's mean vegetable consumption measured as the proportion of meals that included vegetables (Schreinemachers et al. 2020).

Several of the school teachers indeed voiced concern about the sustainability of school gardens as they knew that the project would last only one year. Sustaining the garden requires a small amount of money to buy seeds and hire

labor and it consumes the time of a teacher. Some schools were looking for solutions. Two schools planned to sell vegetables from the school garden to raise funds; while one other school tried to mobilize the support of parents.

> "In this project, we are just involving kids from grades 4 and 5 and their parents. But we have students up to grade 12. So, if we can involve all the students and their parents and ask for a little contribution from each parent like 5 to 50 NPR or some seeds, this program will reach every household, which will make this program sustainable." (School principal, KII-T-4)

## Discussion

### *Drivers of food choice*

Findings from this study provide important insights into the drivers of food choice among children and caregivers in the mid-hills of Nepal three and a half years after the 2015 Nepal earthquake. It shows that the provision of even small amounts of pocket money appears to increase consumption of "junk food," while sending food from home or consuming foods prepared at school contributed to healthier food choices. The dominance of highly processed snack food consumption confirms earlier studies in Nepal (Pries et al. 2016, Pries et al. 2019). Pries et al. (2019) found that high consumption of snack food among children under 2 years of age is associated with inadequate intake of micronutrients and poor linear growth. Our study complements this knowledge by showing how the 2015 earthquake and the humanitarian response to it accelerated the shift toward increased consumption of unhealthy snack foods through the increase in shops selling snack food, the increase in available cash providing people with access to snack food, and the unintended promotion of highly processed snack foods as part of emergency aid.

The long-term effect of the 2015 Nepal earthquake on food behavior was not something we had anticipated in the research but is one of the most revealing findings of our study. Thorne-Lyman et al. (2018) compared nutritional outcomes for women and children before and after the earthquake and found that most outcomes were stable or even improved compared with their pre-earthquake situation. However, that study did not look into the consumption of unhealthy snacks and beverages. It does not necessarily contradict our finding as our data also show increased consumption of rice, pulses and meat as driven by higher cash incomes. Nonetheless, our study shows how external shocks such as an earthquake and the subsequent humanitarian assistance, while well-intentioned and incredibly important to save lives, can bring about unintended consequences in promoting long-term changes in food behavior toward increased consumption of unhealthy food. A more nutrition-sensitive approach to post-disaster recovery is urgently needed.

The positive association between the presence of snack food shops surrounding schools and student's increased snack food consumption confirms the findings of Seliske et al. (2013), who studied this quantitatively for a sample of 158 schools in Canada. Soltero et al. (2017) also highlighted the importance of the food environment surrounding schools for a study in Mexico. Our results show that access to more cash (economic drivers) increases the consumption of healthy food items (meat, rice, pulses), but also of unhealthy ones (snacks, alcohol). This is in line with Imamura et al. (2015) who observed these opposing trends and used it to explain why average dietary quality does not improve when incomes rise. The result that household cash income is not associated with increased vegetable consumption among children confirms various other studies that have pointed at the overriding importance of non-economic factors such exposure, preferences, knowledge, parental behavior and the availability of vegetables in children's homes (Blanchette and Brug 2006; Cooke et al. 2004; Estay et al. 2019; Haß and Hartmann 2018; Snuggs, Houston-Price, and Harvey 2019). Our study also shows that people associate fermented vegetables (*gundruk*) with being poor and associate packaged snack foods and soda drinks with being rich. Such perceptions stimulate unhealthy food choices.

### *Theoretical considerations*

The findings of our study confirm several aspects of theoretical models of food choice as described in Eertmans, Baeyens, and Van den Bergh (2001) and more recently in Chen and Antonelli (2020). First of all, the 2015 Earthquake led to widespread exposure of children and adults to packaged snack foods and confirms the theoretical understanding that increased exposure stimulates liking and can lead to a dramatic increase in the intake of a particular food item. Our findings also confirm these theoretical models with regard to the importance of the social and physical food environment (Chen and Antonelli 2020): children, especially older children, perceive positive social stimuli from their peers from eating snack foods at school; and consumption is further stimulated by snack foods being readily available and accessible in children's physical environment.

The models of Eertmans, Baeyens, and Van den Bergh (2001) and Chen and Antonelli (2020) do not prominently feature the effect of economic drivers on food choice, perhaps because they do not focus on low-income countries. However, our study clearly shows that the availability of cash is the most important driver of changes in food behavior. It is noted, however, that models of the food environment do give much prominence to economic factors such as prices and affordability (e.g., Turner et al. 2020).

Finally, our finding that the combination of home and school gardens appeared effective in stimulating vegetable consumption confirms the observation of Eertmans, Baeyens, and Van den Bergh (2001) that interventions

aimed at altering eating behavior should not just target the individual, but the family as a whole. Such interventions also build on the theoretical understanding that nutritional knowledge is an important driver of food intake, particularly for fruit and vegetables (Chen and Antonelli 2020).

### *Promoting healthy food choices*

Much additional work will be needed to identify effective strategies that mediate the effect of income on unhealthy food consumption while stimulating the consumption of healthy food items such as fruit and vegetables. The study indicates that school garden and home garden interventions may be part of such strategies as they foster more diverse diets among children and their families. This confirms the findings of a review of interventions to increase fruit and vegetable consumption among 6–12-year-old children, which concluded that multi-component school-based interventions, combining classroom teaching, parents and food service components, show the greatest promise for promoting fruit and vegetable consumption (Blanchette and Brug 2006).

School meals provision will be a key aspect of such school-based strategy. School meals were not a focus of our study, but our data do show the importance of serving a midday meal to children in the mid-hills of Nepal as the current provision of two full meals a day – in the morning and in the evening – appears highly inadequate considering physical activity levels as children walk to school for long distances in hilly terrain. Evidence confirms the importance of such midday meals in contributing to better academic performance, school attendance, and nutrition outcomes in rural Nepal (Shrestha et al. 2019, 2020) and this is confirmed by many other studies globally (Bundy et al. 2009; Kristjansson et al. 2016, Global; Panel 2015).

### *Study limitations*

Our study has a number of limitations that are important to keep in mind. First, the study relied on data collected in five schools of one district of Nepal, which is a small sample. Although we should be careful not to generalize these findings, we do expect that the results reflect issues that are common across rural Nepal (and elsewhere).

Second, we could have applied more rigor in the data analysis by producing transcripts and using software-assisted qualitative content analysis. We chose not to do this because the data collected in the five schools showed much similarity and drivers of food choice and major themes appeared strongly from them. As such, we don't expect that software-assisted analysis would have yielded additional insight into the data.

Third, we could have used an existing conceptual framework about food choice to guide our research, for instance, such as developed by Eertmans, Baeyens, and Van den Bergh (2001) and Chen and Antonelli (2020), which separates been food-, individual- and socio-cultural-related factors; or a more holistic food systems framework such as developed by Raza et al. (2020) and Fanzo et al. (2020), which also includes food supply chains alongside external drivers such as policies and climate change. Doing this would have created a deductive approach in which we would have tested an existing theory, whereas the present paper is inductive.

## Conclusion

Using qualitative data from rural Nepal, this study shows that the increased household availability of cash is a key driver of changes in food behavior, including increased consumption of rice, pulses and meat, but also increased consumption of unhealthy snacks, particularly among children. The 2015 Nepal earthquake accelerated this nutrition transition through the increase in shops selling snack food, the increase in available cash, and the provision of snack foods as part of emergency aid. Efforts are needed to promote the consumption of healthy food items, particularly fruit and vegetables, including in post-disaster humanitarian assistance.

Our results suggest various entry points relevant for the mid-hills of Nepal and potentially elsewhere: First, the provision of midday meals is important to satisfy the energy needs of school children and reduce their dependence on snack foods to satisfy their hunger. Second, increasing people's knowledge of nutrition and nutrient-rich food is important to give people the ability to make a more conscious decision about food to balance other factors such as taste, availability and affordability. Third, the availability of a diverse range of fruits and vegetables at affordable prices is important as people considered these items as expensive. School and home garden programs simultaneously increase people's knowledge and the local supply of a diverse range of vegetables and fit it people's local food culture and agricultural system while schools appear a suitable platform for initiating behavior change.

## Note

1. Nepal has a patrimonial society where women join the family of the husband after marriage. Wedding dowry is paid by the bride's family to the groom's family.

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