

LIKE MOTHER, LIKE CHILD?: UNDERSTANDING TRANSITIONS IN DIET, HEALTH, AND NUTRITION IN HUMLA, NEPAL

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Background

Humla is a remote, mountainous district in the far northwest corner of Nepal. For centuries, Humla District had been an epicenter of trade, with routes for goods such as silk, wool, salt, and grain passing over and around this Himalayan region (Fürer-Heimendorf 1975). Despite Humla's historical prominence in regional trade, people of Humla (or Humlis) today have limited contact with the outside world. No roads connect Humla District to the rest of Nepal, and for this reason, it remains one of the most isolated regions of the country (Levine 1989; Haddix McKay 2002; Adhikari 2008; Sanders 2013).

Given the extent of Humla's isolation and its high elevation (3,000–4,000 meters), the ethnic-Tibetans that live in the upper portion of Humla have primarily consumed a traditional diet consisting of barley, wheat, buckwheat, daikon radish, potato, local dairy products (such as milk, yogurt and butter tea) and various forageable herbs. This diet is nutrient dense, high in both micronutrients and fiber, and low in sugar. But the traditional diet is very low in protein, specifically animal protein, as ethnic-Tibetans, being Buddhist, do not kill animals for consumption purposes, even if their food security depends on it.

Since only one percent of the land in Humla is arable, food security has been a major challenge for the local population. In the past, Humlis supplemented their agricultural yields with additional food items procured from the mid-Hill regions of Nepal (such as rice and legumes). Humlis were able to trade Tibetan salt for these items, until restrictions were imposed by the Chinese following the occupation of Tibet in the 1950s.

In 1999 however, the construction of a dirt road connecting Humla to a market in Taklakot (Purang), China began (see Figure 1). This road provided Humlis with an additional food source, and has, since then, played

a major role in the regional food accessibility.¹ In our interviews with the local people, the importance of this new road was palpable. For example, when commenting on the decrease in the uncertainty of food supply, a 32-year-old Humli woman stated that “there is no worry or anxiety these days, because we get everything from Taklakot.” During our field work, the general understanding that Humlis now have easier access to an alternate food source became seemingly obvious. Another 42-year-old male Humla resident underscored the importance of being able to procure food from across the border as he remarked, “Our fields only produce enough for one month! But because of Taklakot, we don’t have any worry.”

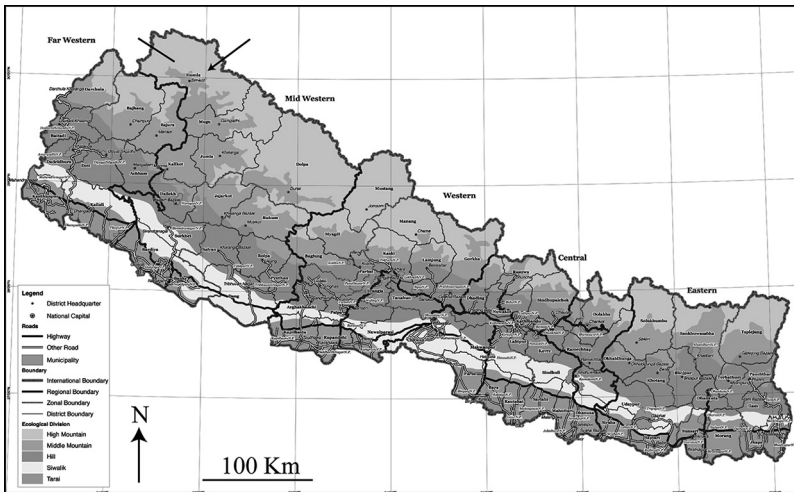


Figure 1: Nepal and Humla: Located in Nepal’s Himal region, Humla is the farthest northwest district in the country (see the black arrow). The black line represents the location of the first road to be built into Humla. The road begins in China and ends 45 km inland in Nepal. This map also shows the location of Simikot, the capital of Humla, where villagers also have the option of purchasing household and food items. Figure source: <http://un.org.np/maps/nepal-administrative-boundaries>

¹ The World Food Program initially oversaw the construction of this road in upper Humla District. It began as a “food for work” program, where workers were paid in white rice for their labor. Since white rice is not a traditional Tibetan food, this led to new diet habits and preferences. This program also had numerous negative livelihood repercussions when it ended a few years later, as many villagers had moved away from cultivating their own fields, and had become reliant on rice as a source of “income.”

Our research demonstrates that although the availability and accessibility of food has increased significantly in Humla, the overall nutrient density in diet has decreased. This is primarily because the foods available in the market are mostly enriched, processed foods such as white flour and ramen noodles, and those high in sugar such as candy, soda pop and fruit juice (see Table 1).

Table 1: Commonly Consumed Foods in Upper Humla

Locally Produced	Traded For	Market Purchased (China)
Wheat flour	Chili peppers	White flour (refined)
Barley flour	Millet	Wheat flour (refined)
Buckwheat flour	Lentils	White rice
Potato	Kidney beans	Oil, Canola (refined)
Daikon radish	Red rice	Eggs
Leafy greens*	Apples	Powdered milk
Garlic*	Apricots	Spices (masala, turmeric)
Tomato*		Salt (iodized)
Pumpkin*		Salt (Tibetan)
Onion*		Hard candy
Yak milk		Chocolate
Yak yogurt		Coca-Cola, other soft drinks
Yak butter		Black tea
Oil (mustard)		Alcohol (liquor)
		Alcohol (beer)
		Fruit juice

* *Villagers that have greenhouses are able to grow these foods.*

So while the locals feel reassured by the increased access to these new food items, the sociocultural determinants behind why certain segments of the population are quick to change their diets remains largely unexamined. Interestingly, there are glimmers in this population, especially among women, of awareness that the new foods are inferior to their traditional diets.

In this paper we describe this and other ethnographic complexities of these changing food habits, taking advantage of the opportunity to study these dietary shifts as they are in the process of occurring. We also seek to describe the factors that play a role in adult decision-making regarding food consumption. In particular, we are interested in understanding how

that decision-making then translates into changing enculturation patterns relating to children's food intake. At the same time, this study also transcends Humla and hopes to use it as an analytical framework to contribute to the debates on sea changes taking place in dietary habits worldwide today. In the context of Humla, our chief aim is to assess whether the developing taste for market-purchased "modern" foods amongst the children is linked to a heightened risk for diet-related non-communicable diseases (DR-NCDs).

The New Road and the Nutrition Transition

The nutrition transition and its ramification on global health is a widely studied topic. Scholars have noticed a growing worldwide shift in diet, away from complex carbohydrates and fiber (derived primarily from local grains and other plant-sourced foods), to one in which most of the caloric value come from refined low-fiber grains, artificial sweeteners, and heavily processed fats, such as vegetable oils (Popkin 1994, 2001; Drewnowski and Popkin 1997). These dietary shifts are widely held responsible for increasing rates of DR-NCDs such as cardiovascular disease, insulin-resistant diabetes, and cancers (Bonow and Eckel 2003; Jahns *et al.* 2003; Popkin 2006). The scale and pace at which DR-NCDs are proliferating in underdeveloped countries is quite alarming.² In Jordan, for example, Madanat, Troutman and Al-Madi (2008) discuss how dietary changes have included a general rise in caloric intake (from an average of 2,165 daily kilo calories [Kcals] in 1965 to an average of 3,161 daily Kcals in 1997) with an increasing percentage of energy supply coming from fats and cereals, especially for uneducated women. This dietary pattern change is an example of one instance where a population is moving from Pattern 3 to Pattern 4 in the nutrition transition (see to Table 2).

The nutrition transition illustrates that certain dietary shifts impact nutritional status, which lead to changing morbidity determinants. A dietary shift from Pattern 3 to Pattern 4, for example, will result in high rates of morbidity from chronic diseases, as a consequence of changes in nutritional status that include higher rates of obesity and other disabling conditions.

² See Madanat, Troutman and Al-Madi (2008) for Jordan; Aounallah-Skhiri *et al.* (2011) for Northern Africa; Riosmena *et al.* (2012) for Mexico.

Table 2: Population Characteristics of the Five Nutrition transition Patterns³

	Pattern 1 Collecting Food	Pattern 2 Famine	Pattern 3 Receding Famine	Pattern 4 Degenerative Disease	Pattern 5 Behavioral Change
Diet	Plants, low-fat wild animals, varied diet	Cereals predominant, diet less varied	Fewer starchy staples, more fruit, vegetables, animal protein, low variety continues	More fat, sugar, processed foods, less fiber	Higher-quality fats, reduced refined carbohydrates, more whole grains, fruit, vegetables
Nutritional Status	Robust, lean population, few nutritional deficiencies	Children and women suffer most from low-fat intake, nutritional deficiency diseases emerge, stature declines	Continued maternal and child health nutrition problems, many deficiencies disappear, weaning diseases emerge, stature grows	Obesity, problems for elderly (bone health, etc.), many disabling conditions	Reduction in body fat and obesity, improvement in bone health
Morbidity	High level of infectious disease, no epidemics	Epidemics, endemic disease (plague, smallpox, polio, tuberculosis), deficiency disease begins, starving common	Tuberculosis, smallpox infection, parasitic disease, polio, weaning diseases (diarrhea, retarded growth) expand, later decline	Rise in chronic disease related to diet and pollution (heart disease, cancer), decline in infectious disease	Increases in health promotion (preventive and therapeutic), rapid decline in cardiovascular disease, slower change in age-specific cancer profile

³ Barry Popkin, a seminal scholar of the nutrition transition, was the first to present and explain this model (1993: 140). This table illustrates a segment of the original table: the “Diet,” “Nutritional Status,” and “Morbidity” profile sections.

Although diet related chronic disease data is lacking in Humla District, there are clear associations between poor diet and numerous health indicators, for example, malnutrition. Malnutrition is an issue that continues to plague children in Nepal. For example, according to the 2014 Nepal Multiple Indicator Cluster Survey, 37 percent of children under five years of age in Nepal are stunted (too short for age), 30 percent are underweight (low weight for age), and 11 percent are wasted (low weight for height) [CBS and UNICEF 2014]. These rates are similar in the mid-West region of Nepal, though this region has a much higher percentage of children under five stunted than the national average (50 percent are stunted, 37 percent are underweight, and 11 percent are wasted) [MoHP, New ERA and ICF 2011].

The Nepali state, with the help of several international organizations, has piloted various projects to address this issue.⁴ However, simply supplying adequate amounts of food is not sufficient to solve these issues as a child's growth and development depends equally on access to nutrient dense food. In that respect, understanding the dietary behavioral shift amongst children in the wake of better access to processed foods in Humla, and cataloguing that vis-à-vis the dietary preferences of the adults around them, is critical in solving the issues of malnutrition in Nepal. Equally important, many non-communicable diseases responsible for a large number of deaths globally,⁵ are preventable by modifying unhealthy diets. A better understanding of these changing dietary patterns in Humla might offer solutions on how best to curb the risk of DR-NCDs in this region, thus increasing overall life expectancy and quality of life.

This research is timely for three primary reasons: 1) As rural road construction in Nepal increases, it is important to understand the dietary consequences of that infrastructural change; 2) By studying the relationship between child nutrition and vulnerability to DR-NCDs in adults (Gluckman, Handon and Buklijas 2010), important policy interventions might help this population circumvent Pattern 4 of the nutrition transition and its associated morbidity causes; and 3) Since the data on NCDs remains incomplete in Nepal due to the absence of evidence-based research (Bhandari *et al.*

⁴ Multi-sector Nutrition Plan (2013–2017), the World Bank's Sunaula Hazar Din Project (2012–2017), and the U.S. Government's Feed The Future program in Nepal are working towards reducing maternal and child under-nutrition.

⁵ In 2012, NCDs caused 68 percent of all deaths (38 million) up from 60 percent in 2000 (WHO 2016b).

2014), a micro-level study might add new perspective on this topic of global significance.

Methods

To assess how the first road in Humla District is affecting the food consumption pattern of villagers, we designed this research as a case-control observational study. Ten months of ethnographic fieldwork was conducted in two villages in upper Humla, one that lies directly on the new road (Gyepo, the case village), and one that lies on the other side of three 13,000-foot mountain passes, and, therefore does not have direct road access (Kale, the control village).⁶ Aside from the proximity, or lack thereof, to the road, these villages are otherwise very similar. They lie at roughly 12,000 feet, grow similar crops, are the only two villages in upper Humla with one harvest season per year, and their inhabitants are Buddhist and ethnically Tibetan.

Gyepo has 36 households and Kale has 31 households. This case-control design allows us to test the central question of this research, namely, how “proximity to the road” impacts consumption behavior? The results presented here are part of a larger study on the macro- and micro-nutrient composition of diets and the nutritional habits of the population in the region (Grocke 2016). We must hasten to add that our findings on the impact of the road on local lives in this paper is equally informed by over two decades of ethnographic research in the region.

To obtain a detailed understanding of food consumption patterns across the study population, we administered a food frequency questionnaire (FFQ) with the person responsible for cooking the majority of the meals in each household in both villages twice, once per season.⁷ The FFQ is the most common dietary assessment tool used in population epidemiologic studies

⁶ Throughout this paper, we use pseudonyms for the village names out of respect for villagers’ confidentiality.

⁷ In most instances, the person responsible for cooking the majority of the meals in the household was a female, though there were some instances when we conducted the FFQ with a male. In Gyepo we were not able to obtain FFQs from five households; these families often left the village for months at a time to run a business near the Chinese border. In Kale we were not able to obtain FFQs from two households; in one case the woman of the house was ill, and in the other, no one from the household felt comfortable answering our questions (see Table 3 for number of FFQs obtained per village, by both season and gender).

of diet and health (Zhuang *et al.* 2012). According to Zhuang *et al.* (2012), the FFQ is the most practical and efficient method for assessing long-term dietary intakes because of its ease in administration, low cost, and ability to rank individuals according to dietary intakes. Because this dietary assessment method had never been carried out in Humla District prior to this research, however, a culturally valid FFQ that fully captured all of the local food options available to the villagers did not exist. To combat this problem, we designed a region-specific FFQ for upper Humla District based on previous ethnographic accounts of the region (Fürer-Haimendorf 1975; Bishop 1990; Haddix 1999; Sharma 2010; Citrin 2013) as well as our first-hand knowledge of Humli food consumption patterns. This custom FFQ includes a list of all the locally grown, traded, and market purchased foods that a person living in either of the two field site villages has access to (the list contains 105 food and drink items).



Photo 1: Gyepo Village (case village). This village is located approximately 30 kilometers from the Nepal/China border. Although the dirt road comes directly through this village, it is only usable during the months of July-November due to the harsh climate and heavy snowfall.



Photo 2: Kale Village (control village). It takes two days to walk from this village to the new road. The path connecting Kale to the road is also very steep, and therefore, is only traversable under favorable weather.

Data from the FFQs were cataloged and analyzed using the Food Processor Nutrition and Fitness Software, a product designed by ESHA Research. Although this software contains nutrient composition data for over 72,000 foods items, a few foods consumed in upper Humla were not included. To address this problem, we first brought the missing items (yak butter, yak fat, yak cheese, and local barley flour) to the nutrition lab at the government of Nepal's Department of Food Technology and Quality for analysis. Once we had the nutritional composition of these aforementioned foods, we added them to the public ESHA database.

Although the primary goal of administering the FFQ was to obtain insight into the micro- and macro-nutrient consumption of adult villagers, during the process of gathering data numerous anecdotes of what children in the village are eating emerged. Local people shared our concerns about these diet shifts. Our data show some important nutrient deficits, and we suggest some culturally appropriate solutions to this important problem. In addition

to drawing on data compiled from the FFQs, this paper draws on participant observation findings, interviews with adults in the villages, and focus groups organized specifically to develop a better understanding of the environmental and socio-economic determinants of dietary pattern change. The following table provides a list of the methods used, as well as a demographic summary, of the individuals included in this research:

Table 3: Summary of Methods Used and Demographic Profile of Villagers Included in Research

	Gyepo				Kale			
	Fall		Spring		Fall		Spring	
Food frequency questionnaire (FFQ)	Female 20	Male 11	Female 24	Male 7	Female 17	Male 12	Female 19	Male 10
Semi-structured interview	15		16		17		19	
Focus groups	Topic: “Child Feeding Practices” (conducted w/5 females); Topic: “Variance in Diet Between Villagers” (conducted w/3 females); Topic “How the Road is Impacting Agriculture” (conducted w/4 males)				Topic: “Child Feeding Practices” (conducted w/4 females); Topic: “Dietary Limitations at Yak Camp” (conducted w/3 males); Topic “What Are ‘Tasty’ Foods” (conducted twice, once w/3 males and once w/5 females)			

This research received Institutional Review Board approval from the University of Montana in Missoula, Montana on 1 May 2014, (IRB #217-13), in addition to approval from the Nepal Health Research Council.

Results

Villagers view the market access provided by the road as having a positive effect in the ease of calorie acquisition and consumption. This is especially helpful since, according to interview data, agricultural yields in both study villages only last an average of five months.⁸ Although trading for food

⁸ Households that can stretch their yields upwards of five months tend to rely on local foods that are easily stored such as various types of flour (bitter buckwheat, wheat, and barley), dried daikon radish (asure), and nettle (which is typically eaten in soups and/or in dumplings [momo]). However, even though food security may

as a mechanism to supplement agricultural yields occurs far less today as compared to the past, locals from upper Humla continue to acquire foods via trade they conduct with villagers that live at lower elevation (i.e., southern Humla District and/or Mugu District). The most valued upper Humla food in terms of trade is bitter buckwheat, as its savory flavor is unique to the area.⁹

Although the new road is increasing villagers' food security, our data suggest that the arrival of the road is co-synchronous with nutritional status complexity, as illustrated by the fact that dietary pattern change is not homogenous either between or within villages. We also found a handful of other factors beside proximity to road that play a significant role in the nutrient density of local diets. These factors included village topography, the ability to grow mustard seed, socioeconomic status, and gender. By studying these determinants, we seek to better understand the reasons behind the decrease in the quality of children's diets.

Environmental and Socio-Economic Determinants of Dietary Patterns

Village Topography and Access to Animal Protein

Kale and Gyepo village are very similar in terms of their growing seasons, elevations, and ethnic composition. However, their environments are extremely different (see Photo 1 and 2). The flat topography of Gyepo makes cultivation and harvest, including collection of firewood, less labor intensive. In terms of caloric expenditure, less energy is spent in Gyepo for the same tasks (everything else being the same) compared to Kale where the steeper landscape takes a heavy toll on the body and requires more caloric energy.

The flat topography of Gyepo also results in villagers not having to take their cattle far from home to graze.¹⁰ This keeps the men, who would typically travel with the cattle, at home, providing a steady source of animal

be achieved for a longer period of time, diet diversity when solely relying on local harvest is very low.

⁹ According to interviews, Kale village is able to grow the best tasting bitter buckwheat in the area. Numerous villagers indicated that having this tasty crop provides them with an advantage in terms of trade.

¹⁰ It is important to note that even though Gyepo village is flat, young men from the village do always have to take animal herds to a "camp," when grazing in the village is limited due to snow. However, the length of time that animals can graze in and around the village is much longer in Gyepo than in Kale due to its flat topography.

protein (in the form of dairy) during the fall months. This was not the case in Kale and was revealed in our FFQ data. While 68 percent of households in Gyepo reported consuming dairy products on a daily basis in the fall, it was exactly the half that number in Kale. Interestingly, spring data were nearly identical for both villages with 27 percent in Gyepo and 24 percent in Kale. When men and cattle return from the yak camps, all family members have equal access to dairy-derived protein. Additionally, since it is typically the men that are away with the animals, having them closer to home ensures that both the women and children have access to their share of animal protein.

The Ability to Grow Mustard and Access to Omega-3 Fatty Acids

A primary source of fat in villagers' diet is oil. Traditionally, the type of oil consumed in upper Humla was mustard oil, which is pressed from the locally grown mustard seed. Although villagers in both Gyepo and Kale village do grow mustard, it is widely known amongst the villagers in upper Humla that the environment in Gyepo lends itself very well to growing this crop. In comparison to villagers from Kale, who now largely supplement their oil production with processed oils (such as corn and soy) from the market in China, villagers in Gyepo often cook their food with mustard oil, which provides them with numerous nutritional benefits.

In addition to helping reduce low-density lipoprotein (LDL) or "bad cholesterol" levels, studies have also revealed that pressed mustard oil consumption can help lower the risk of cardiovascular diseases (Singh *et al.* 1997; Rastogi *et al.* 2004). Its nutritional benefits stem largely from the fact that mustard oil is rich in both monosaturated and polyunsaturated fats, and is also a good source of alpha-linolenic acid (an omega-3 fatty acid).

The human body is capable of producing all of the fatty acids it needs aside from two: linolenic acid, an omega-6 fatty acid, which is pro-inflammatory, and alpha-linolenic acid, an omega-3 fatty acid, which is anti-inflammatory (Simopoulos 2008). Since the human body cannot produce these polyunsaturated fatty acids, they have to be consumed from the diet and are therefore often called "essential fatty acids." Humans need both omega-6 and -3, yet in the right ratios. Scientific research suggests that our hunter-gatherer ancestors consumed these fats in a ratio of roughly 1:1 (De Lorgeril and Salen 2003). This was advantageous as it kept them free from the inflammatory diseases of modern civilization such as heart disease, cancer, and diabetes

(Hibbeln *et al.* 2006). In contrast, the modern American diet has been shown to be closer to a ratio of 20:1 (Kris-Etherton *et al.* 2000; Greenwood 2013).¹¹

FFQ data suggest that Kale villagers' diets contain a much higher amount of processed oils, high in omega-6 fatty acids. Ethnographic data suggest that, since the arrival of the new road in Humla, villagers have relied much more on the processed oils purchased from the market than in previous years. Kale villagers rely even more on this oil than Gyepo villagers. Data also suggest that villagers are not fully aware of the health benefits of consuming locally grown mustard oil. This may contribute to them purchasing the processed oils instead of figuring out ways to either improve their mustard crop yields or trade for locally produced oil.

Socio-Economic Status, Geographic Access and Sugar Consumption

Sugar consumption in the local diet was traditionally limited to natural sugars found in certain fruits and plants. Although natural sugars do contribute to overall sugar intake, they generally cause less of a blood sugar spike compared to the "free sugars" found in the market-purchased foods (e.g., soda pop, chocolate bars, chips, and candy).

The WHO recommends that both adults and children should reduce the intake of "free sugars" to less than ten percent of total energy intake, and to not consume more than 37 grams of added sugar per day. Interview data indicate that villagers from Gyepo are bringing back these items from Chinese market to their villages. In contrast, villagers from Kale rarely bring these "extra" items back with them for consumption in their village, as they typically have to transport the market-purchased foodstuffs. With space constrains in transportation, villagers from Kale typically choose between the types of food they want to purchase (most often opting for flour, oil, and spices). This is further supported by our dietary assessment data. While villagers in Gyepo consume an average of 38 grams of sugar per day, villagers in Kale consume an average of 26 grams per day.

In addition to there being differences in sugar consumption by proximity to road, results also indicate that socio-economic status (SES) is a key

¹¹ A number of countries, such as Canada, Sweden, United Kingdom, Australia and Japan, as well as the World Health Organization (WHO), have made formal population-based dietary recommendations for omega-3 fatty acids (Kris-Etherton *et al.* 2002).

determinant in villagers' sugar intake levels.¹² Those households that are better off have more “disposable income,” and therefore are purchasing so called “prestige items” that are low in nutrient density yet hold social value.¹³ Results indicate that households with high SES living near the road consume an average of 60 grams of sugar per day (see Figure 2).

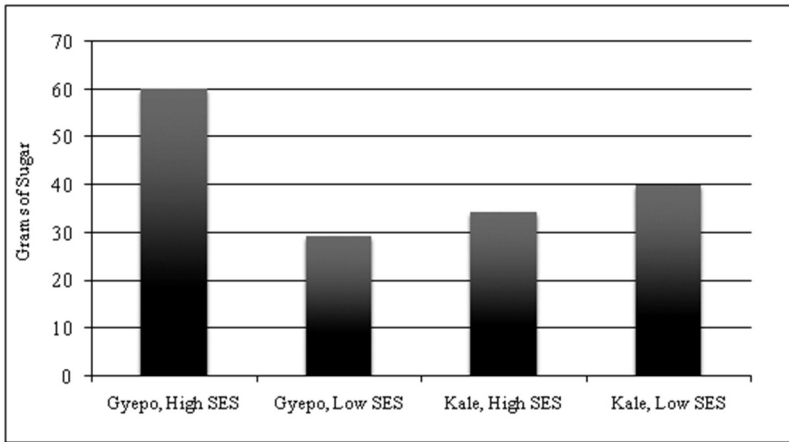


Figure 2: Daily consumption of sugar by “proximity to road” and SES.

Although villagers in Kale and Gyepo still consume much less sugar compared to an average American, the arrival of the road in the region has led to a dramatic shift in foot habits. In the absence of proper dissemination of nutritional education, Humli villagers are at a higher risk of obesity and chronic disease. Gyepo villagers with high SES are consuming, on average, a higher amount of sugar than both villagers in Kale and villagers in Gyepo with low SES, this indicates that “proximity to road” and SES continue to play a significant role in the nutrition transition (from Pattern 3 to Pattern 4).

¹² We used cultural domain analysis to develop local models with which to establish socio-economic status levels of households in both villages (see Grocke 2016 for more detail). This methodology allowed us to categorize households into SES groups of low and high.

¹³ “Prestige foods” refers to meals or foods that are used to symbolize social status (Helman 2007; Dickerson *et al.* 2008).

Gendered Difference in Traditional Food Consumption

Data suggest that factors, such as livelihoods and prestige ascription, are strongly associated with the gendered difference in dietary patterns. Men in Humla ascribe a high prestige value to market-purchased items, and claim that they are “modern” foods associated with travel and urban elites. By contrast, women spend most of their time engaged in tasks in and around the village. This woman, for example, is in the local gristmill, grinding local barley into flour (Photo 3).



Photo 3: Local Gristmill. One of the tasks that women are frequently engaged in during the harvest season is grinding the local barley into flour. A small stream near the village powers this gristmill; one family owns the gristmill, and “rents” it out to other households who pay the owners in flour yields.

Compared to the men in Humla, who often eat at roadside eateries, women eat at home more often, and the home diet typically consists of locally grown whole grains and greenhouse vegetables. Women also do not ascribe nearly as much prestige to market-purchased foods as men. According to one 40-year-old woman,

I do not like eating candy, chocolate, and such things. I do not like the taste, and it does not help with hunger. I get much more energy from our foods like *korā* (buckwheat pancake), *ālu* (potato), and *sisnu* (nettle). Those are the foods I know and like. If I eat those I can go to the fields and work, and I am not hungry for many hours.

In almost all cases, men are engaged in the collection and selling of herbs, timber harvesting, or the buying and selling of goods at the marketplace-livelihoods that often take them away from their villages. While “on the road,” men tend to consume a high amount of packaged foods like ramen noodles, chips and cookies, soda pop, beer, and Chinese liquor with very high alcohol-content.

Not only is this heightened alcohol consumption causing social disputes, but it also has severe, long-lasting health impacts. Although cirrhosis of the liver is arguably the most well-known health impact of consuming high-quantities of alcohol, researchers have linked alcohol consumption to more than 60 unique diseases (e.g., anemia, cardiovascular disease, cancer, dementia, depression, and seizures) [Whitney and Rolfes 2015]. Heavy drinking is also associated with an increased risk of developing an ulcer, as large quantities of alcohol irritate the stomach lining, increasing inflammation. If the inflammation becomes severe, bleeding (or gastritis) may occur (Bujanda 2000). The prevalence of gastritis among adult patients in Humla has been established according to data collected in a series of mobile medical camps conducted from 2011 to 2016.¹⁴

Interview data also suggest that many young boys assist their families by engaging in the aforementioned livelihoods. These young males join with their adult male guardians in consuming high quantities of the Chinese liquor at hotels/restaurants en route to and from the trade destinations.

Women in both villages also enjoy drinking, and some make it a daily ritual. However, while most women reported drinking, they almost exclusively consume locally brewed barley beer called *nechang*, a good source of carbohydrates and energy, unlike the males who preferred the Chinese liquor.

Despite the fact that women seemed more careful than men in terms of their food consumption habits, they were not particularly keen on promoting

¹⁴ Personal communication with Pralhad Dhakal, 2016.

similar habits in their children. This gap in knowledge transfer is alarming; in order to better understand why mothers are not encouraging their children to partake in healthy food consumption, it is important to identify the food on which young children in upper Humla are currently being raised, and the reasoning behind these child rearing decisions.

Infant Feeding Practices

Breast milk has the highest nutrient density for infants and very young children. According to Le Huërou-Luronet, Blat and Boudry (2010), breast-feeding is associated with lower incidence of diarrhea during the early period of life, with lower incidence of inflammatory bowel disease, type 2 diabetes and obesity later in life. In upper Humla new mothers learn the benefits of breast-feeding from other women, most often their own mothers.¹⁵

Data indicate that weaning practices begin anywhere between 1.5 years to three years of age. Our data points to early weaning if the mother is pregnant with another child. Another study on infant feeding in this region suggest work responsibilities and the ability of the mother to produce enough milk as having direct influence on the timing of the weaning (Levine 1988).¹⁶ Since a mother's nutritional status, specifically her micronutrient status, affects both the quality and quantity of her breast milk (Allen 1994), proper nutrition becomes mutually beneficial for both mother and child.

In both Gyepo and Kale villages, the first food a baby is introduced to is *tsampa* (a porridge-like food made from barley).¹⁷ Mothers typically chew up the *tsampa* in their mouths (they do this to ensure it is cool enough for the baby to eat), and then feed their babies this “pre-tested” food. It is typical for babies to be solely breastfed, followed by introduction to *tsampa*

¹⁵ According to interviews, while new mothers are taught the benefits of breast-feeding primarily from their own mothers, other women in the village and/or local staff that work for Humla-based NGOs whose programs are related to maternal and child health also provide breastfeeding advice and information.

¹⁶ The WHO (2016a) recommends continued breastfeeding up to two years of age or longer. In upper Humla, it is typical that the last-born child is breastfed the longest. Often during fieldwork, mothers would indicate that they wished that they could have breastfed some of their children longer, but because they gave birth to another baby, they had no choice but to wean some of their children early.

¹⁷ *Tsampa*, made from local-barley, is a very nutritious food for babies as it is a whole grain containing a high level of protein, calcium, and magnesium.

(while continuing to be breastfed) for a few months, and eventually being introduced to all other available foods.

After the introduction of *tsampa*, there is no particular order in which other foods are introduced into the baby's diet. Parents will introduce all grains, available vegetables and meat, and local butter tea simultaneously to children after a few months of them solely eating *tsampa*. Although the benefit of these weaning practices is that children are introduced to a wide variety of foods early, in some cases, the types of foods being fed to young children in Gyepo and Kale is problematic.

Dietary Patterns of Children

Since the arrival of the road, more and more children are being introduced to market-purchased processed, packaged foods such as ramen noodles, chips, candy, soda pop, energy drinks, and coffee at an extremely young age. According to numerous mothers in Humla, in years prior it was difficult for them to prepare a quick snack for their children in circumstances when the children were hungry but they were too busy to cook a meal from scratch. Mothers now look toward packaged foods not only to curb the hunger of their children, but also as a sort of "entertainment provider" for their children while they complete necessary household tasks (Photo 4).

Often times, while conducting the food frequency questionnaire, we would inquire about the consumption of drinks such as "energy drinks." Mothers would say that that while they themselves do not consume these drinks, they "save" them for their children. Their use of the verb "save" (*bhorwa* in Humli Tibetan) indicates that they believe they are doing something good for their children. We witnessed numerous children drinking coffee, energy drinks, or "sugar water" (water in which mothers would stir in approximately two teaspoons of sugar), often times even in between breastfeeding sessions.¹⁸

Children learn eating habits through the process of enculturation. Children that are currently in their teenage years are consuming locally produced snacks such as a buckwheat flour pancake, toasted barely seeds, or slices of daikon radish with chili sauce. The younger generation (children 0–12 years of age) are, however, becoming used to consuming processed foods

¹⁸ According to the American Heart Association (AHA 2016), children ages 4–8 should consume no more than three teaspoons of "free sugar" per day. According to our observations, one serving of "sugar water" exceeds this daily maximum value.

high in “free sugars.” The latter have come to expect these foods, enjoy the taste of these foods, and may continue to do so unless they are educated on the negative repercussions of a diet that includes a high proportion of such foods. Considering that a child’s nutrition is directly linked to all aspects of their growth and development, it is important to identify the gap between mothers’ prestige ascription of the traditional Humli diet and the associated nutritional benefits, and them feeding market-purchased foods to their children, which results in a much lower acquisition of nutrients.



Photo 4: Local Children Eating Ramen Noodles. These young children are eating ramen noodles as a “snack” in the middle of the day, while their mother is busy completing tasks in and around the house.

Is there a way to ensure that these children, who have grown up with the road and with a taste for unhealthy foods, do not become overweight, thus increasing their risk for DR-NCDs in the near future? One avenue to do so is to educate which market-purchased foodstuffs are nutritionally beneficial for children in upper Humla. According to our research, the culturally appropriate, market-purchased food with the most positive nutritional impact is eggs.

Road as Avenue for Increased Protein Consumption among Children

According to the 2015–2020 dietary guidelines put forth by the Office of Disease Prevention and Health Promotion of the US, 10–35 percent of calories consumed per day should come from protein (USDA 2015). Protein is essential for human health as it aids with growth (especially of children, teens, and pregnant women), repairs tissues, supports immune functions, creates essential hormones and enzymes, and is used as energy when carbohydrates are not available. Protein is found in a variety of food sources, including meats, poultry, fish, meat substitutes, cheese, milk, nuts, legumes, and in smaller quantities, starchy foods and vegetables.

Human body breaks down protein into amino acids (the building blocks of proteins). While humans are able to produce some amino acids (nonessential amino acids), others must be acquired from the diet (essential amino acids) [Whitney and Rolfes 2015]. In general, “complete proteins,” or those that contain all of the essential amino acids, are derived from animal foods (meat, fish, dairy products, eggs). Other sources of protein, including nuts and seeds, legumes, grains, and vegetables, are considered “incomplete proteins,” meaning they do not contain adequate amounts of the nine essential amino acids.

Considering that ethnic-Tibetan Humlis do not have access to fish, only consume dairy in some months of the year, and eat meat under rare circumstances (only when an animal dies of natural causes), there is no regular availability of “complete” or animal-sourced proteins in their diets.

The arrival of the new road in Humla District has made it easier to acquire one type of animal-sourced protein – eggs. But proximity to the road plays an important role in who has access to this food. Thus, in Kale, villagers reported not consuming eggs at all. Typically when we reached the “eggs” item on the FFQ, villagers in Kale would respond, almost in a laughing manner, by replying, “not here, not in our village. We do not get any eggs.” Although villagers could technically bring eggs back from the market in China, they do not because they believe the eggs are too fragile and will break during transport. When we asked villagers in both Gyepo and Kale whether villagers have ever tried to raise chickens for egg production, they cited the threats posed by wolves in raising chicken in the region. When we proposed the possibility of building a fence to protect the chickens, many villagers did not express any interest, primarily due to lack of knowledge surrounding the construction of shelters for them.

Nutrition composition analysis suggests that increasing market-purchased, egg consumption may be the easiest way, in terms of availability, price, and cultural appropriateness, for villagers to increase their “complete protein” intake, which, given the resulting nutritional benefits, is especially helpful for children. Since the minimum daily requirements of protein are relatively low for young children, this avenue of protein achievement is attainable.

For example, healthy children between the ages of one and three need 0.55 grams of protein per pound of body weight. For a child weighing 30 pounds this translates to 16.5 grams of protein per day. While breast milk contains an optimal mix of both whey and casein protein, for those children no longer breastfeeding our nutrition composition analysis confirms that one cup of local yak butter tea has roughly 16 grams of protein. As a child progresses in age, protein needs decrease. Children between four and six years of age need 0.5 grams of protein per pound of body weight, which means that a 45-pound 5-year-old requires 22.5 grams of protein. Since one hard-boiled egg has roughly six grams of protein, this means that if each 5-year-old child in upper Humla would be given one egg per day and consume roughly 1.5 cups of local yak butter tea, his or her daily protein requirements would be met.

Discussion

Results from this study indicate that Humla’s new road is a catalyst for changing dietary patterns, yet suggest that these dietary patterns are not homogenous between villagers or even within households. Topography, crop growing ability, socio-economic status, “proximity to road” and gender all play a role in the nutrient density of villagers’ diets. In terms of gendered differences in food consumption, while women are shying away from unhealthy, market-purchased foods, both men and children are consuming these foods, arguably, to the detriment of their health.

Although Humla’s new road is helping to solve the problem of quantity-of-food related food security, it has given rise to numerous quality-of-food related food security issues. Based on what we know of the nutrition transition and the biological outcomes that result as a consequence of shifting ones diet from complex carbohydrates and fiber to a diet heavily dependent on refined and processed foods, our data suggest that today’s young children in upper Humla are at risk for developing DR-NCDs.

The arrival of DR-NCDs in an area previously unaccustomed to this type of disease will bring about a significant amount of change, including additional causes for early morbidity and mortality. Additionally, a new type of burden will be placed on local health facilities, which they are currently ill-equipped to handle.

Conclusion and Recommendations

Whereas previously, children in upper Humla were at risk of starvation, they now, even those who come from resource-poor households, seem to have access to an adequate amount of calories. However, not all of these calories are nutritionally beneficial. On the contrary, our findings reveal that many of these foods have decreased the nutrient density of children's diets, thus putting them at higher risk for development of DR-NCDs as they age. We recommend two avenues for reversing this trend.

First, we urge local NGO and government programs to educate villagers of the health benefits of their traditional foods (especially the use of mustard oil for cooking and dairy as a dietary staple), the health benefits of a low sugar diet, and the difference in risk factors between drinking locally brewed beer and Chinese hard liquor. Since our data indicate that Kale produces a large yield of tasty bitter buckwheat, while Gyepo produces a large yield of mustard oil, this could be one local trade avenue that is both economically and nutritionally beneficial for villagers.

Second, we urge these institutions and actors to provide information as to a newly available market-purchased food that is nutritionally beneficial – eggs. Access to this food will alleviate some of the nutritional deficiencies that this population is experiencing due to the environmental, cultural, and religious barriers to acquiring the minimum daily-recommended amount of animal protein.

We recommend that these nutrition-based education programs specifically target mothers, as they are the ones who most often make decisions regarding children's food consumption. Since mothers are typically overworked, often having to balance work and home life, they are currently welcoming food options for their children that are quick to prepare and convenient. Without proper education as to the negative long-term health outcomes of consuming processed foods high in sugar, the ease of feeding these foods to their children may continue to dominate other factors, such as potential future health repercussions.

This micro-level study should serve as evidence that nationwide nutrition initiatives, such as the Nepal Government's Multi-sector Nutrition Plan (2013–2017), the World Bank's Sunaula Hazar Din Project (2012–2017), and the U.S. Government's Feed The Future program, should not only continue to be supported, but should expand their target areas to remote regions such as upper Humla, Nepal, and specifically target mothers with young children who are at higher risk for developing DR-NCDs as they age.

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