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SELF-REPORTED HEALTH AND NUTRIENT AVAILABILITY: DO PERCEPTIONS MATTER?

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Abstract

This study aims to examine the relationship between nutrient availability and the self-reported health of individuals in Nepal using the data from the Nepal Living Standards Survey (NLSS) and employing an ordered logit estimation. We find that an increase in the availability of proteins and fats increases the level of self-reported health of individuals in Nepal. However, micronutrient availability's relationship with self-reported health is either mixed or insignificant. We also find that access to a greater variety of food increases self-reported health until individuals meet their basic caloric requirements. Moreover, there are perceptional differences related to the effect of proteins consumed from different food groups (meats, dairy, and lentils) on self-reported health. Finally, macronutrient availability from expensive nutrient-dense foods seems to be the main driver of improvements in self-reported health.

Keywords: *Food, self-reported health, nutrient availability, Nepal, nutrient-dense.*
JEL Codes: D91, I12, I15, Q11

1. Introduction

The effects of calorie and nutrient deficiency are perceived to be numerous and life lasting. Not only does nutrient deficiency directly affect an individual's health, but it also affects their productivity and lifetime earning potential (Alderman et al., 2006; Berha et al., 2021; Tilai et al., 2021; Kim & Mitra, 2022). The World Bank (WB) even lists calorie deficiency as a failure to achieve a minimum acceptable standard of living (Haughton & Khandker, 2009). Several studies have investigated the relationship between calorie intake and the health status of individuals but most of them suffer from methodological weaknesses (Strauss and Thomas, 1998; Bailey, 2021). Therefore, this issue warrants further exploration. This study will be a step in this direction.

This study aims to assess how nutrient availability affects the self-reported health of individuals in Nepal. Moreover, it also explores whether having access to a balanced diet results in higher self-reported health. We also examine if there are perceptional differences related to self-reported health based on the same nutrient made available from different food sources. We employ data from the Nepal Living Standards Surveys (NLSS) dataset and use an ordered logit estimation to ascertain how different dimensions of nutrient availability impact the self-reported health of individuals in a developing country setting.

We contribute to the existing literature in several ways. First, the data used in our analysis contains information on the specific food items consumed by the Nepalese households as opposed to just the data for the major categories of food. Therefore, it provides a more holistic measure of nutrient availability for all the macro- and micronutrients. Second, this paper translates the food consumption of households into a greater number of separate macro- and micronutrients, thereby giving a more comprehensive breakdown of the effect of nutrient availability on self-reported health. Finally, the data used in this study measures food consumption via home production, market purchases, and received in kind which leads to a more complete calculation for food consumption.

We find that a higher availability of proteins and fats can lead to better self-reported health while an increase in carbohydrate availability decreases self-reported health. Moreover, we find a mixed or insignificant effect of micronutrients (vitamins and minerals) on self-reported health, despite the data showing moderate to severe deficiencies for micronutrients (vitamins A, B2, B12, calcium, and iron) in Nepal. Our analysis also suggests that access to a balanced diet also increases self-reported health until caloric needs are fulfilled, with the relationship becoming insignificant afterward. Furthermore, proteins coming from diverse food sources have a differential impact on the self-reported health of individuals in Nepal. The results point to a situation where the fulfillment of caloric needs is the main driver of self-reported health in Nepal i.e. individuals feel better when they consume enough calories especially if the calories are coming from the more expensive nutrient-dense sources of food.

These results provide an opportunity for policymakers to improve self-reported as well as actual health measures in Nepal. Despite improvements in recent decades, access to food and nutrition is still a widespread problem in Nepal (Global Hunger Index, 2020). Therefore, policymakers can focus on the provision of nutrient-dense foods to households, especially those in less accessible mountainous regions, so that self-reported and actual health measures are improved. However, there remains a need to understand motivators other than the availability of nutrient-dense foods that can improve self-reported health in Nepal.

2. Literature Review

The existing literature points to the positive relationship between nutrient availability and human capital measures. These measures range from productivity, income, child mortality, and health measures (Strauss, 1986; Alderman et al., 2006; Berha et al., 2021; Tilai et al., 2021; Kim and Mitra, 2022). The major weakness of this strand of research is the use of household-level food purchases/consumption data to extract nutrient availability for different nutrients. Thus, the relationship explored is essentially between average nutrient availability to a member of a household (rather than actual individual nutrient intake) and human capital outcomes. The usage of this simple average is problematic because a household comprises individuals of different ages implying different nutrient intake requirements (Ali & Villa, 2022). Moreover, there might be unequal allocation of food within the household based on sex and productivity (Rosenzweig & Schultz, 1982; Gittelsohn et al., 1997; Gittelsohn & Vastine, 2003; Hyder, et al., 2005; Harris-Fry et al., 2017; Alonso et al., 2018; Diamond-Smith et al., 2022).

The limiting factor in the availability of nutrient intake data is the higher cost in terms of time and money in collecting this data. However, the collection of data regarding individual nutrient intake is fraught with another kind of risk. Recall methods, especially when it comes to self-reported food intake are highly unreliable as the subjects more often than not under-report their food consumption (Frank, et al., 1992; Schoeller, 1995; Lafreniere et al., 2018; Burrows et al., 2019; Bailey, 2021). Therefore, the usage of individual-level food consumption data does not guarantee the validity of results when looking at the relationship with human capital outcomes.

Strauss and Thomas (1998) points out further problems with surveys collecting individual nutrient intake data. There is usually an assumption of no wastage of food i.e. the consumption of food resulted in a perfect translation into its macro- and micronutrients. This is an unrealistic assumption since the preparation and cooking of food impact its nutrient profile (Bailey, 2021). Moreover, the surveys collecting individual nutrient intake data mostly do not account for food received in kind as well as meals eaten outside the home. Therefore, a better method of collecting individual nutrient intake data would be to weigh ingredients before a meal and wastage afterward. Additionally, the surveys should record the method of cooking every meal so its impact on nutrient intake is accurately calculated. These are all expensive methods of data collection and limited funding prevents the collection of such data. Rather a reliable method is to divide the household-level nutrient availability by standardized ages of the individuals within the household to obtain individual-level nutrient availability.

Some of the existing literature challenges the idea that income increases improve nutrition in poor households (Srinivasan, 1981; Behrman & Deolalikar, 1987; Behrman and Deolalikar, 1989; Logan, 2009; Kaicker et al., 2018). Although this research acknowledges that increases in income results in greater expenditure on food, but contends that this does not translate into a higher nutrient intake without education regarding food and nutrition. Thus, households take into account the characteristics of food apart from their nutritional values when considering what foods to consume. These characteristics range from taste, appearance, smell, and even the societal status attached to the consumption of a particular food (Gittelsohn et al., 1997; Casey et al., 2001; Gittelsohn & Vastine, 2003; Alonso et al., 2018). This is especially important in the context of developing countries where people assign certain perceptional worth to different food items, not necessarily based on their nutritional values (Alonso et al., 2018). Therefore, in such a setting, people with increasing incomes might be spending more on food without increasing their nutrient intake considerably, resulting in the consumption of a diet that is still not balanced.

Several previous studies look at the link between household food insufficiency and self-reported health and conclude that food-insufficient households had significantly greater chances of rating their health status as poor (Vozoris & Tarasuk, 2003; Stuff et al., 2004; Gundersen & Ziliak, 2015). There have also been studies employing a panel dataset to determine a positive relationship between self-reported health and diet (Osler, et al., 2001; Goodwin, et al., 2006; Lainscak, et al., 2014). Finally, self-reported health is positively associated with sex, marital status, living arrangements, physical activity, alcohol usage, and strength of social networks in Nepal (Chalise et al., 2007; Dangi, 2016; Yaya & Bishwajit, 2020). In this paper, we attempt to add to this strand of literature by exploring the effect of nutrient availability on self-reported health in Nepal.

3. Data

The data used for this study comes from NLSS-III (NLSS, 2012). The Central Bureau of Statistics (CBS) of Nepal conducted this survey following the Living Standards Measurement Survey (LSMS) methodology refined by the WB (LSMS, 2022). The NLSS-III was carried out in 2010-11 (CBS, 2011). The chief purpose of the NLSS-III was to streamline data on the living standards of Nepalese households. Moreover, it also aimed to evaluate the effects of different government policies and programs on the socioeconomic measures in Nepal during the last seven years (CBS, 2011). NLSS-III consists of 5,988 households. We use 25,615 individual observations in our analysis.

The NLSS-III consists of twenty modules including housing, migration, health, and education. For this study, the majority of data comes from the "Food Expenses and Home Production" and "Health" modules. The former contains data related to the food consumption in a household during the last seven days through home production, market purchases, and received in kind. The main categories of food covered are "Grains and Cereals", "Pulses and Lentils", "Eggs and Milk Products", "Cooking Oils", "Vegetables", "Fruits and Nuts", and "Fish and Meat". Within each of these categories there are data for specific food items consumed by the household. We convert the food consumption data in these sections into the nutrient availability data for a household using the United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference (USDA 2014). The nutrient availability data comprises macronutrients (proteins, carbohydrates, and fats) and micronutrients. The micronutrients include essential vitamins (A, B1, B2, B3, B6, B9, and B12) and minerals (calcium, iron, and zinc). We choose these nutrients because they comprise the essential protective and growth nutrients for a healthy body (USFDA, 2015). We convert the household-level nutrient availability into individual-level nutrient availability by dividing the former by the number of standardized adults in the household. Claro, et al. (2010) provides the guidelines to calculate the number of standardized adults in a household. Using these guidelines provided in Table 1, we account for the differences in household compositions i.e. the number of adults and children present, each with different nutrient intake requirements.

Table 1. Age Conversion Factors

Age (years)	**Calories (kcal)**	**Adult-Equivalent**
Newborns		
0 to 1	750	0.29
Children		
1 to 3	1300	0.51
4 to 6	1800	0.71
7 to 10	2000	0.78
Men		
11 to 14	2500	0.98
15 to 18	3000	1.18
19 to 24	2900	1.14
25 to 50	2900	1.14
51+		
Women		
11 to 14	2200	0.86
15 to 18	2200	0.86
19 to 24	2200	0.86
25 to 50	2200	0.86
51+	1900	0.75

Source: Claro, et al. 2010.

The data on self-reported health comes from the "Health" module of NLSS-III. Every individual surveyed in NLSS-III answered the question "What is your current health status?" by choosing one of the following four options: excellent, good, poor, or worst. Finally, we use NLSS-III to obtain the data for control variables used in the empirical model explained in section 4. These controls include education level, age, sex, whether the person is a Brahmin, whether the person belongs to a poor household, access to sanitation, clean water, and improved methods of cooking, and the region of the household.

Since our aim is to assess whether access to a balanced diet results in higher self-reported health, we calculate a dietary diversity score for every household. The measure used for dietary diversity in this paper is the food consumption score (FCS). FCS measures nutrient adequacy i.e. fulfillment of basic requirements in terms of macro- and micronutrients and variety in the diet. These are the two primary constituents of a balanced diet. We calculate FCS over a reference period of seven days from a list of eight food groups. Different weights, ranging from 0.5 to 4, are applied to the food groups according to their nutrient density. Table 2 provides these food groups and their associated weights. The next step is to calculate the consumption frequency for every group, which is the number of times every food group is consumed in the reported week. The upper limit for consumption frequency is seven. FCS is calculated by multiplying the consumption frequency and weight for each food group and summing the values over the eight groups (Vulnerability Analysis and Mapping Branch, 2008). We further create an FCS tercile variable (bottom, middle, and top) to explore the impact of moving from a lower tercile to a higher one on self-reported health.

Table 2. Calculation of Food Consumption Score (FCS)

No	Food Items	Food Groups	Weight
1	Maize, maize porridge, rice, sorghum, millet pasta, bread, and other cereals	Main Staples	2
	Cassava, potatoes and sweet potatoes, other tubers, plantains		
2	Beans, Peas, groundnuts, and cashew nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruits	1
5	Beef, goat, poultry, pork, eggs, and fish	Meat and Fish	4
6	Milk, yogurt, and other dairies	Milk	4
7	Sugar and sugar products, honey	Sugar	0.5
8	Oils, fats, and butter	Oil	0.5
9	Spices, tea, coffee, salt, and small, amounts of milk for tea.	Condiments	0

Source: Vulnerability Analysis and Mapping Branch, 2008.

4. Model

This paper aims to examine the relationship between individual-level nutrient availability and self-reported health status. Through this examination, we will assess whether the availability of all nutrients translates to higher health status or if there is a differential response of various nutrients to self-reported health. For example, higher availability of some nutrients might contribute to better self-reported health while other nutrients might do the opposite. We also look at whether a balanced diet (a diet with more diversity) contributes to higher self-reported health. Moreover, we also explore whether consumption of certain types of food items results in higher health status due to the perception of higher health attached to them.

The above analysis will reveal if better nutrition and access to nutrients ultimately result in individuals feeling good enough to rate their self-reported health higher. This is interesting to look at because better nutrition might affect actual and self-reported health differently. In a developing country setting where socioeconomic constraints can affect the individual's actual health negatively, self-reported health might still be higher. This might be because if one is feeling unhealthy most of the time, the steady state of health that individuals are accustomed to is a lower one. This is in contrast to individuals in developed countries where they might be more adapted to a higher steady state of health and any fluctuations in actual health might lead to the self-reported health decreasing. For example, if one feels healthy most of the time, even a small illness might make them rate their self-reported health much lower than the decline in actual health. Although, NLSS-III does not contain actual measures of overall individual health and nutrition such as height-for-age and body mass index-for-age, we rely on the self-reported health data to examine its possible relationship with nutrient availability.

The hypothesis in this paper is that higher nutrient availability results in better self-reported health for people in Nepal. To test this hypothesis, we propose the following model:

$$H_i = f(N_{ij}, X_{ij}, C_j, V_j)$$

where H_{ij} is the self-reported health status of individual i in household j, N_{ij} is the vector of macronutrient and micronutrient availability translated from food consumption, X_{ij} is a vector of individual-specific control variables, C_j is a vector of household-specific control variables for household j, and V_j includes regional and community-level characteristics.

The variable H_i is constructed as an ordinal variable comprising of four categories where "Excellent" = 4, "Good" = 3, "Poor" = 2 and "Worst" = 1. N_i includes the macro- and micronutrient availabilities derived from the weekly food consumption data. The macronutrients consist of proteins, carbohydrates, and fats while the micronutrients comprise vitamins (A, B1, B2, B3, B6, B9, and B12) and minerals (calcium, iron, and zinc). X_i contains sex, education level (primary, secondary, or tertiary), and age of the individuals. C_j comprises whether the household is poor, if the household head considers himself to be from the Brahmin caste, and whether the household has access to piped water, sanitation, and a gas/kerosene stove. Finally, V_j includes regional dummies indicating Eastern, Central, Western, Midwestern, and Farwestern regions. We also include further community fixed effects by controlling for the primary sampling units (PSU). This ensures that identification in our empirical model is a result of variation within rather than across communities.

Equation (1) estimates the impact of nutrient availability for macro- and micronutrients on self-reported health where ε_{ij} capture unobserved heterogeneity:

$$H_i = \beta_0 + \beta_1 N_{ij} + \beta_2 X_{ij} + \beta_3 C_j + \beta_4 V_j + \varepsilon_{ij} \quad (1)$$

When consistently estimated β_1 will reveal the impact of macro- and micronutrient availability on self-reported health. In general, we expect a positive sign for β_1 because an increase in nutrient availability should theoretically lead to a better self-rating of health.

$$H_i = \beta_0 + \beta_1 FCS_{ij} + \beta_2 X_{ij} + \beta_3 C_j + \beta_4 V_j \varepsilon_{ij} \quad (2)$$

The final aim of this paper is to inquire whether there are perceptional differences when it comes to the availability of nutrients. We use the case of proteins to explore if the same nutrient extracted from a variety of food sources has a different effect on self-reported health. To check this, the availability of proteins from its three major sources namely dairy, meat, and lentils is calculated. Meats comprise fish, goat, buffalo, and chicken which are the main types consumed in Nepal. Dairy includes milk, dry milk, condensed milk, yogurt, cheese, butter, and eggs. Finally, lentils cover the proteins consumed from black grams, *masur*, red grams, green grams, vetch, and kidney beans. Thus, we estimate equation (3) to calculate the differential impact of proteins from different sources on self-reported health where $Dairy_{ij}$, $Meat_{ij}$, and $Lentils_{ij}$ refer to the availability of proteins through dairy, meat, and lentils respectively. After the estimation of equation (3), we use a Chi-square test to verify if the coefficients for proteins from different food groups (β_1, β_2, and β_3) are significantly different from each other.

$$H_i = \beta_0 + \beta_1 Dairy_{ij} + \beta_2 Meat_{ij} + \beta_3 Lentils_{ij} + \beta_4 X_{ij} + \beta_5 C_j + \beta_6 V_j + \varepsilon_{ij} \quad (3)$$

Since the dependent variable (H_i) is ordinal, we use an ordered logit model to estimate equations (1), (2), and (3). Finally, we use robust standard errors to correct for heteroscedasticity and autocorrelation in all three equations.

5. Descriptive Statistics

Table 3 provides the means and standard deviations for the key variables in the model. It also provides the recommended weekly intake for all the nutrients that are part of our analysis. Since we derive our macro- and micronutrient availability variables from weekly food consumption data, we use recommended weekly intakes rather than the standard recommended daily intakes. We calculate the recommended weekly intakes using the Dietary Reference Intakes (DRI) tables available on the National Institutes of Health (NIH) website (NIH, 2022). Table 3 shows that one standard deviation below the mean for health status will result in self-reported health being equal to three signifying a "good" health status. On the other hand, being one standard deviation above the mean will translate to self-reported health being equal to four indicating an "excellent" health status. This means that most of the self-reported health in the data were excellent or good i.e. self-reported health is positively skewed.

Table 3. Descriptive Statistics

Variables	Mean	Std. Dev.	Recommended Intake
Health Status	3.55	0.544	-
Weekly Protein (g)	369.24	161.75	350
Weekly Carbohydrate (g)	2622.08	1139.01	1925
Weekly Fat (g)	1426.59	775.01	546
Weekly Vitamin A (mcg)	759.09	766.11	6300
Weekly Vitamin B1 (Thiamin) (mg)	14.71	6.31	8.4
Weekly Vitamin B2 (Riboflavin) (mg)	5.24	3.10	9.1
Weekly Vitamin B3 (Niacin) (mg)	153.55	68.79	112
Weekly Vitamin B6 (mg)	15.64	7.52	11.9
Weekly Vitamin B9 (Folate) (mcg)	3875.21	4024.78	2800
Weekly Vitamin B12 (mcg)	6.56	6.40	16.8
Weekly Calcium (mg)	2219.74	1653.45	9100
Weekly Iron (mg)	100.85	48.91	126
Weekly Zinc (mg)	76.41	36.18	77

The means of macronutrient availability show that on average Nepalese individuals meet their recommended intake for proteins, carbohydrates, and fats. However, being one standard deviation below the mean for proteins and carbohydrates would imply that the individuals do not meet the recommended intake requirement. When it comes to micronutrients, we find that on average the individuals in the sample meet the recommended intake requirement for the vitamins B1, B3, B6, B9, and zinc. On the other hand, Table 3 reveals that on average there is a deficiency in vitamins A, B2, B12, calcium, and iron with severe deficiencies seen for vitamin A and calcium. In the overall Nepalese context, these micronutrient deficiencies are a result of high levels of absolute poverty, overreliance on calorie-dense foods, and the presence of a difficult terrain where not all types of foods can be grown (Global Hunger Index, 2020).

Overall, Table 3 shows that macronutrient deficiency in comparison to micronutrient deficiency is a lesser concern in Nepal. Thus, a higher percentage of households are meeting their first-order needs of fulfilling caloric requirements sufficiently. However, micronutrient deficiencies still prevail, in some cases (vitamin A and calcium) to a severe extent, in Nepal. Generally, as household income rises in developing countries, a substitution from calorie-dense foods to nutrient-dense foods takes place (Ali et al., 2018). This transition can overcome micronutrient deficiencies. In the case of this Nepalese sample, we find that on average this transition has not been completed.

6. Results

Table 4 shows the results of the ordered logit regression with self-reported health as the dependent variable and nutrient availability estimates as the independent variables with regional fixed effects. The coefficients for proteins and fat from the macronutrients are both positive and significant as expected, with proteins having the largest effect on self-reported health status. In the case of proteins and fats, an increase in the availability by one gram increases the ordered log-odds of being in a higher self-reported health category by 0.00159 and 0.000310 units respectively. Proteins having the largest effect on self-reported health might be because of its importance in the building and repair of body tissues (Kreider & Campbell, 2009). Moreover, protein deficiency is also highly prevalent in developing countries, making this result highly important in the context of Nepal (Institute of Medicine of the National Academies, 2006).

Table 4. Effect of Nutrient Availability on Self-Reported Health

Variables	**Self-Reported Health**
Weekly Protein (g)	0.00159* (0.000862)
Weekly Carbohydrate (g)	-0.000291** (0.000142)
Weekly Fat (g)	0.000310*** (2.57e-05)
Weekly Vitamin A (mcg)	-0.000163*** (5.33e-05)
Weekly Vitamin B1 (Thiamin) (mg)	0.0109 (0.0307)
Weekly Vitamin B2 (Riboflavin) (mg)	0.0730** (0.0357)
Weekly Vitamin B3 (Niacin) (mg)	0.00236* (0.00141)
Weekly Vitamin B6 (mg)	-0.000962 (0.0115)
Weekly Vitamin B9 (Folate) (mcg)	1.80e-05 (3.97e-05)
Weekly Vitamin B12 (mcg)	-0.0357*** (0.00957)
Weekly Calcium (mg)	-2.88e-05 (4.53e-05)
Weekly Iron (mg)	-0.00380 (0.00331)
Weekly Zinc (mg)	-0.00187 (0.00570)
Individual and Household-Level Controls	Yes
Community Fixed Effects	Yes
Observations	25,615

Notes: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Conversely, the coefficient for carbohydrates shows a negative sign, suggesting that an increase in availability by one gram decreases the ordered log-odds of being in a higher self-reported health category by 0.000291 units. As carbohydrates usually come from calorie-dense cheaper sources of food, this result shows that higher consumption of such foods can lead to lower self-reported health. On the contrary, proteins and fats are usually present in larger quantities in nutrient-dense foods. The coefficients for proteins and fats suggest that higher consumption of nutrient-dense foods can increase self-reported health. Since previous research has highlighted the importance of nutrient-dense foods in improving actual health measures, we see that the overall effect of macronutrients on self-reported health matches what the impact should have been for actual health measures.

Amongst the micronutrients, only the coefficients for vitamins B2 and B3 are positive and significant. On the other hand, the coefficients for vitamins A and B12 are negative and significant implying that higher availability of these leads to lower self-reported health. This is surprising because Table 3 suggests deficiencies related to both vitamins A and B12. The coefficients for all the other vitamins (B1, B6, and, B9) and minerals (calcium, iron, and zinc) are insignificant showing that they do not affect self-reported health. The lack of significance for the micronutrients, in general, might be because these are consistently required in very small quantities throughout life. Thus, any changes in their availability on a weekly basis should not affect self-reported health. Since we are relying on cross-sectional data of weekly food consumption, it might be difficult to capture how variations in the availability of micronutrients can affect self-reported health. A longer time-series data might prove to be better in gauging the impact of micronutrients on self-reported health status.

Overall, Table 4 reveals two important findings. First, diverse sources of macronutrients fulfilling the energy requirement for individuals can affect self-reported health differently. We find that calorie-dense foods rich in carbohydrates have the potential to hamper self-reported health, whereas nutrient-dense foods, that might be better sources of proteins and fats, can positively affect self-reported health. Second, we find a mixed or no effect of micronutrients on self-reported health. The first finding might suggest that since households that are consuming more nutrient-dense foods have better actual health measures, it leads to a higher self-reported as well. However, the second finding reveals that if better actual health was leading to higher self-reported health, the coefficients for the micronutrients should have been consistently positive and significant. This might point to a scenario where individuals perceive having better health when they consume calories from expensive nutrient-dense foods.

Table 5 presents the results of the ordered logit regression of equation (2). The coefficient of the middle FCS tercile is positive and significant while that of the top tercile is positive but insignificant. This shows that the ordered logit for individuals in the middle FCS tercile of being in a higher self-reported health category is 0.0988 more than for individuals in the bottom FCS tercile. However, this relationship becomes insignificant for individuals in the top FCS tercile. This implies that access to a balanced diet can increase self-reported health at the lower end of the FCS distribution. This might be because the transition from the bottom FCS tercile to the middle FCS tercile might fulfill the individual's caloric needs. The average weekly calories available to individuals in the bottom, middle, and top terciles are 13224 kcal, 14343 kcal, and 14600 kcal respectively. The difference in caloric availability between the bottom and middle terciles is greater than that between the middle and top terciles. Thus, once enough calories are available for consumption, the relationship between FCS and self-reported health becomes insignificant.

Table 5. Effect of Food Consumption Score (FCS) on Self-Reported Health

Variables	**Self-Reported Health**
Middle FCS Tercile	0.0988** (0.0427)
Top FCS Tercile	0.0366 (0.0469)
Individual and Household-Level Controls	Yes
Community Fixed Effects	Yes
Observations	23,297

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Regression with Different Sources of Proteins

Variables	**Self-Reported Health**
Proteins from Meat	0.00122*** (0.000319)
Proteins from Dairy	-0.00125*** (0.000447)
Proteins from Lentils	-4.63e-05 (0.000481)
Individual and Household-Level Controls	Yes
Community Fixed Effects	Yes
Observations	25,615

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We estimate equation (3) to assess if people have a different perceptional view of proteins consumed from different sources as far as their self-reported health is concerned. Table 6 presents the results from the estimation of equation (3). The results show that proteins from meats affect self-reported health positively while those from dairy affect self-reported health negatively. Both these effects are significant implying that people in Nepal do perceive protein sources differently. The effect of proteins coming from lentils on self-reported health is insignificant. When we conduct the chi-square test to check if the coefficients for proteins from meat, dairy, and lentils are statistically different from each other or not, the null is rejected at the 1% level of significance with a chi-square value of 19.24 confirming the former. The main reason for proteins coming from meat sources having a positive impact on self-reported health might be that meat is a relatively expensive source of proteins compared to dairy and lentils. Dairy as a food group is also calorie-dense and a negative and significant coefficient confirms our earlier result that households transitioning towards nutrient-dense foods can improve their self-reported health. Finally, the effect of lentils is insignificant which might be because lentils are calorie-dense and a part of the staple diet in Nepal. Thus, there is less variation amongst households for the consumption of lentils.

7. Conclusion

This study aimed to examine the relationship between nutrient availability and the self-reported health status of individuals in Nepal. We convert the food consumption data available in NLSS-III into macro- and micronutrient availability and use an ordered logit model to see its impact on the self-reported health of individuals.

We find that access to calories coming from expensive nutrient-dense sources of food affects the self-reported health of individuals positively. However, micronutrient availability's effect on self-reported health is either mixed or insignificant despite existing micronutrient deficiencies (vitamins A, B2, B12, calcium, and iron) in Nepal. Our results also indicate that access to a balanced diet improves self-reported health up to the point where caloric requirements are fulfilled. The results also point to a scenario where households perceive the proteins coming from expensive nutrient-dense foods as better for health than those coming from cheaper calorie-dense foods. Overall, meeting the caloric requirement seems to be the main driver of improvements in self-reported health in Nepal.

Since Nepal still struggles with issues of malnutrition and food access, especially in its mountainous regions, policymakers can attempt to increase the self-reported health of individuals by increasing their availability of nutrient-dense foods. Not only this can improve self-reported health, but access to nutrient-dense foods can also potentially improve actual health measures in Nepal. Providing education regarding the benefits of nutrient-dense foods might also make households substitute calorie-dense foods for nutrient-dense foods. However, there is a further need to understand other factors that can positively affect the self-reported health of individuals in Nepal.

Nevertheless, we can improve this study in several ways. First, if a long panel data was available, it could have shown the effects of individual micronutrients on self-reported health in a more accurate manner. This is because since micronutrient deficiencies take a longer time to develop, it would be harder to isolate the effects of micronutrients on self-reported health through cross-sectional data. Second, an approach could have been used to account for the unequal allocation of food within the households. The lack of data on individual nutrient intake prevented the use of such an analysis. Finally, we converted every food item into its respective amount of nutrients assuming it was consumed raw and without wastage. This is an unrealistic assumption as the nutritional status of foods depends on the method of cooking. Therefore, data regarding the cooking techniques employed when consuming food will give a more accurate effect of nutrient availability on self-reported health.

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