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**Working Paper**

## Dietary diversity and children anthropometric outcomes: A quantile regression analysis

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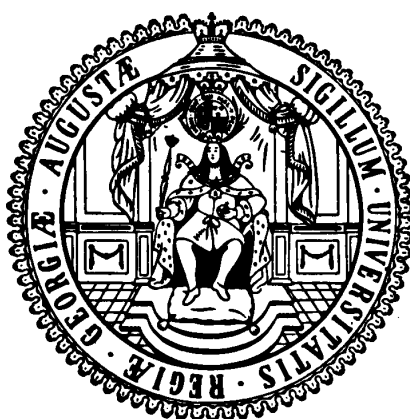
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# **Courant Research Centre**

## **‘Poverty, Equity and Growth in Developing and Transition Countries: Statistical Methods and Empirical Analysis’**

**Georg-August-Universität Göttingen**  
(founded in 1737)



Discussion Papers

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# **Dietary diversity and children anthropometric outcomes: a quantile regression analysis**

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## **Abstract**

This study investigates the relationship between dietary diversity, a measure of diet quality, and health outcomes of young children. We examine this relationship not just at the mean, but also at different points of the conditional distributions of weight-for-age (WAZ) and height-for-age (HAZ) z-scores for children below six years of age, using quantile regression method. We construct five different dietary diversity measures using 14-day recall food consumption data collected in a primary survey conducted in the rural-urban interface of Bangalore. Our results indicate no significant association between household dietary diversity and anthropometric outcomes of children below 6 years of age for any of the five measures.

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## Introduction

Despite concentrated efforts, malnutrition remains a big challenge for the Indian government. While improvements have been observed in past decades, the rates are still substantially high. According to latest available national level data, more than a third of Indian children under the age of five are stunted (38 percent) and underweight (36 percent) (NFHS – IV). Rates of undernourishment are even higher for rural areas. The adverse effect of malnutrition on physical and cognitive development, and thereby on economic and social achievements and quality of life, and mortality are well known (Hoddinott et al., 2008; Strauss and Thomas, 1998). While India failed to achieve its MDG of halving the proportion of underweight children, meeting SDG will require stronger commitment on part of the government.

Health outcomes of an individual are determined by various factors such as food intake (quantity and quality), health supplements, clean and hygienic environment, genetic factors. The uptake for each of these in turn depends on availability, affordability of resources, returns to health outcomes of each individual and nutritional knowledge of the decision maker (last two factors affecting within household distribution of resources) (FAO/WHO 1992, UNICEF 1998). One limitation that has been identified with the health policy in India is its limited focus (Dreze, 2012). Most of the resources are focused on improving the availability of food to poor households and meeting the calorie requirements, and not much importance is given to quality of food, and other inputs.

The current policy focus on, calorie dense but low on micronutrient, cereals imply that a high proportion of Indian population does not have adequate micronutrient intake (about 60 percent children under the age of 6, and 53 percent women are anemic (NFHS-IV), 61 percent of pre-school children have vitamin A deficiency (Kapil and Sachdev, 2011)). The importance of these micronutrients in promoting physical and cognitive growth is well documented. This study focuses on the important role played by better quality diet in improving health outcomes. Since measuring actual intake of micronutrients is difficult, dietary diversity is often used as an indicator of better quality diet or higher micronutrient intake (Ruel, 2003; Dewey et al, 2006; Moursi et al, 2008; Arimond et al, 2010).

A large proportion of studies use food count or food group-based measures of dietary quality. The advantage with such measures is that they can be easily estimated for the demographic group under study. Arimond and Ruel (2004) found a positive association between dietary quality and HAZ-scores for 10 out of 11 countries for children aged 6-23 months. Rah et al (2010) also find that consuming a diverse diet lowers the odds of stunting for children aged 6-59 months in Bangladesh. Similar results were observed by Frempong and Ananim (2017) for Ghana. Amugsi et al. (2014) find reduced odds of being wasted with better quality diet in rural Ghana, but not in urban areas. Conversely, Hatloy et al (2000) find a significant relationship in urban areas of Mali and not in rural areas. There are also differences for different age groups. Perkins et al. (2018) found a positive relationship with HAZ scores for children aged 24-59 months, but not for children aged 12-24 months. Studies such as Rannan Eliya et al. (2013) for Sri Lanka, Osei et al. (2013)

for Nepal, McDonald et al. (2014) for Cambodia and Luna-Gonzalez and Sorensen (2018) for Guatemala found no significant relationship. But one must be careful while interpreting these results as a lot of these studies use past 24 hour as the recall period for measuring dietary diversity. Such indicators may not be reflective of dietary pattern over a longer period. Studies such as Torlesse et al. (2003), Campbel et al. (2010), and Humphries et al. (2017) have used household expenditure data to measure dietary diversity and find positive associations of these measures with health outcomes of children and adult women.

Additionally, all the studies discussed above do not consider if the degree of association varies for individuals with poorer health outcomes, as compared to healthier individuals. To our knowledge Amugsi et al (2017) and Amugsi et al (2016) are among the very few papers that investigate the differential effect of dietary diversity on health outcomes at different points of the conditional distribution of outcomes. Both studies consider sub-Saharan countries, the first examines children below 5 years, while the latter considers the BMI outcomes of women. Both studies find mixed results across countries, quantiles and age-groups, and conclude that the relationship might be context specific. Among adult women, positive association is observed only for Ghanaian women at 90<sup>th</sup> percentile. They do not find any relationship for Namibia and Sao Tome and Principe. Among children, while there was no significant relationship between dietary diversity and HAZ scores for three (Ghana, Kenya and Mozambique) of the five countries considered, a positive effect was observed for all quantiles except the top quartile for Nigeria. Disaggregating by age, the authors find positive relationships at all quantiles for children aged 24-59 months, but a negative relationship was observed at 50<sup>th</sup> and 75<sup>th</sup> percentile for children aged 6-23 months in Nigeria. In Congo, significant positive results are observed for 5<sup>th</sup> and 10<sup>th</sup> quantile. The only consistent result for these countries is that largest effect is observed for 5<sup>th</sup> quantile.

The nature of relationship between diet quality and anthropometric outcomes in Indian context is not well studied. Chandrashekhar et al. (2017) find that in the Indian state of Maharashtra, higher dietary diversity is associated with lower odds of stunting and being underweight among children aged 6-23 months. For Maharashtra and Odisha, Nithya and Bhavani (2018) conduct a study for adolescents and adults and use three different indicators of dietary diversity. They do not find a significant association with adolescent BMI, and weakly significant relationship with HAZ scores. Only for adults do they find robust relationships for all three measures.

In this study, we examine the relationship between dietary diversity and anthropometric outcomes of children aged 0-6 years. Our dietary diversity measures are based on recall period of 14 days and will better capture dietary quality as compared to shorter recall period. Marshall, Burrows and Collins (2014) in a literature review have identified 31 different specifications that have been used in the literature. It is possible that the ambiguity in results is driven by different specifications. We, therefore, consider five different measures of dietary diversity to check if the relationship depends on the choice of metric used. Based on a primary survey conducted in Bangalore in rural-urban

interface, this study contributes to our understanding of the nature of relationship in the Indian context.

This study is based in a unique setting meant to capture the shifting rural-urban interface in face of rapid urbanization in India. Studies that study urban and rural areas separately are not able to capture the behavior and responses of household within this interface. The shift in the interface is expected to bring a change in food and non-food consumption patterns, nutritional outcomes, living conditions etc. In such a dynamic environment, it is possible that the importance of diet quality in improving health outcomes may change. For example, by improving access to wide variety of foods, the diet quality may not vary much between households across regions, and thus we would not find any relationship between dietary diversity and health outcomes. On the other hand, if the diet pattern shifts more towards westernized diet, high in calories but low in micronutrients, then smaller improvements towards higher micronutrient intake (measured by dietary diversity) may lead to stronger improvement in health outcomes. In this study we also examine which of the two mechanism is observed in Bangalore region of India.

The paper is organized as follows. Section 1 explains the sampling design, methodology is explained in section 2 and variable definitions in section 3. Section 4 presents the results and we highlight the strengths and weakness of this study in section 5. Section 6 concludes.

## **I. Study area and sampling design**

The empirical analysis is based on the primary socioeconomic survey conducted in the rural-urban interface of Bangalore in Karnataka state. It is a DFG<sup>4</sup> funded German-Indian collaborative project working on the social-ecological implications of urbanization. The survey includes around 1200 households from two transects cutting through the rural-urban interface of Bangalore. A stratified random sampling<sup>5</sup> approach was adopted to select the households for the survey. First, 61 villages were randomly selected from the total number of villages in both transects. The household selection was done randomly at village level using household lists managed by the “Anganavadi” (kinder garden) center.

The survey included a comprehensive questionnaire on household socioeconomic conditions, its agricultural and non-agricultural activities, and food consumption patterns. For detailed understanding of the household food consumption behavior of the targeted household members, we collected in-depth information on the household food consumption using a standardized questionnaire. Health outcomes are measured through anthropometric outcomes that were collected for all children aged 0-15 years and all the women in the household. We focus on children of age 6 and below, leading to a study

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<sup>4</sup> Deutsche Forschungsgemeinschaft

<sup>5</sup> See Hoffmann et al (2017) for more information on sampling design

sample of 274 children from 222 households. Figure 1 shows the location of sampled households.

## II. Empirical Methodology

Along with ordinary least square (OLS) technique, we have used quantile regression approach to estimate the effect of dietary quality on the conditional distribution of the child health outcome variable i.e., Weight for Age (WAZ) and Height for Age (HAZ) z-scores. The Quantile regression method was first introduced by Koenker and Bassett<sup>6</sup> as a '*location model*'. To formalize quantile regression, consider a real-valued random variable  $Y$  characterized by the following distribution function:

$$F(y) = \Pr(Y \leq y) \quad (1)$$

Then for any  $\tau \in (0,1)$ , the  $\tau^{\text{th}}$  quantile of  $Y$  is defined as:

$$Q(\tau) = \inf\{y: F(y) \geq \tau\} \quad (2)$$

The most common quantiles  $\tau$  from equation (2) are  $\tau=0.25$ ,  $\tau=0.5$ , and  $\tau=0.75$  for the first, the median and the third quartile, respectively. Therefore, unlike OLS that minimizes the squared differences around the mean, quantile regression minimizes the weighted absolute difference between the observed value of  $y$  and the  $\tau^{\text{th}}$  quantile of  $Y$ . It can easily demonstrate that OLS is nested in the quantile regression. In addition, while OLS can be inefficient if the errors are highly non-normal, quantile regression is more robust to non-normal errors and outliers. Quantile regression also provides a richer characterization of the data, thereby illuminating the effect of a covariate in the entire distribution of  $y$ , not merely on its conditional mean (Amugsi et al 2016).

## III. Variable Definitions

The anthropometric measurements of sampled children aged 0-6 were used to calculate the outcome variables – weight-for-age (WAZ) and height-for-age (HAZ) z-scores. The z-scores express the anthropometric value as of standard deviations from the reference mean or median value. These are used as indicators of child growth. The advantage of using z-scores is that they have the same statistical relation to the distribution of the reference around the mean at all ages, which makes the results comparable across age groups and indicators. z-scores are also sex-independent, thus enabling the evaluation of children's growth status by combining sex and age groups.

Household food consumption expenditure and frequency data has been used to construct the dietary quality indicators, which are our main variables of interest here. **Household Dietary Diversity Score (HDDS)** was constructed by a simple count of different food

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<sup>6</sup> Koenker and Bassett (1978)

groups consumed by the household in the past 14 days of the interview. Following the Guidelines for Measuring Household and Individual Dietary (2011) report by FAO, all the food items consumed in a household are grouped into 12 different groups: (i) cereals; (ii) white tubers and roots; (iii) legumes, nuts and seeds; (iv) vegetables; (v) fruits; (vi) meat; (vii) eggs; (viii) fish and fish products; (ix) milk and milk products; (x) sweets and sugars; (xi) oils and fats; (xii) spices and condiments. Each group is assigned a value of one if one or more of the food items belonging to a food group are consumed. The scores were then summed up to have a HDDS ranging from 0-12. We also construct **Food Consumption Score (FCS)**<sup>7</sup> as proposed by WFP (2008). While HDDS is a simple count of number of food groups consumed, FCS is calculated as a weighted average using frequency of consumption of food group. Additionally, to check the robustness of our results we also include a **simple count** of different food items consumed, **Mean Micronutrient Adequacy ratio**<sup>8</sup> (MMAR) and **share of non-cereal calorie**<sup>9</sup> in total household calorie intake in a day.

We classify other explanatory variables into three categories - (i) child characteristics (age and sex); (ii) maternal characteristics (mother age, education, height and occupation); (iii) household characteristics (family size, caste, religion, wealth index<sup>10</sup>, gender of person buying food, decision maker characteristics, access to sanitary facilities and safe drinking water). The choice of explanatory variables was based on the significant correlation with the outcome variable and an extensive review of the literature. Along with these we also control for location (transects) and regional (stratum) dummies. Location dummies are included in the analysis to capture if there is any difference the relationship studied between the two transects. Six stratum were constructed in each transect based on Survey Stratification Index (SSI)<sup>11</sup>. In our estimation regional dummies are captured through six stratum constructed in each transect.

The model used for the multivariate quantile regression analysis summarized in the form of the following equation.

$$y_{\tau} = \beta_0 + \beta_1 DD + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e_t \quad (3)$$

where  $y_{\tau}$  is our outcome variable WAZ or HAZ at quantile  $\tau$ .  $\beta_1$  is our coefficient of interest that quantifies the positive or negative impact of one unit increase in the dietary diversity indicator (mentioned above).  $X_1$ ,  $X_2$ , and  $X_3$  are the vectors of child-level, maternal-level,

<sup>7</sup>[https://documents.wfp.org/stellent/groups/public/documents/manual\\_guide\\_proced/wfp197216.pdf?\\_ga=2.245549057.40039945.1532140937-1661406307.1532140937](https://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf?_ga=2.245549057.40039945.1532140937-1661406307.1532140937)

<sup>8</sup> <https://index.nutrition.tufts.edu/data4diets/indicator/mean-adequacy-ratio-mar-based-nutrient-adequacy-ratio-nar>

MAR is the average of adequacy ratios of three micronutrients vitamin A, iron and zinc.

<sup>9</sup>Based on Bennett's law, J.V. Meenakshi (2016) compares changes in anthropometric outcomes with dietary quality as measured by the share of calories intake from non-cereal diet.

<sup>10</sup> Wealth index is calculated based on number of useful assets, access to cooking fuel, access to electricity and education level of the household decision maker.

<sup>11</sup> SSI was constructed based on two parameters such as distance from city center and built-up area. More information on SSI and stratum can be found in Hoffmann et al (2017).



and household-level characteristics. Vector  $X_4$  comprises of location and regional dummies.

Table 1 presents the descriptive statistics of the sample. Mean WAZ and HAZ of the sampled children is -1.09 and -1.33 respectively, 24 percent of the children were stunted, and 35 percent of them were underweight. These prevalence rates are similar to those observed for the state in DLHS-IV (2012-13). The HDDS for the sampled households is 10.5 and have an FCS of 93 (maximum obtainable value is 112), which indicates that all the sampled households are consuming good quality diet. High diet quality is also reflected in an MAR of 0.9 (implying only 10 percent deficit from the recommended norm) and roughly 50 percent share of non-cereal calorie in total calorie intake. On average mothers, have 9 years of formal education, but only 15 percent are engaged in any kind of remunerative work outside home. The average household size is six. About half of the households belong to the lower caste groups (SC&ST; OBC) and a majority (92%) belong to Hindu religion. More than half of the households have access to the urban environment as only 35(%) of them belong to stratum 5 and 6 which are far away from the city center based on SSI.

In Table 2, we present the average levels of the dietary diversity measures discussed above, by the nutritional status of the child (underweight and stunting). The last column shows that there is not much difference between the dietary quality indicators of malnourished and well-nourished children, suggesting no correlation between the two. The few differences which are statistically significant have economically small values.

Using the food composition tables, we estimate the household level intake of calories, vitamin A and iron from the consumption expenditure data. Next, using the demographic information of the household we calculate the total requirement for these three. Comparing the intake and requirement, we can identify the percentage of households with inadequate intake of calories (58), vitamin A (11) and iron (66). In Table 3, we present the distribution of nutrient adequate households by nutritional status of the child. A strong correlation between the two would imply that a high percentage of households will be in either inadequate nutrient-malnourished child or adequate nutrient-well nourished child category. However, that is not the case as is seen from Table 3. About 40-50 percent of children belong to calorie or iron inadequate households but are well-nourished, implying lack of correlation with both quantity (calories) and quality (micronutrients) of food.

#### **IV. Results and Discussion**

We first present results for HDDS using OLS method in Table 4 and 5 (column2). Some of the predictors may not have a significant association on average but possibly at different points along the conditional distribution of the outcome variable. In these cases, quantile regression is an efficient solution to estimate the covariates at different points of the distribution (Uttamacharya et al 2013). We employ a multivariate analysis using quantile

regression to capture this relation through the entire distribution of the outcome variable. The previous studies on the relationship between the child anthropometric outcomes and its determinants in India have considered only the average effects. We chose 5th, 10th, 25th, 50th, 75th, 90th and 95th quantile of the outcome variables WAZ and HAZ for our estimation and the results are presented in Table 4 and Table 5 (column 3-9).

The OLS results show that there is no relationship between HDDS and anthropometric outcomes. Looking at quantile regression results, we only find positive and significant association of HDDS with WAZ Z-score in the lowest quantile (5th) of the distribution. Here one additional food group is associated with 0.4 standard deviations increased WAZ, *ceteris paribus*. We do not find any significant association between HAZ and HDDS in any of the quantiles. Similar results are also observed in Amugsi et al. (2017) where they did not find any significant association between dietary diversity score and HAZ distribution for Kenya and Mozambique. Similarly, Perkins et al. (2018) have found mixed associations between dietary diversity and growth outcomes for children aged 6 to 12 months and found no association for children aged 12-24 months.

To check the robustness of our results we estimate equation (3) using different indicators of dietary quality – FCS, simple count of food items consumed, MMAR, and share of non-cereal calorie, as mentioned in section III. The results are summarized in Table 6 and Table 7.<sup>12</sup> The results do not differ much even when different indicators of dietary quality are considered for estimation. Thus, we do not find any evidence of significant relationship between dietary quality and anthropometric outcomes of young children in our sample.

Among other covariates, mother's height is positively and significantly associated with both WAZ and HAZ Z-scores in the bottom half of the distribution. To the extent mother's height is an indicator of her long run nutrition, this points to the importance of maternal nutrition on child's health outcomes. Mother's age is significantly and negatively associated with the HAZ scores at 90<sup>th</sup> and 95<sup>th</sup> quantile but surprisingly there is a negative association of years of education of the mother at 95<sup>th</sup> quantile of HAZ distribution. Maternal engagement in labor-intensive activities (and therefore more likely to be low income earning activity) is associated with lower WAZ and HAZ scores for the uppermost quantile of the distribution. The negative association may be due to inadequate childcare due to limited time available with working mothers for childcare.

Household characteristics such as caste and religion have a heterogeneous association with the WAZ and HAZ distribution. We found no significant association between the household size and the health outcomes of the sampled children. The wealth index has a coefficient of 0.17 in the lowest quantile of the WAZ distribution and 0.15 in the 25th quantile of the HAZ distribution; the positive association with health outcomes is observed for only one of the quantiles. The farming households have positive and

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<sup>12</sup> We only present the coefficients for dietary quality variables. The full results, coefficients for all other covariates are available on request.

significant associations in the first five quantiles of the HAZ distribution. Access to sanitation and clean drinking water facilities is positively and significantly associated with 90th (1.51) and 95th (0.93) quantile of the HAZ distribution but there is no significant association of access to sanitation and clean drinking water on WAZ scores.

## **V. Strengths and weaknesses**

Our study uses primary data for the quantile regression analysis of dietary diversity and anthropometric outcomes in the rural-urban interface of Bangalore. Besides the detailed and rich data set, the use of quantile regression is one of the strengths of the study as most of the previous research has examined this association at mean providing only a partial view on the relationship between outcome and explanatory variable. Conducting a robustness check of the results using different measures of dietary diversity is another contribution of this study.

The study also has some limitations. The first, we use of cross-sectional data, which limits our ability to address potential endogeneity concerns. Another weakness is the use of 14-day recall period data to construct dietary diversity score. While it is a better compared to the commonly used one day recall period, it still limits the understanding of possible seasonal variations in the household dietary diversity and its implications for anthropometric outcomes. Another limitation is that the dietary diversity measures have been calculated based on household consumption. To the extent household diversity is a good measure of individual diversity, our results are valid. However, particularly for young children, household dietary diversity might not reflect their own diet quality. The next step therefore is to calculate individual level dietary diversity measures. Finally, while the enumerators were given comprehensive training on probing techniques for food consumed outside home and were regularly monitored during interview, it is possible that some of items consumed outside were not reported.

## **VI. Conclusion**

Our study conducted a quantile regression estimation to analyze the association between the household dietary diversity and anthropometric outcomes of children aged 0-6 years. We used primary data on household food consumption and anthropometric outcomes for 274 children in 222 households in the rural-urban interface of Bangalore. The study showed no significant evidence of dietary quality being associated with better child growth outcomes among children in the sample distribution. The results did not differ much even when different indicators of dietary quality are considered in the estimation model. One of the reasons for insignificant results can be high diet quality among sample households, leading to insufficient variation in the explanatory variable. Another important factor is that these dietary quality indicators are measured at the household

level and not the individual level. However, it is also possible that the link between diet quality and child growth outcomes is much weaker than it is commonly believed.

## Figures and Tables

Figure 1. location of sampled households in two transects

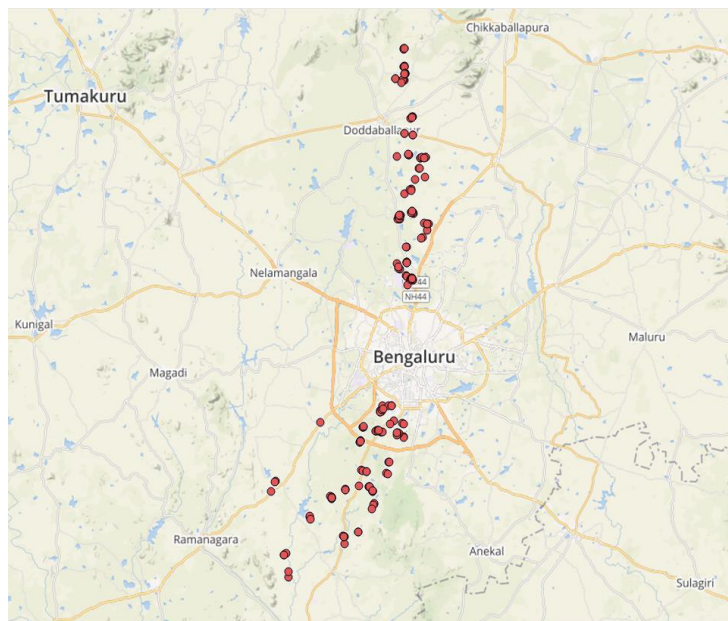


Table 1. Descriptive statistics

| Variable                                 | mean/percentage | SD    |
|--|-----------------|-------|
| Weight-for-age (WAZ)                     | -1.09           | 1.55  |
| Height-for-age (HAZ)                     | -1.33           | 1.96  |
| HDDS                                     | 10.5            | 1.13  |
| FCS (food consumption score)             | 93              | 12.21 |
| Food count                               | 49              | 12.69 |
| MMAR (mean micronutrient adequacy ratio) | 0.87            | 0.15  |
| Share of non-cereal calorie              | 45.01           | 12.71 |
| Child age (months)                       | 36.23           | 17.21 |
| Child sex (dummy; 1=male)                | 52.99           |       |
| Mother height (cm)                       | 153.96          | 6.39  |
| Mother age (years)                       | 26.51           | 5.06  |
| Mother education (years)                 | 9.75            | 3.88  |
| Mother occupation, (housewife) ref       | 86.94           |       |
| Office work                              | 8.96            |       |
| Heavy work                               | 4.1             |       |
| Person buying food (female)              | 22.39           |       |
| HH size (count)                          | 5.98            | 2.33  |
| Caste (general) ref                      | 51.49           |       |
| SC&ST                                    | 26.12           |       |
| OBC                                      | 22.39           |       |
| Wealth Index                             | 9.03            | 2.47  |
| Toilet (dummy, yes)                      | 92.91           |       |
| Filtered water (dummy, yes)              | 54.1            |       |
| Religion (Hindu) ref                     | 92.54           |       |
| Muslim                                   | 5.22            |       |
| Christian                                | 2.24            |       |
| Stratum 1 (urban)ref                     | 12.31           |       |
| Stratum 2 (urban)                        | 16.04           |       |
| Stratum 3 (peri-urban)                   | 13.06           |       |
| Stratum 4 (peri-urban)                   | 24.63           |       |
| Stratum 5 (rural)                        | 24.25           |       |
| Stratum 6 (rural)                        | 9.7             |       |
| Vegetarian family (dummy, yes)           | 9.7             |       |
| Owned house (dummy, yes)                 | 70.15           |       |
| Decision maker (Male)                    | 78.36           |       |
| Transect, north                          | 50.75           |       |

Table 2. Dietary diversity measures by health outcome of children

| Variables                                   | Health outcome of the children |               | Difference     |
|---|--------------------------------|---------------|----------------|
|   | Underweight                    | Normal weight |                |
| Calorie intake (per capita)                 | 2387 (95)                      | 2407 (58)     | - 20 (111)     |
| Calorie intake (consumer equivalence units) | 3155 (123)                     | 3151 (75)     | 4 (144)        |
| Mean Micronutrient Adequacy ratio           | 0.88 (0.02)                    | 0.87 (0.01)   | 0.01 (0.02)    |
| Share of non-cereal calories                | 42 (1.15)                      | 45 (0.80)     | -3 (1.41)*     |
| HDDS  | 10.2 (0.15)                    | 10.6 (0.06)   | -0.4 (0.16)*** |
| FCS   | 89 (1.66)                      | 94 (0.67)     | -5 (1.79)**    |
| Food item count                             | 44 (1.35)                      | 50 (0.78)     | 6 (1.56)***    |
| Percentage of children                      | 25                             | 75            |                |
| Variables                                   | Stunted                        | Not stunted   | Difference     |
|   |                                |               |                |
| Calorie intake (per capita)                 | 2398 (91)                      | 2340 (62)     | 2 (110)        |
| Calorie intake (consumer equivalence units) | 3121 (116)                     | 3149 (80)     | -27 (141)      |
| Mean Micronutrient Adequacy ratio           | 0.87 (0.02)                    | 0.88 (0.01)   | -0.01 (0.02)   |
| Share of non-cereal calories                | 44 (1.22)                      | 44 (0.87)     | 0 (1.50)       |
| HDDS  | 10.4 (0.10)                    | 10.6 (0.08)   | -0.2 (0.13)    |
| FCS   | 91 (1.26)                      | 94 (0.83)     | -2 (1.51)      |
| Food item count                             | 46 (0.94)                      | 50 (0.94)     | -4 (1.43)***   |
| Percentage of children                      | 34                             | 66            |                |

Standard errors in parenthesis. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Table 3: Nutrient adequacy status of the household by nutritional outcome of children.

| Variables             | Health outcome of the children |               |
|-----------------------|--------------------------------|---------------|
|                       | Underweight                    | Normal weight |
| Calorie               |                                |               |
| Adequate households   | 11                             | 31            |
| Inadequate households | 13                             | 45            |
| Vitamin A             |                                |               |
| Adequate households   | 23                             | 66            |
| Inadequate households | 2                              | 9             |
| Iron                  |                                |               |
| Adequate households   | 9                              | 25            |
| Inadequate households | 16                             | 50            |
|                       | Stunted                        | Not stunted   |
| Calorie               |                                |               |
| Adequate households   | 15                             | 27            |
| Inadequate households | 18                             | 40            |
| Vitamin A             |                                |               |
| Adequate households   | 11                             | 24            |
| Inadequate households | 23                             | 42            |
| Iron                  |                                |               |
| Adequate households   | 30                             | 59            |
| Inadequate households | 4                              | 7             |



Table 4. OLS &amp; Quantile regression; Dependent variable: WAZ Z-score for children &lt;6 years of age

| VARIABLES                      | OLS                   | 5th                  | 10th                 | 25th                  | 50th                  | 75th                 | 90th                 | 95th                  |
|--------------------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|
| HDDS                           | 0.0612<br>(0.0932)    | 0.410**<br>(0.187)   | 0.264<br>(0.172)     | 0.0900<br>(0.113)     | 0.142<br>(0.0958)     | 0.0714<br>(0.257)    | -0.183<br>(0.222)    | -0.425<br>(0.284)     |
| Gender<br>(male)               | 0.102<br>(0.206)      | -0.1000<br>(0.342)   | 0.00583<br>(0.412)   | -0.0150<br>(0.248)    | -0.00532<br>(0.213)   | -0.312<br>(0.239)    | 0.246<br>(0.463)     | 0.794<br>(0.553)      |
| Age<br>(months)                | -0.00589<br>(0.00753) | 0.00934<br>(0.0125)  | 0.00131<br>(0.00873) | 0.000647<br>(0.00718) | 0.000321<br>(0.00905) | -0.0109<br>(0.00822) | -0.0136<br>(0.0103)  | -0.0208**<br>(0.0105) |
| Mother height<br>(cm)          | 0.0245<br>(0.0150)    | 0.0212<br>(0.0203)   | 0.0386**<br>(0.0191) | 0.0467***<br>(0.0138) | 0.00719<br>(0.0307)   | 0.0125<br>(0.0254)   | -0.0321<br>(0.0265)  | -0.0292<br>(0.0350)   |
| Mother edu<br>(years)          | -0.0165<br>(0.0196)   | -0.0124<br>(0.0464)  | -0.00977<br>(0.0639) | 0.000801<br>(0.0196)  | -0.00858<br>(0.0218)  | 0.00570<br>(0.0534)  | -0.00592<br>(0.0397) | -0.0550<br>(0.0412)   |
| Mother edu<br>(years)          | -0.000881<br>(0.0355) | 0.0689<br>(0.0535)   | -0.0122<br>(0.0747)  | 0.00701<br>(0.0538)   | 0.0421<br>(0.0526)    | 0.0594<br>(0.0541)   | 0.0498<br>(0.0671)   | -0.0246<br>(0.0690)   |
| mother occ<br>(housewife)      | ref                   | ref                  |                      |                       |                       |                      |                      |                       |
| Mother occ<br>(office)         | -0.375<br>(0.357)     | 0.314<br>(0.654)     | 0.294<br>(0.674)     | -0.195<br>(0.506)     | -0.289<br>(0.400)     | -0.464<br>(0.679)    | -0.0924<br>(0.479)   | -0.772*<br>(0.454)    |
| Mother occ<br>(heavy)          | -0.323<br>(0.510)     | 0.867<br>(1.595)     | 0.420<br>(0.902)     | 0.174<br>(0.525)      | -0.301<br>(0.505)     | -0.596<br>(1.421)    | -1.092<br>(1.296)    | -1.877***<br>(0.354)  |
| Person buying<br>food (female) | -0.227<br>(0.207)     | 0.436<br>(0.349)     | 0.119<br>(0.364)     | -0.255<br>(0.267)     | -0.142<br>(0.296)     | -0.300<br>(0.596)    | -0.415<br>(0.344)    | 0.117<br>(0.401)      |
| HH size<br>(count)             | 0.0345<br>(0.0427)    | 0.0347<br>(0.0755)   | 0.0412<br>(0.0869)   | 0.0723<br>(0.0489)    | 0.0603<br>(0.0481)    | -0.0166<br>(0.0606)  | 0.0700<br>(0.0826)   | 0.0862<br>(0.0584)    |
| caste (general)                | ref                   |                      |                      |                       |                       |                      |                      |                       |
| caste<br>(SC&ST)               | -0.283<br>(0.219)     | -0.0913<br>(0.372)   | -0.0486<br>(0.391)   | -0.0539<br>(0.242)    | -0.442**<br>(0.208)   | -0.156<br>(0.325)    | -0.239<br>(0.396)    | 0.154<br>(0.531)      |
| caste<br>(OBC)                 | -0.161<br>(0.269)     | -0.199<br>(0.689)    | -0.138<br>(0.431)    | 0.0133<br>(0.262)     | -0.271<br>(0.300)     | -0.214<br>(0.639)    | 0.104<br>(0.418)     | 0.636<br>(0.408)      |
| Wealth Index                   | 0.0555<br>(0.0400)    | 0.174*<br>(0.0925)   | 0.103<br>(0.0690)    | 0.0631<br>(0.0497)    | 0.0454<br>(0.0554)    | 0.0333<br>(0.0785)   | -0.102*<br>(0.0598)  | -0.0493<br>(0.0574)   |
| Toilet<br>(yes)                | 0.216<br>(0.399)      | 0.00570<br>(1.075)   | 0.162<br>(0.690)     | 0.0120<br>(0.552)     | -0.00930<br>(0.466)   | -0.0506<br>(1.242)   | 0.00966<br>(0.809)   | 0.517<br>(0.445)      |
| Filtered water<br>(yes)        | -0.0388<br>(0.218)    | 0.152<br>(0.369)     | 0.0775<br>(0.451)    | 0.233<br>(0.277)      | -0.185<br>(0.339)     | -0.196<br>(0.288)    | -0.198<br>(0.355)    | -0.309<br>(0.531)     |
| Religion(Hindu)                | ref                   |                      |                      |                       |                       |                      |                      |                       |
| Religion<br>(Muslim)           | 0.0203<br>(0.311)     | 1.564*<br>(0.898)    | 1.368**<br>(0.655)   | 0.532<br>(0.570)      | 0.244<br>(0.448)      | -0.0521<br>(0.538)   | -0.809<br>(0.543)    | -0.489<br>(0.646)     |
| Religion<br>(Christian)        | -0.865***<br>(0.230)  | -0.532<br>(1.178)    | -1.253<br>(0.840)    | -0.760<br>(0.568)     | -1.043***<br>(0.398)  | -0.921*<br>(0.480)   | 0.618<br>(1.922)     | 1.172<br>(1.283)      |
| Stratum 1                      | ref                   |                      |                      |                       |                       |                      |                      |                       |
| Stratum 2<br>(urban)           | 0.534<br>(0.351)      | 2.271***<br>(0.863)  | 0.749<br>(0.855)     | 0.162<br>(0.332)      | 0.516<br>(0.480)      | -0.00732<br>(0.423)  | 0.0139<br>(0.552)    | 0.424<br>(1.206)      |
| Stratum 3<br>(peri-urban)      | 0.169<br>(0.437)      | 1.582*<br>(0.861)    | -0.0879<br>(0.815)   | -0.133<br>(0.511)     | -0.0124<br>(0.535)    | -0.241<br>(0.609)    | 0.659<br>(0.607)     | 0.252<br>(1.312)      |
| Stratum 4<br>(peri-urban)      | -0.0882<br>(0.346)    | 0.995<br>(0.885)     | -0.290<br>(1.046)    | -0.366<br>(0.436)     | -0.0822<br>(0.558)    | -0.301<br>(0.524)    | -0.139<br>(0.575)    | -0.0941<br>(1.648)    |
| Stratum 5<br>(rural)           | 0.103<br>(0.395)      | 1.255<br>(0.834)     | 0.343<br>(0.798)     | -0.161<br>(0.344)     | -0.0617<br>(0.454)    | -0.276<br>(0.547)    | -0.0371<br>(0.616)   | 0.121<br>(1.351)      |
| Stratum 6<br>(rural)           | -0.355<br>(0.447)     | 0.257<br>(1.747)     | -0.191<br>(0.794)    | -0.550<br>(0.453)     | -0.359<br>(0.573)     | -0.652<br>(0.646)    | -0.938<br>(0.643)    | -1.091<br>(1.521)     |
| Transect<br>(North)            | -0.165<br>(0.195)     | 0.424<br>(0.372)     | 0.188<br>(0.366)     | -0.446*<br>(0.241)    | -0.197<br>(0.253)     | -0.0339<br>(0.588)   | -0.403<br>(0.375)    | -0.203<br>(0.729)     |
| Constant                       | -5.553**<br>(2.550)   | -14.90***<br>(3.905) | -12.69***<br>(3.438) | -10.92***<br>(2.310)  | -4.339<br>(4.572)     | -2.784<br>(4.959)    | 8.663*<br>(4.870)    | 12.04***<br>(3.165)   |
| Observations                   | 268                   | 268                  | 268                  | 268                   | 268                   | 268                  | 268                  | 268                   |
| R-squared                      | 0.105                 | 0.036                | 0.044                | 0.060                 | 0.082                 | 0.061                | 0.008                | 0.011                 |

Robust standard errors in parentheses. The standard errors are clustered at the village-level.

\*\*\*p&lt;0.01,\*\*p&lt;0.05,\*p&lt;0.1

Table 5. OLS &amp; Quantile regression; Dependent variable: HAZ Z-score for children &lt;6 years of age

| VARIABLES                      | OLS                  | 5th                   | 10th                 | 25th                 | 50th                  | 75th                  | 90th                   | 95th                   |
|--------------------------------|----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|------------------------|------------------------|
| HDDS                           | 0.0488<br>(0.119)    | -0.271<br>(0.244)     | -0.0830<br>(0.249)   | -0.000908<br>(0.173) | 0.113<br>(0.138)      | 0.207<br>(0.178)      | 0.159<br>(0.436)       | 0.182<br>(0.178)       |
| Gender<br>(male)               | 0.0784<br>(0.301)    | -0.677*<br>(0.399)    | -0.559<br>(0.443)    | -0.138<br>(0.392)    | -0.0243<br>(0.326)    | 0.207<br>(0.303)      | 0.463<br>(0.426)       | 1.455***<br>(0.338)    |
| Age<br>(months)                | 0.0141*<br>(0.00816) | 0.0410***<br>(0.0131) | 0.0319**<br>(0.0125) | 0.0188*<br>(0.00992) | 0.00796<br>(0.00861)  | 0.0174*<br>(0.00941)  | 0.0130<br>(0.0115)     | 0.0227***<br>(0.00584) |
| Mother height<br>(cm)          | 0.0337**<br>(0.0168) | 0.115***<br>(0.0433)  | 0.0775*<br>(0.0437)  | 0.0344<br>(0.0244)   | 0.0530***<br>(0.0199) | 0.0210<br>(0.0303)    | 0.0735<br>(0.0544)     | 0.0185<br>(0.0224)     |
| Mother edu<br>(years)          | -0.0227<br>(0.0204)  | -0.00414<br>(0.0577)  | -0.00572<br>(0.0523) | 0.00460<br>(0.0335)  | -0.0105<br>(0.0390)   | -0.000941<br>(0.0273) | -0.0866***<br>(0.0285) | -0.0952***<br>(0.0135) |
| Mother edu<br>(years)          | -0.00526<br>(0.0480) | 0.0195<br>(0.0534)    | 0.0555<br>(0.0662)   | 0.000114<br>(0.0589) | 0.00336<br>(0.0544)   | 0.0502<br>(0.0584)    | -0.0872<br>(0.0606)    | -0.187***<br>(0.0303)  |
| Mother occ<br>(housewife)      | ref                  | ref                   |                      |                      |                       |                       |                        |                        |
| Mother occ<br>(office)         | -0.160<br>(0.328)    | -0.0265<br>(0.711)    | 0.364<br>(0.863)     | 0.341<br>(0.600)     | -0.344<br>(0.379)     | -0.467<br>(0.411)     | -0.249<br>(0.336)      | -0.216<br>(0.408)      |
| Mother occ<br>(heavy)          | 0.789<br>(0.911)     | 0.226<br>(1.302)      | 0.859<br>(0.795)     | 0.939<br>(0.901)     | 0.648<br>(0.989)      | 1.266<br>(1.705)      | 2.118<br>(1.311)       | 3.607***<br>(0.825)    |
| HH size<br>(count)             | 0.00875<br>(0.0515)  | 0.0917<br>(0.0721)    | 0.0268<br>(0.102)    | -0.00311<br>(0.0514) | -0.0277<br>(0.0611)   | -0.00991<br>(0.0956)  | -0.0923<br>(0.111)     | 0.00202<br>(0.0875)    |
| caste (general)                | ref                  |                       |                      |                      |                       |                       |                        |                        |
| caste<br>(SC&ST)               | 0.00332<br>(0.332)   | 0.572<br>(0.567)      | -0.138<br>(0.511)    | -0.155<br>(0.385)    | -0.0344<br>(0.378)    | -0.0634<br>(0.330)    | -0.357<br>(0.623)      | -0.459<br>(0.321)      |
| caste<br>(OBC)                 | 0.0902<br>(0.440)    | -0.0747<br>(0.546)    | -0.581<br>(0.468)    | -0.415<br>(0.449)    | -0.315<br>(0.474)     | 0.718<br>(0.862)      | 0.656<br>(0.860)       | 1.406***<br>(0.529)    |
| Religion(Hindu)                | ref                  |                       |                      |                      |                       |                       |                        |                        |
| Religion<br>(Muslim)           | 0.473<br>(0.549)     | 0.224<br>(0.671)      | 0.371<br>(1.150)     | 0.606<br>(0.956)     | 0.679<br>(0.901)      | 0.262<br>(0.810)      | 0.606<br>(0.962)       | 0.443<br>(0.709)       |
| Religion<br>(Christian)        | 0.322<br>(0.366)     | 1.117<br>(0.860)      | 0.724<br>(0.690)     | 0.180<br>(0.471)     | 0.158<br>(0.569)      | -0.0571<br>(0.510)    | -1.185<br>(0.900)      | -2.042***<br>(0.512)   |
| Farming<br>(yes)               | 0.850**<br>(0.360)   | 1.344**<br>(0.602)    | 1.381**<br>(0.701)   | 1.151**<br>(0.468)   | 0.767**<br>(0.344)    | 1.008**<br>(0.483)    | 0.581<br>(0.638)       | 0.591<br>(0.430)       |
| Toilet<br>(yes)                | 0.602<br>(0.587)     | 0.798<br>(0.675)      | 0.479<br>(1.120)     | -0.0365<br>(0.781)   | 0.175<br>(0.608)      | 0.822<br>(0.539)      | 1.507***<br>(0.560)    | 0.888<br>(0.727)       |
| Wealth Index                   | 0.0490<br>(0.0612)   | 0.0966<br>(0.0717)    | 0.0673<br>(0.0954)   | 0.154**<br>(0.0651)  | 0.0773<br>(0.0811)    | 0.0187<br>(0.0770)    | 0.125<br>(0.104)       | -0.0112<br>(0.0577)    |
| Person buying<br>food (female) | -0.240<br>(0.367)    | -1.282*<br>(0.691)    | -0.638<br>(0.474)    | -0.488<br>(0.453)    | -0.373<br>(0.375)     | 0.0365<br>(0.486)     | 0.466<br>(0.486)       | 0.0614<br>(0.357)      |
| vegetarian<br>(yes)            | 0.345<br>(0.759)     | -1.633<br>(1.403)     | -1.100<br>(1.164)    | -0.536<br>(1.229)    | -0.252<br>(0.719)     | 0.637<br>(1.153)      | 0.684<br>(1.201)       | 1.095**<br>(0.514)     |
| owned house<br>(yes)           | -0.295<br>(0.422)    | -0.769<br>(0.829)     | -0.444<br>(0.740)    | 0.000627<br>(0.711)  | -0.353<br>(0.611)     | -1.087*<br>(0.587)    | -0.447<br>(0.648)      | 0.255<br>(0.499)       |
| source_water                   | 0.0679<br>(0.359)    | 0.600<br>(0.441)      | 0.257<br>(0.466)     | -0.0392<br>(0.456)   | -0.0557<br>(0.379)    | 0.189<br>(0.404)      | 0.773<br>(0.482)       | 0.935***<br>(0.306)    |
| decision maker<br>(male)       | 0.141<br>(0.261)     | -0.444<br>(0.537)     | -0.484<br>(0.425)    | -0.00914<br>(0.436)  | 0.165<br>(0.385)      | 0.120<br>(0.407)      | 0.432<br>(0.521)       | 1.054***<br>(0.254)    |
| Stratum 1                      | ref                  |                       |                      |                      |                       |                       |                        |                        |
| Stratum 2<br>(urban)           | 1.101**<br>(0.511)   | 1.717<br>(1.055)      | 1.618<br>(1.464)     | 0.326<br>(0.912)     | 0.301<br>(0.925)      | 1.617*<br>(0.848)     | 3.164***<br>(0.761)    | 2.875***<br>(0.508)    |
| Stratum 3<br>(peri-urban)      | 0.897<br>(0.637)     | 2.083<br>(1.367)      | 2.163<br>(1.628)     | 0.382<br>(0.901)     | -0.0914<br>(1.038)    | 1.816***<br>(0.703)   | 1.949**<br>(0.863)     | 3.538***<br>(0.960)    |
| Stratum 4<br>(peri-urban)      | 0.173<br>(0.521)     | 0.373<br>(1.381)      | 0.142<br>(1.514)     | -0.699<br>(0.800)    | -0.396<br>(0.902)     | 0.909<br>(0.619)      | 1.394*<br>(0.846)      | 1.110**<br>(0.481)     |
| Stratum 5<br>(rural)           | 0.505<br>(0.610)     | 0.626<br>(1.440)      | 0.721<br>(1.495)     | -0.803<br>(0.831)    | 0.0807<br>(0.991)     | 1.861***<br>(0.559)   | 2.440***<br>(0.898)    | 1.385***<br>(0.428)    |
| Stratum 6                      | -0.452               | 1.153                 | 0.854                | -1.484*              | -0.863                | 0.712                 | 0.636                  | 0.334                  |

|              |           |           |          |          |           |          |         |         |
|--------------|-----------|-----------|----------|----------|-----------|----------|---------|---------|
| (rural)      | (0.673)   | (1.410)   | (1.531)  | (0.829)  | (1.074)   | (0.727)  | (0.978) | (0.552) |
| Transect     | -0.301    | -1.181*** | -0.942*  | -0.405   | -0.350    | -0.674** | 0.645   | -0.665* |
| (North)      | (0.211)   | (0.445)   | (0.520)  | (0.401)  | (0.315)   | (0.285)  | (0.655) | (0.399) |
| Constant     | -8.686*** | -22.40*** | -17.32** | -9.631** | -11.33*** | -8.913*  | -14.48  | -4.186  |
|              | (3.161)   | (6.798)   | (7.178)  | (4.733)  | (3.345)   | (5.208)  | (12.56) | (5.062) |
| Observations | 243       | 243       | 243      | 243      | 243       | 243      | 243     | 243     |
| R-squared    | 0.130     | 0.062     | 0.069    | 0.083    | 0.088     | 0.093    | 0.063   | 0.040   |

Robust standard errors in parentheses. The standard errors are clustered at the village-level.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6. Children (below 6 years) – WAZ Z-score – Coefficients from OLS and Quantile regressions

| VARIABLES      | OLS       | 5th      | 10th     | 25th      | 50th      | 75th     | 90th     | 95th      |
|----------------|-----------|----------|----------|-----------|-----------|----------|----------|-----------|
| HDDS           | 0.0612    | 0.410**  | 0.264    | 0.0900    | 0.142     | 0.0714   | -0.183   | -0.425    |
|                | (0.0932)  | (0.187)  | (0.172)  | (0.113)   | (0.0958)  | (0.257)  | (0.222)  | (0.284)   |
| FCS            | 0.00563   | 0.0132   | 0.0259** | 0.0201*   | 0.0120    | 0.00219  | -0.0169  | -0.0394*  |
|                | (0.00842) | (0.0162) | (0.0116) | (0.0117)  | (0.0135)  | (0.0164) | (0.0308) | (0.0203)  |
| Food count     | 0.00858   | 0.0260   | 0.0182   | 0.00723   | 0.0165*   | 0.00232  | -0.00239 | 0.0153    |
|                | (0.00726) | (0.0194) | (0.0169) | (0.00872) | (0.00938) | (0.0109) | (0.0105) | (0.0157)  |
| MMAR           | 0.126     | -1.885   | 0.0746   | 0.0221    | -0.172    | 0.362    | -1.837*  | 0.0873    |
|                | (0.744)   | (1.538)  | (1.254)  | (0.612)   | (1.085)   | (0.999)  | (1.072)  | (0.984)   |
| share of non-  | -0.00539  | 0.0226   | 0.000179 | 0.00239   | -0.00144  | -0.00926 | -0.0163  | -0.0359** |
| cereal calorie | -0.00843  | -0.0184  | -0.0183  | -0.0105   | -0.0128   | -0.0117  | -0.0155  | -0.0153   |

Robust standard errors in parentheses. The standard errors are clustered at the village-level.

\*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Notes – Controls include age and gender of the child, mother's age, education, height, working status, gender of the person buying food, household size, wealth index, access to clean water and sanitation facility, caste, religion, and regional dummies.

Table 7. Children (below 6 years) – HAZ z-score – Coefficients from OLS and Quantile regressions

| VARIABLES      | OLS       | 5th      | 10th     | 25th      | 50th     | 75th     | 90th      | 95th      |
|----------------|-----------|----------|----------|-----------|----------|----------|-----------|-----------|
| HDDS           | 0.0488    | -0.271   | -0.0830  | -0.000908 | 0.113    | 0.207    | 0.159     | 0.182     |
|                | (0.119)   | (0.244)  | (0.249)  | (0.173)   | (0.138)  | (0.178)  | (0.436)   | (0.178)   |
| FCS            | 0.00608   | -0.0306  | -0.0265  | 0.00477   | 0.00637  | 0.0192   | 0.0434*** | 0.0238*   |
|                | (0.00999) | (0.0217) | (0.0177) | (0.00954) | (0.0129) | (0.0167) | (0.0125)  | (0.0137)  |
| Food count     | 0.0113    | 0.000359 | 0.0148   | 0.00946   | 0.0281** | 0.0178   | -0.00249  | 0.0183*   |
|                | (0.00944) | (0.0155) | (0.0183) | (0.0136)  | (0.0116) | (0.0155) | (0.0159)  | (0.00973) |
| MMAR           | 0.187     | 1.081    | 0.232    | 0.0139    | 0.112    | 0.954    | -2.188    | -0.622    |
|                | -1.02     | -1.921   | -2.114   | -1.333    | -1.102   | -1.74    | -2.039    | -1.298    |
| share of non-  | -0.00634  | -0.0386  | -0.0148  | 0.000924  | -0.00445 | -0.0128  | -0.00587  | 0.00558   |
| cereal calorie | -0.0104   | -0.038   | -0.032   | -0.0119   | -0.0142  | -0.0157  | -0.032    | -0.00922  |

Robust standard errors in parentheses. The standard errors are clustered at the village-level.

\*\*\*p<0.01, \*\*p<0.05, \*p<0.1

Notes – Controls include age and gender of the child, mother's age, education, height, working status, gender of the person buying food, household size, wealth index, access to clean water and sanitation facility, caste, religion, and regional dummies.

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