Food Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Food Policy

journal homepage: www.elsevier.com/locate/foodpol

Longitudinal analysis of the intrahousehold distribution of foods in rural Nepal: Relative variability of child dietary quality across age and sex cohorts

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ARTICLE INFO

Keywords:
Intrahousehold food allocation
Animal source foods
Malnutrition
Child dietary quality
Nepal

ABSTRACT

Individual-level dietary data within households are rarely observed over extended periods of time, which limits our understanding of intrahousehold food allocation dynamics. This study explores whether and how dietary patterns of children within households changed over a four-year period in rural Nepal. Fixed-effects analysis of the panel data indicates that there were not disparities in dietary variability between girls and boys, but that there were disparities in dietary variability across age groups. Older children had slightly higher dietary diversity, and their diets were more likely to change as household diets changed, especially for animal sourced foods. For younger children, diets were less diverse but slightly more stable over time. This stability may protect younger children when household diets decline in quality, but younger children may be left out when household dietary quality improves. In contrast, older children reap more gains relative to older children when household dietary quality improves, but would also bear the brunt of food shortages when they arise. These results emphasize the importance of examining differences in dietary quality within households across age groups, especially for children over five years of age who are less likely to be targeted by international nutrition interventions and programs.

1. Introduction

Development programs and projects around the world aim to improve well-being in some way, such as through increased health, wealth, or knowledge. Community development interventions, especially those focused on agriculture, have potential to improve child dietary quality in rural households (Ruel and Alderman, 2013). These programs must operate not only in the context of diverse cultures, societies, and environments, but often also within complex intrahousehold resource allocation processes. The issue of intrahousehold dynamics is particularly relevant for those concerned with improving dietary quality and nutritional status. Food is typically a shared household resource, but different individuals within households have diverse calorie and micronutrient needs, depending on age, life-stage, disease status, and physical activity level. Improving household access to resources is an important development and programmatic goal, but the dynamics of household decision-making are a key factor determining the success or failure of any intervention (Rogers, 1990).

Household resources may be inequitably distributed across different household members, especially during times when household circumstances are changing, such as due to fluctuations in incomes. For farming households, weather variability, harvest fluctuations, or calorie expenditure from agricultural labor may also induce sudden changes in the intrahousehold allocation of resources (Harris-Fry et al., 2017). Despite the importance of within-household analyses, individual-level dietary data within households are rarely observed over extended periods of time, which limits understanding of within-household food distribution dynamics, especially in the context of impact evaluations (Berti, 2012). This study explores whether and how dietary patterns within households changed over a four-year period in the presence of a community-level development intervention in rural Nepal implemented by *Heifer International Nepal* (henceforth Heifer). To do this, we first examined the determinants of child dietary quality in this population, and then measured how child diets co-vary with household diets across age and sex cohorts.

The intervention from which the data for this study were collected has been demonstrated to improve both child health and child dietary quality in Nepal and elsewhere, and these results vary across different

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https://doi.org/10.1016/j.foodpol.2018.06.003
Received 20 November 2017; Received in revised form 2 May 2018; Accepted 19 June 2018

regions and versions of the intervention (Miller et al., 2014; Darrouzet-Nardi et al., 2016; Miller et al., 2017; Rawlins et al., 2014). Intervention activities were provided to specific areas within rural communities and consisted of women's self-help groups which met regularly to promote community cohesion and self-reliance. Two meat-type goats were gifted to participating families at the end of the first year of the intervention. Further details about the intervention itself, and its impacts on dietary quality and child health can be found in Miller et al. (2014), Darrouzet-Nardi et al. (2016), and Miller et al. (2017). During the study period, data on both child-level and household-level dietary intake were collected, offering a unique opportunity to study intrahousehold dynamics over a 4-year period in a population at high risk of malnutrition and food insecurity.

This article does not focus on the impact of the *Heifer* intervention itself, but instead on the intrahousehold dynamics over the same study period. The central hypothesis of this study is that the intrahousehold allocation of foods – measured as responsiveness of child dietary quality to household dietary quality over time – in rural Nepal differed across sex and age cohorts. Differences in dietary quality response matter for child well-being, because even short periods of malnutrition can affect growth and development (Dewey and Begum, 2011). There may be disparities in the levels of dietary quality at any single point in time, or disparities in how dietary quality changes over time for different cohorts of children. This study focused primarily on the latter possibility.

We found that there were disparities in the responsiveness of child dietary quality with respect to child age, but not child sex. The response of child diets to changes in household diets was stronger in older children, especially for animal sourced foods. The corollary to this is that older children are not as protected during times of shortage compared with younger children, because child dietary response also occurs when the quality of household-level diets declines. However, older children do reap benefits during times of plenty for the household, compared with the youngest children whose diets are less responsive to household dietary change. Understanding age-based disparities in food consumption for children older than 5 years is essential because they are an under-studied cohort for which food and nutrition policies are not typically tailored.

2. Background

Although nutrition is improving in Nepal, inadequate child dietary quality is still a problem of public health significance, especially for rural families. Approximately 41% of the population in Nepal lives in rural areas (MOHP & ICF International, 2017). The 2016 *Demographic and Health Survey* (DHS) in Nepal indicated that, for children 6–23 months of age, only 35% of them were fed a minimally acceptable diet in the 24-hours preceding the survey; 35.8% of children under age five were stunted, and 9.7% of children under age five were wasted (MOHP & ICF International, 2017). These prevalence rates of undernutrition are still high, but have been improving over the past 20 years: 57% of children under age five in Nepal were stunted, and 15% of children were wasted in 1996. Micronutrient status may be a particular concern in school-aged children and adolescents. There are several concerning prevalent micronutrient deficiencies among school-aged children in Nepal, where 91.7% of children experienced at least one micronutrient deficiency (Schulze et al., 2014). Iron and iodine are especially important due to their influence on cognitive development (Khatiwada et al., 2016).

These indicators stress the importance of understanding how households allocate constrained resources across different family members, especially children. The present study utilizes a panel dataset of children ranging from 6 months to about 13 years of age during the fourth year of data collection. Unfortunately, detailed and generalizable data on the health and nutritional status of children over age 5 and under age 15 are typically not collected by nationally representative surveys such as the DHS, and little attention is given to older children in the primary literature (Alam et al., 2010). This omission, although it may be necessary due to logistical and financial constraints of complex surveys, limits how much we know about the nutritional status and dietary quality of children over five years of age.

A long history of work in the applied economics, anthropology, sociology, nutrition, and public health literature has examined the intrahousehold dynamics around control of resources, particularly between sexes (Belachew et al., 2011). For example, a study in Bangladesh found nutritional discrimination against girls, as evidenced by 16% higher calorie consumption among boys compared with girls under age 5 (Chen et al., 1981). Sex bias against girls may be related to a lack of maternal empowerment (Trapp et al., 2004), or future economic and labor market opportunities for women. In Nepal, boys are more susceptible to stunting when adverse events occur during gestation, but girls are more susceptible to stunting when adverse events occur during infancy, suggesting the possible presence of sex bias in child feeding practices (Mulmi et al., 2016). However, other work has found evidence that contradicts gender bias against girls. In Nepal, there is evidence for sex bias against adult women and pregnant women, but not against girl children (Harris-Fry et al., 2018; Gittelsohn, 1991). In Peru, there is some evidence for calorie bias against toddler-aged children with respect to their individual needs, but no differences across the sexes in the same population (Graham, 1997). Some studies examine inequitable distributions in food quantities, which may miss the important aspect of dietary quality (Messer, 1997).

A child's age may also affect how health inputs – such as food and healthcare – are allocated within households. In Nepal, age bias has been observed in parental perceptions of the severity of childhood illnesses (Pokhrel and Sauerborn, 2004). Evidence from rural Burkina Faso indicated that there was age bias in the allocation of healthcare resources, but not sex bias (Sauerborn et al., 1996). The authors hypothesized that it was optimal for households to allocate healthcare to those members of the household who were more economically productive (Sauerborn et al., 1996). There is evidence that mothers may protect the caloric intakes of the youngest household members during times of high food prices (Block et al., 2004; Kuku et al., 2011), but inaccurate parental perceptions of the food needs of younger children may contribute to inequitable distributions (Graham, 1997). A literature review found that there was wide variation in relative caloric adequacy between age groups; depending on the setting, younger children were sometimes protected in terms of their caloric intake, but not always (Berti, 2012).

2.1. Dietary diversity and animal sourced foods

We measured dietary quality in this study by dietary diversity, which is a count of the number of food groups from which an individual had consumed (Ruel, 2003). Dietary diversity is a direct determinant of nutritional status, especially for key micronutrients such as vitamin A and iron, which are found predominantly in animal sourced foods (ASF) (Arimond et al., 2010; Arimond and Ruel, 2004). Dietary diversity has been associated with child nutritional status and household food security, independent of income and socioeconomic status across many settings (Arimond and Ruel, 2004; Hoddinott and Yohannes, 2002). Dietary diversity is often measured using 24-hour recall data (Arimond et al., 2010). Recent evidence comparing biochemical nutritional markers with different dietary recall instruments indicates that 24-hour recalls and other simple indicators perform well at estimating nutrient intake (Prentice et al., 2011: Arimond et al., 2010). Importantly, recent work has demonstrated that a 10-item food index performs better than a 7-item food index at predicting nutritional adequacy of a diet (FAO, 2016; Caswell et al., 2018). Deriving actual nutrient intake from more detailed dietary surveys can also be quite informative, but may result in measurement error for nutrients as well as for calories. Using dietary diversity as an outcome can help avoid some uncertainties. Still, all measures of dietary intake have benefits and drawbacks depending on