



Poverty, food insecurity and nutritional deprivation in rural China: Implications for children's literacy achievement

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ARTICLE INFO

Keywords:

International education
Development
Literacy
Poverty
Health
China

ABSTRACT

Globally, food insecurity is a significant contextual aspect of childhood. About 850 million people were undernourished worldwide during the period 2006–2008, including 129.6 million people, or 10 percent of the population, in China (FAO, 2011, pp. 45–46). Implications of food insecurity for children's schooling in developing country contexts are poorly understood. Analyses of a survey of children from 100 villages in northwest China show that long-term undernourishment and food insecurity strike the poorest disproportionately, but not exclusively; long-term undernourishment matters for literacy via early achievement; and, after adjusting for socioeconomic status, long-term undernourishment, and prior achievement, food insecure children have significantly lower literacy scores.

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1. Introduction

According to guidelines developed by an expert working group of the American Institute of Nutrition (Cook and Frank, 2008, p. 193), food insecurity is defined as “Limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.”¹ Evidence suggests that insecure access to nutritious food remains a significant global problem. According to the Food and Agriculture Organization's *State of Food Insecurity in the World* (2011, pp. 45–46), 850 million people were undernourished worldwide during the period 2006–2008, including 129.6 million people, or 10 percent of the national population, in China.

Food insecurity has been linked to a wide variety of adverse health and developmental outcomes in children and adults—both nutrition-related and non-nutrition related (Cook and Frank, 2008; American Dietetic Association, 2010). Food insecurity is associated with higher prevalence of inadequate intake of key nutrients (Rose et al., 1998; Casey et al., 2001; Lee and Frongillo, 2001a,b,c; Adams et al., 2003), risk of overweight status in women and some girls (Olson, 1999; Alaimo et al., 2001c; Laitinen et al., 2001;

Townsend et al., 2001; Dinour et al., 2007; but see Kuku et al., 2012 for insignificant effects of food insecurity on children's overweight status in the US), depressive symptoms in adolescents (Alaimo et al., 2002), poorer interpersonal relations, less self control, and non-cognitive skills impairments and general academic difficulties and social developmental delays in children (Kleinman et al., 1998; Murphy et al., 1998; Alaimo et al., 2001a; Reid, 2000; Stormer and Harrison, 2003; Ashiabi, 2005; Howard, 2011; Roustit et al., 2010). Results from a longitudinal study of welfare recipients in the United States show that household food insecurity is associated with poor physical and mental health of low-income black and white women (Siefert et al., 2004). Food insecurity is also associated with more behavioral problems (Olson, 1999; Slack and Yoo, 2005), poorer school performance (Olson, 1999; Alaimo et al., 2001a; Dunifon and Kowaleski-Jones, 2003), and adverse health outcomes (Alaimo et al., 2001b; Cook et al., 2004; Weinreb et al., 2002) in children. Data from the Early Child Longitudinal Study-Kindergarten Class show that reporting at least one indicator of food insecurity was significantly associated with impaired learning in mathematics from fall to spring of the kindergarten year (Winicki and Jemison, 2003) and with impaired learning in reading from kindergarten to third grade (Jyoti et al., 2005). Belsky et al. (2010) characterize “material hardship related to food”—food insecurity, food insufficiency, and hunger—as a “reliable correlate of cognitive, behavioral, and emotional problems among low income children,” but note that many, though not all, of the disadvantages are explained by other features of household structure.

The knowledge that we have about the consequences of food insecurity for children's well-being is limited in a number of ways. Relatively few studies have employed longitudinal data (Winicki

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¹ According to the same guidelines (Cook and Frank, 2008, p. 193), a food secure household is one in which there is “Access by all people at all times to enough food for an active, healthy life.” Food security includes, at a minimum: (1) the ready availability of nutritionally adequate and safe foods and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies).

and Jamison, 2003; Jyoti et al., 2005). Most utilize data from developed countries, and most employ a fairly limited set of educational measurements. Focusing on the case of rural children in an impoverished province in western China, we address these limitations in this project. Our dataset includes household measures of food insecurity reported by mothers and measures of long-term nutrition status (measured anthropometry), as well as a purpose-designed literacy assessment administered to children. We combine these measures with detailed measures of socioeconomic status of households, a strategy that allows us a close look at links between food insecurity and poverty. Finally, we employ a longitudinal dataset that allows us to adjust for baseline school performance.

We begin with the descriptive task of establishing prevalence of food insecurity among children, and the relation of this issue to poverty and to measured anthropometry. Next, we address our main analytic question: whether food insecurity is linked to children's learning outcomes, measured by a literacy assessment, before and after adjusting for baseline school performance and long term nutrition (captured by anthropometry measures).

2. Food insecurity, undernutrition, and education in China

Undernutrition persists as a problem in parts of rural western China. The prevalence of child stunting declined dramatically in China from 1992 onwards, but a significant divide separates Western and Eastern provinces and rural and urban areas. The ratio of the prevalence of stunting in rural and urban areas increased from 3.5 to 7.2 between 1992 and 2002 (Svedberg, 2006).

While inadequate nutrition remains a serious problem in China's poor rural households, studies of rural children's nutrition and schooling are few and largely descriptive. Jamison (1986) linked nutrition to school achievement used a data set of 3000 children from five different provinces in China. Jamison and his colleagues found that height-for-age, a measure of long-term nutritional status, predicted school performance, measured by grade-for-age; similar findings prevailed through the 1990s, as shown in a replication using the China Health and Nutrition Survey data (Yu and Hannum, 2007). Using data from northwest China, Yu and Hannum (2007) found that home nutrition environment, measured as a scale of food variety, was associated with household socioeconomic status and children's school performance, and operated as a significant mediator of poverty effects on schooling for children in early primary grades. We are not aware of published work linking food insecurity to school performance in China.

3. Data and methods

3.1. Data

This study focuses on data from rural children who are residents of Gansu Province. Relative to China as a whole, Gansu Province exhibits high rates of illiteracy and prevalent poverty. As one of China's poorest provinces, Gansu provides a useful case study for investigating food insecurity-education linkages in a less developed setting. We employ data from the Gansu Survey of Children and Families (GSCF). In the summer of 2000, 2000 children aged 9–12 and their families in 100 rural villages in Gansu Province were interviewed. The sampling strategy involved a multi-stage, cluster design with random selection procedures employed at each stage. At the final stage, children were sampled from lists of all 9–12 year-old children in selected villages, enabling us to avoid concerns about selection bias that afflict school-based samples. Questionnaires were designed for the sample children and their mothers, fathers, teachers, principals and village leaders. In 2004,

original interviewees were revisited, as well as a new sample of oldest younger school-aged siblings.

3.2. Measures

We report results based on two measures of food insecurity. First, we employ a dichotomous measure, household food insecurity, which is based on mothers' responses to the following question: in the past year, which of the following statement describe best your family's food supply? The answer options are (1) often not having enough food; (2) Sometimes not having enough food; (3) Always having enough food. We defined a *food insecurity* dummy variable as "1" if the answers were (1) and (2), else 0. We show descriptives for this variable as reported by mothers in 2000 and 2004, but all analyses rely on the 2004 variable.

We also report results using a different food insecurity specification: a scale variable that we refer to as the food insecurity severity index.² Mothers who reported being food insecure were asked a series of six questions, shown in Table 1, about actions that might be undertaken to respond to food shortages in the preceding year. If they answered that each action had been taken, they were then asked about the frequency of the action. To create the scale, we generated six new variables—one for each of the six questions about the frequency with which each action had been taken. We set the frequency to 0 for food secure households and for households that reported not having taken the action specified in the original question. Other values for these questions were 1 "only in one or two months;" 2 "in some months, but not every month;" or 3 "in almost every month". We then generated a summative scale of the standardized items ($\alpha = 0.7898$).

Child's long-term nutritional status is indicated by measured weight and height at Wave II. Using the U.S. CDC 2000 growth reference, we calculated height- and weight-for-age Z scores, and defined "stunting" as having a less than -2 height-for-age Z score and "severely underweight" as having a less than -2 weight-for-age Z score.

Our main analytic outcome is a measure of school functioning: a purpose-designed literacy assessment, standardized (mean = 0, sd = 1).

Our analyses also include controls for socioeconomic background (mother's and father's years of education, wealth), demographic factors (age and sex), and prior educational performance (cognitive test scores in 2000, school based test scores in 2000, and years of education attained).

3.3. Analytic approach

We first describe the scale of food insecurity and nutritional deprivation in rural Gansu. Next, we analyze food insecurity and nutritional deprivation measures as dependent variables, with an emphasis on the degree to which nutrition is linked to socioeconomic status. Finally, we conduct regression and propensity score matching analyses of the relationship of literacy achievement to food insecurity, before and after adjusting for long-term nutritional status, socioeconomic status, and children's prior academic performance. Most analyses will focus only on the original sample of target children, but for some regression models, we are able to use household random and fixed effects

² Cook and Frank (2008, p. 194) report on a standard Food Security Scale and a Children's Food Security Scale that have been scored and validated in the United States. Our index adapted this approach to the context of rural China, and the context of a multipurpose survey. Our study contains a similar but smaller set of items.

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