

Child Hunger: its Prevalence and Association with BMI and Dietary Intake among Somali Refugee Children in the U.S.

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Abstract:

The primary objectives of the study were to estimate the prevalence of child hunger and its relationship to dietary intake and body mass index (BMI) among Somali refugee children. This article also examined the sociodemographic risk factors of child hunger in Somali households. Somali refugee mothers and children twelve years old or younger (n = 195) were recruited to participate in a cross-sectional survey. During the survey, children's height and weight were measured to calculate BMI while their mothers were interviewed to collect information on sociodemographics, food insecurity, and children's dietary habits. Results indicated that 23 percent of households experienced child hunger. Overall, underweight or BMI < 5th percentile was significantly higher in children who experienced hunger. In terms of dietary intake, compared to food secure or mild to moderate food insecure households, intake of green leafy vegetables was significantly lower (OR: .32; CI: .15–.68; p = .003) while intake of eggs was higher (OR: 23.65; CI: 9.57–58.45; p < .000) among children experiencing hunger. Logistic regression showed that acculturation indicators such as poor English proficiency (OR: 17.76; CI: 1.50–20.14; p = .022) and shorter length of stay in the United States (OR: 3.27; CI: 1.26–8.47; p = .015) increased the likelihood of child hunger.

Keywords: Somali | children | child hunger | refugees | underweight | overweight | food insecurity

Article:

According to the UN High Commissioner for Refugees' (UNHCR), a refugee is a person who is unable or unwilling to return to his or her country of nationality because of well-grounded fear of persecution (UNHCR 2007). The UNHCR seeks a durable solution for the refugees. In addition to voluntary repatriation and local integration in the country of asylum, the third solution the

UNHCR seeks for refugees is resettlement in a developed country. Under this resettlement program, each year approximately 100,000 refugees are expected to settle in the developed countries like the United States, Canada, and Australia. In recent years, there has been a significant increase in the number of refugees from Somalia (Abild 2009). In the United States, the majority of the African refugees are of Somali origin (UNHCR 2007).

Food insecurity, mainly defined as limited or uncertain access to food of acceptable quality and quantity in socially desirable ways, has been found to be an indicator of poor health in children (Gundersen and Kreider 2009). To measure food insecurity, two common scales, the U.S. Food Security Scale (Bickel et al. 2000) and the ten-item Radimer/Cornell Hunger scale (Radimer et al. 1990), are often used. These two scales assess food insecurity using slightly different constructs. In the case of the ten-item Radimer/Cornell Hunger Scale, food insecure households are grouped into the household level, where compromises are made on the quality of the food, and the moderate adult level, where adults of the household make reductions in their diet. The most severe level is referred to as child hunger; at this stage, children in the households also experience reduced food intake or child hunger. The U.S. Food Security Module divides households into four categories of food security ranging from conditions where the household has no trouble accessing food (high food security) to situation where members of the household worry about the food affordability (marginal food security). Low food security is found among households where the quality and variety of food is compromised, and very low food security is found in households where there is reduced food intake because of food shortages.

In 2008, 21 percent of households with children in the United States experienced food insecurity at some time during the year. Among these households, primarily adults experienced very low food security and children were protected in most cases. However, one or more children in 1.3 percent of households reduced their food intake or experienced very low food security at some time during the year (Nord et al. 2009). Although household income is a strong predictor of food insecurity, certain population groups are more vulnerable to food insecurity. For instance, in 2008, 24 percent of single-headed families experienced food insecurity compared to 10 percent households with married couples. Similarly, food insecurity was experienced by 18 percent of Hispanic households compared to 6 percent white non-Hispanic households (Nord et al. 2009). Additionally, a number of studies indicate that the prevalence of food insecurity and child hunger are higher among immigrants and refugees in comparison to the native population in the United States (Chilton et al. 2009; Dharod et al. in press; Hadley and Sellen 2006; Hadley et al. 2007; Kersey et al. 2007; Sellen and Hadzibegovic 2003). Chilton et al. (2009) found that immigrant households were at higher risk for food insecurity and children from these households had greater odds of fair or poor reported health than low-income children of U.S.-born mothers. Although there is a paucity of studies examining food insecurity in refugee populations, the body of work demonstrates that refugees in the United States experience a disproportionate level of food insecurity and child hunger. A pilot study with Somali refugees resettled in the northeast region of the United States found that two-thirds of the Somali households were food secure and

in 26 percent of those households indicated child hunger (Dharod et al. in press). Hadley and colleagues (2007) examined the prevalence of child hunger in a sample of 101 Liberian refugees in the United States. Results indicated child hunger or very low food security in 16 percent of households. Similarly, in a study with Sudanese refugees it was found that among 73 percent of food insecure households, 12 percent experienced child hunger (Sellen and Hadzibegovic 2003).

Several studies report a strong association between hunger and poor health outcomes among children. Children experiencing hunger have increased rates of illness, hospitalizations, and poorer overall health status (Alaimo et al. 2001; Cook et al. 2004; Weinreb et al. 2002). In addition, food insecurity has been shown to affect children's social skills and academic performance (Alaimo et al. 2001; Jyoti et al. 2005). Child hunger is also associated with poor dietary habits. Results of a study conducted by Skalicky et al. indicate that food insecure children were 2.4 times more likely to have iron deficiency anemia than food secure children (Skalicky et al. 2006). Kaiser et al. conducted a study with Mexican American children to examine the relationship between dietary intake and food insecurity. Results indicate that children experiencing hunger were less likely to meet the recommended servings of different food groups when compared with children from food secure or marginally secure households (Kaiser et al. 2002). Among Liberian refugees, Hadley and Sellen (2006) showed that fruit intake was significantly lower among children who experienced food shortage and hunger. Kirkpatrick and Tarasuk (2008) found that food insecure children ages 1–3 and 14–18 years consumed fewer fruits and vegetables, while food insecure children ages 1–8 years ate fewer dairy products.

In developing countries, food deprivation causes low body weight in a large proportion of the children. In contrast, the effect of limited access to food on children's growth is often less obvious in developed countries such as United States. In fact, some researchers suggest that periodic decreases in the consumption of food may promote overeating and obesity later in the life (Dinour et al. 2007). Several studies have examined the association between food insecurity and overweight rate among children (Casey et al. 2006; Dubois et al. 2006; Jyoti et al. 2005; Kaiser et al. 2002; Kasper et al. 2000). These studies show inconsistent results in the association between body weight status and food insecurity in children. Some studies in the United States indicate that food insecurity is associated with overweight children while others do not. To a great extent, the relationship between food insecurity and weight varies with the age of the children and gender. Results of an epidemiological study showed that over a period of several years, preschool children from food insecure households had a significantly greater gain in body weight and body mass index (BMI) than did children from food secure families (Jyoti et al. 2005). Casey et al. (2006) analyzed the National Health and Nutrition Examination Survey 1999–2002 to examine the association between food insecurity and BMI among children 3–17 years old. The results indicate that, after controlling for ethnicity, gender, age, and the family poverty index level, very low food security or child hunger was associated with a child being at risk for overweight status. So far, most of the studies in the United States examining the effect of food insecurity on health have been carried out with native-born children. Specifically, to our

knowledge there is no study examining the association between child hunger and body weight status among refugee children. This is an important gap in knowledge considering alarmingly high rates of food insecurity and especially child hunger among refugee families in the United States.

Lewiston, the second largest city in the state of Maine, received the first influx of Somali refugees in 2001. With approximately 4,500 Somali residents, Lewiston represents the city with the highest proportion (approximately 11 percent of the total population) of refugee population in the United States. The Somali families living in Lewiston are originally from Somalia or Kenyan refugee camps. However, many families are secondary migrants who arrived from other cities in the United States, mainly from the greater Atlanta, Georgia area. The primary objectives of this article are to examine the prevalence of child hunger and to assess the relationship of child hunger to dietary intake and BMI in refugee children from Somalia. As a secondary objective, sociodemographic risk factors of child hunger are examined.

METHODS

The study was approved by the institutional review board of the University of Southern Maine. This study was a collaboration between the University of Southern Maine and St. Mary's Regional Medical Center in Lewiston, Maine. During the study period (October 2006–December 2007), 195 Somali women were recruited to participate in a cross-sectional survey. The three major domains of the survey were (1) sociodemographics, (2) food insecurity, and (3) dietary intake habits. Earlier qualitative work performed with members of Lewiston's Somali community revealed that the women make shopping decisions in the household. In addition, many of the women are mothers of young children (Decker 2006). Therefore, as part of the sampling criteria for this study, participants had to be a mother of at least one child that was between the ages of 2 and 12 years. Participants were asked to select one of their children as an index child for the study. Dietary intakes as well as height and weight data were collected of the index child.

Formative Process

To assess food insecurity, the Radimer/Cornell Hunger scale was selected. The scale has demonstrated good validity in a variety of cultural contexts (Lenya et al. 2008; Welch et al. 1998; Zerafati et al. 2007). Additionally, the ten-item scale has a lower response burden than other food insecurity instruments. The Acculturation and Nutrition Needs Assessment (ANNA) questionnaire, developed for low-income Puerto Rican families (Pérez-Escamilla et al. 1998), was used for the sociodemographic section of our instrument. Because the ANNA questionnaire represents a survey instrument developed for a specific minority population, it was used as a framework in developing a questionnaire appropriate for the Somali community. A short food frequency instrument was used to assess dietary intake. Once the first draft of the survey instrument was developed, it was reviewed by three bilingual Somali health workers. A review process was carried out to develop the culturally appropriate survey questionnaire. After the

review and once appropriate changes were made, the original English survey questionnaire was translated into Somali, which was then back translated into English by a third party. Based on the back translation results, the survey questions in English and Somali were revised to correct any inconsistencies. To carry out the survey, three bilingual Somali women were recruited and trained on the research protocol, selection criteria, anthropometric measurements, and confidentiality of the data. Before conducting the main survey, a pilot survey (n = 35) was carried out to streamline and standardize data collection procedures. The survey development process and pilot survey results are explained in detail elsewhere (Dharod et al. in press).

Main Survey

The specific inclusion criteria for participation in this survey were (1) Somali women residing in the Lewiston area, (2) main meal preparers of the household, and (3) having at least one child 12 years or younger. Interested participants meeting the study criteria were read the consent form in either English or Somali and were asked to give written consent. All of the interviews were conducted at the participants' homes in their preferred language (i.e., English or Somali). Information on the child's age, gender, and dietary habits were collected during an interview; at the end of the interview, the child's anthropometric measurements were taken. The interview lasted for approximately 45 minutes and participants were each paid \$15 on completion of the interview.

Sociodemographics

During the interview, information on household size, monthly household income and participants' education, and marital status was collected. Additionally, participants were asked about their English proficiency and duration of their stay in the United States.

Food insecurity

As mentioned earlier, the ten-item Radimer/Cornell Hunger scale was used to assess food insecurity and child hunger. The scale follows a progression representing the different situations low-income families face when there is not enough money for food. The scale initially inquires about whether a participant worries about food affordability and is followed by inquiring about changes in the quality of food. The scale also inquires about whether adults of the family reduce or cut down on their meals because of a shortage of money. The scale progresses to severe situations, with the last two statements inquiring about alterations or reductions in the children's diet. For each statement, the following three options were provided to the participants: (1) never true, (2) sometimes true, and (3) always true.

Dietary habits

Survey participants were asked to provide the dietary intake habits of the index child. A short food frequency questionnaire was used to measure daily intake of the following food groups: (1)

grains, (2) beans/lentils, (3) meats, (4) eggs, (5) dairy, (6) starchy vegetables, (7) green leafy vegetables, (8) other vegetables, and (9) fruits.

Anthropometric measurements

At the end of the survey interview, children's height and weight were measured using a standard procedure. A portable wooden ruler and digital weighing scale were used to measure height and weight, respectively. For a weight measurement, the scale was placed on a firm floor (or on a noncarpeted surface). Before measuring the weight, children were asked to remove shoes and heavy clothing (e.g., sweaters or jackets). The weight measurement was taken twice, and the average was recorded. The scales provided to each interviewer were calibrated weekly for accuracy. For height measurement, a ruler was placed on a noncarpeted surface, and children were asked to remove shoes and any hair accessories. Height was measured to the nearest eighth of an inch, while weight was recorded to the nearest quarter pound. For children, the BMI was calculated using the Centers for Disease Control and Prevention's (CDC) gender-specific BMI-for-age growth charts. The CDC BMI-for-age charts are derived from U.S. norms; therefore, this chart may not accurately reflect growth in Somali children, particularly refugee children who have recently emigrated to the United States.

Statistical Analyses

SPSS version 17.0 (SPSS, Inc., Chicago, IL) was used for univariate, bivariate and multivariate statistical analyses. At the child level, dietary intake, age, gender, and BMI variables were used. In addition, participants' self-report on food insecurity and sociodemographic variables were included for the analyses.

Descriptive frequencies were used to analyze the sociodemographic characteristics of the study participants. On the basis of the CDC age and gender-specific growth charts, children's BMIs were categorized into four categories: (1) underweight (<5th percentile), (2) normal weight (5th–84th percentile), (3) at risk of overweight (85th–94th percentile), and (4) overweight (\geq 95th percentile). Descriptive frequencies were carried out to analyze the BMI distribution overall as well as by age and gender. With respect to age, the children were grouped into two age categories: (1) 2–5 years old (preschool children) and (2) 6–12 years old (school-aged children). To analyze the relationship between children's BMI status and food insecurity, the chi-square test was carried out.

For each item on the food insecurity scale, 0 was assigned for a “never true” response, while 1 point was assigned for affirmative responses (i.e., sometimes true and often true). Hence, participants giving negative answers (never true) to all the 10 items received a 0 score and were considered food secure, while scores from 1 to 10 indicated different levels of food insecurity. The score was divided into four categories: (1) 0, food secure; (2) 1–4, household level food insecurity; (3) 5–7, adult level food insecurity; and (4) 8–10, child hunger. Multiple logistic regression was carried out to estimate sociodemographic predictors of child hunger. Logistic

regression was carried out using the “Enter” method and results were expressed as an odds ratio (OR) and 95 percent confidence interval (CI). Unlike the stepwise method, all the variables were entered in a single step without setting any *p* value for inclusion or exclusion. Food frequency responses were converted to assess whether children consumed food from a particular food group at least once a day. Lastly, associations between child hunger and daily intake of different food groups in children were estimated by calculating the odds ratio. Results were considered statistically significant at a probability value of ≤ 0.05 .

RESULTS

As shown in Table 1, the average age of child participants was approximately five years, and a little over half of them were boys. The minimum household size was two, while the maximum was twelve people. The average household consisted of approximately five members, of which two to three were children or members under 17 years of age. More than half of the participants (59 percent) reported household income of \$1,000 or less per month (see Table 1). As shown in Table 1, the majority (58 percent) of participants spoke only Somali and other languages such as Arabic at home. The participants had been in the United States for an average of five years, with 56 percent having been in the United States for three years or less. Regarding English proficiency, seventy-three percent of the participants reported that they spoke English poorly or were unable to speak English (see Table 1). Approximately, half of the participants had no formal education or schooling, and two-thirds of the respondents were married. We did not ask what specific tribal group they belonged to but all the survey respondents, or mothers of the index child, were born in Somalia.

Table 1. Age, Gender, BMI and other Sociodemographic Characteristics of Somali Children (n = 195)

| Variables | n (%) | Mean \pm range |
|-------------|----------|------------------|
| Children | | |
| Age | | |
| 2–3 years | 65 (34) | 5.48 \pm 2.83 |
| 4–6 years | 70 (36) | |
| 7–9 years | 39 (20) | |
| 10–12 years | 21 (10) | |
| Gender | | |
| Male | 101 (52) | – |

| | | |
|---|----------|-----------------|
| Female | 94 (48) | |
| Mother and Household-level Characteristics | | |
| Family Size | | |
| 2–4 members | 50 (27) | 5.59 ± 2.10 |
| 5–7 members | 88 (44) | |
| 8 and above | 57 (29) | |
| Monthly Household Income ^a | | |
| ≤\$1,000 | 108 (59) | 947.39 ± 490.40 |
| \$1,001–1500 | 54 (29) | |
| >\$ 1500 | 21 (12) | |
| Number of years living in the U.S. ^b | | |
| 1–3 years | 109 (56) | 4.65 ± 3.54 |
| 4–6 years | 43 (22) | |
| 7 or more years | 43 (22) | |
| Primary language spoken at home ^b | | |
| Somali only | 106 (54) | – |
| Somali and English, equally | 82 (42) | |
| Somali and other languages (mahi mahi, Arabic etc.) | 7 (4) | |
| English proficiency ^b | | |
| Very good–Good | 53 (27) | – |
| Poor–Do not speak English | 142 (73) | |
| Education ^b | | |
| No formal schooling | 95 (48) | – |
| Eighth grade or less | 79 (41) | |
| High school or more | 21 (11) | |

| Marital status ^b | | |
|-----------------------------|----------|---|
| Married | 142 (73) | – |
| Single/Separated/Divorced | 53 (27) | |

^an = 183; ^bMothers' information.

Regarding the prevalence of food insecurity, only one-third (33 percent) of the households were food secure while the remaining households experienced some level of food insecurity. Severe level of food insecurity or child hunger was seen in 23 percent of the households.

Overall, 22 percent of the study children were underweight, 25 percent were overweight or at risk of overweight, and the remaining children were normal weight. As shown in Figure 1, the BMI distribution pattern was similar between preschool and school-age children.

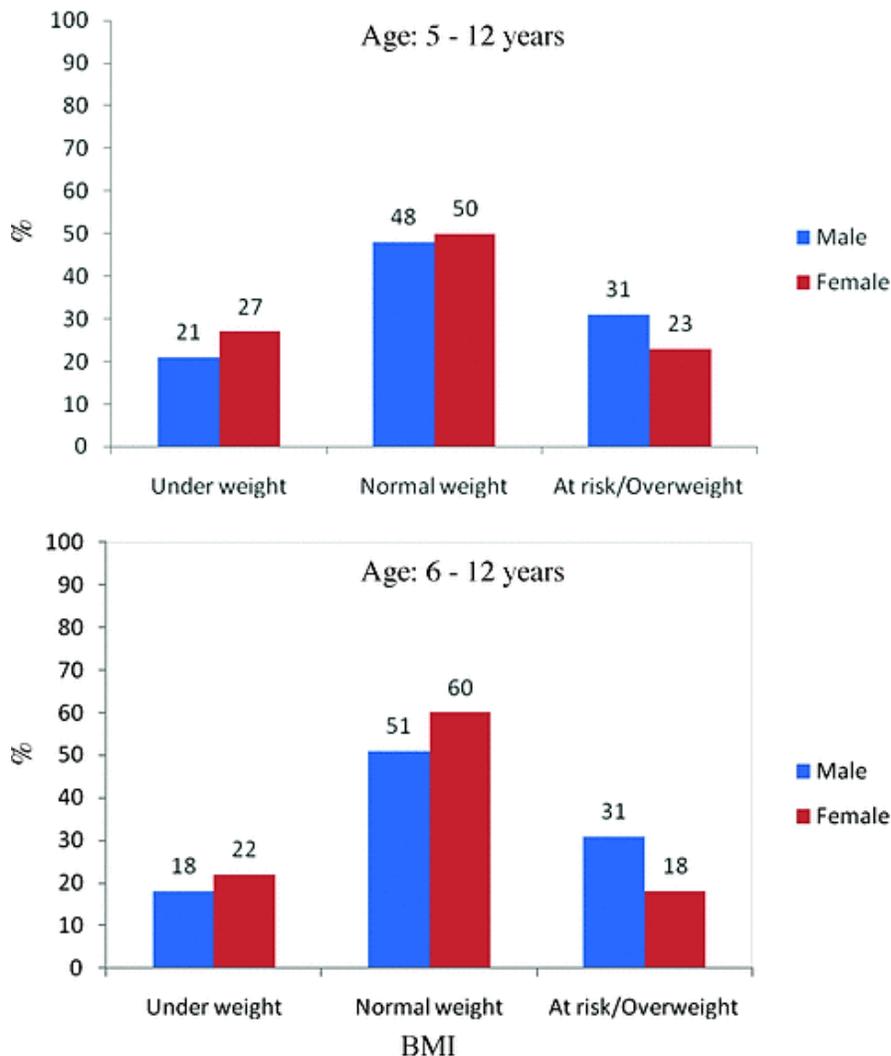


Figure 1. BMI status of Somali refugee children by age and gender ($n= 195$).

In estimating the relationship between food insecurity and BMI status, results showed that the prevalence of underweight among children was significantly higher in households experiencing child hunger (see Table 2). Regarding overweight or at risk of overweight children, a higher proportion was seen in adult level food insecure households compared to food secure households. Moreover, the proportion of at risk or overweight children was significantly lower in severe food insecure households (i.e., child hunger). When BMI was stratified by gender, as shown in Table 2, the significant difference was found among girls more so than among boys. When stratified by gender, underweight was more common among girls experiencing child hunger while this difference was not seen in boys. In the case of age groups, a significant difference by food insecurity was found among preschool children but not among school-age children. As shown in Table 2, 43 percent of preschool children experiencing severe level of food insecurity or child hunger were underweight. In school-age children, no significant difference in BMI status was seen by food security or insecurity levels.

Table 2. Relationship between Food Security/Insecurity Status and BMI in Somali Children (n = 195)

| BMI Status | Food Insecurity: Mild (Household level) | Food Insecurity: Moderate (Adult level) | Food Insecurity: Moderate % | Food Insecurity: Severe (Child Hunger) % | P^a |
|--------------------------|--|--|------------------------------------|---|----------------------|
| Overall (n = 195) | | | | | |
| Underweight | 12 | 13 | 24 | 41 | 0.003 |
| Normal Weight | 61 | 50 | 44 | 50 | |
| At risk or Overweight | 27 | 37 | 33 | 9 | |
| Gender | | | | | |
| Male (n = 101) | | | | | |
| Underweight | 10 | 14 | 27 | 31 | 0.506 |
| Normal Weight | 58 | 48 | 45 | 44 | |
| At risk or Overweight | 32 | 38 | 28 | 25 | |

| | | | | | |
|-----------------------|----|----|----|----|--------------|
| Female (n = 94) | | | | | |
| Underweight | 15 | 11 | 18 | 46 | 0.003 |
| Normal Weight | 64 | 56 | 41 | 54 | |
| At risk or Overweight | 21 | 33 | 41 | – | |
| Age | | | | | |
| 2–5 years (n = 108) | | | | | |
| Underweight | 17 | 7 | 17 | 43 | 0.009 |
| Normal Weight | 45 | 50 | 50 | 51 | |
| At risk or Overweight | 38 | 43 | 33 | 6 | |
| 6–12 years (n = 87) | | | | | |
| Underweight | 9 | 19 | 32 | 33 | 0.095 |
| Normal Weight | 74 | 50 | 36 | 44 | |
| At risk or Overweight | 17 | 31 | 32 | 23 | |

^aChi-square.

Multivariate logistic regression was carried out to understand the sociodemographic risk factors of child hunger. The results showed that a household income of less than \$1,500 per month increased the risk of child hunger. Child hunger was three to four times higher among Somali families with relatively lower incomes when compared with those who had an income of more than \$1,500 per month. Besides household income, acculturation proxy indicators (i.e., number of years in the United States and English proficiency) were significant predictors of child hunger. The likelihood of child hunger was three times higher among participants who had been in the United States for three years or less. Additionally, English proficiency was a significant predictor of child hunger. The odds of a household experiencing child hunger were seventeen times higher when the mother reported poor or very poor English skills. In addition, being single, divorced, or

widowed was also a significant risk factor of child hunger after controlling for income and education level (see Table 3).

Table 3. Sociodemographic Predictors of Child Hunger among Somali Households

| Sociodemographic predictors | OR | CI | P^a |
|------------------------------------|-----------|------------|----------------------|
| <u>Education</u> | | | |
| No formal schooling | .30 | .036–2.61 | .279 |
| Eight grade or some high school | .40 | .045–3.60 | .417 |
| High school or more | 1.00 | | |
| <u>Monthly Household Income</u> | | | |
| Less than \$1,000 | 4.67 | .000 | .998 |
| \$1,001–1,500 | 3.20 | .000 | .998 |
| >\$1,500 | 1.00 | | |
| <u>Marital Status</u> | | | |
| Single/Separated/Divorced | 3.20 | 1.24–8.26 | 0.016 |
| Married | 1.00 | | |
| <u>Household size</u> | 1.17 | .93–1.47 | 0.181 |
| <u>Number of years in the U.S.</u> | | | |
| 3 or less years | 3.27 | 1.26–8.47 | 0.015 |
| 4 or more years | 1.00 | | |
| <u>English Speaking Skills</u> | | | |
| Poor or very poor | 17.76 | 1.50–20.14 | 0.022 |
| Good or very good | 1.00 | | |

Total cases included in the analyses are 180. Dependent variable: Household without child hunger = 0 (n = 135); Household with child hunger = 1 (n = 45); ^aMultiple logistic regression using ‘Enter’ method; OR: Odds ratio; CI: Confidence Interval.

Logistic regression was also carried out to estimate the difference in dietary intake between children with and without child hunger. As shown in Table 4, a significant difference was seen in the intake of green leafy vegetables and eggs. Daily intake of eggs was significantly higher

among children experiencing child hunger compared with their counterparts. In contrast, daily intake of green leafy vegetables was significantly lower among children experiencing child hunger. The odds of children consuming green leafy vegetables was about 70 percent lower at the severe level of food insecurity (i.e., child hunger.)

Table 4. Relationship between Hunger and Dietary Intake Habits of Somali Children (n = 195).

| Food Groups (Examples) | OR | CI | P^a |
|---|-----------|------------|----------------------|
| Grains (Bread, Anjeera) | 1.53 | .32–7.28 | 0.589 |
| Beans (Lentils, Chick peas) | 0.50 | .20–1.22 | 0.131 |
| Meat (Chicken, Goat) | 0.64 | .29–1.44 | 0.288 |
| Eggs | 23.65 | 9.57–58.45 | 0.000 |
| Dairy | 1.15 | .08–1.39 | 0.998 |
| Starchy Vegetables (Potato, Yam) | 0.69 | .34–1.40 | 0.299 |
| Green Leafy Vegetables (Spinach, Turnip greens) | 0.32 | .15–.68 | 0.003 |
| Other Vegetables (Okra, Tomato) | 0.65 | .33–1.28 | 0.216 |
| Fruits (Banana, Mango) | 1.06 | .50–2.26 | 0.861 |

OR: Odds Ratio; CI: Confidence Interval; Multiple logistic regression using ‘Enter’ method. Daily consumption of a particular food group at least once a day.

Independent variable–Reference category: household without child hunger (n = 150); Contrast category: household with child hunger (n = 45);

Dependent variable: Consumption of a particular food group less than once per day = 0; Daily consumption of a particular food group = 1.

^aMultiple logistic regression using ‘Enter’ method last line: Daily consumption of a particular food group at least once a day.

DISCUSSION

Our results indicate that the prevalence of food insecurity and child hunger in this Somali community is substantially higher than in the U.S. population at large. Compared to the 2008 U.S. national average, very low food security where household members including children reduced food intake or experienced hunger was almost twenty times (23 percent vs. 1.8 percent) higher in our study population. Like other food insecurity studies with refugee populations in the

United States, our study also indicates that more than one-fifth of the food insecure households experience child hunger (Dharod et al. in press; Hadley and Sellen 2006; Hadley et al. 2007; Sellen and Hadzibegovic 2003). As in previous research on refugees in the United States, proxies of acculturation (e.g., number of years in the United States and English-language proficiency) were strong predictors of child hunger in this study. In a study by Hadley and Sellen (2006), it was found that 57 percent of Liberian refugee families living for less than a year in the United States experienced child hunger compared to 42 percent of those who were in the United States for more than a year. This suggests that besides income, other sociocultural factors may have a greater influence on food insecurity among refugee families. Specifically, new arrivals with little English-speaking ability may experience limited job opportunities, difficulties locating resources including traversing through new food choices and navigating the vastly different food system. As expected, household income affected the likelihood of experiencing child hunger. Among this group of low-income households, those living in households earning less than \$1,500 per month were more likely to experience child hunger than were families earning more than \$1,500 per month.

We did not ask about tribal group affiliation, but all participants reported following the Islamic religion and being born in Somalia. The typical Somali meal consists mainly of meat (goat, camel, or beef), rice, pasta, and/or traditional bread (*anjeera*). In addition to geographic influences, the Somali people's food choices are governed by the religious prescriptions on what is permissible (*halal*) and what is prohibited (*haram*). The Islamic dietary laws prohibit pork, as well as any other meat and meat products that come from animals that have not been slaughtered according to the defined techniques (*halal*). Given such a situation, less acculturated Somali mothers may be more anxious about shopping for food in regular grocery stores and may limit food shopping to items that they are sure meet the religious guidelines. This uncertainty may make Somali meal preparers more food insecure. This was mentioned in a focus group discussion with Somali women in another study, they raised a concern about poor accessibility to *halal* foods to prepare meals (Decker 2006).

Compared with state and national level estimates, the prevalence of underweight in Somali children is very high (Maine Center for Disease Control and Prevention's Maine Physical Activity and Nutrition Program 2007). In our study, we see the influence of food insecurity on the BMI of children in both directions; that is, child hunger is associated with underweight while adult level food insecurity is associated with overweight. Previous studies have not shown any association between the extreme level of food insecurity or hunger and underweight among children in the United States. However, these studies do indicate a higher or comparable BMI in children from food insecure households when compared to food secure households. (Casey et al. 2006; Dubois et al. 2006; Jyoti et al. 2005). In this study, when stratified by age, the prevalence of underweight was significantly higher in preschool children than school-age children experiencing hunger. This may be because of the opportunity for school-aged children to participate in federally funded meal programs in schools. Participation in the National School

Lunch Program, School Breakfast Program, and National Food Service Program may help school age children to gain weight and alleviate hunger sensation. The prevalence of undernutrition among preschool children may be attributed to several different factors. Firstly, differential growth patterns in the United States and Somali children may explain these differences. Secondly, some households may have experienced persistent food insecurity, which may have led to low birth weight and poor growth among the children. Further analysis was not carried out to test if time in the United States was associated with BMI. However, it is possible that recently arrived children are more prone to lower weight reflecting poor nutrition in refugee camps compared to children who have been in the United States for a longer time. In most of the patriarchal societies such as Somali, gender differences exist and boys are given more privileges than girls. This may also be the reason why girls, more so than boys, were underweight at extreme levels of food insecurity. When food is scarce, boys may be more protected from food deprivation than girls.

In estimating relationships between dietary habits and children's hunger, our results indicate that the intake of green leafy vegetables was relatively low while the intake of meat was not affected at all. Consistent with our results, Hadley and Sellen (2006) found no significant difference in the intake of meat but the intake of fruits was significantly lower in Liberian children with hunger. In this study egg intake was significantly higher in children experiencing hunger. As a less expensive option, eggs may have been used as a meat substitute when the household budget is low. Studies examining the impact of food insecurity on dietary intake have shown that fruit intake is more vulnerable to change than other food groups (Kaiser et al. 2002; Kirkpatrick and Tarasuk 2008; Skalicky et al. 2006). In addition to cost, a general perception that fruits do not satisfy hunger may make this food group more vulnerable to change. Additionally in our case, poor familiarity to indigenous fruits and vegetables may deter food insecure Somali mothers from trying and including them in a daily diet.

CONCLUSIONS

Considering the high prevalence of child hunger and limited research, more studies are essential to understand the relationship between hunger, BMI, and nutritional status in refugee children. The difference in the relationship between food insecurity and BMI by gender begs future research into how cultural norms and gender play roles in predicting the effect of food insecurity on health. It is possible that the time in the United States affected the relationship between food insecurity and BMI for age among refugee children. Perhaps, the children with low BMI are more likely to be found among those children who have been in the United States for a shorter time still and who may be catching up on poor growth experienced while in refugee camps or in transit country. Future research should aim at understanding the impact of previous living conditions on the health of refugee children in the United States. Additionally, longitudinal studies exploring the link between food insecurity and children's BMI are needed to determine growth pattern and the roles that gender and school-based food assistance programs may play in determining children's growth trajectories. Considering such a high prevalence of food

insecurity, it is important to understand what food management and coping mechanisms Somali mothers use to alleviate episodes of hunger. Given the evidence that poor knowledge of readily available fruits and vegetables may lead to a poor nutrient diet for refugee families, it is important for refugees to receive an orientation on how to navigate grocery stores and identify food items on sale, and how to access readily available healthy food items, including fruits and vegetables. Along with job training and English-language classes, resettlement agencies can offer this program during the initial resettlement period. To continue the support, culturally competent nutrition education programs designed to improve the Somali community's knowledge about inexpensive, healthy food choices and recipes are warranted.

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