

Working to Eat: Vulnerability, Food Insecurity, and Obesity Among Migrant and Seasonal Farmworker Families

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Background Food insecurity and obesity have potential health consequences for migrant and seasonal farm workers (MSFW).

Methods Thirty-six Latino MSFW working in eastern North Carolina whose children attended Migrant Head Start completed interviews, focus groups and home visits. Content analysis, nutrient analysis, and non-parametric statistical analysis produced results.

Results MSFW (63.8%) families were food insecure; of those, 34.7% experienced hunger. 32% of pre-school children were food insecure. Food secure families spent more money on food. Obesity was prevalent in adults and children but the relationship to food insecurity remains unclear. Strategies to reduce risk of food insecurity were employed by MSFW, but employer and community assistance is needed to reduce their risk.

Conclusions Food insecurity is rooted in the cultural lifestyle of farmwork, poverty, and dependency. MSFW obesity and food insecurity require further study to determine the relationship with migration and working conditions. Networking and social support are important for MSFW families to improve food security. Policies and community/workplace interventions could reduce risk of food insecurity and improve the health of workers. *Am. J. Ind. Med.* 53:443–462, 2010. © 2010 Wiley-Liss, Inc.

KEY WORDS: food security; hunger; migrant farmworkers; farmworker occupational health risk

INTRODUCTION

Poverty, unemployment, and food insecurity drive Latino families to seek work in farm labor in the United

States. Although most migrant farmworkers are Latino single males of Mexican origin, many farmworkers in eastern North Carolina live with their families, have young children to support, and have distinct needs and risks. This study describes the food security risk among a group Latino farmworker families and conditions that contribute to dependency [Clark et al., 2000, p. 2] which perpetuates their vulnerability and sustains food insecurity. These families identified obesity and related chronic disease, especially diabetes, as emerging problems for themselves and their children and asked why they were becoming more overweight. This paper examines whether or not food insecurity is linked to obesity among adults and children and broaches the question of how the conditions that underlie poor food security contribute to chronic health conditions such as obesity and occupational illness and injury.

From interviews with parents we describe how environmental conditions over which farmworkers have little control

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underlie the culture of migrant farm work increasing their vulnerability to food insecurity and poor health. The story of how migrant farmworker families experience food insecurity and cope with its challenges, provides context for community and workplace interventions to reduce food insecurity and improve health among migrant and seasonal farmworker (MSFW) families and highlights the need to address farmworker obesity and chronic disease as a part of occupational health in research and practice.

Background

Migrant and seasonal farmworkers (MSFW) experience unique occupational health and safety risks because of the agricultural work environment and also because of the lifestyle their occupation fosters. Illnesses and injuries may stem from agricultural environmental exposures within the home and on the farm, but the health of the workers overall and their abilities to prevent illness and injury often stem from the conditions imposed by the culture of migrant farmwork, which includes dependency and poverty [Villarejo et al., 2000; Averill, 2002; Wirth et al., 2007]. An ecological approach that includes food and nutrition systems and dietary decision making [Ward, 2007] may improve the health of MSFW families.

Food insecurity is lack of access at all times to enough food for an active and healthy lifestyle due to socioeconomic and environmental barriers. Food insecurity can exist both with and without hunger. Hunger occurs with lack of access to sufficient food and eating regularly to prevent both stomach pain and the desire to eat. Food insecurity without hunger occurs when food is available to eat, but the food lacks in sufficient variety to meet the nutritional needs for growth, energy balance, disease protection, and maintenance of body functions. Recent research in North Carolina among MSFWs has estimated food insecurity levels to be between 36 and 42% in adults and 56.4% for families with children [Quandt et al., 2004b, 2006] compared to 11% in the general U.S. population [Nord et al., 2007]. Wirth et al. [2007] and Weigel et al. [2007] report higher levels of food insecurity and hunger among MSFW in Fresno County, California (45%) and on the Texas-Mexico border (82%).

Living in a food insecure household carries serious health implications. Research among adults with food insecurity has demonstrated associations between food insecurity and poor physical and mental health [Kaiser et al., 2007], poorer self-reported health status [Stuff et al., 2004], and diabetes mellitus [Seligman et al., 2007]. Several studies have implicated a relationship between food insecurity and obesity [Townsend et al., 2001; Hanson et al., 2007; Martin and Ferris, 2007; Ortiz-Hernandez et al., 2007], but other studies do not support this link [Rose and Bodor, 2006; Whitaker and Sarin, 2007]. Food insecure households often lack dietary diversity [Yeudall et al., 2007]

and experience low levels of fruit and vegetable consumption [Tarasuk, 2001; Kaiser et al., 2003; Tingay et al., 2003; Tarasuk et al., 2007].

The literature documents risk and protective factors for food insecurity. Kaiser et al. [2007] found that after controlling for income, risk factors for food insecurity included Hispanic or Black race/ethnicity, less than a 12th grade education, being unmarried, being younger than 55, being Spanish-speaking, having spent less than half of one's life in the USA, experiencing sadness or depression, feeling overwhelmed, poor physical/mental health that interferes with activities, and fair to poor general health. Kaiser et al. [2002] found that for Mexican-American children, food insecurity was positively correlated with limited education, lack of English proficiency, and low income. In a study of legal immigrants in California, Texas, and Illinois, Kasper et al. [2000] found that predictors of hunger were income below federal poverty level, receipt of food stamps, Latino ethnicity, and poor English. Children of Mexican immigrant families are at greater risk of child hunger than non-Latinos [Kersey et al., 2007]. Mazur et al. [2003] found that among Latino households with children, food insecurity was positively associated with both lower levels of acculturation and income. Wirth et al. [2007] found that income was the single greatest predictor of hunger and food insecurity, followed by migratory status. On the other hand, strong social support systems are protective against food insecurity [Lemke et al., 2003; Hadley and Sellen, 2006] and hunger [Martin et al., 2004].

Hunger and food insecurity present a unique occupational health problem because of vulnerability and associated dependency of MSFW families due to their low level of control over working and living conditions that have become a part of the culture of migrant farm work. For example, food insecurity was associated with gastrointestinal infection, poor mental health, diabetes, cardiovascular disease, but the links between food insecurity and obesity were unclear [Weigel et al., 2007]. Obesity and chronic diseases such as diabetes can heighten the risk of occupational injury and illness [Shulte et al., 2007]. Poor health status increases the risk of MSFW for work related injuries, including falls, cuts, and musculo-skeletal injuries; and infectious diseases, including food borne illnesses [Villarejo et al., 2000; McCurdy et al., 2003] but the contribution of obesity and food insecurity to these injuries and illnesses has not been studied.

PARTICIPANTS AND METHODS

The study population was the MSFWs who participated in agricultural labor during the 2005 growing season in eastern North Carolina and participated in the East Coast Migrant Head Start Program (ECMHSP) at two sites. Study participants, all from Mexico except for two from

Guatemala, worked in row crops and tobacco and lived in temporary housing provided by a crew leader or farmer/producer. The study participants, except for one family, depended upon the crew leader or grower for access to work and wages, food, equipment, housing, transportation, and health care. One family had their own car which, when they had money for fuel and time off from work, allowed them to be less dependent. This family was included in the sample, because they expressed similar responses to their experiences in farm work and housing as the others without cars. Figure 1 Research Design describes the study. Of 120 farmworker families participating in ECMHSCP in two centers, 59 agreed to participate of which 36 adults completed all interviews and questionnaires.

Of the 59 families who chose to participate in the study, 17 were excluded because they had a family member working as a staff person at the ECMHSC and were not solely dependent on migrant farm work for income. The group of 17 was older, had higher incomes, had more children, the average age of their children was older, had lived in both North Carolina and the United States longer, and six of the 17 were African American. Of the 42 families remaining who depended only on seasonal farm work for income and followed the migrant stream, six families withdrew because of moving out of state for work, and we collected no socio-demographic information for them. Adult members from the 36 remaining families completed all household interviews and were included in the analysis. We focused on the family, defined by parent(s) and children who lived together, rather than households because household structure was not stable but based on need and availability of places to live.

Of the 36 adults, parents of children, in the sample, 58% (21) were living as a couple with children, 14% (5) were living in extended families, 22% (8) were living with unrelated families, and 6% (2) were single parents living alone with children. All adults and teen-aged children were reported to be working as farmworkers. Eighteen (50%) had resided in North Carolina for one-half year or longer, two for less than half a year, seven were NC residents, and nine (25%) refused to answer. Eight (31%) had resided in the US for more than 5 years and 12 (33%) immigrated less than 5 years ago,

and 13 (36%) refused to answer. The sample was equally divided among those coming from rural environments and those who had lived in large cities. Only one adult was from a town of 50,000. Over one-half came from the southern part of Mexico or Guatemala and only two from the northern desert. See Table I Demographic Characteristics of Sample Households, n = 36.

Sampling and Recruitment

Households were recruited from two ECMHSP that served 120 families across an eight county region at the time of data collection; see Figure 2, MSFW Housing Locations for Participants, 2005. All adult family members and their children were eligible and were recruited during the required monthly ECMHSP parent meetings. Each adult completed the informed consent process privately in their preferred language with a trained interviewer, signed the consent after any questions were answered, and received a copy of the signed consent document. We were aware of MSFW families working in the region whose young children

TABLE I. Demographic Characteristics of Sample Households, n = 36

	Number	Percent	Mean	Range
Household size			4.5	2–8
2–3	9	25		
4–5	19	53		
6–8	8	2		
Total	36	100		
Household income (\$)			\$396	\$200–\$800
\$200–\$399	16	44		
\$400–\$599	12	34		
\$600–\$800	8	22		
Total	36	100		
Age of children (years)			4 years	<1–17 years
<2	12	23		
2–5	28	54		
6–10	9	16		
11–14	0	0		
15–18	3	5		
Total	52	100		
Children in household			1.97	2–8
1–2	19	53		
3–4	14	39		
4–6	3	8		
Total	36	100		
Age of parents (years)			29 years	19–44 years
19–25	9	25		
26–35	18	50		
36–45	9	25		
Total	36	100		

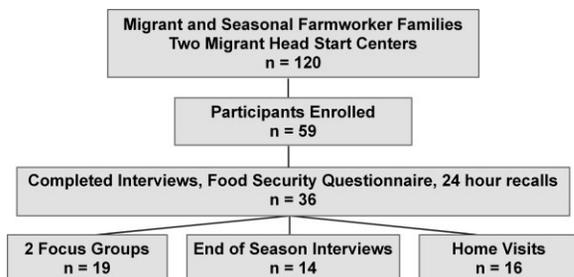


FIGURE 1. Research design.



FIGURE 2. MSFW housing locations for participations, 2005.

were not enrolled in the Head Start Program, but attempts to recruit them through farm visits failed. The sample was most likely representative of families whose children attend the ECMHSC, but not necessarily of all MSFW families in eastern NC. One way that this sample may have differed from non-ECMHSC families was participation in government services and benefits. All ECMHSC families received government services including Head Start, Medicaid for uninsured children, and the Women, Infants and Children's Supplemental Food Program (WIC).

Data Collection Methods

Demographic and household composition information including questions about place of origin, length of stay in North Carolina, length of time working in migrant and seasonal farm work, household income, amount of money spent weekly on groceries, and heights and weights were collected at ECMHSC parent meetings. Appointments were scheduled for interviews. Each participant was asked to complete the structured USDA food security interview which took approximately 15–20 min to complete. The 18-question instrument employed was developed by the USDA and was designed for Spanish-speaking populations of differing national origins [Harrison et al., 2003]. English-speaking participants were given the English version of the USDA instrument [Bickel et al., 2000]. All data were collected between June and November, 2005, ending with the focus groups.

Secondly, the household adult members were asked to complete a semi-structured, respondent driven interview which consisted of two parts: (1) a structured 24 hr recall in which the mother was asked to reconstruct all foods consumed by herself and her preschool children (including food descriptions, preparation, and the time, place and social environment during consumption) within the previous 24 hr period beginning with the most recently consumed foods and working backwards through the time period; and (2) a dietary history chronicling the family's migration to the US and changes in dietary habits due to migration. Fathers and older children completed their own recalls and contributed to the dietary histories as needed, of which the mother was the primary respondent. All couples came as couples to the US,

except for one, who met in the United States doing farmwork together and married.

The dietary recall method entailed asking the participant to recall foods, probing for details about the food and amount consumed, recalling any forgotten foods, and then reviewing the list to correct any inaccuracies. The person was also asked if the intake was unusual in any way due to any circumstances. Samples of store bought food packages, paper forms, and household measures were used to estimate amounts and the results were recorded on a form. We attempted to collect two dietary recalls from each participant, one dietary recall at the time of the initial interview and one within 2–6 weeks later; however only 21 households completed a second recall by the end of the growing season. We were unable to conduct two recalls with all of the participants because of migration. For those participants who had two recalls, the results were averaged. The results were recorded on forms by the interviewers. The recalls were done on Tuesdays through Saturdays to cover the days that the migrants were usually working. Reliability of 24 hr dietary recalls is improved when two or more recalls are conducted and the recalls include both week day and weekend days, but to be able to estimate micronutrient intake accurately for the purposes of epidemiological studies 7–14 days analyzed with complex statistical tests are advised [Thompson and Subar, 2008]. The recalls for the pre-school children underestimate intake because they were limited to foods consumed while in the mother's care and did not include foods consumed at the ECMHSC where two meals and two snacks were provided. The recall provided a picture of what foods pre-school children eat at home, but not of their complete diet.

During the dietary history, descriptions of food sources, availability and acquisition, preparation and service were elicited. Questions probed the reasons for migration to the US and NC. Changes in the types of foods eaten, typical meal patterns, snacking, and the perceived quality of the foods in their home country and in the US were discussed. Food security in the home country was determined in the dietary history interview by asking whether or not the participant had sufficient food to eat and if they did not have sufficient food, whether or not they experienced hunger as a result of not having access to sufficient food in their home country. The answers were coded into three categories: (1) those who said they always had sufficient food to eat and (2) those who said they did not have access to a variety of sufficient foods, and (3) those who said they experienced hunger regularly due to lack of enough food. They were also asked to describe the amount of servings of meat, fruits, vegetables, dairy products, soft drinks and alcohol, snacks and sweets consumed in the home country compared to what they currently were consuming. The mothers were asked to describe what foods they thought were appropriate and good for their children's health and why they thought so. The interviewer took notes using the words and language from the

informant. The interviews were recorded on forms by the interviewers and reviewed immediately at the end of the interview by both parties to clarify any answers. The dietary history was conducted as an active conversation [Holstein and Gubrium, 1995] during which the participant often told stories about preparing and sharing food with loved ones. The analysis of themes and explanations of behaviors emerge from what was said in conversation. The interviews lasted about 2 hr.

The interviews occurred in the participant's homes when they were not working ($n = 16$). The interviewers toured the home, including the kitchen, allowing an assessment of the adequacy and safety of the food storage and preparation areas and gardening space. The remaining 20 interviews were conducted at the ECMHSCP facility; transportation and childcare were provided as needed. Families received their choice of \$20 worth of grocery staples and vegetables, or of a \$20 cash card. Interviews were conducted by both the first two authors (non-native) and four bilingual native speakers of Spanish with origins in Mexico (2) and Honduras (2). The native Spanish speakers were trained interpreters with previous experience working with Latino farmworker families as interviewers in research studies as well as in clinical and educational services. None were employed by the ECMHSP nor were previously known to the participants. Interviews were conducted in either Spanish or English, according to the preference of the participant, and the interpreters were present for all interviews conducted by non-native Spanish speakers.

Findings from the interviews were presented at an ECMHSP parent meeting at each center after preliminary analysis. At that time parents were asked to discuss the results, ask questions, and rank order their greatest concerns. The concerns raised helped structure the focus group questions. Two focus groups (one at each ECMHSP location), were conducted with a convenience sample drawn from the parents who participated in the study (19 participants). The participants included single and married parents, with one through four children. All participants spoke some English and were familiar with the communities around the ECMHSCP. Parents noted for their roles in organizing and participating in parent meetings and for helping new families find services and adjust to the area participated in the focus groups. Focus groups were conducted in Spanish, tape recorded, transcribed, and translated. Focus group participants received a meal of the group's choice before the sessions which served as a social hour and relaxed everyone for the interview. The focus group discussions took 2 hr.

The content of the focus group included quality of life issues, child health, food security and access to desired foods and health care services, health problems, working conditions and wage labor, household budgets, and recommendations for programs and services to improve food security.

Focus group queries included (1) what things were necessary for children to grow up healthy: what were ways they can improve their children's health; (2) food security including asking what changes in work conditions, life style, and environment could assist them with improving food security and safety, how families currently cope with not having enough food at certain times, and what the ECMHSP and the local community did and could do to improve access to healthful foods, especially fresh produce; (3) their concerns with obesity and developing diabetes and other chronic diseases and access to preventive health care and treatment for illness and injury; and (4) what changes could best improve their lifestyles and well-being as migrant and seasonal farmworker families.

Twenty-Four Hour Dietary Recalls

We used the recall method in combination with the dietary history to understand the MSFW dietary experience as it was related to their lifestyle and work. The results of the recall data cannot be generalized to all MSFW families, but can be used to help describe food insecurity among groups of families. The results provide descriptive information about the types of foods consumed and suggest potential clinical and sub-clinical nutritional risks related to the pattern of food intake among the group. Dietary recalls were coded when entered into Food Processor 10.2 [ESHA Research, Portland, OR, 2003] for nutrient analysis and exported into Excel spreadsheets which were uploaded for analysis with Statistical Package for the Social Sciences (SPSS, version 15.0). Nutrient data was compared by food security status for two separate samples of adults and children using the Mann-Whitney and chi-square nonparametric statistical tests. Because of the small sample size, we used non-parametric statistics. Non-parametric statistics do not require the data to fit a normal distribution; however, for most of the nutrition variables, despite the small sample, the distribution was not far from normal although some were slightly kurtotic.

Heights and Weights

Trained staff measured height and weight of adults and children over the age of 2 years using a portable stadiometer (Seca 225, Seca GMBH & Co, Hamburg, Germany) and a digital medical scale (Tanita WB 100, Tanita Corp, Tokyo, Japan). Participants removed their shoes, coats, jackets, sweaters, sweatshirts, vests, bags, and hair accessories and emptied their pockets before being measured. Height was taken in duplicate and measured to the nearest 0.1 cm; weight was measured in duplicate to the nearest 0.1 kg. If the measurements differed by more than 0.2 cm or 0.2 kg, a third measurement was taken and the two closest measurements were averaged. BMI percentile for age was calculated using the CDC SAS macro `gc_setup` [Division of Nutrition,

Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, 2008]. Children under the age of 2 were measured by trained NC Migrant Head Start early childhood assessment staff using the protocols from the CDC [Kuczmarski et al., 2000]. Childhood obesity was defined as Body Mass Index (BMI) $\geq 95\%$, overweight as $85\% \leq \text{BMI} < 95\%$, normal weight as $25\% \leq \text{BMI} < 85\%$, and underweight as $\text{BMI} < 5\%$ [Barlow, 2007]. Adult obesity was defined as a BMI greater than or equal to 30 kg/m^2 , and overweight was defined as a BMI greater than or equal to 25 kg/m^2 .

Data Analysis

Using the food security questionnaire, results were divided into three categories measuring food security status: food secure, food insecure without hunger, and food insecure with hunger. Question 1 of the questionnaire assessed barriers to food security, and questions 2–16 determined each family's food security status. Determination of household food insecurity status was made as follows: households were considered food secure if participants answered positively to each question 0–2 times, food insecure without hunger if they answered positively 3–7 times, and food insecure with hunger if they answer positively 7–15 times, following the scale recommended by the USDA at the time of the study. Recently, the USDA changed the categories measuring food insecurity to high food secure, marginal food security, low food security, and very low food security (please see <http://www.ers.usda.gov/Briefing/FoodSecurity/Labels.htm>). The categories of “with hunger” and “without hunger” were eliminated because the instrument did not measure the physiological response of hunger pain, which may result due to lack of adequate food intake. The categories used in this paper allow comparisons to be made with other studies.

Food security status was used as the outcome measure and was related to predictors of income, living situation, family size, dietary patterns, and dietary recalls (see additional details below). Each food insecure group was compared to the food secure group. Comparisons were done at the family and the individual level. At the individual level, analyses for adults and children were done separately. Only the pre-school aged children attending the ECMHSCP were reported in this analysis. Children under 24 months were excluded because of large variation among those being breastfed. Children older than 7 years, for whom dietary data were available, were not included in this analysis because there were only four with an age spread from 8 to 16 years; however, all these were categorized as food insecure. Children who were food insecure without hunger and food insecure with hunger were grouped for analysis because of small cell sizes. Children who were food secure were only compared to all children who were food insecure (either with

or without hunger). Non-parametric statistics were used due to small cell sizes.

Qualitative results of field notes, dietary histories, and open ended interviews were analyzed using content analysis identifying patterns of key words and concepts that emerged in the data. Three of the four Spanish interpreters worked with the first two authors to determine the meanings of the key words and concepts. Results from the content analysis were then coded and entered into Microsoft Excel and SPSS for descriptive statistical analysis and nonparametric comparisons by food security status.

RESULTS

The ECMHSCP households experienced a high level of food insecurity: 63.8% (23 of 36) of adults experienced food insecurity, and of the food insecure, 34.7% (8 of 23) experienced food insecurity with hunger. Among 30 pre-school aged children aged 2–7 years attending Migrant Head Start, 56% (17 of 30) were food insecure, and, of the food insecure, only 3 were from families who experienced hunger.

Food Security and Nutrition of Adults and Pre-School Children

Table II demographic characteristics of migrant and seasonal farmworkers aged 19 and Older by Food Security Status summarizes differences among adults who were food secure compared to those who were not. The groups who were food insecure both with and without hunger also experienced food insecurity in their home country ($P < 0.01$). Those with food insecurity with hunger had a smaller family size ($P < 0.01$). Among the children of the families who attended the ECMHSCP, those who were food insecure also experienced food insecurity in their home country. The food secure children came from families who spent a higher percentage of their income on food ($P < 0.05$), see Table III Median (min, max) for demographic characteristics of migrant and seasonal farmworker children aged 2–7 years by Food Security Status.

Reduced energy and nutrient intake was associated with food insecurity and food insecurity with hunger for adults and children. Food insecure adult MSFWs with hunger experienced low dietary intakes of energy ($P < 0.05$), specifically energy from carbohydrates ($P < 0.05$) compared to both food insecure and food secure MSFWs, see Table IV Median (min, max) for Nutrients from 24-hr recalls of Migrant and Seasonal Farmworkers aged 19 and Older by Food Security Status. Those who were food insecure with hunger also experienced lower intakes of dietary fiber ($P < 0.01$), folate ($P < 0.05$), and calcium ($P < 0.05$) as reported in the dietary recall.

The dietary data reported in Table V Median (min, max) for Selected Nutrient Characteristics from 24-hr Recalls of

TABLE II. Demographic Characteristics of Migrant and Seasonal Farmworkers Aged 19 and Older by Food Security Status^a

	Food secure, n = 13	Food insecure, no hunger, n = 15	Food insecure with hunger, n = 8
Age (years)	27 (22, 44)	28 (24, 47)	30.5 (19, 40)
Female/male (n)	8/5	9/6	4/4
Family size (number of persons)	5 (2, 8)	5 (3, 6)	4 (3, 5)*
Number of children in family	2 (1, 6)	3 (1, 4)	2 (1, 3)
Food insecurity in home country	27%	67%*	75%*
Income	400 (220, 620)	500 (200, 650)	550 (250, 800)
Percent of income spent on food	50% (20%, 60%)	33% (20%, 50%)**	30% (20%, 60%)
BMI (n = 6, 6, 2)	27.5 (22.4, 40.6)	27.0 (21.4, 38.3)	27.2 (26.7, 27.8)

^aUsing Mann–Whitney or chi-square non-parametric tests food secure individuals are compared with food insecure, no hunger and food insecure with hunger for all characteristics except gender.

* $P < 0.1$.

** $P < 0.05$.

Children Ages 2–7 Years, by food security group was collected from interviews with the mothers about foods consumed by their children while in their care and does not include the foods consumed while children were attending the ECMHSCP. The results indicate the diet mothers provide in the home and support the nutritional need for the foods provided by the ECMHSCP for all children, but especially for the food insecure children. Among the pre-school children of MSFWs, those who were food insecure differed from those who were food secure by having lower intakes of energy from fat and protein, a lower intake of energy than recommended for healthy growth ($P < 0.05$), and a lower intake of calories from protein than recommended for healthy growth ($P < 0.01$). Vitamin A and calcium were also lower

for the food insecure children and lower than recommended ($P < 0.05$). Lower amounts of omega-3 fatty acids and cholesterol, needed for brain growth and development were also found among the food insecure children.

Income Levels and Food Insecurity

Participants in all food security groups reported similar amounts of weekly income ranging from \$200.00 to \$800.00 with the median ranging from \$400.00 among the food secure to \$550.00 for the food insecure with hunger. Although income earned was similar among all of the participants, those families who spent a larger percentage of their income on food were food secure compared to those who were food insecure, both with and without hunger, for both adults and pre-school aged children ($P < 0.05$) (Tables II and IV). The amount of bills or obligations that a family had determined the amount they could spend on food. All families reported that being out of work led to food insecurity and hunger because of the impact on their income. In addition, lack of work caused them to spend any cash reserves for food and to search for work; however, focus group discussions emphasized that few MSFW had any cash reserve and that saving money was difficult at best and out of the question for workers with young children. Cash reserves were required to protect the ability to relocate to a new job, so when cash reserves were used for food, resources to relocate to a new job might be impaired leading to continued food insecurity. None of the families reported that food money was spent on alcohol, although most reported buying beer occasionally. When probed, none of the mothers reported going without food in order to buy alcohol.

TABLE III. Median (Min, Max) for Demographic Characteristics of Migrant and Seasonal Farmworker Children Aged 2–7 Years by Food Security Status^a

	Median (min, max)	
	Food secure, n = 13	Food insecure, n = 17
Age (years)	3 (1, 7)	4 (1, 7)
Female/male (n)	9/4	8/9
Family size (number of persons)	5 (4, 8)	5 (3, 6)
Number of children in family	3 (2, 6)	3 (1, 4)
Food insecurity in home country	40%	71%**
Income	380 (220, 600)	510 (200, 800)
Percent of income spent on food	50% (30%, 60%)	32% (20%, 50%)**
BMI centile (n = 12, 11)	97.5 (12.7, 99.9)	65.5 (3.3, 98.7)
Overweight or obese (%)	73% (n = 12)	33% (n = 11)*

^aUsing Mann–Whitney or chi-square non-parametric tests, children who are food secure compared with children who are food insecure for all characteristics except gender.

* $P < 0.1$.

** $P < 0.05$.

Overweight and Obesity

All participants reported being concerned about overweight and the development of obesity among their children

TABLE IV. Median (Min, Max) for Nutrients From 24-hr Recalls of Migrant and Seasonal Farmworkers Aged 19 and Older by Food Security Status

	Food secure, n = 13	Food insecure, no hunger, n = 14	Food insecure with hunger, n = 8
Calories	2,113 (324, 3,288)	1,503 (399, 5,118)	1,561 (1,169, 1,770)**
Ratio of calories to RDA	1.05 (0.2, 1.6)	0.7 (0.2, 2.6)	0.7 (0.5, 0.9)**
Calories from fat	678 (203, 1,174)	338 (190, 2,364)	518 (380, 757)
Calories from protein	374 (85, 688)	322 (134, 903)	347 (245, 420)
Calories from carbohydrate	1,089 (30, 1,437)	859 (73, 2,581)	646 (218, 1,016)**
Percent of calories from sugars	14% (3%, 42%)	17% (4%, 32%)	18% (3%, 25%)
Dietary fiber (g)	26 (1, 55)	24 (3, 90)	13 (4, 22)*
Ratio of fiber to RDA	0.7 (0, 1.4)	0.7 (0.1, 3.6)	0.4 (0.1, 0.9)*
Cholesterol (mg)	348 (88, 777)	286 (99, 670)	455 (284, 592)
Ratio of cholesterol to RDA	1.1 (0.3, 2.6)	1.0 (0.3, 2.2)	1.5 (1.0, 2.0)
Sodium (mg)	1,457 (449, 3,064)	1,623 (471, 9,876)	1,525 (893, 4,227)
Vitamin A (RAE)	2,564 (1,091, 22,577)	1,444 (380, 6,869)	1,368 (738, 3,173)
Vitamin C (mg)	45 (1.3, 181)	79 (8, 280)	30 (5, 65)
Vitamin E (mg)	3.4 (1.3, 8.3)	2.4 (0.2, 5)*	2.5 (2.0, 3.0)
Folate (DFE)	164 (50, 621)	146 (24, 635)	72 (43, 125)**
Calcium (mg)	566 (143, 928)	430 (26, 1,952)	349 (113, 478)**
Ratio of calcium to RDA	0.6 (0.1, 0.9)	0.4 (0.03, 2.0)	0.3 (0.1, 0.5)**
Iron (mg)	11.6 (2.4, 29.6)	14.1 (4.6, 43.4)	10.7 (9.8, 13.2)
Zinc (mg)	12.7 (1.9, 26.3)	10.2 (2.8, 35.6)	11.4 (8.2, 20.3)

^aUsing Mann–Whitney non-parametric test, food secure individuals are compared with food insecure, no hunger and food insecure with hunger for all nutrients.

* $P < 0.1$.

** $P < 0.05$.

and themselves. Overweight and obesity were prevalent among all food security groups of adults; the median BMI score for adults from all groups fell between 27.0 and 27.5 (considered overweight). Among children, this was not the case, Table IV demographic characteristics of migrant and seasonal farmworker children aged 2–7 years by Food Security Status. Those children who were food insecure were less overweight and obese than those who were food secure. The food secure children had a median BMI percentile score of 97.5 with a range of 12.7–99.9, indicating a prevalence of obesity in the population. The food insecure children (median BMI percentile score of 65.5 with a range of 3.3–98.7) experienced less obesity and overweight as a group than the food secure children ($P < 0.01$). Children with a BMI under the 5th percentile were considered malnourished for energy and, perhaps, other nutrients and required medical attention. The ECMHSCP referred all children who were obese or underweight to clinicians for evaluation.

Height and weight data were measured for only 14 of the 36 adult participants who had completed the food security and dietary data collection. Although all children were measured for height or length and weight, correct birthdates were only able to be provided for 23 of the 30 children included in the analysis.

Obesity, Chronic Disease, and Work

All adults reported that weight gain affected their ability to work in the fields. Every respondent had experienced back pain, and back injuries preventing regular work were reported by two participants. Another reported that her farmworker father was unable to work due to a back injury and his obesity. One of the women reporting a personal back injury could not go back to work until she lost weight, which she did by eating once per day. Although all were concerned about developing chronic diseases such as heart disease, high blood pressure, and diabetes, only two reported having been treated clinically. Another participant reported not being able to work at one time because a foot wound would not heal. One reported that her husband could not work in the fields any longer due to lack of control of diabetes and high blood pressure problems, which resulted in a loss of income and created additional pressure on her to work more. Gastrointestinal illnesses were noted regularly in conversations, but were not mentioned as a concern, unlike the development of chronic disease and obesity. Obesity and chronic disease, especially diabetes and high blood pressure, were a major concern because these conditions could cause illness and injury that would prevent the farmworker from earning a living. MSFW felt they had

TABLE V. Median (Min, Max) for Selected Nutrient Characteristics From 24-hr Recalls^a of Children Ages 2–7 Years, by Food Security^b

	Median (min, max)	
	Food secure, n = 13	Food insecure, n = 17
Calories	446 (300, 1,888)	393 (174, 1,011)**
Ratio of calories to RDA	0.4 (0.25, 1.9)	0.3 (0.15, 0.8)*
Calories from fat	145 (100, 520)	80 (4, 305)**
Calories from protein	128 (43, 267)	83 (5, 190)**
Ratio of protein to RDA	1.7 (0.8, 5.1)	1.1 (0.1, 3.6)*
Calories from carbohydrate	252 (123, 1,146)	213 (120, 505)
Percent of calories from sugars	16% (11%, 34%)	24% (0%, 66%)
Dietary fiber (g)	2.1 (0.1, 21)	3.5 (0.4, 8)
Cholesterol (mg)	110 (24, 315)	22 (0, 143)**
Sodium (mg)	847 (132, 2,181)	378 (8, 1,814)**
Omega-3 fatty acids	0.3 (0.1, 0.9)	0.14 (0.03, 0.7)**
Vitamin A (RAE)	98 (1,686)	24 (1,324)**
Ratio of vitamin A to RDA	0.3 (0, 1.7)	0.1 (0, 1.0)**
Vitamin C (mg)	19 (1, 88)	6 (0, 56)
Vitamin C to RDA	1.1 (0.1, 6)	0.3 (0, 3.7)
Vitamin E (mg)	0.4 (0.2, 4.6)	0.3 (0, 2.5)
Ratio of vitamin E to RDA	0.06 (0.03, 0.8)	0.04 (0, 0.4)
Folate (DFE)	100 (12, 876)	42 (12, 227)
Calcium (mg)	367 (155, 1,088)	167 (13, 643)**
Ratio of calcium to RDA	0.6 (0.3, 1.9)	0.3 (0.02, 1.3)**
Iron (mg)	2.5 (1.2, 34, 9)	2.1 (0.4, 8.2)
Ratio of iron to RDA	0.4 (0.2, 3.5)	0.3 (0.1, 1.1)
Zinc (mg)	2.8 (1.0, 9.3)	3.0 (0.2, 5.5)
Ratio of zinc to RDA	0.9 (0.3, 2.5)	0.6 (0, 1.8)

^aThe recalls are from parents based on foods provided in the home; all children received the same type of additional foods at the Migrant Head Start Centers, but we were unable to document the amounts consumed at the centers for each child during the 24 hr period.

^bUsing Mann–Whitney non-parametric test, children who are food secure compared with children who are food insecure for all nutrients.

* $P < 0.1$.

** $P < 0.05$.

more control over a bout of diarrhea than the development of chronic disease.

When the MSFW households were compared to the those households that had one parent employed by the ECMHSCP that had completed the food security questionnaires, the ECMHSCP households experienced a higher rate of food security and less food insecurity and food insecurity with hunger. Of the ECMHSCP staff, 47% (8 of 17) compared to 63.8% (23 of 36) of the participants experienced food insecurity without hunger and 18% (3 of 17) of the staff reported food insecurity with hunger compared to 34.7% (8 of 23) of the participants. They also earned more money on average (\$460 per week compared to \$396), worked in a clean workplace with regular hours and breaks, had trans-

portation, and participated in regular in-service training about health, nutrition, food safety, and child development. The ECMHSCP workers did not report concerns or incidences of backache or injury or worries about obesity preventing them from working. They did share concerns about not working when the center closed, but most were confident that if laid off, they could find another job because of their skills. They all preferred child care work to being in the fields because of the hours, environment, and opportunities for education and other employment besides farm-work.

Twelve (six of whom were Hispanic and six of whom were African American) of the 17 teachers, all female, and 14 of the 36 participants, all female, consented to having their height and weight measured to determine BMI. Seventy-five (75) percent of teachers, were obese (9 of 12) compared to 29.5% (4 of 14) of the 36 participants who were women. Of the nine teachers who were obese and the one who was overweight (BMI = 29.3 kg/m²), 5 of 10 (50%) were Hispanic immigrants who had been farmworkers before. Both teachers and participants expressed concerns about obesity, diabetes, and high blood pressure, but the participants related their obesity problem to their lifestyle as farmworkers because they had no alternative explanation. For example, farmworkers reported that they got lots of exercise every day at work and did not eat much, yet their weight increased each year. One worker asked, “Can you tell me why we are getting so fat? We work hard all day in the field, we are not eating more, yet we are gaining weight!” Focus groups confirmed that weight gain was perceived as a major problem and was feared because of its links to chronic diseases and potential disability.

The teachers attributed their obesity to family history (African Americans), lack of exercise, and eating fried foods or sweets, categories of individual qualities and behaviors. With greater food security, the teachers had access to more food and opportunities to eat than farmworkers. Their work was less physically strenuous than working in the field. They also had been in the United States longer. The sample was too small to analyze relationships among these variables. Differences in explanations for obesity between the farmworkers and ECMHSCP workers may reflect acculturation and/or exposure to health education on the job.

Patterns of Daily Food Consumption, Work, and Food Security

Participants reported dietary changes with immigration (24 of 36, 66%). Dietary changes commonly mentioned were increasing the amount and frequency of meats, drinking sodas, eating processed foods and snacking. In the home country families tended to eat three meals together, except when they had no food due to lack of work. The urban workers reported drinking more soda in the home country

than those from rural areas, and they ate less homemade foods such as cheese. Foods in the home country were often locally produced or bought in local markets. Urban residents were more familiar with shopping in a supermarket.

In the United States, farmworkers usually ate breakfast (breads, cereals, coffee) and a dinner with meat and whatever else they had. Some workers carried leftovers or packaged foods from home to work and ate hurriedly, unless the work was slow and they could take a break. If work was competitive or very busy, they did not break except to drink some water or use the bathroom. At the time of the interviews most reported eating tomatoes daily, as many were picking them. In the US, the families ate out more often, usually on a Sunday at fast food restaurants, which their children liked. Both parents were responsible for shopping for groceries, and, although most women cooked, the men would prepare food at home as well.

Time and money often determined what the farmworkers ate and can be seen as a trade off and a dilemma. When one was not working there was time to prepare meals but without working, there was no money to buy food. A mother, from a rural area, aged 32, contrasted her food and work experiences in her home country with the United States, "... at home we had time to grow and make food but no money to buy it. . . here we have no time to prepare food, but we have money to buy it. It was better food at home when we had food, but sometimes we did go hungry because there was no work. Here we have work." Locating work in which to exchange time for money through their labor underlies the cultural lifestyle of the migrant farmworker family, their dependency, vulnerability and food security.

The reasons for dietary change with immigration were related primarily to food access, availability and cost as well as the organization of work. Obtaining food was always dependent on having regular income, transportation to the store, and a time and place to prepare the food. Food in the home country, especially among those from the rural regions, was thought to be more delicious and desirable, but local foods were dependent on harvest availability and opportunities to work for cash to buy food, both unpredictable. In the United States, food, especially meat and soft drinks, were less expensive and plentiful, compared to the home country. Some foods like cheese, dairy, and fresh vegetables were considered too expensive to buy in supermarkets, but there were no local, inexpensive sources of these foods near their homes. The fresh tomatoes and peppers they consumed were usually procured from the fields taken, given, or bought from the grower. A farmworker related, "Why should I pay \$3.00 a pound for tomatoes at Wal-Mart when I work all day picking them for pennies?"

The quality and safety of the foods in the United States was a concern, especially among those who recently immigrated and who had not become acculturated to American food markets. A mother, aged 23, reported not

wanting to eat meat from US supermarkets, "I look at the meat (in plastic) but do not buy it. I don't know that animal. How long has it been dead? Is it safe to eat?" She preferred to share a purchase of a goat or lamb or to eat a freshly shot deer, but these meats are not frequently in the diet. But even those who had lived in the US for 10 years recalled the foods from home as tastier and fresher. A grandmother from Veracruz, Mexico who had been in the USA for 13 years, aged 39, described the diet from her home: "... we had beans, rice and corn every day for breakfast and lunch and dinner. . . corn, beans and rice. We made our tortillas. For breakfast we had posole each week. I made cheese every day. We had fruits and vegetables. We ate vegetables we cannot buy here (that are not available in NC). We did not eat meat except on special occasions. We had fish. It was a lot of work and sometimes we did not have enough food, but it was good to eat. We just drank water. No sodas, sometimes fruit drinks that were homemade."

Meal patterns were affected by the work schedule, which left little time to prepare foods or eat meals. All reported that they tried to take minimal breaks while in the field because they were paid by the piece. Some women felt particularly vulnerable to taking a break because they might be criticized for lack of productivity by some male workers. The participants felt that the pressure to pick the most in the least time could be severe and kept workers in the field even when they knew they should really take time to eat and drink water, especially on hot days. All participants reported returning home from work tired and without much time to prepare a meal, especially when young children required attention. Lacking transportation or funds for eating out, families reported making do with foods that were in the house and easy to prepare.

All participants came to the United States in search of employment opportunities to earn enough money to feed the family. In their home countries, opportunities to earn a living wage were scarce; but if they did not work, they would not eat: no cash, no food. In the United States, they had opportunities to earn cash for food, but because of long hours, lack of access to fresh foods, and poor living conditions, they were not able to prepare nutritious and safe meals regularly. Parents worked 10–12 hr/day 6 days a week and had 1 day to shop, wash clothes, and rest. Participants offered cultural, economic, and occupational explanations for food insecurity and hunger in the United States; whereas, food security and hunger problems in their home countries were consistently explained by lack of opportunity to work or crop failure, as summarized in Table VI reasons reported for food insecurity in Mexico and the United States, June–November, 2005, $n = 36$. The major reasons for food insecurity in the United States were related to lack of control over working conditions, lack of transportation to access affordable food, dependency on employers, lack of work, inadequate housing, and lack of sufficient earned money to cover expenses. All of

TABLE VI. Reasons Reported for Food Insecurity in Country of Origin and the United States, June–November, 2005, n = 36

Country of origin	United States
Lack of money to buy food	No time to prepare food
Lack of work: "If you don't work, you don't eat"	Cannot find affordable fresh foods
	Food shopping is once a week or every 2 weeks
Crop failure	Too tired from work to cook food
	Food goes bad
	Produce does not look fresh
	Food does not taste good: food has no flavor
	Too many bills to pay, not enough money
	Breaks in work availability: poor weather, poor harvest, sickness, or work-related injuries
	Lack kitchen/equipment to prepare food
	No time or place to grow vegetables or raise animals
	Need to remain mobile
	No time to eat while working in fields
	Lack of transportation to stores

these explanations reflect dependency and vulnerability to risk of food insecurity as a part of the cultural lifestyle of migrant farmwork and are beyond the control of the farmworker, but often within control of the employer and community.

Home Kitchens and Food Safety

Observations during home visits with 16 families found that all kitchens lacked adequate, safe, and clean storage for foods. All kitchens had a table; a shelf or cupboard; a sink with running water; a stove; and a refrigerator. The refrigerators did not always cool properly. One home had a new looking refrigerator that worked well, but the other refrigerators were damaged, rusty, or had surfaces unable to be cleaned. When housing was shared by families, separate food storage areas were not available. Perishable foods were left on tables or counters; frozen meat was left out to thaw during the day. Food waste was stored in the kitchen area in open containers. Signs of roaches, ants, flies, and rodents were visible in the homes, and parents reported difficulties in cleaning kitchens adequately due to old carpeting, damaged flooring and/or counters. Cleaning tools were very limited. Hot summers required doors and windows to be left open and screens had holes or were often missing. Household insecticides were often used for insect control in the kitchen.

Individual servings of processed, wrapped foods, such as cracker/nabs and canned soda were often visible. Families purchased them because they did not need refrigeration, did not spoil, and stayed clean. Families also reported carrying home-prepared foods to the fields for breaks but had no access to proper cold food storage or reheating during the

workday, making the processed, pre-packaged foods popular. Water stations for hand washing in the fields were lacking. Living and working conditions may create food safety problems which impinge on food security.

Management of Food Insecurity: Work, Personal Strategies and Community Services

Focus group discussions and individual interviews offered insight into the management of food security by farmworker families. Preventing food insecurity required a combination of regular work, careful budgeting, participation in programs and services offered, and dependence on the community for emergency foods. When farmworkers had adequate work and were paid, sufficient food could be purchased, but depended on the availability of transportation to markets that sold a variety of fresh and staple foods at low cost. Food security always was a problem because of their cultural lifestyles, their approach to cope with the daily circumstances of migrant farmwork. Conditions that reduced work opportunities in turn made food security precarious. These conditions included the unpredictability of field crop work, access to harvest schedules and opportunities for work, the location and timing of jobs, the ability to relocate quickly, anxiety about immigration and speaking English, and dependency on others, such as crew leaders and employers. Most of these factors were outside of the farmworker's control. Still, all agreed that work opportunities in the United States, including farmwork, were more attractive than opportunities at home. Because work opportunity was greater in the US, the risk of food insecurity was less.

Families participated in community programs and services for families with young children, which reduced food insecurity. WIC foods for preschool children and pregnant or breastfeeding women were obtained by all families and the ECMHSP provided meals daily to children and at meetings to parents. Finding the services and knowing how to use them also took time and trust. The ECMHSP staff, health outreach workers, and experienced parents helped to explain and identify services.

The ease with which the workers could benefit from community resources varied. The participants all expressed satisfaction with the ECMHSP and agreed that a major benefit of enrolling their children in Migrant Head Start was the security of knowing their children would be adequately fed two meals each day. The biggest concern they had about the ECMHSP was putting their children on the bus and worrying if the bus driver was a responsible driver and caretaker. Participants appreciated most WIC foods and health services, but reported they became confused by the nutrition education they received especially regarding breast feeding and the use of formula. Many who breast fed received formula which they felt should be fed to the infant despite breastfeeding. Mothers often believed that the formula was better for the baby than breast milk and “more American.” The mothers wanted to breastfeed their babies and did not understand mixing formula or how to combine formula with breastfeeding. WIC services and the food package were not well understood. For example, everyone had an expectation that WIC should provide enough food to feed a family. Even though some WIC personnel could speak Spanish, it was not spoken properly and the staff could not answer questions well.

When out of work they depended on local churches, the Catholic Social Ministries, the Episcopal Farmworker Ministry, and local food banks to provide emergency foods; however, transportation problems could prevent emergency food pick-up. Emergency food and community assistance was appreciated and used, but workers reported that some distribution sites required legal papers before giving food, which made them fear the service, even when they were legally working. Farmworker families avoided all situations that might jeopardize their ability to work and make a living, especially immigration problems. Working was the most important thing to be able to do to prevent food insecurity, and they did what was necessary to protect their abilities and opportunities to work. The NC Food Bank, a major source of food aid, has policies that prohibit their distribution sites to require documentation, but some organizations did so anyway.

Finding affordable sources of fresh fruits and vegetables was challenging. Although they did not have time or safe yards in which to grow their own foods, all desired local produce and wondered why the food they harvested was not sold directly on the farm or in local stores. Supermarket

produce was not always good, did not keep between trips to the store, and was expensive. Some farmworkers reported taking foods from the field home or eating it, unwashed, in the field. Crew leaders or growers sometimes gave families surplus produce. Several participants reported having been given so much of one type of food, such as cantaloupe, that they could not use it before it went bad. When crops were abundant or blemished, the grower or crew leader often gave the surplus to the workers.

Another strategy was to buy the cheapest foods, even if they were not desirable or healthy choices. All mothers interviewed could list the kinds of foods required for health, including five or more servings of fruits and vegetables, but they could not always heed their knowledge because the foods were too expensive to buy or their access limited by transportation and time. Not all farmworkers understood how to plan grocery shopping or food budgets.

From focus group and individual interviews, periodic hunger and food insecurity were a part of the lifestyle of being a migrant farmworker in the United States, an occupational risk; and the risk was less in the United States than in their home country. Most reported that, although they would like to go home, they could not do so because of lack of money and regular employment. Opportunities to make money in exchange for hard work were better in the United States and farmwork fit their cultural lifestyles as migrants and provided the best opportunity they could find given their abilities and vulnerability. American agriculture needed them and they needed farmwork to make a living.

DISCUSSION

Food insecurity affects the nutrition and well being of migrant farm workers and their young children. The eastern NC farmworker families included in this study provide a picture of the interrelationship between their lifestyles, working conditions, food insecurity and the concern that growing obesity may impair their ability to work due to disability. We discuss the vulnerability of MSFW families to food insecurity and question the role that migration plays in food insecurity compared to that of farmwork alone; the possible association of the occupation of migrant farm work with obesity in farmworker families; and make recommendations for reducing the risk of food insecurity for MSFW families.

Vulnerability and Food Insecurity: Social Networks, Migration, and the Community

Farmworkers consider risk of food insecurity to be a part of the lifestyle of migrant and seasonal farmwork and seek

out strategies to reduce the vulnerability inherent in their lives to give them more control. For vulnerable populations, human agency and culture set the context from which relationships between social structure, organizations and environments can be seen to affect outcomes such as food security and health. Farmworkers are vulnerable because they are exposed to risks of which they have little control and they depend on others who have both the opportunities and abilities to control the conditions under which they work and live. The risk of food insecurity for farmworkers is thus embedded within the cultural lifestyle of migrant farmwork as a part of global agricultural production. Their first line of defense against food insecurity is to find and maintain regular work throughout the growing season, of which migration is a means to work.

Farmworker families migrate from one seasonal job to another in an effort to maintain employment and reduce food insecurity, but the costs and benefits of migrating must be weighed when deciding to move a family from one community to another. For example, many complex socio-ecological and environmental factors interact to determine a farmworker family's food insecurity, of which migration is one. The degree to which the organization of farm work contributes to food insecurity is complicated by migration; however, the organization of farm work and the living conditions of the farmworkers at any one place can be altered to reduce the risk of food insecurity. The degree to which food security influences migration decisions is not known and needs to be determined within the context of work opportunities and community support.

Many of the conditions that underlie agricultural work and food insecurity, cannot be controlled by the farmworker, such as wages, weather, the availability and number of workers to do a job, harvest size and condition, housing quality, and transportation. Farmworkers cope with these problems through social networking [Massey, 1999]. Networks provide information about strategies to procure and maintain access to resources, job opportunities, cultural associations, and human services. Eastern North Carolina farmworker families responded to food insecurity by accessing services and emergency foods, budgeting, reducing expenses, seeking local fresh produce, and sharing housing and transportation. Another strategy was for one member to take a job outside of farm labor within the local community. For example, some farmworkers in this study worked for the ECMHSCP as teachers, aides, janitors, and cooks.

Not all farmworkers have the abilities to secure non-farmwork employment because it often requires education, the ability to speak English well, and transportation in addition to networking. For example, the farmworkers that obtained the ECMHSC teacher jobs had lived in the United States and North Carolina longer and had legal immigration status. Non-farm work jobs can improve job security and

working conditions that favor being food secure even when they are seasonal, for example, the number of ECMHSCP staff jobs were dependent on enrollment from month to month, yet, those workers experienced greater food security than those whose members did farm work. This may be due to the working conditions of the jobs allowing the workers more control over their lifestyles or to better social support systems, or both. These opportunities occur within the local community, which gets left behind when migration occurs. Migration to find another job is also a strategy for reducing food insecurity, but migration may increase vulnerability as well.

Immigration status and migrating across national borders is known to increase vulnerability and dependency [Vasquez-Leon, 2009]. Migrating within the United States may compound the problem of food security through disrupting social networks, services, and resources that help reduce risks. Following a migrant stream and participating in services located along it help maintain networks which can reduce food insecurity. For example, if the ECMHSCP knows where a family is moving, they try to link the family to migrant services in their new location.

Following a particular migrant stream over several years helps families build social networks, especially through organizations like the Migrant Head Start Program, which operate along the migrant stream. When known as a dependable resource, they serve as a nexus for creating and sustaining the social networks that help migrant farmworkers reduce their vulnerability and develop more choices while they are migrating. The ECMHSCP provides not only child care services, but a place where social networking can occur increasing opportunities for access to food, work, health care, social services, and education.

Food security within local communities, where the farmworker families live while not migrating, can be improved when employers and community agencies work together. Some conditions affecting food security such as work breaks, hygiene, housing, and access to food can be controlled by the employer. Other factors such as access to foods can be organized by the community through churches, social programs, and other institutions in collaboration with growers and crew leaders. Reducing food insecurity among farmworkers can best be accomplished when communities build a network that protects farmworkers through environmental and policy changes as well as creating organized networks to manage emergency resources effectively. Of the many strategies that may be possible for farmworker families to reduce food insecurity, all depend on social networking because it reduces their vulnerability and dependency through shared experiences, knowledge and resources. Networks need to occur within local communities, regions, and along migrant streams to provide a food security safety net that can reduce vulnerability in the cultural lifestyles of farmworker families.

Obesity and Occupational Health Among Farmworkers

Obesity among the farmworker adults and children is significant and presents a health risk. Hispanic children and adults in the United States have some of the highest rates of obesity [Ogden et al., 2008; Centers for Disease Control, 2009] and an increase in obesity among Hispanics occurs across generations [Bates et al., 2008]. Weight gain occurs with the first generation and is correlated with years of residence [Himmelgreen et al., 2004; Barcenas et al., 2007], but is not necessarily due to assimilation [Park et al., 2009]. Our sample is too small to determine if length of residence is correlated with weight gain for the adults and children. Obesity in populations is an expression of complex environmental and biological interactions. While energy balance in individuals is strongly influenced by diet and physical activity, environmental exposures and socio-cultural and political economic constructions allow systems to be reproduced that initiate and sustain obesity in populations.

The farmworkers were aware of their weight gain and of risks of obesity, but did not know how to control the problem for themselves or their children. An explanation for their obesity may be found in the nutrition transition [Popkin and Gordon-Larsen, 2004] which documents global nutritional epidemiological changes in which poor populations bear a disproportionate burden of obesity and chronic disease. Food insecurity associated with poverty has been linked to obesity among vulnerable populations [Popkin, 2004], but our sample size was too small to determine the relationship between obesity and food security for adult farmworkers because obesity was prevalent among all adult food security groups. Among pre-school children the food secure children were obese and the food insecure underweight, which also occurs during the nutrition transition. For the farmworkers in this study, obesity linked to diabetes and cardiovascular diseases as well as musculoskeletal injuries may cause a disability that could threaten their ability to work, and support their family. Food insecurity is a potential outcome of work-related disability associated with obesity.

Obesity can affect work opportunities and performance and also modify workplace exposures and health outcomes: obesity and overweight may affect those working long hours in high demand, low-control environments [Shulte et al., 2007]. Migrant farm workers experience such conditions daily in their work [Villarejo and Baron, 1999; Villarejo et al., 2000; Hansen and Donohoe, 2003]. Obesity may both be an outcome of work-related exposures and a co-risk factor for the development of diseases and it may also modify biological responses to toxic exposures. The farmworkers we studied raised concerns about not understanding how they could be gaining weight given their physical activity levels

and eating habits. Obesity prevention studies among farmworkers should be a priority given the prevalence of rising obesity rates among adults and children, especially among those of Hispanic origin. Although nutrition and active lifestyle promotions are recommended for all, simply assuming that obesity among farmworkers is due to individual eating and activity habits may not only be inaccurate but potentially harmful to the treatment of obesity in the individual and to the development of appropriate, effective, multi-level, population-based interventions for the community.

Obesity may modify the risk for musculo-skeletal disorders, vibration related injuries, occupational asthma, and cardiovascular disease. Obesity could also modify response to occupational stress, immune response to chemical exposures, and risk of disease from occupational exposure to neurotoxins [Shulte, 2007]. Musculo-skeletal injuries are the most common reported injuries among farmworkers followed by injuries of the skin [Henning et al., 2008; Anthony et al., 2009]. Farmworkers experience occupational asthma and respiratory disease and cardiovascular diseases [NCFH Fact Sheet, 2009]. Pesticide exposure among farmworkers accounts for 71% of reported cases of acute pesticide poisonings between 1998 and 2005 [Calvert et al., 2008] and migrant farmworkers experience agricultural chemical exposures [Moses, 1989; Arcury and Quandt, 1998; Macauley et al., 2006]. The growing prevalence of obesity among farmworkers may increase the risk of illness and injury among this vulnerable population; however workplace exposures and lifestyle conditions imposed by farmwork that may contribute to the rise of obesity require investigation.

Organophosphate exposure, known to affect neurological function, has recently been confirmed as interfering with metabolism leading to obesity and diabetes in rat models [Lassiter et al., 2008]. Because farmworkers have a high risk of exposure to organophosphates in the workplace and home [Quandt et al., 2004a; Arcury et al., 2001; Bradman et al., 2007], farmworker complaints of increased obesity and the development of diabetes warrants investigation.

Acculturative psychosocial stress was linked to anxiety and depression among farmworkers [Hovey and Magaña, 2002; Hansen and Donohoe, 2003]. The expression of “nerves” among migrant farmworkers as an embodiment of distress over conditions of economic need and powerlessness was associated with migrant farm work in Canada [Mysyk et al., 2008; England et al., 2007]. Farmworkers work in environments where they have little control, are pressured by piece-work wages and the demands of completing farm work within constraints of timing due to weather and market and are required to work long hours without adequate breaks, all of which create high stress levels [Hiott et al., 2008]. All of these conditions, especially over long periods of time, precipitate high stress levels.

Studying the relationship between obesity and work among farmworkers is further complicated because the worksite is also the home and the models of the interrelationships of work, obesity, and disease proposed by Shulte [2007] need to be modified to include variables associated with the cultural lifestyles of farmworkers. Farmworkers and their families represent a special population that can be exposed to stigmatization and who often are not adequately protected by government policies and law. Care must be taken to protect them from discrimination, including “blaming the victim” in conducting research on obesity. An ecological model [Ward, 2007] is appropriate to investigate obesity as an outcome of occupational exposure that considers the cultural lifestyle and vulnerability of farmworkers without “blaming the victim.” Ecological models, such as proposed by Ward [2007, p. 555], structure the complexities of health problems with multi-level complex etiologies; demonstrate the interrelationships and constraints among social and cultural structures, the physical environment, and individual behavioral choices. This approach can be used both to study complex health problems and to propose and test interventions at the individual, family, community, social, and environmental levels. Such a model can give rise to a culturally competent comprehensive and reinforcing system to address complex health problems in populations such as obesity and food insecurity.

Interventions to prevent obesity provide opportunities for employers, public health providers, and the rural farming community to join forces to advocate for social policies and environmental changes that improve work environments. They can unite to build and coordinate programs and services that give farmworkers opportunities to reduce food insecurity, reduce stress, increase recreational physical activity, and reduce workplace exposures. Grower/producers must have an active role in planning and participating in the development of policies at the state or national level, in addition to working as partners within their local communities. Risk communications regarding obesity and work must be specific and based on adequate scientific research as well as being culturally sensitive to both the farmworker and employer. State collaborative boards composed of farmers, public health officials, farmworkers, scientists, and farmworker advocates and service providers could be created to develop policies and recommend environmental changes; however, local efforts that grow out of respectful collaborations among community stakeholders are essential to address farmworker food security and health promotion. This approach can be effective for the farmworker, but also can have a broader, long term benefit for the local economy and community where farmworkers live and work. In addressing farmworker food security and obesity at the local level, efforts should be made to provide the same considerations for the farm family, who may also be susceptible to poor food security and obesity.

Recommendations for Reducing Food Insecurity and Risk of Obesity

Long-term reduction of food insecurity risk must be rooted in the elimination of poverty and improvement of social justice for farmworkers by increasing wages, self-efficacy, and control over their labor and lives. Statewide policies and laws for farmworker safety and food safety already exist as do policies for the distribution of emergency food supplies in North Carolina’s rural counties. Passing more regulations will not solve the problem of food insecurity or improve farmworker safety and health. Effective short and intermediate term interventions at the community level will be the most effective for reducing risk of food insecurity among farmworker families. Local and regional policies are needed to support intervention efforts.

Educating communities about farmworkers, their economic contributions to agriculture, and food security will prepare local leaders to address food security among farmworker families where they live and work. Providing statewide education to farm employers, health service providers, and community leaders about food insecurity and farm safety is needed. Education about the lives of migrant farmworker families, reasons for migration, and demographics would assist in putting a face on the farmworker in the community and reduce ethnic tension, prejudice against farmworkers, and misinformation about agricultural employment which can sabotage well-meaning efforts. Specific recommendations are based on focus group results, discussions with farmworker service providers and advocates, and community non-profit organizations concerned with the health and food security of the farmworkers in eastern North Carolina. All recommendations recognize the importance of local community organization and environmental change to improve food security and protect farmworker health.

Access to Safe and Nutritious Foods

Farmworker access to safe and nutritious foods is affected by the environment in three significant ways: lack of availability of locally grown produce at affordable prices and locations near to the workplace; transportation to food markets that have a wide variety of affordable foods; and safe and accessible places to store, prepare, and eat foods in the home and workplace. Local farmers who employ farmworkers could be encouraged to grow gardens producing seasonal vegetables and fruits that could be sold at low cost to the farmworkers. Alternatively local farms that already are growing produce for direct sales might collaborate with the county level cooperative extension service to establish local produce stands near migrant farmworker housing or provide a mobile farm market unit to deliver produce in the evenings to farmworker camps, migrant clinics and/or educational

centers. Corner store, tiendas, and taquerias near workplaces and homes could be asked to carry local fresh produce at reasonable prices for farmworkers already shopping there and to participate as a vendor in the WIC program.

Transportation to purchase foods on a regular basis is often provided by a crew leader or employer on a weekly or bi-weekly basis. Sometimes, especially for mothers with infants and small children, food supplies run out before a shopping day arrives. Emergency transportation could be provided as a mission of a local church or arranged in conjunction with a WIC program. Transportation problems in rural areas exist for many members of the community other than farmworkers. The federal and state governments need to investigate developing regional bus and ride sharing services for vulnerable populations in rural communities. Grants can be written by community partner organizations to help fund these initiatives.

Food security and safety for farmworkers can be improved through modifying the work environment. The NC Gold Star Grower Program [2007] already has recognized farmers who have modified the work environment to assure food safety, health, and security of workers. (See <http://www.nclabor.com/ash/goldstar.htm> for information and access to a video that highlights growers who have pioneered some of these recommendations.) Large and small growers can find ways to adapt these suggestions. For example, one grower provided a hot communal meal everyday to all workers. He was able to reinforce task and safety instructions, distribute needed personal safety equipment, and receive input from the workers about crops and work progress while sharing food. Growers might also provide fresh, washed fruit and vegetables and individually wrapped whole grain snacks along with the drinking water at the worksite.

Recreational fields near farmworker housing could be installed where the workers can play football (soccer) and other sports for physical activity and relaxation. When the farmworkers are not using the space, local children or school teams might use the fields for soccer programs. Service clubs could help build and maintain the fields. Liability insurance for farmers who provide recreational space should be affordable or the facility could be covered by a Good Samaritan rule.

The NC Gold Star Growers, previously discussed, take great pride in the housing they provide to their workers. All housing units should have working appliances, especially freezers and refrigerator storage, clean food storage areas for each family in the housing unit, and separate places for hand washing, clothes washing, garbage disposal and food preparation. Screens for doors and windows need to fit well and flooring should be washable. Simple cleaning equipment and supplies should be provided for home maintenance when farmworkers arrive.

Piece-work wages are typical among farmworkers. This system of reimbursement for labor creates competition among the workers and they are not motivated to stop working to eat or drink. Growers and crew leaders could require mandatory “stop and refresh” break times for all workers to take bathroom breaks, eat, and rehydrate. After a break, workers should be more efficient and productive.

Portable hand washing areas, separate from food preparation and safe food storage areas should be available in the field. Incentive programs to encourage farmers to provide these services and statewide recognition of growers providing a “safe and healthy farm” from grower associations and the Farm Bureau would encourage these changes. Plans and costs for services in conjunction with low interest small business loans or grant programs would help growers create/improve facilities. Ultimately grower/producers would realize production benefits from these efforts, and once well-established so that the benefits can be experienced by all stakeholders, these changes can be modified as needed and incorporated into farmwork culture.

Community Services To Promote Food Security

Emergency food services are located in most rural counties, but are poorly coordinated, especially for vulnerable farmworkers. Local level community organizations could band together to manage a county wide or regional emergency food program to distribute food and/or provide transportation. Churches and non-profit organizations with kitchens could be organized to offer a community kitchen program. The community kitchens could provide meals on site or to be delivered to farmworker camps and homes in times of need. Growers, crew leaders, and service providers could advise the kitchens when workers are out of work and in need of services. The community kitchens could serve as educational centers and sites for delivery of health services such as WIC, vaccinations, or health testing. Food banks could work with the community kitchens for food distribution on a weekly basis and the kitchens could serve as model centers to teach food preparation and safety to farmworkers and other community members. Grant funds and donations, in combination with a “pay as you can” system could fund these services.

Farmworker Family Choices and Behaviors

Although the farmworkers knew what foods were appropriate to maintain health and that obesity resulted from lack of physical activity and dietary habits, practicing healthy behaviors is limited by information and opportunities. WIC programs could benefit from Latino, native Spanish speaking breastfeeding advisors to work with new mothers. WIC

nutritionists need to be knowledgeable about the home conditions and the shopping habits of their participants as well as their food preferences, beliefs, and attitudes about infant and child feeding. WIC and ECMHSCP have access to culturally appropriate Spanish language educational materials about nutrition and food safety, but food security and safety cannot be remedied by more education without addressing the problem of access.

Migrant families depended on informal social networking to share information about food access and health care. Trusted informal leaders in the migrant community, such as key parents and staff from the ECMHSCP, farmworkers who organize local football leagues, older farmworkers who have become crew leaders, and lay health workers with the Migrant and Seasonal Farmworker Health Clinics could be organized and trained to identify families at risk and provide service related information to them. These informal leaders could be marketed in the community through branding and culturally appropriate codes so that farmworkers could readily identify them to those in need. Social marketing campaigns through local clinics and service providers, schools, churches, grower associations, corner stores and supermarkets, and the workplace could provide places for marketing to build awareness and encourage the unencumbered use of local services by those in need.

Farmworkers have already identified budgeting money as a strategy to prevent food insecurity; therefore, informal community leaders who have budgeting skills may be identified to assist those in need. Money management classes emphasizing food shopping and tips for reducing food costs without reducing diet quality could be provided to parents at the ECMHSCP during parent meetings or through community colleges, local clinics, and public schools. Latino business leaders, the Self Help Program, and cooperative extension service agents have resources to assist with this need, but need to be networked for farmworker access and trained to understand the special need of migrant farmworker families.

These recommendations could be used alone or coordinated together to improve food security and safety of migrant farmworker families, and at the same time, benefit the larger community as a whole. As within the farmworker community itself, social networking in communities where farmworkers live and work is necessary for improving food security and safety in a cost efficient and effective manner. Policy recommendations for safe migrant housing and farm work practice already exist to improve the safety and health of farmworkers, but they are not routinely followed or accepted by employers for many reasons. Rural communities need to work together at the local level to set local policies and encourage employers to improve working conditions and housing for farmworkers. Social marketing campaigns to recognize counties that “partner up” to care for their farmworkers could reward efforts. Farm Bureau, businesses, Cooperative Extension, Latino and multi-cultural

non-profits, and civic organizations could provide leadership for these efforts. Local or regional health departments, educational providers, and non-profits are capable of seeking funds for these projects and have the ability to monitor programs for outcomes to assure quality control.

Significance and Limitations of Findings

This study calls attention to the role of vulnerability and dependency in the culture of migrant farmworker family lifestyles and in the understanding food insecurity and its interrelationships with working conditions of farmworkers, occupational health, and migration. The burden of obesity and chronic disease among farmworker families is reviewed in light of recent literature recognizing that obesity can be associated with occupational health. More complex ecological models and social epidemiology measures are needed to tease out the relationships among working conditions, migration patterns, obesity, and occupational health. The information provided by the study can be used to develop culturally appropriate community level interventions, policies, and funding programs to reduce food insecurity of MSFW families and their communities. Small sample size prevents results to be generalized to all MSFW families; however food security findings are similar to other studies with larger samples [Quandt et al., 2004b, 2006; Weigel et al., 2007; Wirth et al., 2007]. Relationships among food security and obesity, food security and migration, and food security and the health or nutrition status of the sample are not able to be determined from this formative study.

CONCLUSION

Food insecurity and obesity are significant problems among migrant farmworker families and may be associated with the working conditions, culture, and lifestyle of farmworkers. Migrant farmworker families experience an elevated risk of hunger and food insecurity compared to the general US population and lack control over occupational conditions that can lead to hunger, which contributes to their vulnerability and dependency. Farmworker families practice strategies to cope with food insecurity but to improve and sustain a secure food system, they require community support and intervention. Obesity was prevalent in study sample for all adult food security groups, but the relationship to food security is unclear. Farmworkers depend on supplemental food programs provided through the WIC and Head Start programs and social networking to reduce risks of food insecurity.

Obesity among farmworkers requires further investigation because the migrant farmworker works long hours in the kind of high demand, low control work environment associated with obesity among workers. Occupational exposures may contribute in part to the development of

obesity experience by Hispanic migrant farmworkers, and obesity may also contribute to occupational injuries and illnesses they experience. Research hypotheses to test the association of obesity and development of chronic diseases such as diabetes with occupational health of farmworkers should be developed and tested. The extent to which migration contributes to food insecurity and obesity among farmworkers needs to be teased out of the conditions of farmwork alone to understand effective ways to address food insecurity and obesity. Dependency and migration both must be considered to solve the problem of food insecurity and improve the health of farmworkers in the workplace. An ecological model would facilitate the development of appropriate and cost-effective interventions for the farming community as a whole. Risk of food insecurity, obesity and occupational injury and illness can be addressed through community interventions at the local and regional levels with support from state and federal policies and funding. This study demonstrates the importance of conducting a larger study of the nutrition of migrant farm worker families and its relationship to chronic diseases and occupational risks of illness and injury and best practices for prevention. A food security and migration survey could be added to an existing national farmworker and agricultural survey to address this issue in a cost-effective way.

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