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# FOOD INSECURITY AND FREQUENCY INTAKES OF FRUITS AND VEGETABLES OF HOUSEHOLDS IN A SOUTHEASTERN U.S. REGION

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**Objectives.** We sought to determine the prevalence of food insecurity using food insecurity experience-based scales (FIES) and frequency consumption of fruit and vegetable in households with preschool-aged children. **Methods.** As part of a larger study which included teacher training, a pre-assessment survey of 191 parents and caregivers of preschool children was conducted in a Florida District. Based on the food insecurity experience-based scale (FIES) that was developed for monitoring global hunger, families' responses to nine food security questions were categorized into 4 levels: Anxiety and uncertainty about the household food supply, insufficient quality and preferences of the type of food, insufficient food intake and its physical consequences, and hunger. A fruit and vegetable frequency Likert-scale type questionnaire measured intakes. **Results.** Eighty-two percent of the respondents were food secure, and an overall 18% reported food insecurity at some level. Using FIES model as a continuum indicator of food insecurity, 18% of respondents reported anxiety and uncertainty in food supply; 16.1%, 16.2 and 19.7% responded to three questions that measured the domain labeled as compromising or limited variety of food due to resources; 11.8%, 8.7%, and 2.7% of participants responded to three questions that measured the domain labeled as experiencing reduced intake; while a smaller percentages experienced hunger (4.3% went to sleep hungry and 1.5% experienced whole day/night hunger). Fruit and vegetables were consumed at least one time per day or week by all levels of food insecure households. Significant mean differences in consumption frequency were found for fresh and canned/frozen vegetables and canned/frozen fruits. **Conclusion.** Despite the levels of food insecurity experienced by the households, fruit and vegetable intake in some form was consumed at least one time each week. A nutrition intervention is needed to assist food insecure individuals with appropriate food choice even with limited supply.

**Introduction** | Food insecurity persists as a public health challenge among developed<sup>1,2</sup> and developing countries.<sup>3</sup> In 2018, 11.1 percent of U.S. households were food insecure at least some time during the year, including 4.3 percent (5.6 million households) that had very low food security. This means that at times the food intake of one or more household member was reduced and their eating patterns was disrupted because the household lacked money and other resources for procuring food.<sup>4</sup> In 2017, the overall county food insecurity data for Florida, showed a rate of 13.4%; whereas in Northeast Florida the rate is 15.6%.<sup>5</sup> These rates are higher than the national average imploring the importance of exploring this area for public health interventions.

Food insecurity is defined as the lack of access to enough food for an active, healthy life, which results from limited or uncertain access to nutritionally adequate and safe foods in socially acceptable ways.<sup>6,7</sup> Many factors are at play with how food insecurity is measured and how accurate the correlations are with the measurement and the multidimensional concept. This has been an ongoing challenge to researchers and practitioners. As such, several research initiatives explored and tested various options for monitoring and measuring household food insecurity (access).<sup>7-10</sup> In addition, based on a review of evidence from 22 different scale applications, an article examining commonalities in the experience and expression of food insecurity (access) across cultures identified four domains and sub-domains of food insecurity (access)

that has been shown to be general across different countries and cultures.<sup>11</sup> The authors recommended that questions related to these domains be used as the basis of future food insecurity (access) scale measures.<sup>11</sup>

Since no one indicator of food and nutrition security can account for all complexities, new approaches are proposed each year.<sup>12,13</sup> The food insecurity experience scales (FIES) is one of those measures that is defined as an experience-based metric of severity of food insecurity that relies on people's direct responses to a series of questions regarding their access to adequate food.<sup>12,13</sup> Experience-based scales were developed to fill a recognized gap in the ability to measure food insecurity and capture social aspects that other measures do not.<sup>12,13</sup> The construct of food insecurity that the FIES aims to measure is a more restricted concept within the broader, more encompassing definition.<sup>13</sup> The advantage of the FIES is that it enables measurement of the food insecurity which can then be analyzed together with other indicators and contribute to a more comprehensive understanding that inform policies and interventions.<sup>12,13</sup>

**Food Insecurity and Dietary Intakes** | It is well established that food security status influences food choices.<sup>14</sup> Studies have shown that adult women in food insecure households have decreased fruit and vegetable consumptions and an increased risk for chronic diseases, such as diabetes.<sup>14-17</sup> Other studies have investigated the relationship of food insecurity and its impact on dietary factors with mixed results.<sup>17,18</sup> Tariku et al.<sup>18</sup> reported that food insecurity was significantly associated with undiversified diet of an adolescent group in Ethiopia. Tomayko and colleagues<sup>19</sup> reported that food insecure adults consumed significantly lower amounts of vegetables, but the same group had significantly higher intakes of fruit juice and fried potatoes than food secure adults.<sup>18</sup> In that same study,<sup>19</sup> children who were categorized as food insecure had significantly higher intakes of fried potatoes, soda, and sports drinks. Dietary guidelines for Americans recommend daily consumption of fruits and vegetable intakes.<sup>20</sup> The recommended amount of vegetables at the 2,000-calorie level is 2½ cup-equivalents of vegetables per day.<sup>20</sup> Weekly amounts from each vegetable subgroup are recommended to ensure variety and meet nutrient needs.<sup>20</sup> Similarly, the recommended amount of fruits at the 2,000-calorie level is 2 cup-equivalents per day. One cup of 100% fruit juice counts as 1 cup of fruit.<sup>20</sup> At least half of the

recommended amount of fruits should come from whole fruits and juices should be 100% juice, without added sugars.<sup>20</sup> Canned fruit options with low amounts of added sugars and one-half cup of dried fruit counts as one cup-equivalent of fruit.<sup>20</sup>

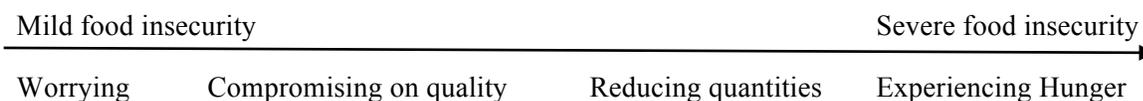
It is imperative to determine fruit and vegetable intake in relation to food insecurity in order to develop interventions to specifically target these underserved populations. The present study evaluated levels of households experienced-based food insecurity and the frequency consumption of fresh fruits, vegetables, 100% fruit/juices, canned/frozen fruit/vegetables, leafy vegetables, and dried fruits.

**Methods** | Prior to the start of the study, the Institutional Review Board (IRB) at the University of North Florida approved all study protocols. Dyads consisting of an adult parent or caregiver and a child (2–5 years old) from the same household that were enrolled in 1 of 6 Head Start centers in a large southeastern metropolitan area were included. All participants were recruited from a larger study evaluating a nutrition curriculum, *Healthy Habits for Life*. Parents and caregivers were recruited at a health-screening day for a yearlong assessment related to nutrition and health. Parents and caregivers completed an initial questionnaire that included household food security questions and dietary frequency intakes of fruits and vegetables. Demographic information was collected, and food insecurity was assessed using a validated 9-items Household Food Security Survey from the USDA. Responses to the food security questions were scored and summarized scores were used to determine food security status. Those scores were analyzed against the frequency of consumption for fruits and vegetables (canned, frozen, or fresh) in the ANOVA. The 9 food security questions were further divided into four domains using established and validated evidence of food insecurity experienced-based scale:<sup>12,13</sup> anxiety or worry; insufficient diet quality; insufficient food/reducing intake; and hunger as shown in Table 1 and illustrated in Fig 1. A food frequency questionnaire measuring 100% juices of fruits and vegetable, fresh, canned/frozen, and dried fruits and vegetables were examined for dietary consumption patterns among participants. Responses for the food frequency were measured on a scale of 1-6-point; where 1 = never, 2=at least 1 time weekly, 3 = 2-5 times weekly, 4= 6 or more times weekly, 5= at least 1 time daily, and 6 = 2-3 times daily. Food security status, the dependent variable was measured from the 9-item household food security survey of the

USDA and a one-way ANOVA coupled with Dunnett t (2-sided) post-hoc comparison was used to determine mean differences in responses. The group of 1 time daily was used as control and compared to all other groupings for significant differences in responses.

Data were computed using the Statistical Program for Social Sciences (SPSS, version 25, IBM corporation, Somers, NY). Descriptive data were analyzed using means and frequencies. A P value of less than .05 was used to identify statistical significance.

**Figure 1.** FIES continuous scale measures for food insecurity



**Table 1.** Household Food Insecurity Access Survey displayed in categories as levels of experienced-based food insecurity.

Food Insecurity Categories	Sample Questions from 9-Item Survey
<b>Domain 1:</b> Anxiety and uncertainty about the household food supply:	1. Did you worry that your household would not have enough food?
<b>Domain 2:</b> Insufficient Quality (includes variety and preferences of the type of food):	2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? 3. Did you or any household member have to eat a limited variety of foods due to a lack of resources? 4. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
<b>Domain 3:</b> Insufficient food intake and its physical consequences	5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? 6. Did you or any household member have to eat fewer meals in a day because there was not enough food? 7. Was there ever no food to eat of any kind in your household because of a lack of resources to get food?
<b>Domain 4:</b> Hunger	8. Did you or any household member go to sleep at night hungry because there was not enough food? 9. Did you or any household member go a whole day and night without eating anything because there was not enough food?

**Results** | Eighty-two percent of the respondents (n=157) were food secure, and 18% (n=34) reported food insecurity at some level. Using the FIES model as a continuum indicator of food insecurity, 18% of respondents reported anxiety and uncertainty (worry) in food supply; 16.1%, 61.2 and 19.7% responded yes and was categorized as experiencing compromising or

limited variety of food due to resources; a response of yes to 3 more questions resulted in 11.8%, 8.7%, and 2.7% being placed in the category/domain of experiencing reduced intake; while a smaller percentage reported experiencing hunger (4.3% went to sleep hungry and 1.5% experienced whole day/night hunger).

**Table 2.** Household Food Insecurity status and frequency of fruit and vegetable intakes.

<b>Levels of Food Insecurity using Experience Scale (FIES)</b>	<b>Sample Questions</b>	<b>Percentage (%) of participants in the sample responded “Yes”</b>	<b>Predominant Frequency responses for Fruit and Vegetable Intake</b>
Anxiety or uncertainty (Worry)	Did you worry...?	18.0	At least one time daily or weekly
Insufficient or Compromising Quality (limit variety)	Were you/household not able to eat types of foods?	16.2	At least one time daily or weekly
	Ate limited variety of foods?	16.1	At least one time daily or weekly
	Eat some foods that you really did not want to eat?	19.7	At least one time daily or weekly
Insufficient Food intake (reducing intake)	Did you/household have to eat a smaller meal...not enough food?	11.8	At least one time daily or weekly
	Eat fewer meals in a day because there was not enough food?	8.7	At least one time daily or weekly
	Was there ever no food to eat of any kind in your household?	2.7	At least one time daily or weekly
Hunger (sleep, or all day/night)	Did you/household go to sleep at night hungry?	4.3	1-2 times weekly
	Go a whole day and night without eating anything because there was not enough food?	1.5	Once weekly

Intakes of fruit and vegetables of all variety were examined by levels of food insecurity. At least all levels of food insecure participants reported consumption of some type of fruits and vegetables at least one time weekly or once daily. Results of the levels of food insecure and fruit and vegetable consumption are summarized in Table 2. In addition, one-way ANOVA was computed comparing food security status (scores) of participants who reported varying levels of fruit and vegetable consumption. Overall, statistically significant differences among fruit and vegetable consumption was found ( $F(6, 157) = 4.08, p < .05$ ). Dunnett  $t$  (2 sided) was used to examine main effects or interactions between consumption frequencies. Significant interactions and mean differences for consumption patterns one time daily and 2-3 times daily of fresh vegetables (mean difference of 1.476,  $p = 0.012$ ), canned or frozen vegetables (mean difference of 1.744,  $p = 0.020$ ), and canned or frozen fruits (mean difference of 1.833,  $p = 0.042$ ) were found. No significant interactions were found for leafy vegetables, 100% fruit juice, vegetable juice, or fresh fruit consumption frequencies ( $p > .05$ ).

**Discussion** | Food insecurity remains a challenge globally. In the United States, an estimated 88.2 percent of U.S. households were food secure throughout the entire year in 2017.<sup>4</sup> Children and adults were food insecure in 7.7 percent of U.S. households with children in 2017.<sup>4</sup> The food secure group spends more on foods than the average American. Coleman-Jensen and colleagues<sup>4</sup> in the USDA's report, stated that in 2017, "the typical food-secure household spent 23 percent more on food than the typical food-insecure household of the same size and household composition". The prevalence of food insecurity in households in this study was higher (18%) than national (11.1%), state (13.4%) and Northeast Florida (15.6%) statistics.<sup>4,5</sup> This has significant implications for nutrition education and public health practice.

Dietary recommendations for consumption of fruits and vegetables includes daily intakes from a variety of vegetable and fruit groups, and limited amounts of dried fruits and juices.<sup>20</sup> Findings indicate that fruit and vegetable intake frequency is low, in that participants consistently reported consumption frequencies of "at least once weekly or daily", which is an indication of inadequacy. The categories of "6 or more times weekly" or "2-3 times daily" were rarely selected by the food insecure households in our study.

The finding in this present study, is supported by other studies findings that examined food insecure households and reported low intakes of fruits, vegetables, and fresh produce in general.<sup>14-22</sup> One study reported a significant inverse relationship of food insecurity with fruit intake and the positive association with fast food and soda intakes among a group of California veterans.<sup>21</sup> Such results are commonly reported in research with vulnerable populations. For example, another study among 1874 low income adults, Mello and colleagues<sup>22</sup> noted that food insecure participants were more likely to consume high fat and juice intakes over other nutrient-dense food options like vegetables and fruits. Our findings indicate the need for nutrition interventions in this area of food insecurity in order to increase intake of fruits and vegetables and impact overall health. Kropf et. al<sup>16</sup> noted that having access to farmer's markets is one strategy that can be applied to aid with increasing intakes of fruit and vegetables among food insecure households.

**Limitations** | One limitation to the study is a small sample size. More preschools need to be sought out for future studies to increase the power of the results. However, the study was conducted in six- preschools across 3 counties, which was able to add diversity to the studied population. Dietary intakes were not measured, but rather a self-reported frequency pattern in the form of a food frequency questionnaire was used. Self-reported data is not the most reliable indicator of actual intake and is measured using a 24-hour recall or food record tools.

**Implications for Public Health Practice** | Within this small group of participants, a higher than state's percentage of food insecurity was noted. These households were targeted because it contained preschool-age children. Several studies have linked negative childhood consequences including overweight, obesity and undiversified dietary intakes to food insecure households.<sup>18, 23-27</sup> Despite the small area studied, the findings add substance to the evolving body of literature on experienced-based food insecurity and limited intakes of nutrient dense foods. It also points to need for public health application and interventions. Further studies on a larger sample of preschool-age households are needed, but understanding strategies employed by households may help inform future interventions to address food insecurity.

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