

# Development, Validity, and Cross-Context Equivalence of the Child Food Insecurity Experiences Scale for Assessing Food Insecurity of School-Age Children and Adolescents

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## ABSTRACT

**Background:** Children ages 6 to 17 years can accurately assess their own food insecurity, whereas parents are inaccurate reporters of their children's experiences of food insecurity. No globally applicable scale to assess the food insecurity of children has been developed and validated.

**Objectives:** We aimed to develop a globally applicable, experience-based measure of child and adolescent food insecurity and establish the validity and cross-contextual equivalence of the measure.

**Methods:** The 10-item Child Food Insecurity Experiences Scale (CFIES) was based on items previously validated from questionnaires from the United States, Venezuela, and Lebanon. Cognitive interviews were conducted to check understanding of the items. The questionnaire then was administered in 15 surveys in 13 countries. Other items in each survey that assessed the household socioeconomic status, household food security, or child psychological functioning were selected as criterion variables to compare to the scores from the CFIES. To investigate accuracy (i.e., criterion validity), linear regression estimated the associations of the CFIES scores with the criterion variables. To investigate the cross-contextual equivalence (i.e., measurement invariance), the alignment method was used based on classical measurement theory.

**Results:** Across the 15 surveys, the mean scale scores for the CFIES ranged from 1.65 to 5.86 (possible range of 0 to 20) and the Cronbach alpha ranged from 0.88 to 0.94. The variance explained by a 1-factor model ranged from 0.92 to 0.99. Accuracy was demonstrated by expected associations with criterion variables. The percentages of equivalent thresholds and loadings across the 15 surveys were 28.0 and 5.33, respectively, for a total percentage of nonequivalent thresholds and loadings of 16.7, well below the guideline of <25%. That is, 83.3% of thresholds and loadings were equivalent across these surveys.

**Conclusions:** The CFIES provides a globally applicable, valid, and cross-contextually equivalent measure of the experiences of food insecurity of school-aged children and adolescents, as reported by them. *J Nutr* 2022;152:2135–2144.

**Keywords:** children, adolescents, food insecurity, validity, cross-contextual equivalence

## Introduction

Children and adolescents are sensitive to their environments and vulnerable to stressors in their environments physically,

psychologically, and socially (1). From multiple perspectives—including developmental, life course, cumulative disadvantage, and intergenerational perspectives—stressors in the environments of children and adolescents can have both immediate

and long-term consequences. Children and adolescents who experience food insecurity (as assessed by themselves or by parents), a common stressor in environments of children and adolescents globally, do poorly in many ways, including having a greater likelihood or greater intensity of behavioral problems, disrupted social interactions, compromised school performance (2–12), poor dietary intake (12–16), low physical activity (9, 11), low physical function in daily activities and exercise (14–17), poor general physical health and illness (18), poor mental health (19–23), and shame (24, 25).

An initial investigation of the experience of food insecurity prioritized adult perspectives, focusing on mothers as the traditional food decision-makers and primary actors in acquiring and managing food (26). Therefore, most of what we thought we knew about child and adolescent food insecurity was based on reports from mothers, including that food security is a household issue involving a managed process and that parents try to protect their children and adolescents from food insecurity.

Subsequent investigations in which children and adolescents aged 6–17 years were interviewed revealed several subconstructs of their experiences of food insecurity: children and adolescents are aware of food insecurity cognitively, emotionally, and physically and take responsibility for it by participating in adult strategies for managing food resources, initiating their own strategies to make food resources stretch, and generating resources in terms of food or money for food (27–30). These 6 subconstructs differ in several ways from the 4 subconstructs of the experience of food insecurity identified from mothers in an initial, qualitative study done by Radimer et al. (26), which were diminished quantity and quality (i.e., healthfulness) of food and psychological (i.e., uncertainty and compromised choices) and social (i.e., acquiring food in unacceptable ways and nonnormative patterns of eating) experiences of food insecurity.

Parents try to provide sufficient qualities and quantities of food and emotional support around eating but are not fully successful at protecting children (30). Parents nevertheless may believe that they are effective in such protective strategies and, therefore, report erroneously that their children do not experience food insecurity. Furthermore, protection is attempted in multiple directions: parents to children, parent to parent, children to parents (especially mothers), and children to children (especially older to younger children). Parents are not fully knowledgeable about their children's experiences of food insecurity in part because some child experiences are hard for another person to detect: for example, feelings of worry, sadness, and hunger are not easily observed. Moreover, children's efforts to protect parents often involve an intentional lack of communication (24), as children try to prevent parents from the added burden of knowing about the child's food-related hardships. For example, in a qualitative study of 16 families in which fathers, mothers, and children were interviewed in

South Carolina, only about half of parents knew about their children experiencing cognitive and emotional awareness of food insecurity and no parents knew about their children experiencing physical awareness, initiating strategies to stretch food resources, and generating resources (30). Overall, parents knew about only 40% of children's experiences across the 6 subconstructs of child food insecurity.

Consequently, in studies from several countries, agreement of adult reports with child and adolescent reports of food insecurity was generally poor (13, 19, 29–34, 35). Children ages 6 to 17 years can accurately assess their own food insecurity, whereas parents are inaccurate reporters of their children's experiences of food insecurity based on comparisons of accuracy against criterion variables and on in-depth, qualitative studies (13, 19, 30, 33, 35).

Current national and global systems can assess household food insecurity, including among households with children and adolescents, but generally cannot provide accurate information about the food-insecurity experiences of children and adolescents within those households (3). Two exceptions provide limited information from adolescents about their own food insecurity experiences. The Food Insecurity Experience Scale (FIES) is conducted annually in the Gallup World Poll, but only for adolescents  $\geq 15$  years of age (36), and the WHO Global School-Based Study Health Surveys are conducted for school-going adolescents  $\geq 11$  years of age, using only 1 item about having enough to eat. No systems currently assess children's experiences for children younger than 11 years of age or not in school. Furthermore, current systems do not assess all of children's experiences of food insecurity, leaving out potentially consequential experiences, such as a lack of choice; feelings of deprivation, discouragement, shame, and guilt; worries about parents' well-being; and accessing food in socially unacceptable ways or having socially nonnormative patterns of eating.

Therefore, given the importance of accurate assessment of children's and adolescents' experiences of food insecurity, innovation is needed to directly assess the range of ways in which children, across global contexts, experience food insecurity. Doing this assessment requires the development and validation of a cross-contextually equivalent measure that is suitable for children and adolescents and taps the multiple subconstructs that characterize child and adolescent food-insecurity experiences. Such a measure would be valuable for quantifying the extent of child and adolescent food insecurity, identifying which children have which experiences in which contexts, and determining which actions will ameliorate these experiences. To that end, the aim of this study was to develop a globally applicable, experience-based measure of child and adolescent food insecurity and to establish the validity and cross-contextual equivalence of the measure.

## Methods

### Development of scale

During the summer of 2019, the first 5 authors created the Child Food Insecurity Experiences Scale (CFIES), a questionnaire developed by selecting and adapting items previously developed (from in-depth qualitative interviews) and validated (against a definitive classification made from in-depth qualitative interviews or quantitative criterion variables) for 3 questionnaires from the United States (33), Venezuela (13), and Lebanon (35). A parsimonious set of items was sought to provide data on multiple subconstructs of children's experiences of food insecurity: uncertainty, compromised dietary quality or preferences, eating less, going hungry, and emotional awareness. The set of items

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Supplemental Table 1 is available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at <https://academic.oup.com/jn/>.

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Abbreviations used: CFIES, Child Food Insecurity Experiences Scale; FIES, Food Insecurity Experience Scale; IFPRI, International Food Policy Research Institute; IFPS, International Food Policy Study; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

also needed to reflect universal experiences that children may have of food insecurity based on the available data. Initially, 14 items were developed, and the set was subsequently reduced to 10 items based on extensive discussion about which items were most important conceptually and were likely to be cross-contextual equivalent. The items were constructed as questions, with the possible responses to each question being many times, 1 or 2 times, or never in the last 12 months (Box 1). Item wording was refined to be as simple as possible and easily translatable into multiple contexts and languages, initially Spanish and French. The translations and back-translations into Spanish and French were done with the input of multiple first-language colleagues experienced in questionnaire design. The CFIES questionnaire was reviewed by the investigators in the International Food Policy Study (IFPS), an annual, multicountry survey of adults and adolescents to evaluate the impacts of national food policies. Investigators conducted cognitive interviews in 2019 with 8 children aged 10–13 years in Canada to check understanding and improve the wording of the items. No issues about understanding, retrieval, judgment, or responses were found in the cognitive interviews or during administration in surveys.

### Box 1:

#### Questionnaire for the Child Food Insecurity Experiences Scale

##### *Lead in*

Now we are going to ask you some questions about food. For each question, please answer whether it happened many times, 1–2 times, or never in the past 12 months.

##### *Questions*

In the last 12 months ...

1. Did you worry that food at home would run out before your family was able to get more?
2. Did you worry about how hard it is for your parents/guardians to get enough food for your family?
3. Were you not able to get the food you wanted because there wasn't enough money?
4. Has the size of your meal been cut because your family didn't have enough food?
5. Were you hungry but didn't eat because your family didn't have enough food?
6. Did you skip a meal because your family didn't have enough food?
7. Did you feel tired or weak because your family didn't have enough food to eat?
8. Did you feel embarrassed or ashamed because your family didn't have enough food?
9. Did you feel sad or mad because your family didn't have enough food?
10. Did you feel embarrassed or ashamed about any of the things you or your family had to do to get enough food?

##### *Responses for each question*

Many times; 1 or 2 times; never; don't know; or refuse to answer

### Administration in surveys

The IFPS administered the CFIES questionnaire to adolescents 10–17 years of age in 6 countries (i.e., Canada, Australia, United Kingdom, United States of America, Mexico, and Chile) in November and December 2019, before the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic began (Table 1). The sample was obtained through parents or guardians in the Nielsen Consumer Insights Global Panel in each country. Both probability and nonprobability sampling methods were used to establish the panels. Adults from the panels in each country were contacted using email and screened to determine whether any adolescents lived in their household. If so, parents or guardians were given information about the study and asked for permission for the adolescents' participation. One child per

household was invited to participate. The surveys were administered online using well-established methodology. The study was reviewed by and received ethics clearance from the University of Waterloo Research Ethics Committee.

The International Food Policy Research Institute (IFPRI) and University of Ghana administered the CFIES questionnaire in 10 neighborhoods in Accra; 5 were randomly drawn from the poorest Accra neighborhoods and 5 were drawn from better-off neighborhoods. A census was conducted in each neighborhood, and 96 households with an adolescent 12–19 years of age were randomly selected to participate in the survey. Data collection occurred in March 2020, ending prematurely because of the pandemic. Given the large number of languages used in Accra, translating the questionnaire was not practical, and it was administered in English. Training activities were done in English, including extensive training based on enumerators' backgrounds. Survey Solutions, free software developed by the World Bank, was used for data collection on tablet computers. Consent for adolescent minors was provided by the parents or legal guardian, and assent from minors was also obtained. Ethical clearance was obtained from the Noguchi Memorial Institute for Medical Research Institutional Review Board and the IFPRI Institutional Review Board. Also, the study team and survey firm informed local and regional health and education authorities and community representatives before starting the study activities.

Researchers from the American University of Beirut in Lebanon administered the questionnaire to children and adolescents 9–14 years of age attending 20 public schools in January and February 2020, just before the pandemic. Parent and caregiver consent forms were distributed to students in grades 4, 5, and 6 in the schools, with a response rate of about 87%. Following parent or caregiver consent, 80 children in each grade were randomly selected for interview. The respondents were about half Lebanese and half Syrian refugees. Assent was obtained from all children in private preceding survey administration. No child refused participation. The protocol was approved by the Ministry of Education and Higher Education in Lebanon and the University Institutional Review Board.

Authors Aurino and Wolf administered the questionnaire in rural, northern Ghana in April to June 2021, during the pandemic, to children ages 5–9 years and adolescents ages 10–17 years. For this study, the 2 age groups were considered separately as 2 surveys. One child in each age group was sampled per household in the Northern, Savannah, Northeast, Upper East, and Upper West regions of Ghana. Data were collected face to face. Informed consent was obtained from the primary caregiver, and then the child's assent to participate was obtained. The protocol was approved by the Innovations for Poverty Action ethical review board and, through an interagency agreement, the University of Pennsylvania Institutional Review Board.

In 2021, UNICEF carried out a study in multiple countries in the Eastern and Southern Africa regions, in which data were collected on food-insecurity experiences of adolescents aged 15–18 years in the context of the SARS-CoV-2 pandemic. Data were collected from May to September 2021 using computer-assisted telephone interviewing. Ethical approval for the survey was received in each participating country in early 2021 from a recognized ethical review board by the UNICEF participating country offices. Informed consent was obtained from participants.

### Criterion variables for investigating validity of the scale

Criterion validity means that a test measure predicts other measures as expected (35). Items available in each survey were selected as criterion variables to which to compare the scores from the CFIES. A strong association of the CFIES with criterion variables provides evidence of criterion validity. Variables were selected based on previously established relationships with experiences of food insecurity. From the IFPS survey, we used 3 criterion variables based on questions asked to the adolescents: “Does your family have enough money to pay for things your family needs?”; “Think about the last 7 days. How many days did you eat breakfast?” (37–39); and “Think about the last 7 days. How many days did you sit down to eat dinner or supper with at least

**TABLE 1** Samples available and statistics on the items and scale scores (range 0–20) for the Child Food Insecurity Experiences Scale

Survey	Source	Age, years	Sample, <i>n</i>	Scale score			Cronbach alpha reliability	Variance explained by 1 factor	Prevalence of experiences, %			
				Mean	SD	IQR			None (0)	Few (1–6)	Several (7–10)	Many (11–20)
Canada	International Food Policy Study	10–17	3682	1.65	3.51	0–1	0.92	0.97	64.8	26.4	4.5	4.3
Australia	International Food Policy Study	10–17	1435	2.29	4.08	0–3	0.93	0.94	55.7	31.0	7.4	5.9
UK	International Food Policy Study	10–17	1519	2.34	4.14	0–3	0.93	0.97	55.6	30.4	6.9	1.2
USA	International Food Policy Study	10–17	1599	2.84	4.58	0–4	0.93	0.95	50.7	32.9	7.4	9.1
Mexico	International Food Policy Study	10–17	1617	2.92	3.89	0–4	0.90	0.94	38.7	46.2	8.7	6.4
Chile	International Food Policy Study	10–17	1252	3.33	4.01	0–5	0.88	0.94	29.9	53.0	9.8	7.3
Accra, Ghana	International Food Policy Research Institute	12–18	448	3.29	4.86	0–5	0.94	0.92	49.9	30.2	10.0	10.0
Lebanon	American University of Beirut	9–14	1601	3.26	4.20	0–5	0.90	0.98	35.9	44.6	12.4	7.1
Northern Ghana	Aurino-Wolf	5–9	2124	4.52	4.79	0–7	0.89	>0.99	26.1	45.1	17.1	11.8
Northern Ghana	Aurino-Wolf	10–17	2388	5.86	5.39	1–10	0.92	>0.99	20.6	39.5	20.9	19.0
Eswatini	UNICEF	15–18	206	10.1	6.52	5–16	0.92	>0.99	8.3	25.7	18.0	48.1
Kenya	UNICEF	15–18	198	10.5	6.79	4–16	0.93	0.96	10.6	20.7	16.2	52.5
Lesotho	UNICEF	15–18	240	10.4	6.59	4–17	0.92	0.95	7.5	24.6	19.6	48.3
Malawi	UNICEF	15–18	318	8.23	5.58	4–12	0.89	0.96	10.4	31.5	24.5	33.6
Uganda	UNICEF	15–18	197	8.53	6.27	3–13	0.90	0.99	13.2	28.9	19.8	38.1

1 of your parents/guardians?” (40). From the IFPRI survey, we used 4 criterion variables based on questions asked to adult respondents: the Household Food Insecurity Access Scale (41) and 3 measures of wealth (type of toilet facility used, ownership of home, and number of rooms in house).

From the Lebanon survey, we used 5 criterion variables: head-of-household employment status, mother’s or primary caregiver’s schooling, whether the child or adolescent had breakfast the prior day, child or adolescent dietary diversity score, and child or adolescent self-esteem score. The head-of-household employment status variable had 3 categories: unemployed, employed part-time, and employed full-time. The mother’s or primary caregiver’s schooling variable had 4 categories: never attended or less than Brevet (examination at the end of middle school), Brevet, secondary school baccalaureate, and university. Dietary diversity was calculated as the number of 10 food groups consumed (42). For the self-esteem scale (43), children and adolescents were asked to respond “strongly disagree,” “disagree,” “agree,” or “strongly agree” to the following 10 statements: 1) on the whole, I am satisfied with myself; 2) at times I think I am no good at all; 3) I feel that I have a number of good qualities; 4) I am able to do things as well as most other people; 5) I feel I do not have much to be proud of; 6) I certainly feel useless at times; 7) I feel that I am a person of worth, at least on an equal plane with others; 8) I wish I could have more respect for myself; 9) all in all, I am inclined to feel that I am a failure; and 10) I take a positive attitude toward myself. The self-esteem score was standardized to a z-score (i.e., with a mean of 0 and SD of 1).

From the northern Ghana survey, we used 4 criterion variables. Two were based on questions asked of adult respondents that were relevant to both children and adolescents: the Food Insecurity Experiences Scale (36, 44), which assesses adult and household food insecurity, and a wealth index. The wealth index was constructed as the sum of 6 binary indicators of material well-being: improved housing construction materials; improved cooking fuel; and ownership of a gas stove, refrigerator, working fan, and working television. Two other criterion variables for motivation and self-esteem were asked of adolescents but not younger children; these variables reflect psychological well-being, which has been associated with food insecurity (1, 5, 23, 24). For the motivation scale (45), adolescents were asked to respond “always no,” “sometimes no,” “sometimes yes,” or “always yes” to the following 9 statements: 1) I like going to school; 2) going to school interests me a lot; 3) I would go to school even if I were not obliged to do so; 4) going to school allows me to learn many useful things; 5) I choose to go to school to learn many things; 6) in life, it’s important to go to school; 7) I study to get a nice reward; 8) I study to please my parents or my teacher; and 9) I study to show others how good I am. The self-esteem scale was the same as that used in Lebanon (43). Both the motivation and self-esteem scores were standardized to z-scores.

## Analyses

The responses to the CFIES questions were coded with 2 indicating many times, 1 indicating 1 or 2 times, and 0 indicating never (in the last year), and a summed scale was created with a range of 0 to 20. An ordinal classification was also created, based on the number of experiences and the judgment of the authors, as no food insecurity experiences (score 0), few experiences (score 1 to 6), several experiences (score 7 to 10), and many experiences (score 11 to 20). For each survey, reliability (i.e., internal consistency) was estimated using the Cronbach alpha, and a confirmatory factor analysis was done to examine the factor structure based on classical measurement theory.

To investigate accuracy (i.e., criterion validity), linear regression was used to estimate the association of the CFIES scores with the criterion variables for each survey (46). The CFIES score was the dependent variable for the criterion variables from the IFPS and the IFPRI surveys. The CFIES score was also the dependent variable for the employment, schooling, and breakfast criterion variables from Lebanon and for the Food Insecurity Experiences Scale and wealth index criterion variables in the northern Ghana survey. The dietary diversity and self-esteem scores from Lebanon and the motivation and self-esteem scores from the northern Ghana survey were used as the dependent variables because these criterion variables are, presumably,

consequences of food insecurity. For the criterion variables from the IFPS, the analyses were done with all 6 countries combined, adjusting for country, and separately for each country.

To investigate cross-contextual equivalence (i.e., measurement invariance), the alignment method was used, based on classical measurement theory. Classical measurement theory was appropriate because the items were neither selected nor expected to be ordered hierarchically—that is, to have a strong gradient in the frequency of affirmations—as is assumed for the Rasch model (35). The alignment method was developed to investigate approximate equivalence across many groups (47). The method uses rotation criteria like that used in exploratory factor analysis to obtain an optimal equivalence pattern under the assumption that most parameters are approximately equivalent, even if a few are not (48). The model was done using a logit link with robust maximum likelihood estimation and specifying responses as ordinal. We compared the percentages of nonequivalent loadings and thresholds across surveys and used a criterion of <25% total nonequivalence ( $\geq 75\%$  equivalence) to indicate approximate alignment (49). Both free and fixed alignment models were used. Because the results were similar, results were reported from the free alignment model, which may be more accurate than the results of the fixed model when there are many groups and some nonequivalence (47).

## Results

The mean scale scores for the CFIES ranged across the 15 surveys from 1.65 to 5.86 and the Cronbach alphas ranged from 0.88 to 0.94 (Table 1). The prevalences of many experiences of food insecurity were less than 20% in 10 of the 15 surveys but were one-third to one-half for each of the last 5 surveys. For each survey, a 1-factor model fit the data well, with the variance explained by 1 factor ranging from 0.92 to >0.99. For the northern Ghana surveys combined, the means  $\pm$  SDs of the wealth index and Food Insecurity Experiences Scale were  $1.17 \pm 1.32$  and  $4.42 \pm 2.65$ , respectively. The Cronbach alpha for the latter scale was 0.853.

## Accuracy

For the 6 countries from the IFPS combined, the CFIES score was associated with each criterion variable (all  $P$  values < 0.001). The family having “barely enough money,” “enough money,” and “more than enough money” (compared with not enough money) to pay for needs was associated with 4.43, 7.81, and 7.96 fewer points, respectively, on the CFIES score (Table 2). Each additional day eating breakfast was associated with 0.262 fewer points on the CFIES score. Each additional day eating dinner with parents or guardian was associated with 0.293 fewer points on the CFIES score. Similar results were found for each of the 6 countries when analyzed separately (not shown).

For the survey in Accra, Ghana, each additional point on the Household Food Insecurity Access Scale was associated with 0.421 more points on the CFIES ( $P < 0.001$ ). Compared with having a water closet, having a pit latrine (or Kumasi Ventilated Improved Pit latrine) was associated with 0.910 more points ( $P = 0.203$ ) on the CFIES and having a public toilet was associated with 1.38 more points ( $P = 0.007$ ). Compared with owning a home, renting was associated with 1.15 more points ( $P = 0.030$ ) on the CFIES and living free was associated with 1.35 more points ( $P = 0.041$ ). Each additional room in the house was associated with 0.589 fewer points on the CFIES ( $P = 0.026$ ).

For the Lebanon survey, the household head being employed part-time was associated with 1.49 fewer points on the CFIES

**TABLE 2** Regression of Child Food Insecurity Experiences Scale score (range 0–20) on criterion variables<sup>1</sup>

Survey, <i>n</i>	Criterion variable	Category or unit	Coefficient	<i>P</i> value
International Food Policy Study, 11,104	Having enough money (ref: not having enough money)	Barely enough	– 4.43	<0.001
		Enough	– 7.81	<0.001
		More than enough	– 7.96	<0.001
	Eating breakfast	Each additional day	– 0.262	<0.001
		Dinner with caregivers	Each additional day	– 0.293
Accra, Ghana, 448	Household Food Insecurity Access Scale	Each additional point	0.421	<0.001
		Toilet facility (ref: water closet)		
		Pit latrine	0.910	0.203
		Public toilet	1.38	0.007
	Ownership of home (ref: owning own home)	Renting	1.15	0.030
Lebanon, 1601	Number of rooms in home	Each additional room	– 0.589	0.026
		Household head employment (ref: unemployed)	Employed part-time	– 1.49
	Mother schooling (ref: none or less than Brevet)	Employed full-time	– 11.72	<0.001
		Brevet (middle school)	– 0.766	0.003
		Secondary baccalaureate	– 0.970	0.006
Northern Ghana 5–9 years, 2124	Had breakfast the prior day (ref: no)	University	– 1.49	0.004
		Yes	– 1.07	<0.001
Northern Ghana 10–17 years, 2388	Food Insecurity Experience Scale	Each additional point	0.565	<0.01
		Wealth index	Each additional point	0.229
Northern Ghana 10–17 years, 2388	Food Insecurity Experience Scale	Each additional point	0.815	<0.01
		Wealth index	Each additional point	0.414

<sup>1</sup>Abbreviations: ref, reference.

score and the household head being employed full-time was associated with 1.72 fewer points (both *P* values < 0.001; Table 2). The mother having more schooling was associated with a lower CFIES score in a graded manner (*P* < 0.006). Having had breakfast the prior day was associated with 1.07 fewer points on the CFIES score (*P* < 0.001). Each additional point on the CFIES was associated with 0.0752 fewer points on the dietary diversity score and a 0.0240 lower *z*-score on the motivation scale (both *P* values < 0.001; Table 3). That is, a difference of 10 points on the CFIES (for example, between having no experiences and 10 experiences) was associated with 0.752 less dietary diversity and a 0.240 lower *z*-score on the motivation scale.

For the northern Ghana survey, each additional point on the adult and household FIES was associated with 0.565 and

0.815 points more on the CFIES for ages 5–9 and 10–17 years, respectively, and each additional point on the wealth index was associated with 0.229 and 0.414 fewer points on the CFIES for ages 5–9 and 10–17 years, respectively (all *P* values < 0.01; Table 2). For adolescents, each additional point on the CFIES was associated with a 0.022 lower *z*-score on the motivation scale (*P* < 0.01; Table 3). That is, a difference of 10 points on the CFIES (for example, between having no experiences and 10 experiences) was associated with a 0.22 lower *z*-score on the motivation scale. When controlling for household food insecurity, each additional point on the CFIES was associated with a 0.017 lower *z*-score on motivation (*P* < 0.01). For adolescents, each additional point on the CFIES was associated with a 0.010 lower *z*-score on the self-esteem score (*P* < 0.05). When controlling for household food insecurity, each additional

**TABLE 3** Regression of dietary diversity and self-esteem scores for adolescents in Lebanon and motivation and self-esteem scores for adolescents in northern Ghana on Child Food Insecurity Experiences Scale score<sup>1</sup>

Survey, <i>n</i>	Criterion variable	Model	CFIES <sup>2</sup>		FIES <sup>3</sup>	
			Coeff.	<i>P</i> value	Coeff.	<i>P</i> value
Lebanon, 1601	Dietary diversity score <sup>4</sup>	CFIES only	– 0.0752	<0.001	—	—
	Self-esteem, <i>z</i> -score	CFIES only	– 0.0240	<0.001	—	—
Northern Ghana, 2388	Motivation, <i>z</i> -score	CFIES only	– 0.022	<0.01	—	—
		CFIES and FIES	– 0.017	<0.01	– 0.024	<0.05
	Self-esteem, <i>z</i> -score	CFIES only	– 0.010	<0.05	—	—
		CFIES and FIES	– 0.003	>0.05	– 0.034	<0.01

<sup>1</sup>Abbreviations: CFIES, Child Food Insecurity Experiences Scale; Coeff., coefficient; FIES, Food Insecurity Experience Scale.

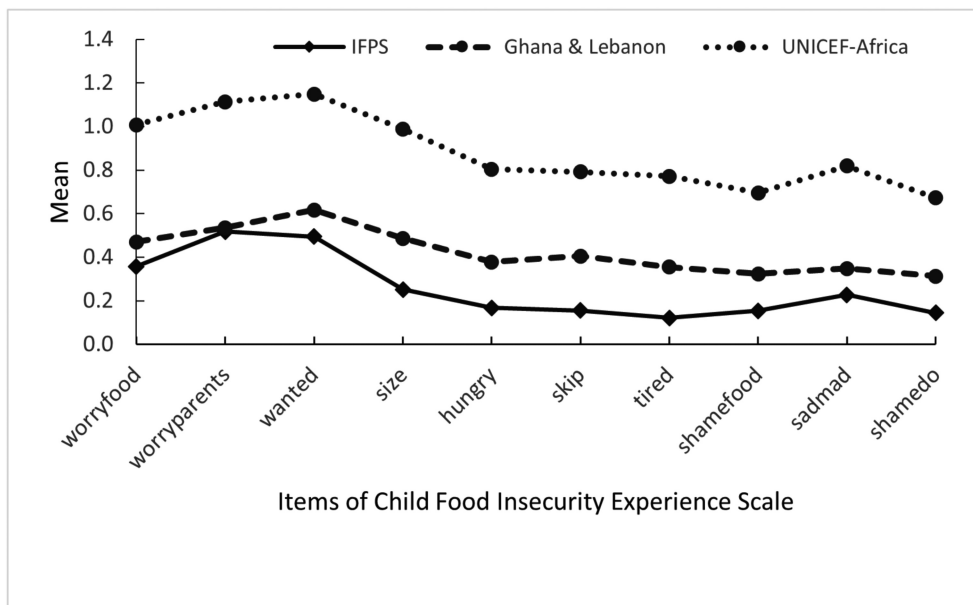
<sup>2</sup>CFIES range, 0–20.

<sup>3</sup>FIES range, 0–8.

<sup>4</sup>Range, 0–10.

**TABLE 4** Means of each item, by survey

Survey	Worry for food scarcity	Worry for parental ability to get food	Not able to get wanted food	Size cut of meal due to lack of food	Hungry and unable to eat due to lack of food				Tired or weak due to lack of food	Shame for lack of food	Sad or mad about lack of food	Shame for methods used to get food
					Skipped meal due to lack of food	Skipped meal due to lack of food	Skipped meal due to lack of food	Skipped meal due to lack of food				
Canada	0.239	0.300	0.334	0.141	0.117	0.102	0.087	0.115	0.146	0.105		
Australia	0.333	0.429	0.476	0.191	0.144	0.136	0.122	0.153	0.222	0.142		
UK	0.321	0.445	0.434	0.205	0.146	0.143	0.124	0.175	0.217	0.170		
USA	0.388	0.486	0.534	0.267	0.186	0.178	0.133	0.206	0.270	0.199		
Mexico	0.385	0.662	0.548	0.322	0.203	0.189	0.137	0.125	0.245	0.122		
Chile	0.475	0.781	0.640	0.385	0.206	0.183	0.122	0.148	0.259	0.126		
Accra, Ghana	0.434	0.454	0.568	0.432	0.245	0.301	0.234	0.175	0.236	0.213		
Lebanon	0.358	0.479	0.494	0.377	0.229	0.299	0.265	0.270	0.312	0.218		
Northern Ghana, 5–9 years	0.469	0.501	0.618	0.503	0.478	0.438	0.409	0.368	0.367	0.356		
Northern Ghana, 10–17 years	0.621	0.705	0.784	0.630	0.556	0.579	0.508	0.477	0.475	0.462		
Eswatini	1.255	1.301	1.234	1.197	0.799	1.182	0.770	0.761	0.904	0.712		
Kenya	1.141	1.254	1.166	1.164	1.055	0.990	0.925	0.881	0.990	0.886		
Lesotho	1.210	1.294	1.375	1.048	0.960	0.782	0.988	0.927	0.859	0.850		
Malawi	0.838	0.915	1.129	0.972	0.826	0.700	0.738	0.623	0.883	0.566		
Uganda	0.970	1.171	1.216	0.960	0.724	0.638	0.779	0.578	0.794	0.638		
Mean over surveys	0.629	0.745	0.770	0.586	0.458	0.456	0.423	0.399	0.479	0.384		



**FIGURE 1** Mean of each item, grouped by the IFPS (6 surveys), Ghana and Lebanon (4 surveys), and UNICEF-Africa (5 surveys). See Box 1 for the full questions. Abbreviation: IFPS, International Food Policy Study.

point on the CFIES was associated with a 0.003 lower *z*-score on the self-esteem score ( $P > 0.1$ ).

### Cross-contextual equivalence

Averaging across the 15 surveys, the most frequently affirmed items, as captured in the mean, were not being able to get the foods wanted, worry about parental ability to get food, worry about running out of food, and cutting the size of meals (Table 4). The least frequently affirmed items were feeling shame for things they had to do to get enough food and not having enough food. The patterns of mean responses were similar for the groups of 6 surveys from the IFPS, 4 surveys from Ghana and Lebanon, and 5 surveys from Africa collected by UNICEF (Figure 1).

The percentages of equivalent thresholds and loadings across the 15 surveys were 28.0 and 5.33, respectively, for a total percentage of nonequivalent thresholds and loadings of 16.7, which is well below the guideline of <25%. That is, 83.3% of thresholds and loadings were equivalent, providing evidence of cross-contextual equivalence for these surveys.

## Discussion

The CFIES was reliable, accurate in differentiating groups of children and adolescents, and cross-contextually equivalent for assessing child and adolescent experiences of food insecurity. Reliability, estimated as internal consistency, was uniformly high. Accuracy in differentiating groups was established by comparing the CFIES scores to multiple criterion variables that were theorized to be either determinants or consequences of child experiences of food insecurity (46). The alignment method demonstrated equivalence of loadings and thresholds in the ordinal model, meaning that estimates of mean scale scores and prevalences based on the scale scores across contexts were scalar equivalent (46).

The CFIES complements the FIES, which was developed by the FAO to provide estimates of prevalence with the

cross-country equivalency needed for global monitoring of individuals  $\geq 15$  years (36), by providing a means to collect data on the experiences of children and adolescents as young as 5 years of age that are comparable across countries. The subconstructs of compromised dietary quality or preferences and eating less are assessed similarly by the CFIES and the FIES (Supplemental Table 1). The CFIES has an additional item for the subconstruct of uncertainty that assesses worry about how hard it is for parents or guardians to get enough food for the family and an additional item for the subconstruct of going hungry that assesses whether the child or adolescent felt tired or weak because the family didn't have enough food to eat. Furthermore, the CFIES has 3 items to assess the subconstruct of emotional awareness, which is not assessed by the FIES. Assessing this subconstruct of emotional awareness for school-aged children and adolescents is crucial given the profound emotional experiences of children with food insecurity (27, 28). The FIES was developed using items known to have a strong gradient in the frequency of affirmations; this gradient is interpreted to represent the severity of experiences (44). In contrast, the CFIES, like previous scales to assess child and adolescent self-reported experiences (33, 35), does not exhibit a strong gradient in the frequency of affirmations, which is expected given the multiple subconstructs—each of which is salient for children—that are reflected in the items.

The study included the use of large samples from 15 surveys and data collection both before and during the SARS-CoV-2 pandemic (which may have increased experiences of food insecurity in some locations). Multiple modes of data collection were used successfully for administration of the questionnaire in the 15 surveys; studies comparing modes of data collection have generally found small differences in reporting (50), and any such differences should not have affected the examinations of validity and cross-contextual equivalence of the CFIES. Multiple criterion variables were used to establish the accuracy of groups. No definitive measure or classification of child experiences of food insecurity was available, so accuracy for classifying individuals could not be established (46). Future



research should develop and use such a definitive measure alongside the CFIES, as has been done by several previous studies of adult and child food insecurity (44). Data were available from the Western hemisphere, Australia, the Middle East, and Africa, but not from other global regions. Future research should be done in these other regions. Opportunities for doing cognitive interviewing and field testing of the CFIES items in other regions for this study were stymied by the pandemic. The surveys in which we were able to include the CFIES were primarily of adolescents and not younger children. Although previous research has shown that assessments of experiences of food insecurity from preadolescent school-aged children is reliable and accurate, future research with the CFIES should include more samples with this age group.

The CFIES provides a measure of the experiences of food insecurity of school-aged children and adolescents, as reported by them, that is globally applicable and suitable for assessment and monitoring of populations that is comparable across countries. For future assessment and monitoring of populations, we suggest that the prevalences of several or many (i.e., 7 or more) experiences be reported and tracked. Given the importance of nutrition for the well-being of children (51) and adolescents (52) and the importance of food security for nutrition, along with the evidence that only children and adolescents themselves, rather than adults, can accurately report their experiences of food insecurity, deploying this measure in data systems is needed. The UNICEF Multiple Cluster Indicator Surveys program, which includes a questionnaire for children and adolescents ages 5 to 17 years, is considering the CFIES as a complementary module for the seventh round of the program, resources permitting. Other survey venues that collect data from school-aged children and adolescents are needed (4). Collecting data using the CFIES will support research aimed at nuanced understanding of the contexts, consequences, and mechanisms through which food insecurity affects children and adolescents and of the interventions needed to promote children's well-being.

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### Data Availability

Data described in the manuscript, code book, and analytic code will be made available upon request pending application and

approval by the corresponding author and the owner of the data.

### References

1. Sameroff AA. Unified theory of development: a dialectic integration of nature and nurture. *Child Dev* 2010;81(1):6–22.
2. Alaimo K, Olson CM, Frongillo EA. Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatrics* 2001;108(1):44–53.
3. Cotugna N, Forbes S. A backpack program provides help for weekend child hunger. *J Hunger Environ Nutr* 2008;2(4):39–45.
4. Fram MS, Bernal J, Frongillo EA. The measurement of food insecurity among children: Review of literature and concept note. Innocenti Working Paper No. 2015-08. Florence (Italy): UNICEF Office of Research; 2015.
5. Jackson DB, Vaughn MG. Household food insecurity during childhood and adolescent misconduct. *Prev Med* 2017;96:113–7.
6. Jyoti DF, Frongillo EA, Jones SJ. Food insecurity affects school children's academic performance, weight gain, and social skills. *J Nutr* 2005;135(12):2831–9.
7. National Research Council. Food insecurity and hunger in the United States: an assessment of the measure. In: Wunderlich G, Norwood J, editors. *Food insecurity and hunger in the United States*. Washington (DC): National Research Council; 2006.
8. Hannum E, Liu J, Frongillo EA. Poverty, food insecurity and nutritional deprivation in rural China: implications for children's literacy achievement. *Int J Educ Dev* 2014;34(1):90–7.
9. Belachew T, Hadley C, Lindstrom D, Gebremariam A, Lachat C, Kolsteren P. Food insecurity, school absenteeism and educational attainment of adolescents in Jimma Zone Southwest Ethiopia: a longitudinal study. *Nutr J* 2011;10(1):29.
10. Aurino E, Fledderjohann J, Vellakkal S. Inequalities in adolescent learning: does the timing and persistence of food insecurity at home matter? *Econ Educ Rev* 2019;70:94–108.
11. Aurino E, Wolf S, Tsinigo E. Household food insecurity and early childhood development: longitudinal evidence from Ghana. *PLoS One* 2020;15(4):1–19.
12. Jamaluddine Z, Sahyoun NR, Choufani J, Sassine AJ, Ghattas H. Child-reported food insecurity is negatively associated with household food security, socioeconomic status, diet diversity, and school performance among children attending UN relief and works agency for Palestine refugees schools in Lebanon. *J Nutr* 2019;149(12):2228–35.
13. Bernal J, Frongillo EA, Rivera J. Food insecurity reported by children, but not by mothers, is associated with lower quality of diet and shifts in foods consumed. *Matern Child Nutr* 2016;12(3):546–57.
14. Fram MS, Ritchie LD, Rosen N, Frongillo EA. Child experience of food insecurity is associated with child diet and physical activity. *J Nutr* 2015;145(3):499–504.
15. Sharkey JR, Nalty C, Johnson CM, Dean WR. Children's very low food security is associated with increased dietary intakes in energy, fat, and added sugar among Mexican-origin children (6–11 y) in Texas border Colonias. *BMC Pediatrics* 2012;12(1):16.
16. Aurino E, Morrow V. "Food prices were high, and the dal became watery". Mixed-method evidence on household food insecurity and children's diets in India. *World Dev* 2018;111:211–24.
17. To QG, Frongillo EA, Gallegos D, Moore JB. Household food insecurity is associated with less physical activity among children and adults in the U.S. population. *J Nutr* 2014;144(11):1797–802.
18. Casey PH, Szeto KL, Robbins JM, Stuff JE, Connell C, Gossett JM, et al. Child health-related quality of life and household food security. *Arch Pediatr Adolesc Med* 2005;159(1):51–6.
19. Bernal J, Frongillo EA, Herrera A, Rivera JA. Food insecurity in children but not in their mothers is associated with altered activities, school absenteeism, and stunting. *J Nutr* 2014;144(10):1619–26.
20. Alaimo K, Olson CM, Frongillo EA, Briefel RR. Food insufficiency, family income, and health in US preschool and school-aged children. *Am J Public Health* 2001;91:781–6.
21. Alaimo K, Olson CM, Frongillo EA. Family food insufficiency, but not low family income, is positively associated with dysthymia and suicide symptoms in adolescents. *J Nutr* 2002;132(4):719–25.

22. Chilton M, Rabinowich J. Toxic stress and child hunger over the life course: three case studies. *J Appl Res Child* 2012;3(1).
23. McIntyre L, Williams JVA, Lavorato DH, Patten S. Depression and suicide ideation in late adolescence and early adulthood are an outcome of child hunger. *J Affect Disord* 2013;150(1):123–9.
24. Bernal J, Frongillo EA, Jaffe K. Food insecurity of children and shame of others knowing they are without food. *J Hunger Environ Nutr* 2016;11(2):180–94.
25. Frongillo EA, Bernal J, Rampalli KK, Massey E, Adams EJ, Rosemond TN, et al. Experiences and situations of shame among food-insecure adolescents in South Carolina and Oregon. *Ecol Food Nutr* 2022;61(1):64–80.
26. Radimer KL, Olson CM, Greene JC, Campbell CC, Habicht JP. Understanding hunger and developing indicators to assess it in women and children. *J Nutr Educ* 1992;24(1): 36S–44S.
27. Fram MS, Frongillo EA, Jones SJ, Williams RC, Burke MP, DeLoach KP, et al. Children are aware of food insecurity and take responsibility for managing food resources. *J Nutr* 2011;141(6):1114–9.
28. Bernal J, Frongillo EA, Herrera H, Rivera J. Children live, feel, and respond to experiences of food insecurity that compromise their development and weight status in peri-urban Venezuela. *J Nutr* 2012;142(7):1343–9.
29. Ghattas H, Sassine AJ, Aqeel M, Hwalla N, Obeid OA, Sahyoun NR. Children's experiences of food insecurity in Lebanon: a qualitative study. *J Hunger Environ Nutr* 2018;13(1):28–39.
30. Frongillo EA, Fram MS, Escobar-Alegria JL, Pérez-Garay M, Macaoda MM, Billings DL. Concordance and discordance of the knowledge, understanding, and description of children's experience of food insecurity among Hispanic adults and children. *Fam Community Health* 2019;42(4):237–44.
31. Nord M, Hanson K. Adult caregiver reports of adolescents' food security do not agree well with adolescents' own reports. *J Hunger Environ Nutr* 2012;7(4):363–80.
32. Hadley C, Lindstrom D, Tessema F, Belachew T. Gender bias in the food insecurity experience of Ethiopian adolescents. *Soc Sci Med* 2008;66(2):427–38.
33. Fram MS, Frongillo EA, Draper CL, Fishbein EM. Development and validation of a child report assessment of child food insecurity and comparison to parent report assessment. *J Hunger Environ Nutr* 2013;8(2):128–45.
34. Nalty CC, Sharkey JR, Dean WR. Children's reporting of food insecurity in predominately food insecure households in Texas border Colonias. *Nutr J* 2013;12(1):15.
35. DeVellis RF. Scale development: theory and applications. Second edition. Thousand Oaks (CA): Sage Publications; 2003.
36. Cafiero C, Viviani S, Nord M. Food security measurement in a global context: the food insecurity experience scale. *Measurement* 2018;116:146–52.
37. Potamites E, Gordon A. Children's food security and intakes from school meals. Final Report. Contractor and Cooperator Report No. 61. Princeton (NJ): Mathematica Policy Research, Inc; 2010.
38. Fletcher JM, Frisvold DE. The relationship between the School Breakfast Program and food insecurity. *J Consum Aff* 2017;51(3):481–500.
39. Lee YS, Kim TH. Household food insecurity and breakfast skipping: their association with depressive symptoms. *Psychiatry Res* 2019;271:83–8.
40. Rosemond TN, Blake CE, Shapiro CJ, Burke MP, Bernal J, Adams EJ, et al. Disrupted relationships, chaos, and altered family meals in food-insecure households: experiences of caregivers and children. *J Acad Nutr Diet* 2019;119(10):1644–52.
41. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of household food access: indicator guide (v. 3). Washington (DC): FHI 360/FANTA; 2007.
42. FAO. Minimum dietary diversity for women. Rome (Italy): Food and Agriculture Organization; 2021.
43. Rosenberg M. *Conceiving the self*. New York (NY): Basic Books; 1979.
44. Frongillo EA. Validity and cross-context equivalence of experience-based measures of food insecurity. *Glob Food Sec* 2022;32:100599.
45. Guay F, Marsh HW, Dowson M, Larose S. Assessing academic motivation among elementary school children: the Elementary School Motivation Scale (ESMS). Australian Association for Research in Education 2005 conference papers. Melbourne (Australia): Australian Association for Research in Education; Accessed at: <https://www.aare.edu.au/data/publications/2005/gua05378.pdf>.
46. Frongillo EA, Baranowski T, Subar AF, Toozé JA, Kirkpatrick SI. Establishing validity and cross-context equivalence of measures and indicators. *J Acad Nutr Diet* 2019;119(11): 1817–30.
47. Asparouhov T, Muthén B. Multiple-group factor analysis alignment. *Struct Equ Model* 2014;21(4):495–508.
48. Muthén B, Asparouhov T. Recent methods for the study of measurement invariance with many groups: alignment and random effects. *Sociol Methods Res* 2018;47(4):637–64.
49. Muthén B, Asparouhov T. IRT studies of many groups: the alignment method. *Front Psychol* 2014;5:978.
50. Lyberg L, Kasprzyk D. Data collection methods and measurement error: an overview. In: Biemer PP, Groves RM, Lyberg LE, Mathiowetz NA et al., editors. *Measurement errors in surveys*. New York (NY): John Wiley & Sons; 1991.
51. Victora CG, Christian P, Vdaletti LP, Gatica-Domínguez G, Menon P, Black RE. Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *Lancet North Am Ed* 2021;397(10282):1388–99.
52. Norris SA, Frongillo EA, Black MM, Dong Y, Fall C, Lampl M, et al. Nutrition in adolescent growth and development. *Lancet North Am Ed* 2022;399(10320):172–84.