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Proxy measures of household food consumption for food security assessment and surveillance: comparison of the household dietary diversity and food consumption scores

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Abstract

Objective: To provide an overview of the household dietary diversity score and the food consumption score, two indicators used for food security assessment and surveillance, and compare their performance in food security assessments in three countries.

Design: Cross-sectional cluster sampling design using an interview-administered structured questionnaire on household food security, including household-level food group consumption measured over 1 d and 7 d.

Setting: Survey data are from Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda.

Subjects: Households in Burkina Faso (*n* 3640), Lao PDR (*n* 3913) and northern Uganda (*n* 1956).

Results: Spearman's correlation coefficients between the scores were 0·73 in Burkina Faso, 0·65 in Lao PDR and 0·53 in northern Uganda. Prevalence-adjusted kappa coefficients showed substantial strength of agreement in two countries. The proportion of agreement between the two scores ranged from 85 % in Lao PDR to 65 % in northern Uganda. Dietary profiles based on food group consumption using score tertiles were comparable. Rankings of the most food-insecure areas within a country corresponded well in northern Uganda and Burkina Faso but not in Lao PDR. Both indicators showed moderate correlations with other proxy measures of food security.

Conclusions: The comparative study highlights the similarities and differences between the food consumption and household dietary diversity scores. Similar classification of the most food-insecure areas within sub-national levels was obtained. The choice of indicator for food security assessment and surveillance will vary depending on user needs.

Keywords
Household food security
Household food access
Dietary diversity
Food consumption

Many organizations involved in food security assessments use qualitative instead of quantitative measures of dietary intake. Quantitative dietary assessment techniques use data collected primarily at individual level to calculate dietary energy and nutrient intakes, which are then compared with nutrient requirements. Quantitative dietary survey methods are difficult to implement, particularly in developing countries, due to cost, logistics and other considerations such as respondent burden[1]. Qualitative measures of household food consumption, such as dietary diversity and food consumption scores, are attractive as the information required for their construction is less time-consuming and costly to collect than that for quantitative dietary intake methods.

Both the FAO and the World Food Programme (WFP) use information on dietary diversity as one element to inform food security analysis; however, the organizations use different data collection methods and analytical strategies[2–4]. The FAO uses a 1 d household dietary diversity score (HDDS) based on guidelines produced by the Food and Nutrition Technical Assistance Project[5] and the WFP uses a food consumption score (FCS). Both the HDDS and the FCS have been validated in different countries as proxy measures of household per capita

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Table 1 Main features of each method

Characteristic	FCS	HDDS
Recall method and time period	List-based recall of HH consumption and frequency of consumption over the past 7 d	Qualitative 'free' recall of all food/drink consumed by any HH member† during the past 24 h
Number of food groups used to create the score	8	12
Number of food groups in the questionnaire	Varies by country context	16
Weighting of food groups	Each food group consumed receives a weight from 0·5 to 4	Each food group consumed has a value (weight) of 1
Typical cut-off points	≤21·0 = poor 21·5–35·0 = borderline >35·0 = acceptable	Population distribution of scores used to form tertiles (or quartiles) for analysis of groups
Out-of home-food consumption	Not counted in the FCS	Not counted in the HDDS

FCS, food consumption score; HDDS, household dietary diversity score; HH, household.
†In this method food consumed by only one member of the HH and not the others is still recorded. For example, if a child was given a piece of fruit to eat as a snack this is recorded as 'yes' for fruit even if no other members of the HH ate fruit.

energy intake[6–9]. The tools are both used for monitoring and surveillance of household economic access to food[4] and in both methods collected data can also be used to identify dietary patterns and consumption of specific foods. Information obtained from either measure is most useful for application within a given country or similar agro-ecological zone, rather than across countries and regions which have diverse dietary patterns.

FAO guidelines[2] describe tools adapted for a decentralized* level utilizing simple data collection and analytical techniques requiring minimal statistical expertise. In addition to creation of a dietary diversity score for measuring population-level dietary diversity, the guidelines recommend creating dietary profiles and using the data to identify the proportion of households consuming food groups of special interest, such as dark green leafy vegetables or organ meat.

The FCS uses information on both dietary diversity and food frequency (number of days the food is consumed per week) and applies a weighting system[3]. Generally assessments are undertaken with national or regional WFP staff and analysis is performed by a trained staff member.

WFP and FAO have been called on to work together to support coherent action to address food insecurity[10] and often work in the same countries and undertake joint food security assessments. There are also situations where FCS and HDDS could both be incorporated into decision making on food security; for example, both indicators could be available for use within the Integrated Food Security Phase Classification[11]. FAO and WFP have recognized the need to provide guidance on comparing results obtained from the two indicators and to work together to harmonize indicators currently used by each organization[12]. The objective of the current study is to evaluate the similarities and differences between dietary patterns and food consumption classification obtained from the FCS and HDDS within three diverse settings.

Methods

Data sets from Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda were used in a comparative analysis of the household dietary diversity and food consumption tools. In each site, the survey included questions about household dietary diversity during the previous 24 h and past 7 d. Tables 1 and 2 summarize the main methodological differences of the two measures in data collection, indicator construction and analytical approach. Table 2 looks more specifically at the food groups and weighting used to construct each score.

Description of the household dietary diversity methodology

The dietary diversity questionnaire in the HDD method elicits information on consumption of sixteen food groups over the reference period of the past 24 h. The list of sixteen food groups is the same for any country/context.† The person primarily responsible for meal preparation for the household is asked to recall all meals, snacks and beverages consumed inside the home by any household member. The enumerator then checks with the respondent for any food groups not mentioned in the recall. To create the HDDS, the sixteen‡ food groups in the questionnaire are aggregated into twelve food groups. The HDDS is the sum of the number of the twelve food groups consumed (range 0–12; Table 2).

* Tailored for use at various administrative levels including district and regional level, but also appropriate for use at national level.

† In areas where red palm oil is consumed, the list of food groups is expanded to seventeen.

‡ Sixteen groups are collected to allow greater analytical flexibility.

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Table 2 Food groups used to construct the two scores

FCS		HDDS		
Food group	Weight	Food group in questionnaire	Food group used to calculate HDDS	Weight
Cereals, tubers and root crops	2	Cereals	Cereals	1
		White roots and tubers	White roots and tubers	1
Meat and fish	4	Organ meat	Meat	1
		Flesh meat		
		Fish	Fish	1
		Eggs	Eggs	1
Milk	4	Milk and dairy	Milk and dairy	1
Oil/fats	0·5	Oils and fat	Oils and fat	1
Fruit	1	VA-rich fruits	Fruits	1
		Other fruits		
Vegetables	1	VA-rich vegetables and tubers	Vegetables	1
		Dark green leafy vegetables		
		Other vegetables		
Pulses	3	Pulses, legumes and nuts	Pulses, legumes and nuts	1
Sugar	0·5	Sweets	Sweets	1
Condiments (not counted in FCS)	0	Spices, condiments and beverages	Spices, condiments and beverages	1

FCS, food consumption score; HDDS, household dietary diversity score; VA, vitamin A.

Description of the food consumption methodology

To construct the FCS, information on household-level food consumption is gathered from a country-specific list of food items and food groups. The respondent is asked about the household's frequency of consumption in number of days over the past week for each food group/item. Food items are then grouped into eight specific food groups. The consumption frequencies (number of days of consumption over the previous 7 d) of the eight groups are summed. Any frequency values over seven are capped at seven. This value obtained for each food group is multiplied by a food group weight. The sum of the weighted food group scores is the FCS.

Description of the data sets

In Lao PDR, WFP conducted a Comprehensive Food Security and Vulnerability Analysis survey. The sampling frame was based on data from the 2005 census. The sample included rural households from twenty-five villages in sixteen provinces, applying a two-stage cluster sample procedure. The total household sample size was 4000; out of these, 3926 households participated in the survey and 3913 households had complete data for both HDDS and FCS. The questionnaire included items on income, total expenditure, expenditure on food and asset ownership. To construct the FCS, food consumption information was collected on twenty-three food items. Respondents were asked whether anyone in the household had consumed the food item/food group in the past 7 d and if yes, the number of days the item/group was consumed. They were then asked whether anyone in the household had consumed the item/group in the previous 24 h. The HDDS for Lao PDR is based on a sum of eleven instead of twelve food groups. The score does not include the food group spices, condiments and beverages.

In northern Uganda, WFP conducted an Emergency Food Security Assessment in 2007. The sample universe consisted of all villages in the resettled areas in Lira and all camps for internally displaced persons in Gulu, Pader, Kitgum, Apac & Oyamin, and Amuria & Katakwithe districts. Population figures in the camps were based on the WFP distribution figures and population figures for the resettlement area came from the Government of Uganda. A two-stage cluster sample procedure was applied. Camps or villages were selected with probability proportional to size, while households were randomly selected from a camp/village list. The total household sample size was 1980; out of these, 1958 households participated in the survey and 1956 households had complete data for both HDDS and FCS. Food consumption information was collected using a list of nineteen items. Respondents were asked the number of days each item/group was consumed inside the house during the past 7 d and the number of times anyone in the household consumed it in the previous 24 h. The HDDS was based on a sum of eleven instead of twelve food groups. The score does not include the food group spices, condiments and beverages.

In Burkina Faso, WFP conducted a Nutritional Survey in 2007 in collaboration with UNICEF and with technical support of the Institut de Recherche pour le Développement. The survey was representative of five rural regions: Sahel, North, Central North, East and South West. Villages were selected by probability proportional to size and households within each village were selected using the random walk method. The sample included 3640 households, all with complete data for both HDDS and FCS. The HDDS is constructed using all twelve recommended food groups.

Data analysis

Data analysis was carried out using the SPSS for Windows statistical software package version 13·0 (SPSS Inc., Chicago, IL, USA). Statistical significance was assessed at $P < 0{\cdot}05$.

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Table 3 Descriptive statistics for FCS and HDDS in Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda (N. Uganda)

Indicator	Burkina Faso (*n* 3640)	Lao PDR (*n* 3913)	N. Uganda (*n* 1956)
FCS			
Mean	45·0	51·1	36·1
SD	16·4	13·9	12·2
Range	5·5–112	8–112	5–100
HDDS			
Mean	4·6	5·2	3·3
SD	1·3	2·1	1·4
Range	0–11	1–11	0–11
Spearman correlation between FCS and HDDS†	0·73*	0·65*	0·53*

FCS, food consumption score; HDDS, household dietary diversity score.
*Correlation was statistically significant ($P < 0·05$).
†Scatter plots of FCS by HDDS are provided as supplementary figures 1–3.

Descriptive statistics are reported taking into account survey design. Spearman's correlation was used to test the correlation between the two scores and between each score and other food security indicators. The kappa coefficient (κ) was used to assess the proportion of agreement between the percentage of food groups consumed based on the recall periods and the percentage of 'habitual' consumption:

$$\kappa = (P_o - P_c)/(1 - P_c),$$

where P_o is the proportion of observed agreements and P_c is the proportion of agreement expected by chance[13]. The kappa coefficient is influenced by prevalence and becomes lower when frequency of the desired outcome is low or high. To account for this, both unadjusted and prevalence-adjusted kappa coefficients were calculated. The Landis and Koch definitions of fair, moderate and substantial strength of agreement were used[14].

Theoretical probabilities of consumption of selected food groups on one out of seven days were calculated in order to compare these with reported consumption over the 1 d period. The theoretical probability of one-day consumption of a food group was calculated as:

$$\frac{1}{7}\sum_{i=0}^{7} i \times p_i,$$

where p_i is the percentage of households consuming the food group over i days of the week. If the food group was not consumed at all over the week, its probability of being consumed in the past 24 h is 0/7 or 0 %, whereas if it was consumed every day of the week, its probability is 7/7 or 100 %; and so on. The probability of consumption in the past 24 h for each food group was then multiplied by the percentage of households reporting i number of days of consumption. A Z test for proportions was used to compare the percentage of households consuming the food groups over the 1 d recall with its theoretical probability of one-day consumption.

Cut-off points of the FCS and the HDDS were used to compare classification of food-insecure areas at sub-national levels. WFP has established cut-off points of FCS ≤ 21·0 to indicate poor food consumption and FCS = 21·5–35·0 to indicate borderline food consumption[3]. The FAO guidelines[2] do not provide a standardized cut-off point for defining food-insecure households. In the current analysis a cut-off point for HDDS of ≤3 food groups was compared with FCS ≤ 35·0 (poor and borderline food consumption).

Results

Descriptive statistics and correlation between the two scores

The mean FCS and HDDS for each country are presented in Table 3. Spearman's correlations between FCS and HDDS were significant in all three countries. The best correspondence to FCS ≤ 21·0 was HDDS between 2 and 3 food groups, while FCS ≤ 35·0 corresponded to HDDS slightly higher than 3.

Unadjusted kappa coefficients showed a moderate strength of agreement in Burkina Faso and fair strength of agreement in Lao PDR and northern Uganda (Table 4). Over 80 % of households were classified the same way in Burkina Faso and Lao PDR. There were fewer similar classifications in northern Uganda. Adjusting the kappa coefficients for prevalence improved the strength of agreement in Burkina and Lao PDR, but not in northern Uganda.

Figure 1 illustrates a comparison between the percentage of positive response over 1 d and the probability of obtaining the same percentages over a 7 d period using the theoretical probabilities described in the Methods section. Comparisons are made for those food groups which have the same definition for both indicators. There was a consistent tendency across all countries for a slightly higher percentage of households to report consuming the food groups over the past 24 h compared with their theoretical consumption probabilities of one out of seven days. These differences were significant for all food groups except for dairy in Lao PDR and northern Uganda and dairy, oil and pulses in Burkina Faso.

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Table 4 Kappa coefficients for HDDS and FCS in Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda (N. Uganda)

		Kappa		Proportion of agreement (%)	Strength of agreement	
		Unadjusted	Prevalence adjusted		Unadjusted score	Adjusted score
Burkina Faso	HDDS ≤ 3 and FCS ≤ 35	0·57	0·65	82	Moderate	Substantial
Lao PDR	HDDS ≤ 2 and FCS ≤ 35	0·34	0·72	85	Fair	Substantial
	HDDS ≤ 3 and FCS ≤ 35	0·40	0·61	80	Fair	Substantial
N. Uganda	HDDS ≤ 2 and FCS ≤ 35	0·31	0·33	65	Fair	Fair
	HDDS ≤ 3 and FCS ≤ 35	0·33	0·35	66	Fair	Fair

HDDS, household dietary diversity score; FCS, food consumption score.

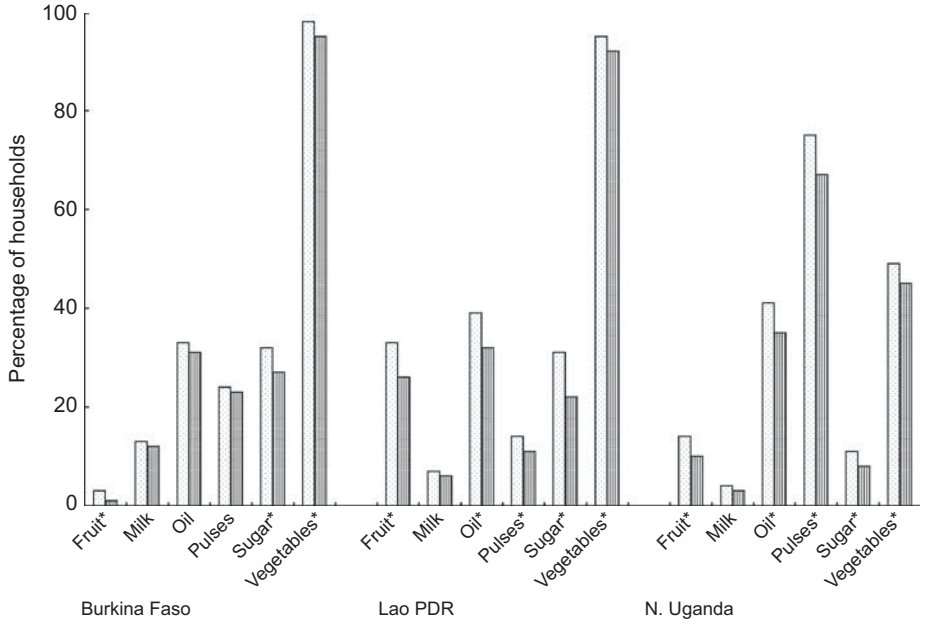

Fig. 1 Comparison of 1 d recall (▨) and theoretical probability of consuming the food group on one out of seven days (▥) in Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda (N. Uganda). *Significant difference between percentages ($P < 0·05$)

Comparing prevalence of food insecurity at sub-national level

For programmatic purposes it is important to identify the most disadvantaged areas within a country. In the current analysis we used the FCS definition of 'poor and borderline food consumption' (FCS ≤ 35·0) compared with HDDS ≤ 3. The percentage of households with low FCS and low HDDS along with the respective rank by each score are shown in Table 5. Applying a 'prevalence threshold' (30 % or more of households below the cut-off points in this example) to distinguish food-secure and food-insecure strata resulted in similar classification of three out of five regions in Burkina Faso, ten out of sixteen provinces in Lao PDR and eight out of nine strata in northern Uganda. In Burkina Faso, there was correspondence of rank for three out of five sub-national strata. The rankings were the same for the three most food-insecure regions. In northern Uganda, there was correspondence of rank in four out of nine strata. Both scores ranked Apac & Oyam and Pader transit camps as the first and second most food-insecure areas. In Lao PDR, rankings for HDDS and FCS corresponded in Bokeo, ranked most food insecure, and in Vientiane and Champassak, ranked most food secure. We made no attempt to compare sub-national strata across counties because scores are influenced by differences in dietary patterns.

Correlation of the two scores with other indicators of food security

The FCS and HDDS demonstrated similar strength of correlation with other food security indicators (Table 6). In Burkina Faso and Lao PDR there were no striking differences in the magnitude or significance of the correlation coefficients. In northern Uganda, the FCS presented higher correlation coefficients with every tested indicator, with the exception of percentage of expenditure on food.

Analysis of dietary patterns

The dietary profiles of the lowest and highest tertiles for HDDS and FCS are compared in Table 7. The food groups

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Table 5 Ranking of FCS and HDDS by geographical strata in Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda (N. Uganda)

	Ranking† of % HH below cut-off point		Percentage of HH below cut-off point	
	Using FCS	Using HDDS	FCS ≤ 35	HHDS ≤ 3
Burkina Faso				
Region				
Centre North	2	2	38	26
East	5	4	22	14
North	3	3	30	19
Sahel	4	5	25	15
South West	1	1	51	34
Lao PDR				
Provinces				
Attapeu	12	4	9	34
Bokeo	1	1	42	61
Bolikhamxay	13	14	4	9
Champassak	16	16	2	3
Huapanh	5	8	21	25
Khammouane	10	2	10	49
Luang Namtha	9	11	16	14
Luang Prabang	8	5	17	32
Oudomxay	6	3	19	41
Phongsali	7	10	19	19
Saravane	2	13	30	13
Savannakhet	14	12	4	14
Sekong	4	6	25	31
Vientiane	15	15	4	9
Xayaboury	11	7	10	28
Xieng Khoang	3	9	26	21
N. Uganda				
Strata				
Gulu Mother Camp	5	3	45	81
Gulu Transit Camp	3	6	51	63
Kitgum Mother Camp	4	4	50	71
Kitgum Transit Camp	7	5	43	68
Pader Mother Camp	8	7	38	61
Pader Transit Camp	2	2	76	82
Apac & Oyam Mother Camps	1	1	82	84
Amuria & Katakwi Mother Camps	9	9	28	40
Lira Resettlement	6	8	46	49

FCS, food consumption score; HDDS, household dietary diversity score; HH, household.
†Rank of 1 is most food insecure.

listed for the HDDS column represent those food groups consumed by 50 % or more of the households in the given tertile. The food groups listed for FCS represent food groups consumed on ≥3 d and ≥4 d of the previous 7 d by 50 % or more of the households in the given tertile.

The dietary profiles for the lowest tertiles of HDDS and FCS provide nearly the same picture for all three countries. When looking at food groups consumed by households in the highest tertiles, the HDD method appears to capture more detail. Comparing food groups consumed three or more rather than four or more times per week corresponded better with HDD profiles.

Discussion

Correlation coefficients of the two scores were significant in all countries. Adjusted kappa coefficients showed substantial agreement in overall classification for two out of three countries. When looking at sub-national rankings, there was agreement by rank of the most food-insecure area in all three countries. Rankings of the more food-secure areas were more discrepant, particularly in Lao PDR. Dietary profiles for the lowest score tertiles were nearly identical, with greater differences in food group consumption across the two measures for the highest tertiles. Both scores performed similarly when correlated with other indicators of food security available in each data set. One limitation of the present study is the score cut-off points used. Application of a universal cut-off point across countries may carry different interpretations, particularly at upper ends of the scores, due to regional variations in dietary patterns and food systems[15].

The remainder of the discussion aims to provide a description of how the main differences between the two methods affect the comparability of the two scores. The main methodological differences include: (i) the number and definitions of food groups used to construct the score; (ii) the length of reference period used in the recall; (iii) the application of weights to food groups; and

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Table 6 Correlation of FCS and HDDS with other indicators of food security in Burkina Faso, Lao People's Democratic Republic (Lao PDR) and northern Uganda (N. Uganda)

Country	Food security indicator	Correlation with FCS	Correlation with HDDS
Burkina Faso	Number of meals the day before		
	Children aged 0–5 years	0·27*	0·22*
	Children aged 6–14 years	0·30*	0·28*
	Females aged 15 years or older	0·32*	0·33*
	Males aged 15 years or older	0·29*	0·30*
Lao PDR	HH total expenditure	0·30*	0·30*
	Total food expenditure	0·23*	0·24*
	Per capita food expenditure	0·22*	0·22*
	Per capita non-food expenditure	0·31*	0·28*
	Percentage food expenditure	−0·04*	−0·01
	Asset index	0·32*	0·33*
N. Uganda	HH total expenditure	0·27*	0·17*
	Total food expenditure	0·17*	0·08*
	Total non-food expenditure	0·30*	0·22*
	Per capita total expenditure	0·24*	0·16*
	Per capita food expenditure	0·14*	0·06*
	Per capita non-food expenditure	0·29*	0·22*
	Percentage food expenditure	−0·05*	−0·11*
	Number of meals the day before		
	Adults aged 13 years or older	0·32*	0·22*
	Children aged ≤6 years	0·23*	0·11*
	Children aged 7–12 years	0·24*	0·16*

FCS, food consumption score; HDDS, household dietary diversity score; HH, household.
*Correlation was statistically significant ($P < 0·05$).

Table 7 Dietary profiles using HDDS and FCS tertiles

	Lowest tertile			Highest tertile		
Country	HDDS	FCS ≥ 3 d	FCS ≥ 4 d	HDDS	FCS ≥ 3 d	FCS ≥ 4 d
Burkina Faso	Cereals Vegetables Condiments (not a group in FCS)	Cereals† Vegetables Fruit	Cereals† Vegetables	Cereals Vegetables Fish Sugar Oil Condiments (not a group in FCS)	Cereals† Vegetables Meat/fish/eggs Fruit Sugar Oil	Cereals† Vegetables Meat/fish/eggs Fruit
Lao PDR	Cereals Vegetables	Cereals† Vegetables Meat	Cereals† Vegetables	Cereals Tubers Vegetables Meat Fish Eggs Fruit Oil Sugar	Cereals† Vegetables Meat/fish/eggs Fruit Oil Sugar	Cereals† Vegetables Meat/fish/eggs
N. Uganda	Cereals Pulses	Cereals† Vegetables	Cereals†	Cereals Pulses Tubers Vegetables Oil	Cereals† Pulses Vegetables Oil	Cereals† Pulses

HDDS, household dietary diversity score; FCS, food consumption score; Lao PDR, Lao People's Democratic Republic; N. Uganda, northern Uganda.
†This food group includes cereals, tubers and root crops.

(iv) the construction of a score combining frequency and dietary diversity.

Number and definition of food groups

When comparing results of dietary patterns by tertiles, the HDD method captured more detail in the highest tertile, while the lowest tertile for both methods reflected the same diet. The number and definition of food groups is mainly responsible for the variation in detail seen at the higher levels of each score. The rationale in the HDD method for including a more disaggregated list of food groups is to allow more versatility with analysis. For example, disaggregation of animal source foods into four groups (meat, fish, eggs and dairy) allows for detection of differences in consumption of these foods across groups with different characteristics or over time.

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The province of Saravane in Lao PDR provides a good example of how the definition of food groups affected the scores. The percentage of households falling below the defined cut-off point was 30 % for FCS and 13 % for HDDS. Saravane was ranked as the second most food-insecure area by FCS, but as one of the most food-secure areas (thirteenth out of sixteen) by HDDS. Eighty-nine per cent, 63 % and 41 % of households reported consuming meat, fish and eggs over the past 24 h. For calculation of FCS, these food groups are aggregated into one group. Fifty-two per cent of households consumed meat/fish/eggs all seven days, the equivalent of 28 points for FCS. Consumption of the meat/fish/egg food group for the remaining 48 % was spread evenly across zero to six days. There was also a tendency in this province for foods reported consumed only two to three times per week, to have been reported consumed in the previous 24 h.

Length of reference period

The analysis indicated that the 24 h household recall of individual food groups was always slightly higher than what would have been hypothetically captured for any one day out of a recall period of 7 d. For example, in the 24 h recall, oil was reported as consumed by 33 %, 39 % and 41 % of households in Burkina Faso, Lao PDR and northern Uganda, while the theoretical probability of consuming oil on any given day was 31 %, 32 % and 35 %, respectively. Most of the differences were small but statistically significant, and could be explained by a level of over-reporting for 1 d, under-reporting over 7 d or some combination of both errors.

Previous research suggests that the most likely explanation is under-reporting during the longer recall period rather than over-reporting during the 1 d recall. Recall error increases the longer back into the past respondents are asked to remember and this memory error leads to under-reporting of consumption[16]. Savy *et al.* found that there was a greater recall error with 2 d and 3 d recalls compared with 1 d recalls[17].

Weighting of food groups

The HDDS weights all food groups equally as if each food group were assigned a weight of 1, whereas the FCS applies a weighting system to the different food groups. Weighting had an impact on the comparability of the two scores in the present analysis. Provincial-level data from Lao PDR were analysed in more depth to investigate the greater divergence. The diet in Lao PDR is dominated by cereals, vegetables and fish. FCS weights assigned to cereals, vegetables and fish are 2, 1 and 4, respectively, while in the HDDS each of these food groups has a weight of 1. If the three food groups were consumed by the household over the previous day, the HDDS would be 3 while the FCS would be 7. The magnitude of the difference between the two scores is compounded by the number of days in the week that the higher weighted food groups are consumed. These differences may become particularly evident in more food-secure areas where availability of food groups assigned higher weights by FCS such as meat, fish and milk is greater.

Research on the FCS has shown the weights used do not improve the accuracy of the score over an unweighted score in terms of correlation with energy intake[8]. Rose *et al.* found that when comparing various types of food consumption scores, the use of food group weights based on formulas derived in a locally specific context provided the strongest correlation with a proxy measure of household dietary energy availability[9]. While locally designed weighting systems may produce the strongest correlations, the data needed to construct them are often not available. Rose *et al.* conclude that differences in performance of weighted compared with unweighted scores did not merit replacing an existing data collection system, but could be considered in new systems. If performance of the indicator is improved, then weights may be warranted in both the FCS and HDDS. Further validation of the appropriate weights to use is needed. However, assigning locally derived weights for use in specific locations would reduce the measure's value as a standardized indicator for multi-country use.

Combining dietary diversity with frequency of consumption

Traditional food frequency methodology uses a combination of diversity and frequency, but generally to assess dietary patterns over a much longer time frame of months to a year. The International Food Policy Research Institute (IFPRI) concluded that indicators based on a recall period of 7 d combining frequency (number of times consumed per week) and diversity were preferable to scores using only diversity[8]. In two out of three countries in the IFPRI study, the FCS, which takes the frequency of consumption into account, correlated better with household energy intake than simpler measures using only dietary diversity. The merit of a score based on a 1 d recall period combining frequency (number of times per day) of consumption with diversity has not been the subject of much research in developing countries, but the added accuracy achieved with scores that combine frequency and diversity should be weighed against the additional time and effort required for survey training, data collection, respondent fatigue and data analysis.

Conclusions

Both the HDDS and the FCS are used as proxy indicators of household access to food; however, the indicators are not interchangeable and a decision as to which one to collect should be made before undertaking any data collection. The current analysis showed that the choice of number of food groups and the use of weighting have an impact on the comparability of the indicators.

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Harmonization of certain aspects of data collection and analysis, such as the number and types of food groups used to create the indicator, could be one step towards improving comparability. More work is needed on both methods to identify the most appropriate cut-off points for defining food-insecure populations. The choice between collecting information for HDD or FCS depends on the time and resources available for data collection and the needs of the user. The HDD tool provides a useful snapshot of the situation at population level and is an attractive choice for ongoing tracking of programmes and in situations where time and resources for data collection and analysis are limited. The FCS, due to the combination of a longer reference period and incorporation of consumption frequency, requires slightly more data collection time but provides a more complete picture of consumption, and may be chosen by practitioners when more detail is needed, such as during in-depth food security assessments. Emphasis should be placed on consistent use of the chosen indicator to allow tracking of trends over time or comparisons across locations.

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