Food Insecurity in the Northern Part of Cameroon: Calorific Contribution Approach versus Score of Dietary Diversity

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ABSTRACT

For years, Cameroon has been considered as self-sufficient in agricultural production and was able to feed its population. But in recent years, the Country experienced food shortage and starvation in some rural areas in its northern part. Our aim is to characterize households in food insecurity. A series of approaches are used to describe the multi-faceted dimensions of food insecurity.

The objective of this paper is to measure and analyse food insecurity in the northern part of Cameroon using two approaches: score of dietary diversity and calorific contribution approach. The first approach is a simple counting of food groups consumed over a specific period and the second allows computing per capita dietary energy consumption for households or individuals. Both approaches result in classifying households into three categories according to food consumption level: acceptable, borderline, poor.

Cameroon Households Survey 2007 (ECAM3), conducted from September to December 2007 in Twelve thousand households in Cameroon, is a database with information on detailed daily expenditures of households in food consumption for two weeks (Section 15 of the main questionnaire). We focus on data of the rural household of the northern part of Cameroon. These records serve to compute food security indicators related to the above two approaches using FAO Technical conversion factors for agricultural commodities. A

distribution of household per capita dietary energy consumption for rural households in the northern part of Cameroon is proposed. We then compare the results obtained from the two approaches.

Keywords: Food Insecurity, Calorific Contribution, Spearman correlation Coefficient.

RESUMÉ

Longtemps considéré comme un bastion de la sécurité alimentaire, la famine a toqué à la porte de certaines Régions du Cameroun au cours des récentes années, notamment la zone septentrionale. Cette étude a pour but d'analyser l'insécurité alimentaire à partir de deux instruments mettre en pratique deux instruments: le score de consommation alimentaire (SCA) et les Disponibilités Energétiques Alimentaires (DEA).

Les données utilisées proviennent de la troisième Enquête Camerounaise Auprès des Ménages (ECAM 3) réalisée par l'Institut National de la Statistique du Cameroun de Septembre à Décembre 2007, qui a permis de toucher environ 12 000 ménages dans toute l'étendues du territoire national. La section 15 de cette enquête regroupe les données sur les dépenses et acquisitions quotidiennes des ménages collectée pendant deux semaines au moment de l'enquête.

Il est question de construire un score de SCA pour les ménages ruraux vivant dans la partie septentrionale du Cameroun à partir de la consommation des différentes produits alimentaires qu'ils ont des deux semaines de collecte de l'enquête ECAM 3. Les scores obtenus par les ménages permettent de classer ceux-ci en ménages à consommation alimentaire pauvre, limite ou acceptable suivant une échelle de classification proposée. Utilisant les coefficients calorifiques des différents aliments que propose la FAO, nous calculons les DEA pour chacun des ménages ruraux. Ce qui permet de classer les ménages également en trois catégories. La démarche consiste dès lors à faire une comparaison des résultats obtenus et trouver des éléments de réponse permettant d'expliquer les différences de classification.

Mots clés : insécurité alimentaire, disponibilité énergétique, corrélation de Spearman

1- Introduction

Due to its agro-ecological diversity[1], Cameroon shows great potentialities for agricultural production and livestock. Up till the late 1980s, the country was considered self-sufficient in agricultural production and played a role of food garret for its neighbouring countries. In the early 1990s, the country began spending billions of CFA francs to import cereals (rice and wheat) and other foodstuffs. This situation led the Government and International Organisations to pay more attention to food insecurity questions in the country, particularly in the northern part where climatic conditions are not favourable.

In 2007 and 2011, the World Food Programme (WFP) conducted a Comprehensive Food Security and Vulnerability Analysis (CFSVA) in Cameroon in order to provide an understanding of food security and vulnerability situation of rural households. One major

[1] The country is general divided into five agro-ecological zones with each of them suitable for specific agricultural and livestock

conclusion of these studies is that the highest prevalence of food insecurity and vulnerability households is usually in the Far North, North and Nord-west regions, two of which are located in the northern part of Cameroon. This part of the Country is generally considered as chronically food deficit due to difficult climatic conditions. The CFVSA relies on data collected at the level of households. In general large household surveys such as the "third Cameroon Households Survey 2007" (ECAM3) are conducted by the National Institute of Statistics (NIS). This survey aimed at measuring poverty in rural and urban areas of the country and took place between September and December 2007 to. The resulting database contains information on detailed daily expenditures of households in food consumption for two weeks (Section 15 of the main questionnaire).

This paper aim is to measure and analyse food insecurity in the northern part of Cameroon using information on rural households, collected during ECAM3. One of the main problems with measuring household food security is the absence of a single indicator that could capture the definition of 'food-insecure households'. Indeed, there is not a single internationally recognized indicator and standardized method applied in measuring food insecurity. Therefore, among the proxy indicators of food security, we selected two: an indicator of dietary diversity and the calorific contribution approach. Both indicators can be used to classify households into categories according to food consumption level (example: acceptable, borderline and poor).

This paper starts by presenting the methodological approaches used to measure food insecurity in the Northern part of Cameroon. The second point of our paper focuses on ECAM3 database and all the treatments made on initial variables to obtain inputs for calculating our indicators. We then comment the results obtained from each indicator and compare them before drawing a conclusion.

2- Methodological approach

Food insecurity is a multifaceted phenomenon that can be measured using several approaches. In this section, we present two of them after giving a definition of food security.

2.1. The concept of food security

Over time, several definitions and indicators of food security has been proposed. But the most widely accepted and well known definition of food security was adopted during the World Food Summit in 1996. The definition states that food security is achieved "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". This definition can be applied at the individual, household, national, regional and global levels and points the four main dimensions covered by the concept of food security:

- Availability of sufficient food;
- Access to the resources needed to acquire food;
- Utilisation, including nutrition, food safety and quality;
- Stability of availability and access.

However, the definition adopted during the World Food Summit in 1996 is not an operational one because it does not indicate how to measure the proportion of food-insecure households.

Practically, food insecurity is described through a series of approaches depending on the objective targeted or the structure who conduct the study. For example, FAO recommends two dietary diversity indicators in measuring food security: the Household Dietary Diversity Score (HDDS) based on twelve food groups and the Women's Dietary Diversity Score (WDDS) based on nine food groups (Kennedy G., 2011). The reference time is 24 hours. The World Food Programme (WFP) has adopted the Food Consumption Score (FCS) to evaluate food intake and food security. In this paper, two proxy indicators of household food security are applied: An indicator of dietary diversity, namely the FCS and a calorific contribution approach.

2.2 Score of Dietary diversity

Dietary diversity is defined as the number of individual food items or food groups consumed over a given period of time. The dietary diversity indicator applied in this paper is the WFP's FCS. It is a dietary diversity indicator constructed by counting the number of food groups, out of an eight aggregate food groups, consumed by a household in the past 7 days. It is a frequency-weighted diet diversity score. The FCS is calculated using the frequency of consumption of eight different food groups consumed by a household.

Algorithm to compute FCS:

1. *Using standard 7-day food frequency data, group all the food items into specific food groups*

2. Sum the consumption frequencies of food items within the same group.

3. Any consumption frequency greater than 7 is recoded as 7.

4. Multiply the value obtained for each food group by its weight (see Table 1 below), thus creating weighted food group scores.

5. Sum the weighed food group scores, thus creating the Food Consumption Score (FCS).

6. Using the appropriate thresholds (see Table 2 below), recode the variable food consumption score from a continuous variable to a categorical variable for the Food Consumption Groups (FCGs).

Mathematically the FCS can be written as:

$$FCS = \sum x_i a_i.$$

x_i is the number of day in which a food group i product has been consumed by the household within the reference period

a_i are weight coefficient for each foods group (Table1)

Table 1: *Food group use to construct FCS*

	Aggregated food groups	Weight
1.	Main staples	2
2.	Pulses	3
3.	Vegetables	1
4.	Fruit	1
5.	Meat and fish	4
6.	Milk	4
7.	Sugar	0.5
8.	Oil	0.5

Source: WFP 2008.

Households are considered highly exposed to food insecurity if their FCS is low. Table 2 below gives the profile of Household alimentation

Table 2: *Food consumption profile*

FCS	Profile
0-28	Poor
28-38	Borderline
38 and plus	Acceptable

Source: WFP 2008

2.3 Calorific contribution approach

This approach is based on caloric value of food consumed by households. The quantities of food consumed by households or individuals, recorded during survey, are converted into calories using calories tables. The indicator is similar to a monetary poverty indicator (see Zoyem J. et al., 2008). The needs of each household in caloric consumption depend on the characteristic of its members (sex, age, activity level, …). Therefore the require calorie need by a given household to satisfy its needs are computed as follows:

$$HCA_{eq} = \frac{\sum_{j=1}^{m} Q_j A_j}{\sum_{i=1}^{k} u_i}$$ (see Zoyem J. et *al.* , 2008).

Where u_i is the number of adult equivalent of the household i,
Q_j is the quantity of the product j (food), acquire by the household and,
A_j is the quantity of calories contained in 100 gr of product j.

Calories consumption per "adult equivalent" is needed to take into account the variation of individual dietary energy needs by age and sex and the difference between households in their demographic composition. The household calories availability per adult equivalent (HCAeq) are used to compute calorific indicator of food insecurity similar to monetary poverty indicator

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\frac{(Z - D_i)^\alpha}{Z}$$

Using this approach, one can construct calories consumption groups with reference to indicated thresholds (IFPRI, 2008): under 1470 kcal/capita/day, poor; from 1470 to less than 2100 kcal/capita/day, borderline; equal or greater than 2100 kcal/capita/day; Acceptable.

3- Dataset presentation and arrangement

This study uses information collected by the National Institute of Statistic (NIS) of Cameroon in the process of the third Cameroonian Households Survey 2007 (ECAM3). The survey was conducted from September to December 2007 in approximately twelve thousand households all over the country. ECAM3 database contains detailed information on daily expenditures of households in food consumption for two weeks (Section 15 of the main questionnaire). We focus our analysis on the three regions of the northern part of Cameroon namely: Adamaoua, North and the Far-North (Cameroon is divided into ten regions).

In order to obtain calorific values from the information collected during the survey, the quantity of food consumed by households given in monetary values are transformed into calories. Calorific contribution for each food product consumed by the household is obtained by multiplying the quantity consumed by its caloric power. FAO Technical conversion factors for agricultural commodities Tables are used for this purpose (conversion is given for a 100 gr quantity).

Table 3: *FAO Technical conversion factors for agricultural commodities – Cameroon*

Food	Kilocalories (for 100 grams)	Food	Kilocalories (for 100 grams)
Corn flour	363	Meat of beef	225
Corn	356	Plantain	75
Sugar refined	387	Concentrated of tomato	76
Sugar cane	30	Sorghum	343
Concentrated of tomato	76	Spaghetti	367
Palm oil	884	Millet	340
Onion	24	Refined oil	884
Banana	60	Wheat	334
Beans	341	Flour of wheat	364
Gumbo	13	Cool milk of cow	61
Yam	101	Milk in powder	496
Potato (Arish)	48	Potato (suit)	92
Cassava cool	109	Dehydrated Cassava	384
Shelled rice	362	pepper	318
Egg	163	Rice	280
Other roots and tubers	91	Chocolate	393
Other cereal	340		

Source FAO

The main limitation of our dataset is that, initially ECAM3 was not a “Food security” survey. Consequently, in order to apply concepts related to food insecurity measurement as previously presented, there were some arrangements to make. The major problem in calculating calorific contribution is the unit of measure for food items acquired by households. In most cases, food was measured using Local Unit of Measure (LUM) and did not offer the possibility to compute directly the calories consume by households.

The arrangement made on our dataset was firstly to affect each food item in a food group and identify the period of acquisition of the food item. To compute the calorific indicator, we transformed each quantity given in LUM into a standard unit of measure (gram). These transformations were done using daily expenditure of households in each food item, the unit price for each food item given in Kg for the reference period (during the survey) and the correspondence tables between LUM and standard unit measure obtained at the Early Warming Unit of the Department of Agricultural Surveys and Statistics in the Ministry of Agriculture and Rural Development of Cameroon.

4- Results and discussion

In our analysis we consider only two food consumption groups in classifying the rural households in the northern part of Cameroon: the poor or households facing food insecurity and those not facing food insecurity (borderline and acceptable). A threshold of 2400 kcal/capita/day is used for the calorific contribution approach. It is inspired from the food balance sheet of Cameroon published by the Ministry of Agriculture and Rural Development.

In order to appreciate the link between calorific contribution approach and FCS, we computed a Spearman's correlation coefficient between the two indicators. It appears that, globally the values of the two indicators are very, with high standard deviations (table 4). It means that there is inequality in the distribution of food security in the northern part of Cameroon as shown in graph 4 (annex). The same situation was observed while calculating the monetary poverty in the same regions (INS, 2008).

Table 4: Description of the FCS and calorific indicator of household

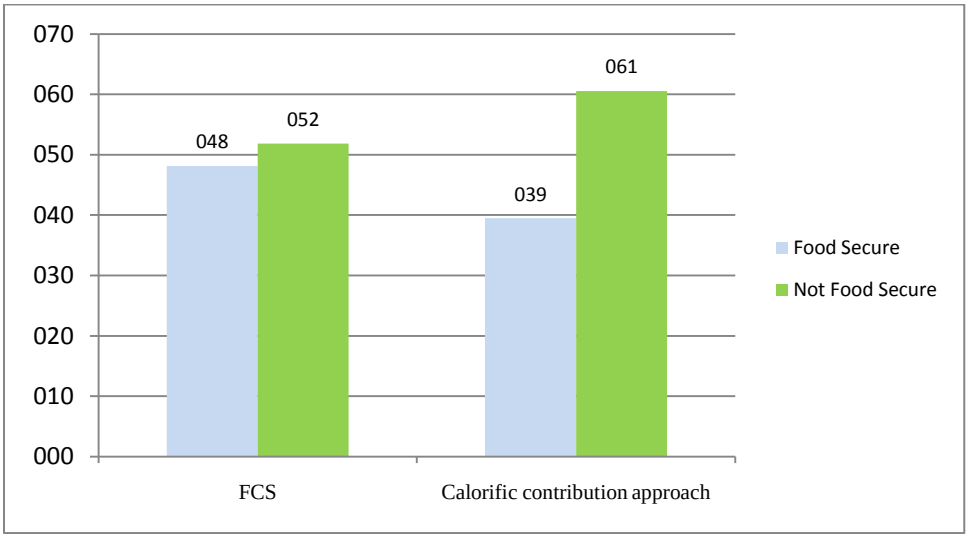
	Adamaoua	Far-North	North	Northern Region
Calorific contribution Indicator				
Mean	2376.35	2295.56	2044.27	2243.11
SD	1107.77	1097.59	1061.32	1095.43
Minimum	508.02	500.58	560.16	500.58
Maximum	4960.70	4940.85	4964.56	4964.56
Food Consumption Score				
Mean	55.17	39.41	39.94	42.00
SD	22.49	19.01	15.32	19.55
Maximum	10.00	.50	2.00	.50
Minimum	110.50	112.00	112.00	112.00
Spearman correlation between FCS and Calorific Indicator	$\rho = 1 - \frac{6\sum d_i^2}{912(912^2-1)} = -0.0020538$			

Source: ECAM3, Authors

[1]the p-value of the test of nullity of ρ is 0.950608, meaning that the hypothesis of nullity of ρ is not rejected.

The spearman correlation coefficient is significantly equal to zero. We can therefore conclude that there is no correlation between the two indicators. The proportion of rural households exposed to food insecurity in 2007 appears to be very high in all the three regions.

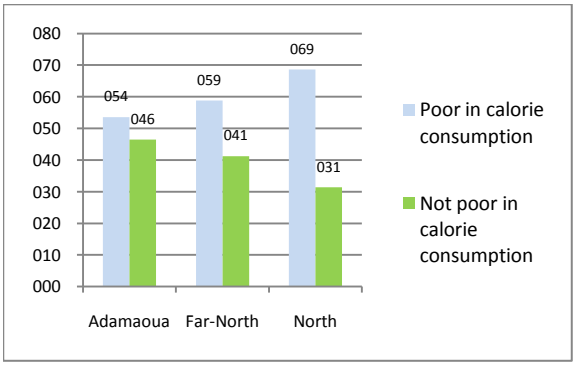
As we can see from graph 1 below, whatever the approach used to measure food insecurity, the proportion of rural households exposed to foods insecurity is higher than 52 %.



Graph 1: *Distribution (%) of household according to their profile of food insecurity and the method of computing indicators*

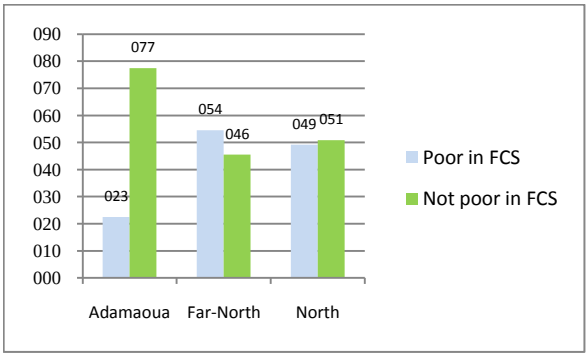
Source: ECAM3, Authors

Looking at the result in each region; North stands to be the region with the highest proportion of rural households exposed to food insecurity with an estimation of 63% and 53% respectively for calorific contribution approach and FCS. On the one hand, rural households in the Adamaoua region appear to be less exposed to food insecurity. The estimated proportion of rural households facing food insecurity in this region using FCS and calorific contribution approach is respectively 22.54% and 53.52 %. On the other hand the Far-North region, both indicators result in estimating the proportion of rural households exposed to food insecurity respectively 54% and 59%). The classification between the three regions resulting from the method of calorific indicator is similar to the result obtained from monetary poverty indicator. This is because the construction of the monetary poverty line uses calories consumed by households.



Graph 3: *Profile (%) of food insecurity in the Northern part of Cameroon using calorific indicator*

Source: *Ecam3 Authors*



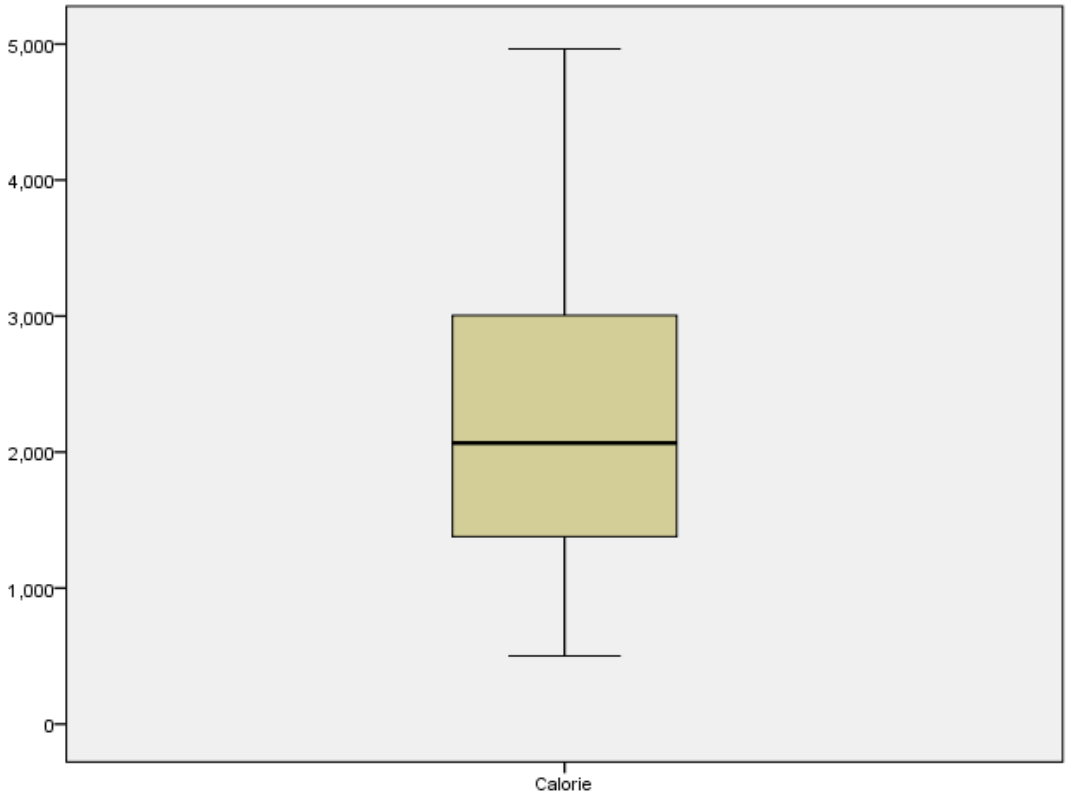
Graph 2: *Profile (%) of food insecurity in the Northern part of Cameroon using FCS*

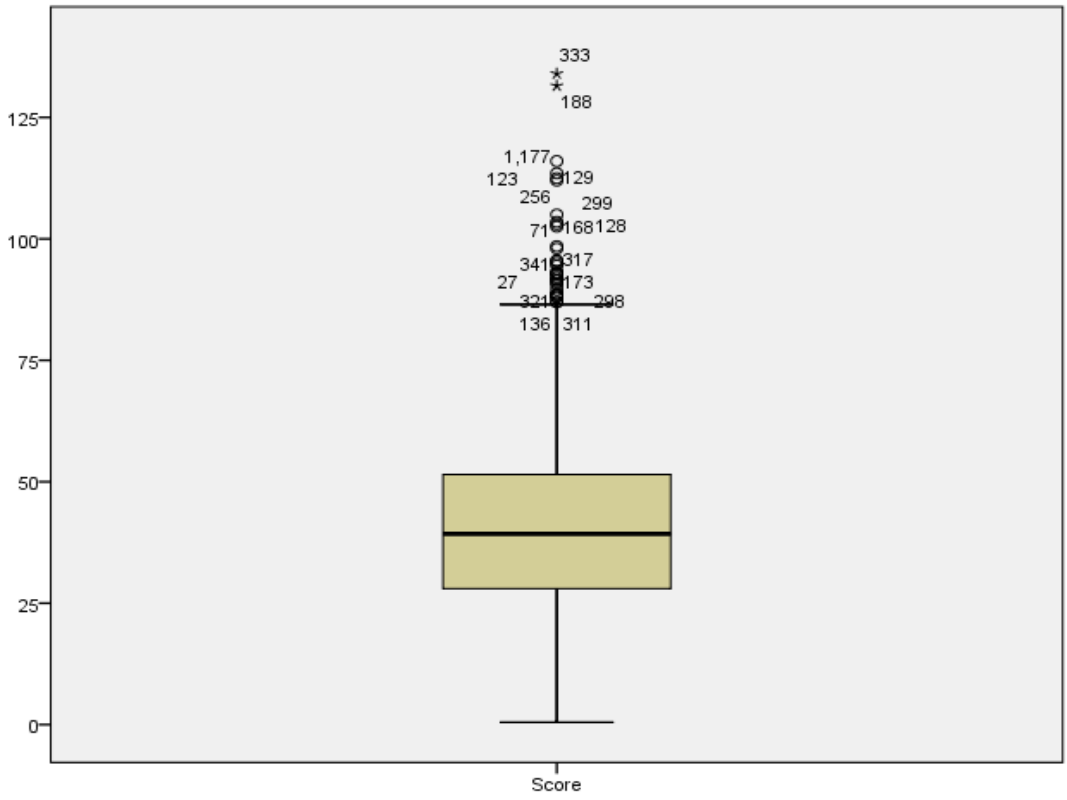
Source: Ecam3 Authors

Conclusion

Our objective in this paper was to compare two approaches used to measure food insecurity at the level of rural households with application in the northern part of Cameroon. At the final step of our effort, we found that there is not significant correlation between the two indicators. Also, we saw a large dispersion in the results obtained by the FCS approach. Nevertheless, the classification given by both indicators are almost similar and not very far from the results of the monetary poverty calculated using the data from the same survey. Moreover, the results of monetary poverty show a large unequal distribution of rural households in the northern part of Cameroon. However, ECAM3 seems not very suitable for food security analyses, for example the specific calculation of the calorific indicator is more precise when data are collected all over an agricultural campaign. Given our result, it is difficult to say which approach is optimal and, choosing an approach for food insecurity depends on time and financial means at the disposal of the researcher or institution.

<u>Annexe:</u> distribution of calorific indicator and FCS respectively





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