

**Guide to estimating per capita consumption of staple
foods using Household Income and Expenditure Survey
(HIES) data**

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Forward

This guide outlines the steps necessary for estimating per capita intake of staple foods using HIES data. HIES/LSMS data provide estimates of food purchases, rather than individual food consumption. We will estimate individual consumption using food expenditure data at the household level as a proxy. We assume the following when using HIES/LSMS expenditure data to estimate per capita food consumption:

- Foods are distributed within households based on energy requirements (there is no direct measure of intra-household food allocation in the HIES)
- Foods are not wasted or spoiled
- Foods are not shared outside of the household
- Foods are not fed to animals

Although these assumptions are not always met, HIES/LSMS data provide an opportunity to estimate per capita consumption, on a population level, where true individual consumption data are lacking.

In this analysis, we will estimate per capita daily staple food intake in CONSUMERS ONLY. Hence, if the household did not purchase the food product, they should not be included in the per capita estimates. We will generate estimates of per capita intake in consumers only, which will not translate into population per capita intake. Estimations in consumers only will allow us to realize the impact of fortification in those consuming the fortified foods.

1. **Begin by identifying where the following important variables used for estimating consumption of staple foods reside.**

*Please note that not all surveys will contain all of the following variables.

a. General demographic characteristics

- Socioeconomic status (SES)
 - Usually constructed as: “very poor”, “poor”, and “non-poor”
- Rural/Urban
 - Other geographic distinctions (e.g., region), if important
- Indigenous/non-indigenous (if applicable)
- Ethnic group (if applicable)
- Number of persons in household
- Age of each household member
- Sex of each household member

b. Variables related to food purchases

These questions vary between surveys.

- Foods purchased in past year (yes/no)
 - Frequency of purchase (e.g., daily, weekly, bi-monthly, monthly, annually)
- Frequency of foods purchased during the dry and wet season (if applicable)
- Foods purchased in past X days (yes/no)
- Quantity of food purchased in given time period and associated units of measure
 - * units of measure will be addressed in step #3

c. Variables related to food acquired by other means (without purchasing)

- Home production
- Free (e.g., food aid)
- Gift from family/friends, etc.

- Barter
- Any other questions relating to acquiring food without purchasing (amount of food acquired, frequency, etc.)

d. Foods (*additional relevant staple foods may also be included on this list*)

- Oil
- Sugar
- Salt
- Bouillon cubes
- Powdered soups
- Rice
- Wheat flour
 - Wheat flour-containing foods such as bread
- Maize flour
 - Maize flour-containing foods
- Pasta
- Complementary foods

e. The “weight” variable, so that population estimates can be made (*note that datasets may contain both a household and an individual weight*)

After identifying all important variables, merge appropriate household/demographic datasets with the food dataset.

- Datasets should be merged on the common variable “household ID” (this variable will have varying names, depending on the survey)

Outcome of STEP #1: *all important variables have been identified and are contained in a single dataset.*

2. Create a household “Adult Equivalent Unit (AEU)” variable.

- The household AEU variable accounts for variation in household composition and varying individual energy requirements. The following variables are needed to construct AEU:
 - Household size
 - Age
 - Sex
- Begin by constructing individual AEU, using the following table of age and sex-specific energy requirements published by FAO in 2004:

		Males		Females	
Age (years)		Energy (kcal/day)	Ad. Eq.	Energy (kcal/day)	Ad. Eq.
< 1 *		661	0.22	661	0.22
1	2	950	0.31	850	0.28
2	3	1125	0.37	1050	0.34
3	4	1250	0.41	1150	0.38
4	5	1350	0.44	1250	0.41
5	6	1475	0.48	1325	0.43
6	7	1575	0.52	1425	0.47
7	8	1700	0.56	1550	0.51
8	9	1825	0.60	1700	0.56
9	10	1975	0.65	1850	0.61
10	11	2150	0.70	2000	0.66
11	12	2350	0.77	2150	0.70
12	13	2550	0.84	2275	0.75
13	14	2775	0.91	2375	0.78
14	15	3000	0.98	2450	0.80
15	16	3175	1.04	2500	0.82
16	17	3325	1.09	2500	0.82
17	18	3400	1.11	2500	0.82
18	30	3050	1.00	2400	0.79
30	60	2950	0.97	2350	0.77
≥60		2450	0.80	2100	0.69

The 18-30 year old male will serve as the referent population, and all other values are calculated by dividing each age/sex group by the male referent value. For example, the AEU for a 1-2 year old male is 950/3050 (0.31).

Sample SAS code for creating AEUs:

```
if q04_age lt 1 then AEU=0.22; *q04_age=age in years, q03_sex=sex  
where 1=male;
```

```
if 1 le q04_age lt 2 and q03_sex=1 then AEU =.31;  
if 2 le q04_age lt 3 and q03_sex=1 then AEU =.37;  
if 3 le q04_age lt 4 and q03_sex=1 then AEU =.41;  
if 4 le q04_age lt 5 and q03_sex=1 then AEU =.44;  
if 5 le q04_age lt 6 and q03_sex=1 then AEU =.48;  
if 6 le q04_age lt 7 and q03_sex=1 then AEU =.52;  
if 7 le q04_age lt 8 and q03_sex=1 then AEU =.56;  
if 8 le q04_age lt 9 and q03_sex=1 then AEU =.60;  
if 9 le q04_age lt 10 and q03_sex=1 then AEU =.65;  
if 10 le q04_age lt 11 and q03_sex=1 then AEU =.70;  
If 11 le q04_age lt 12 and q03_sex=1 then AEU =.77;  
If 12 le q04_age lt 13 and q03_sex=1 then AEU =.84;  
If 13 le q04_age lt 14 and q03_sex=1 then AEU =.91;  
If 14 le q04_age lt 15 and q03_sex=1 then AEU =.98;  
If 15 le q04_age lt 16 and q03_sex=1 then AEU =1.04;  
If 16 le q04_age lt 17 and q03_sex=1 then AEU =1.09;  
If 17 le q04_age lt 18 and q03_sex=1 then AEU =1.11;  
If 18 le q04_age lt 30 and q03_sex=1 then AEU =1.0;  
If 30 le q04_age lt 60 and q03_sex=1 then AEU =.97;  
If 60 le q04_age lt 97 and q03_sex=1 then AEU =.80;
```

```
if 1 le q04_age lt 2 and q03_sex=2 then AEU =.28;  
if 2 le q04_age lt 3 and q03_sex=2 then AEU =.34;  
if 3 le q04_age lt 4 and q03_sex=2 then AEU =.38;  
if 4 le q04_age lt 5 and q03_sex=2 then AEU =.41;  
if 5 le q04_age lt 6 and q03_sex=2 then AEU =.43;  
if 6 le q04_age lt 7 and q03_sex=2 then AEU =.47;  
if 7 le q04_age lt 8 and q03_sex=2 then AEU =.51;  
if 8 le q04_age lt 9 and q03_sex=2 then AEU =.56;  
if 9 le q04_age lt 10 and q03_sex=2 then AEU =.61;  
if 10 le q04_age lt 11 and q03_sex=2 then AEU =.66;  
If 11 le q04_age lt 12 and q03_sex=2 then AEU =.70;  
If 12 le q04_age lt 13 and q03_sex=2 then AEU =.75;  
If 13 le q04_age lt 14 and q03_sex=2 then AEU =.78;  
If 14 le q04_age lt 15 and q03_sex=2 then AEU =.80;  
If 15 le q04_age lt 16 and q03_sex=2 then AEU =.82;  
If 16 le q04_age lt 17 and q03_sex=2 then AEU =.82;  
If 17 le q04_age lt 18 and q03_sex=2 then AEU =.82;  
If 18 le q04_age lt 30 and q03_sex=2 then AEU =.79;  
If 30 le q04_age lt 60 and q03_sex=2 then AEU =.77;  
If 60 le q04_age lt 97 and q03_sex=2 then AEU =.69;  
run;
```

- Next, **sum** individual AEU for each household to create a Household AEU variable.

Outcome of STEP #2: the household AEU variable was created

3. Standardizing units of measure for foods and converting to daily intake.

- Units of measure such as grams, pints, “units” (e.g., 1 “unit” of bread) must be standardized for EACH food. Standard conversion factors should be used (e.g., 1 pound= 453.6 grams). If non-standard measures such as satchels, bags, sacks, etc. are included, their weight, in grams, must be estimated a priori for each food. It’s common to find a mix of units for each food (e.g., pounds, grams, kilograms, bags). It’s especially important to standardize units of measure for different breads because bread purchases are commonly reported as units (e.g., 1 loaf) rather than grams.
- Food purchases are estimated for the past X days, depending on the questionnaire. Divide the grams purchased by X days in order to estimate total daily consumption. Often, surveys report either purchases in the past 7 days (divide by 7) or the past 15 days (divide by 15).

Sample SAS code for standardizing units of measure and converting to daily intake:

**note that in this example, respondents were asked about food intake in the previous 7 days*

```
if units=1 then Grams = foodamount/7*28.35;    *1 ounce=28.35 grams*;
if units=2 then Grams = foodamount /7;        *grams*;
if units=3 then Grams = foodamount /7*453.59; *1 pound=453.59 grams*;
if units=4 then Grams = foodamount /7*1000;   *1 KG = 1000g*;
if units=5 then Grams = foodamount /7*750;    *1 sack of sugar = 750
grams*;
```

- Remember to restrict your analysis to foods that were purchased (not home-grown, etc.)

Outcome of STEP #3: each food should now correspond with a standard unit of measure (usually grams) and represent DAILY intake.

4. Estimating Fortified Wheat Flour Equivalents (FWFEs)

- FWFEs are calculated based on the proportion of wheat flour in the food product and the amount consumed each day. Wheat flour-containing foods such as breads, cakes and crackers contain varying proportions of wheat flour. For example, it's estimated that sweet bread and French bread in Guatemala contain 65% and 77% flour, respectively. FWFEs are calculated by multiplying each product by the proportion of wheat flour it contains and then adding together all products.
- For example, FWFEs= sweet bread + French bread + wheat flour + cake + crackers

When accounting for the proportion of flour in the foods, the calculation of FWFEs may look like this:

$$\text{FWFE} = (0.65 * 200 \text{ g/d}) + (0.77 * 100 \text{ g/d}) + (15 \text{ g/d}) = 222 \text{ g/d FWFEs}$$

Outcome of STEP #4: a FWFE variable was created

5. Estimating per capita food intake in consumers (interim estimate)

- Per capita intake of purchased foods can be estimated by daily consumption of food in grams by household AEU's.

Per capita food purchases for example, sugar:

$$\frac{\text{Grams of sugar per household per day (calculated in STEP \#3)}}{\text{Household Adult Equivalent Units (calculated in STEP \#2)}}$$

Outcome of STEP #5: an interim per capita intake variable (grams/day) was created for each food, including FWFEs

6. Deleting extreme outliers

- Very extreme outliers should be deleted at this point. Using the variable created in Step #5 (interim per capita intake), use the following equation to identify and delete outliers exceeding the 75th percentile by more than 3 times the interquartile range: $Q3 + (3 \cdot IQR)$ where $Q3$ = the 3rd quartile (75th percentile) and the IQR = Interquartile range (distance between 25th and 75th percentile). Because we are generating daily per capita intake estimates, it's important to delete extreme outliers to avoid unrealistic intakes such as 7,000 grams of sugar per person, per day.

Outcome of STEP #6: deletion of very extreme outliers

7. Final estimation of per capita intake in consumers

- Once very extreme outliers have been deleted, per capita intake can be estimated for the total population and by area (rural/urban or geographic area), poverty level, ethnicity, etc.
- Remember to account for sample weights

Outcome of STEP #7: generation of final estimations of per capita intake

Notes

- Remember to estimate per capita intake in consumers only.
- To specifically estimate the potential impact of fortification on women of reproductive age, multiply the per capita estimates by 0.79 (AEU for 18-30 year old women). The same can be done in children by multiplying the estimate by the AEU for the specific age/sex group of interest.

- When using per capita intake to estimate the proportion of EAR fulfilled, remember to account both for loss of specific nutrients due to degradation and for bioavailability of specific nutrients.