Determination of food consumption patterns prior to dietary exposure assessment of populations of Benin, Cameroon, Mali and Nigeria to harmful residues and contaminants.

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Introduction

The Total Diet Study (TDS) approach provides a snapshot of the dietary exposure of populations. In the framework of a 3-year Standard and Trade Development Facility funded project (STDF) implemented by the Food and Agriculture Organization of the United Nations (FAO) and the technical support of the World Health Organization (WHO) a TDS is currently taking place in Benin, Cameroon, Mali and Nigeria.

The study aims to assess **human dietary exposure** to **toxic chemicals** of the populations of eight locations, by processing **food expenditure data** from official household budget surveys.
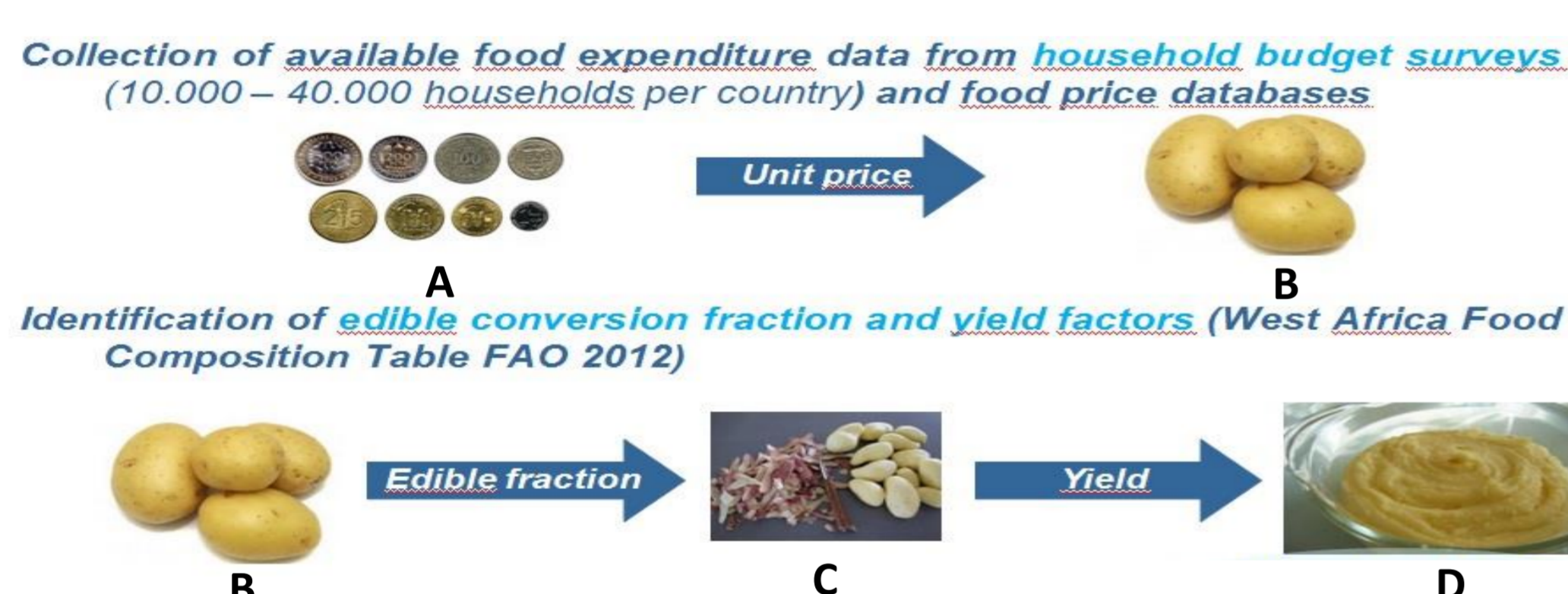
These data were processed from an extraction of 4 databases including a total exceeding 70.000 households to assess the *i)* average and *ii)* high consumers **dietary patterns** in four countries of Sub-Saharan Africa.

Experimental

Conversion of food purchase value into food quantity as consumed

Figure 1: Data processing via the SPSS software.
The process stages are: **A:** food value (*currency*), **B:** food as bought (*g*), **C:** edible food (*g*), **D:** food as consumed (*g*)

Collection of available food expenditure data from household budget surveys (10.000 – 40.000 households per country) and food price databases

Identification of edible conversion fraction and yield factors (West Africa Food Composition Table FAO 2012)

### Conversion of household members into a standard unit

Figure 2: Adult male equivalence table provided by the National Bureau of Statistics (*Nigeria*).
Columns 2 an 3 define the fraction of adult male equivalent (AME) of any household member depending on the age and gender of the subject.

Age Group	Male	Female
Less than 1 year	0.25	0.25
1 to less than 4 years	0.45	0.45
4 to less than 7 years	0.62	0.62
7 to less than 11 years	0.69	0.69
11 to less than 15 years	0.86	0.76
15 to less than 19 years	1.04	0.76
19 to less than 26 years	1.00	0.76
26 to less than 51 years	1.00	0.76
51 years and above	0.79	0.66

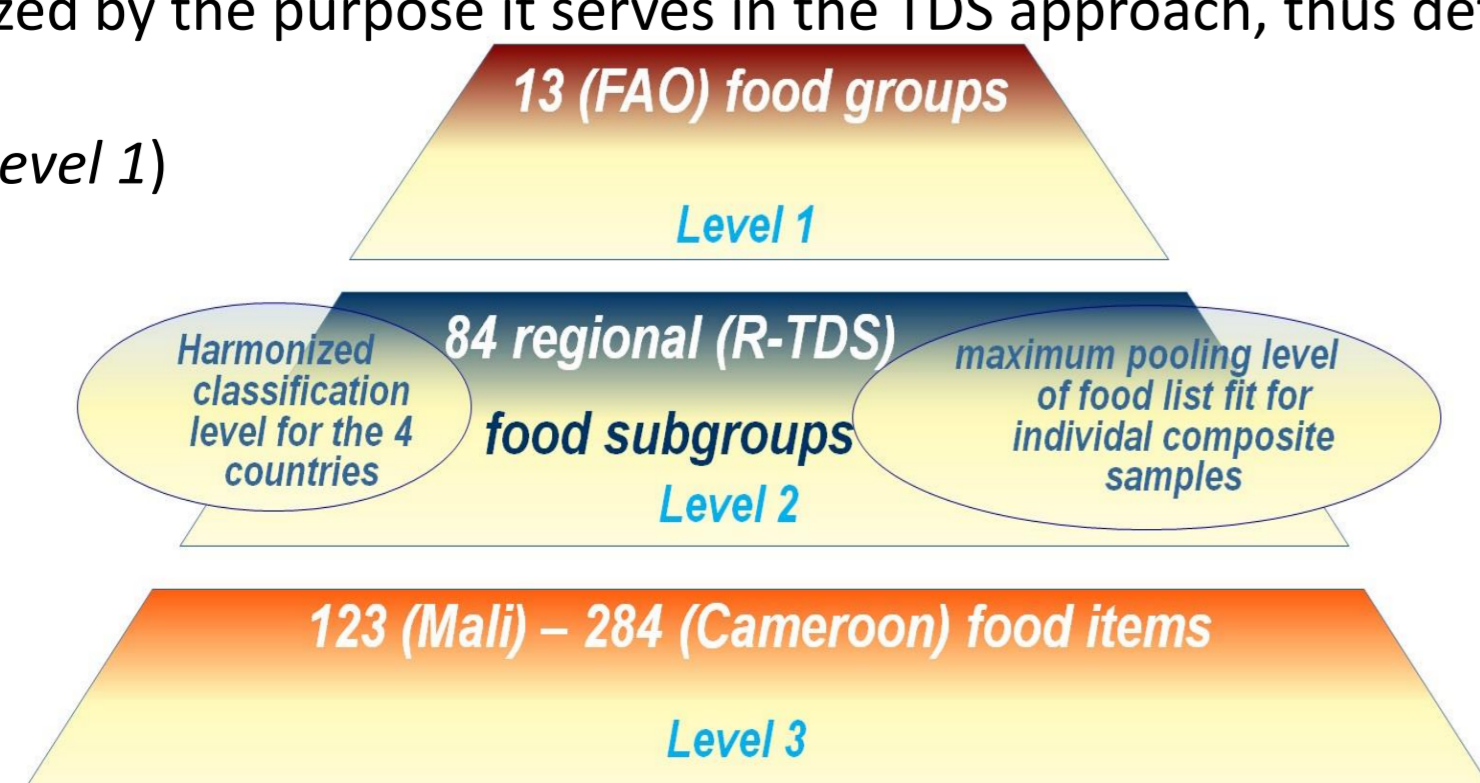### Purge from over/under reporting households

Figure 3: Selection of normally reporting households on the basis of energy intake by adult male equivalent.
Households reporting less than 1200 or more than 5100 kcal/adult male equivalent/day were removed from datasets prior to calculating the average and percentile 95 intakes.

Distribution of households per energy intake
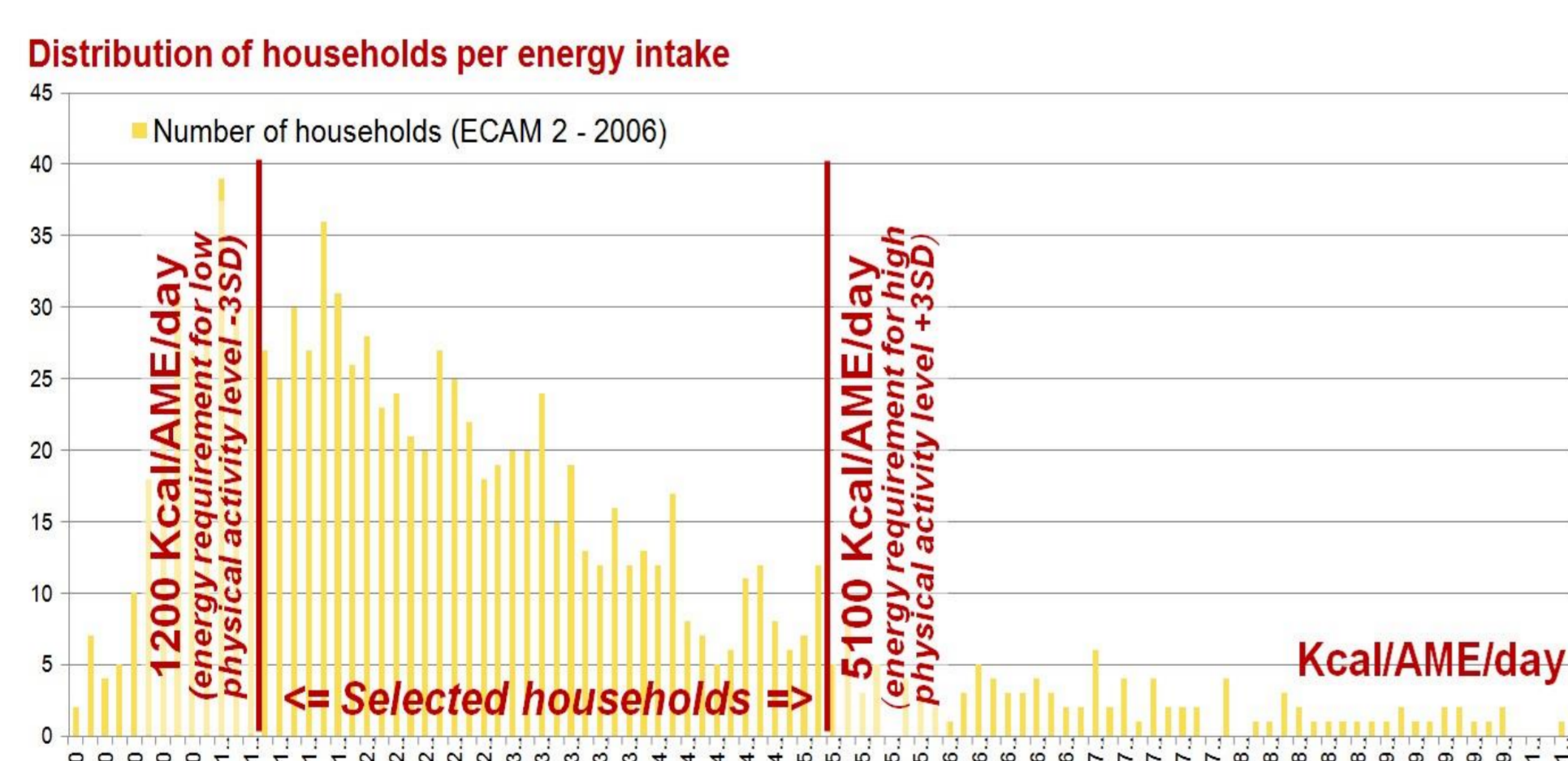
Definition of the food classification

Figure 4: Food classification represented as a 3-strata pyramid hierarchy. Each stratum equals 100% of the diet. The average and percentile 95 consumptions were assessed at each level of the hierarchy.
Each level can be characterized by the purpose it serves in the TDS approach, thus defining :

1. Consumption patterns (*level 1*)
2. Pooled samples (*level 2*)
3. Subsamples (*level 3*)

13 (FAO) food groups — Level 1
Harmonized classification level for the 4 countries — 84 regional (R-TDS) food subgroups — maximum pooling level of food list fit for individual composite samples — Level 2
123 (Mali) – 284 (Cameroon) food items — Level 3

Results and discussion

Inter-country food consumption patterns

Figure 5: Average daily consumption by food groups (*unit: g/adult male equivalent/day*) of populations of the 4 countries of the study.

FOOD GROUP (level 1)	BENIN	CAMEROON	MALI	NIGERIA	SD
CEREALS	1005	800	1403	905	264
TUBERS	317	384	33	412	173
LEGUMES	91	121	48	127	36
VEGETABLES	109	140	44	67	43
FRUITS	7	164	44	24	71
NUTS/SEEDS	2	6	1	5	3
MEAT	6	13	16	11	4
EGGS	1	3	17	2	7
FISH	16	23	10	13	6
MILK&DAIRY	11	8	19	11	5
FAT/OIL	36	41	19	25	10
BEVERAGES	86	93	6	24	44
MISCELLANEOUS	141	158	95	50	49
TOTAL	1829	1955	1755	1676	118

Intra-country food consumption patterns

Figure 6: Average daily consumption by food groups (*unit: g/adult male equivalent/day*) of populations of the 8 study centers of the study

FOOD GROUP (level 1)	LITTORAL	BORGOU	DOUALA	NORTH	BAMAKO	SIKASSO	LAGOS	KANO	SD
COUNTRY	BENIN	BENIN	CAMEROUN	CAMEROUN	MALI	MALI	NIGERIA	NIGERIA	ALL
CEREALS	849	1094	437	1409	1310	1172	503	1249	368
TUBERS	227	338	267	94	53	42	570	43	187
LEGUMES	50	43	89	150	49	51	149	65	45
VEGETABLES	204	89	111	133	81	35	76	49	53
FRUITS	25	2	178	18	94	42	47	7	59
NUTS/SEEDS	2	1	3	1	0	0	1	3	1
MEAT	13	21	10	22	29	10	23	5	8
EGGS	5	0	6	1	64	8	15	1	21
FISH	33	8	32	13	14	10	24	3	11
MILK&DAIRY	45	14	13	4	32	8	35	8	15
FAT/OIL	38	18	44	19	20	11	39	28	12
BEVERAGES	149	119	139	84	15	3	94	16	59
MISCELLANEOUS	375	126	232	152	131	64	69	47	109
TOTAL	2017	1874	1563	2099	1893	1457	1645	1524	242

Interpretation

Dietary patterns of the study populations show the largest variations for cereals and tubers food groups, in absolute terms. Intra-country variations of dietary patterns may be more extensive than inter-country variations, partly depending on whether the study centers are located by the ocean or closer to the Sahel. High consumption of cereals in particular seems to be a determinant factor for exposure assessment associated with populations dwelling in northern, semi-arid and arid locations of Sub-Saharan Africa.

Conclusion

Dietary patterns of populations of Benin, Cameroon, Mali and Nigeria were assessed thanks to a replicable and cost-effective method based on national **household budget surveys**, which are mandatorily updated every five years in African countries. **Cereals** and **tubers** consumption levels turn out to be the most significant differences among the 8 study centers, most probably resulting in differential dietary exposure patterns with regard to contaminants and residues such as mycotoxins and pesticides, which will be subsequently assessed.