# Total Diet Study (TDS) Training Workshop for sub-Sahara Africa

# Centre Pasteur du Cameroon
# Yaoundé - Cameroon

# 1-5 March 2010

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# 2. Executive summary

The first regional training workshop held in Sub-Sahara Africa on March 1st to 5th 2010, was organized by the Centre Pasteur of Cameroon (Department of Hygiene and Environment), the WHO (Department of Food Safety and Zoonoses), the FAO (Nutrition and Consumer Protection Division), the French National Institute for Agronomic Research (WHO Collaborator Centre Met@risk) and was mainly financed by Standards and Trade Development Facility. Fourteen participants coming from Burkina Faso, Mali, Senegal, Nigeria and Cameroon attended the workshop.

This workshop has been differently conducted as compared to previous TDS workshops which were mainly based on lectures and few exercises. In this workshop, few lectures were given, while emphasizing the drafting of the project proposal and the understanding of the decisions to be taken in the planning of a TDS and their implications on data quality.

The strategic priorities regarding the monitoring of chemicals in foods were elaborated by each country and were compiled. These priorities were based on both health considerations and international trade issues.

Based on these priorities, a draft proposal had been elaborated and it is anticipated to be submitted to Standards and Trade Development Facility later this year after a final review and completion by participants at national level.

# 3. Introduction

The need for monitoring chemicals in the food supply is essential as consumers are unable to know to which toxic chemicals and nutritional imbalances they are exposed through the foods they consume.

Toxic chemicals may affect all major organs in the body, causing serious health outcomes like cancer, birth defects, reproductive disorders, kidney and liver dysfunction, hormonal imbalance, immune system suppression, musculoskeletal disease, cardiovascular diseases, and brain damage.

National authorities have the responsibility and obligation to ensure that toxic chemicals, such as pesticides, heavy metals, environmental contaminants and natural occurring toxins, are not present in food at levels that may adversely affect the health of consumers.

While monitoring for compliance with regulatory standards is essential for consumer protection and facilitation of trade, governments need to assess public health risks arising from the presence of toxic chemicals in foods, by estimating the actual dietary exposure of contaminants for comparison with their corresponding toxicological reference intakes.

Thus, estimating the dietary exposure of contaminants is indispensable for risk assessment and can also be used in determining whether there may be a relationship between observed adverse effects in humans and exposure to a particular contaminant. Contaminant exposure assessments are equally critical for making sound decisions in the regulation of chemicals and food safety.

The Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization requires that health and safety requirements related to food must be based on sound scientific risk assessment. Dietary exposure estimates are also used in developing standards, guidelines and other recommendations at national and international level, including in the context of the *Codex Alimentarius* Commission. Finally, dietary exposure estimates can provide assurance that regulatory systems that have been established are effective in protecting the public health.

The World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) promote the use of total diet studies as one of the most cost-effective methods to monitor the potential health impact of chemicals in the food supply. Consequently, there is a growing interest by countries in conducting total diet studies.

In order to promote the undertaking of reliable and comparable total diet studies worldwide, four International Total Diet Study Workshops have been sponsored: in Kansas City in July 1999, in Brisbane in February 2002, in Paris in May 2004 and in October 2006 in China. Additionally, many regional TDS workshops were held in the world. This was the first regional training workshop held in Sub-Sahara Africa.

# 4. The Training Workshop

## Welcome and opening remarks

Pr Dominique Baudon welcomed the participants and underlined that the Centre Pasteur of Cameroon (CPC) was delighted to hold the first regional training workshop on Total Diet Studies in sub-Saharan Africa. He was thankful for the financial and technical implication of WHO, FAO, INRA, and for the funding by STDF/WTO. He explained that the CPC, as a National Reference and Public Health laboratory is involved on biological and chemical foods risk assessment and was identified by the United Nations Industrial Development Organization as potential laboratory to be accredited at international level for food safety.

Dr Philippe Verger was at his first official journey as representative of the WHO Department of Food Safety and Zoonoses. He was delighted to promote TDS on behalf of both FAO and WHO. He underlined the lack of scientific data from African countries to enable them to fully participate at the *Codex Alimentarius* activities. The participation of African countries in Codex activities is a key issue to allow them to play a role in international trade area and in particular to support the export of safe food on the international market. He also added that Africa is a priority of WHO for food safety at short and mid-terms. He stated the objectives of the training workshop that were to strength the understanding of TDS principles and methodology by national risk managers and to elaborate a regional TDS project proposal.

The representative of the Ministry of Public Health in Cameroon recognized that the African experience of urbanization, industrialization and development have contributed to the emergence of man-made environmental hazards with harmful effects on the environment, food and health. She also added the need to address these new and emerging environmental threats including persistent organic pollutants (POPs), dioxins and furans, heavy metals, electronic and electric wastes, and natural toxins. She pointed out the need of new public health policies to help reduce morbidity and mortality rate in African communities.
She welcomed the participants and acknowledged the international community as STDF/WTO, WHO, FAO, INRA and all the stake holders for their contribution. She recognized the importance of the training workshop, underlined the participants responsibilities to implement TDS in their country. Then she declared the ceremony opened.

## Workshop Overview

The training workshop was organized by the Centre Pasteur of Cameroon, WHO, FAO and INRA, was partially financed by Standards and Trade Development Facility (STDF). Fourteen participants from Burkina Faso, Senegal, Mali, Nigeria and Cameroon attended the workshop (annex 1).

The agenda (annex-2) of the 5-day workshop included some presentations on important aspects of total diet studies, as risk analysis, risk assessment, food consumption data, sampling plan, potential chemical contaminants, analytical methods, and food analysis laboratories; but the main emphasis was placed on practical aspects in the implementation of a TDS and on the drafting of a project proposal for a regional TDS to be submitted to STDF.

Because many of the participants spoke either French or English, the workshop was held in both languages. Most participants were from institutions and organizations potentially being able to carry out a TDS. Before their arrival at the workshop, they investigated the national situation in terms of potential contamination problems, availability of food consumption data and laboratories (annex-3).

During the workshop, the **CCRABE** principle for TDS was developed to focus on the important areas in the implementation of a TDS:

- **C**onsumption data
- **C**oncentration data of chemicals
- **R**isk of chemicals for population
- **A**nalytical feasibility and data quality including sampling
- **B**udget
- **E**conomical considerations including trade

The course was structured in several building blocks to develop a gradual understanding of the implementation of a TDS. The first building block was to create a general understanding of TDS in the context of risk assessment and the different steps to take in the planning (day1). The next unit were the food list and the sampling aspects (day 1 and 2). Thereafter, the different aspects of chemical contamination were elaborated in terms of risk, origin, importance and concentration as well as analytical methods and data quality (day 3). Thereafter, on day 4 and 5, practical exercises were done to develop a food list and to outline the draft project proposal.

Participants started developing a food list based on FAOSTAT data and the GEMS/food cluster J. The participants transformed the available data into daily amount of foods as consumed (i.e. in the way as eaten in the population) by applying yield and edible coefficients. Discussions took place on the compositing of foods, how to find information on their cooking method and to decide which foods should be analysed for which contaminants. Based on the GEMS/food cluster J, 22 foods were selected contributing to 90 % of the food supply of Burkina Faso, Mali, Nigeria and Senegal. **It was decided that these 22 foods will be the common basis of foods in the regional TDS**.

In the five countries, food consumption data are available from Household Budget Surveys (HBS): Burkina Faso (1998), Cameroon (2001), Mali (1988 or 2003), Nigeria (2003) and Senegal (2002). As these data are on household level, a differentiation of exposure according to regions will be possible but not by age or sex. These HBS consumption data will be used to develop the final national food list which will include these above mentioned 22 foods while adding other relevant foods at national level. Each country will transform the available consumption data from as purchased to as consumed, select the foods to be included in the TDS food list, select an appropriate cooking method and the percentage of consumption of different preparation methods and varieties/brand names per food. Thereafter, different decisions need to be taken: (1) which foods are regional foods (i.e. samples to be analysed per region) or national foods (one sample per country); and (2) if emphasis will be placed on a larger coverage of foods (analyse more foods), regions (less foods but analyse the same foods in different regions), or of seasons (less foods or regions but analyse the same foods in different seasons), and (3) on the degree of compositing of foods. These decisions will mainly depend on the available budget and on the difference in expected contamination. Participants are aware that compositing may mask a potential high contamination of one food in a composite sample.

If consumption data were available at regional level, exposure could be calculated at regional level. In this case, countries need to take this aspect into account when deciding if foods will be analysed as a composite of several different foods (e.g. different fruits) or individually (per food). If major foods were consumed in different amounts per region and analysed individually, regional differences in exposure could be demonstrated.

**It was decided that foods will solely be sampled in cities.**

A first budget estimation (estimated to be between 200,000 to 400,000 US$) revealed that in total, **each country will be able to analyse about 90 food samples**.

It was decided to place the first priority on heavy metals and minerals, on mycotoxins (aflatoxin B and G) and POPs (only PCBs and organochlorine pesticides). While pesticides, veterinary drug residues and others chemicals in food were recognized as potential health hazard, the additional cost for analysis will be taken into account before deciding on the final list of chemicals to be analysed.

A proposal for governance including constrains, general organisation and elaboration phase of the RTDS project proposal were discussed and adopted (annex-4).

The draft project proposal developed during the workshop (annex-5) was based on the information received from the five countries on their situation in terms of health risk from chemical contamination.

## Closing remarks

Dr Philippe Verger, Dr Ruth Charrondière and Pr Max Feinberg thanked all the participants for their enthusiasm and contributions during the 5-days workshop. They acknowledged Pr Dominique Baudon for the local arrangements and efforts in making the workshop run well. Pr Dominique Baudon agreed to help coordinating the Regional TSD as the General Director of Centre Pasteur of Cameroon on the behalf of the Ministry of Public Health in Cameroon. All of the lecturers and participants expressed the hope that the workshop being a starting step for strong foundation for future collaboration among all of the organizations present; as well as among participants to conduct TDS in Sub-Sahara Africa.

# 5. Annex -1: List of participants and lecturers

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# 6. Annex -2: Agenda

**Training Workshop Agenda**
**held in Yaoundé-Cameroon (1st - 5th march 2010)**

| **Day-1 / Monday -1st March 2010** | | |
|---|---|---|
| **Time** | **Activity** | **Person in charge /Lecturer** |
| 8h00 | Reception of participants | Marie Madeleine Gimou (MMG) |
| 8h30 | Introduction of participants | - |
| 9h30 | Objectives and planning of the Workshop | Philippe Verger (PV) |
| 10h | *Coffee break* | |
| 11h | Risk analysis : Health effects | PV |
| 11h30 | Risk analysis : Economic and Trade aspects | Jean Martin ETOUNDI |
| 12h | *Lunch* | |
| 12h45 | Scientific risk assessment process | PV |
| 15h | *Coffee break* | |
| 15h30 | Food consumption data: usefulness and practical use<br>Food consumption : Data sources<br>Sampling Exercise per country | PV<br><br>Ruth Charrondière (RC) |
| 17h30 | End | |
| **Day-2 / Tuesday March 2nd 2010** | | |
| 8h30 | Sampling exercises restitution<br>Chemical contaminants identification per country<br>Introduction to the CCRABE principle | Max Feinberg (MF)<br>PV |
| | Importance of a Regional TDS (RTDS)<br>GEMS/Food consumption Cluster Diets | MF<br>PV |
| 10h00 | *Opening Ceremony* | |
| 12h30 | National and Regional management of RTDS | PV |
| 13h00 | Proposition for governance and coordination of the RTDS | PV<br>MF |
| 13h30 | Sampling Plan - Sampling preparation<br>Food purchasing instructions – Food preparation<br>Practical aspects and logistics | MF |
| 15h30 | Coffee break | |
| 16h | TDS – Yaoundé/ Cameroon experience<br>(History and results) | MMG |
| 17h30 | End | |

| | | |
|---|---|---|
| **Day-3 / Wednesday March 3rd 2010** | | |
| 8h30 | Data on chemical contaminants<br>( Senegal, Burkina Faso, Mali, Nigeria) | Orish Ebere Orisakwe |
| 9h15 | Summary of ongoing situation per country<br>Potential contaminant problems<br>Food consumption data available per country<br>Existing laboratories per country | Senegal, Mali, Burkina Faso, Cameroon, Nigeria |
| 10h00 | Coffee break | |
| 10h30 | RTDS : Scientific components | PV and MF |
| | RTDS : Proposal for governance | PV and MF |
| 12h30 | Lunch | |
| 13h30 | Food consumption data source<br>Sampling Exercises | RC |
| | How to develop your own country TDS food list<br>Practical exercises (Cluster J)<br>Cameroon exercises (Food consumption data) | RC |
| 15h30 | Coffee break | |
| 16h00 | How to develop your own country TDS food list<br>Practical exercises (Cluster J)<br>Cameroon exercises (Food consumption data) | RC |
| 17h00 | Analytical methods – Quality Assurance | MF |
| 17h30 | End | |
| **Day-4 / Thursday March 4th 2010** | | |
| 8h30 | Analytical methods – Quality Assurance<br>Food analytical Laboratories<br>Criteria for choosing a lab | MF |
| 10h30 | Coffee break | |
| | Practical exercises Cluster J – Food consumption data calculation on Excel sheet - Food list | RC<br>MF |
| **12h30** | Lunch | |
| 13h30 | Per country : Practical exercises Cluster J – Food consumption data calculation on Excel sheet - Food list. | All |
| 15h30 | Coffee break | |
| 16h | RTDS Draft proposal | All |
| 17h | RTDS governance and coordination : Discussion | All |
| 17H30 | End | |
| **Day-5 / Friday March 5th 2010** | | |
| 8h30 | RTDS governance and coordination : adoption | All |
| 10h30 | Coffee break | |
| 11h | Conclusions | All |

| | | |
|---|---|---|
| 12h30 | Lunch | |
| 13h30 | End of the workshop and departure of the participants | - |
| 17h30 | Training workshop: Redaction of the report | RC, PV, MF, MMG |

# 7. Annex 3: Context and justifications for national strategic priorities

## Burkina Faso

**Short Presentation**

Located in the middle of West-Africa, more precisely in sub-Saharan Africa, Burkina Faso is a landlocked country. Its size is about 274, 200 km ² and shares common borders with Mali, Côte d'Ivoire, Togo, Ghana, Benin and Niger with a population estimated at 13,902,972 inhabitants, and a general growth rate of 2.64 % per year and a density of 48 inhabitants per km ² (INSD, on 2006). Burkina Faso has a Sudanian climate, due to its geographical situation, divided into two main seasons: a long dry season which lasts 7 to 8 months from November to April and a rainy season lasting for a period of five months from May to September. The temperatures vary between 16 to 45 degrees Celsius with an average annual rainfall of 300 mm (in the North) and 1,200 mm (in the South).The economy of Burkina-Faso is mainly based on agriculture and cattle breeding, involving about 86 % of the working population and contributing to more than 32 % in the Gross Domestic Product (GDP). Its agriculture is extensive and very little funds are allocated to that activity essentially based on rain crops. In fact, despite its apparently low implication in the economy looking at the high number of its rural population, agriculture still remains the cornerstone of economic growth, since many of the activities conducted in the other sectors are based on agriculture. In Burkina Faso, agriculture is specifically based on cereal crops (corn, sorghum, millet, rice, etc.) and breeding (cattle, goats and sheep) and poultry. The industrial activity is less developed and concentrated in certain part of the country, mainly Bobo- Dioulasso and Ouagadougou.

**Brief description of an existing Food Safety system, its role and its difficulties**

Many laboratories working in food quality monitoring exist in Burkina Faso and they generally check exportation products. Foodstuff intended to national consumption often undergoes little monitoring unless on the initiative of the owner (instigator), it is a free-will approach. Only the public health national laboratories (LNSP) of the Ministry of Health and the laboratories of the General Inspectorate of Economic Affairs (IGAE) have the ability to check food contamination risk, to set up regular observations systems, to measure or to assess substances or microbes which presence in or on foodstuffs could be harmful for the health of the populations.

**Potential chemical contaminations problems**

The presence of chemical and biological contaminants in the population's consumption products represents a serious threat for their health and for the socio-economic development of the countries. There are essentially mineral pollutants made up of heavy metals, toxic trace elements, nitrates and nitrites, phytosanitary products, residues of veterinary products and mycotoxins. Their presence in food is due to pollution and environmental conditions, the industry and the excessive use of chemicals in food production and processing and therefore to human activity.

In Burkina Faso, environmental pollution is generally attributable to the mismanagement of household's and biomedical waste, to the anarchical use of fertilisers, pesticides and their impact, to the industrial waste and the natural reserves of heavy metals. The solid waste produced such as plastics are either scattered on the ground or burned by the inhabitants, or taken to unchecked dumps.
The same is also true for waste water and septic tanks poured in rainwater evacuation pipes leading to environmental pollution and to spread of diseases. The impacts of pesticides and fertilisers in air, soils, vegetations, surface and groundwater are less related to the quantities used than to the types of imported products. With the development of agricultural activities there is an increasing anarchic introduction of pesticides and fertilisers which are, either expired or not complying with the current international standards. The situation gets worse with the development of gold mining giving rise to the use of the processing extraction methods involving heavy metal-based products like mercury and arsenic. In the absence of a strict processing agreement on waste elements and the above-mentioned procedures, the risk of soil, ground and surface water contamination becomes a threat for the populations living in these areas. Some of these practices were questioned when the populations and the animals were poisoned in the North and Sahel regions. This situation is likely to favour the introduction of many chemical contaminants in foodstuff coming from agriculture, animal and forests consumed by the population.

The climate and environmental conditions in Burkina Faso often characterised by high temperatures and high level of humidity, the malicious practices in relation with harvest and preservation facilitate the proliferation of moulds such as *Aspergillus, Penicillium* and *Fusarium* present in many foodstuff like corn, groundnut etc. in certain region of Burkina Faso.

The strong demand in high consumption products contributed to modify in agricultural practices so as to redirect these practices toward an increasing productivity and distribution systems involving several people (intermediaries). The bad practices of agricultural productions (BPAP), transportation and storage procedures, the trivialization of the use of prohibited or authorised preservation products in inappropriate dosage (too much or low) become rampant. The considerable number in the import of certain staple commodities (oil, rice, milk, sugar, etc.) with suspicious origin, call for the vigilant eye of the administration to check some of the potential contaminants of these products. Some exportation products like groundnut, honey, cotton seeds are often rejected because they contain harmful molecules due to environmental pollution or bad agricultural practices. All these practices represent biological and chemical threats for the environment, the health of consumers and the export of certain products. The risk of people being contaminated by the food chain remains therefore a constant concern.

**Description of food consumption data (i.e. Household budget survey),**
The last survey on food consumption conducted at the national level was in 1998. There are also data obtained from located geographical surveys. A survey on households' food consumption was carried out in the city of Ouagadougou in the framework of the project Alisa. In 2009, a survey on cereal crops consumption was also conducted with 217 households in the city of Dori and its neighbouring villages.

**Description of the structure able to carry out TDS**
To date, Burkina Faso does not have laboratories accredited for the analysis of chemical contaminants like pesticides, heavy metals and mycotoxins. However it does have many State-

approved laboratories to conduct analysis on the nutritional composition and some chemical and microbiological food contaminants. These laboratories are listed in the following ministries: the Ministry of Higher and Secondary Education and Scientific Research (MESSRS), the Ministry of the Animal and Fishing Resources (MRAH) and the Ministry of Health (MS). For the study of an exhaustive foodstuff, the laboratories of Foodstuff Technology Department (DTA) of the Research institute in applied Sciences and Technologies (IRSAT) and that of the National Centre of Scientific Research and Technology (CNRST) have a broad experience in the monitoring of foodstuff originating from vegetable, animal and forest. These laboratories of the DTA established in 1991 and called Laboratory of Biochemistry and Food Technology (LBTA) were restructured in 1997 to become the Food Technology Department has been involved since 2005 in a process of accreditation of its laboratories in order to carry out analysis of some physical, chemical and microbiological parameters. Many researchers and technicians are present in this department which is equipped with laboratories allowing them perform several biochemical, chemical, technological and microbiological analyses.

**Conclusion**

For a society to run smoothly and its population to benefit from a good health, it is vital to have access to a healthy and nourishing diet. However, harmful chemical contaminants such as aflatoxin, pesticides, heavy metals, residues of veterinary products present in foodstuff constitutes a threat for the population's health in Burkina Faso just like in other countries. Their presence in foodstuff intended for export purposes is a stumbling block to business and trade at the regional and international level. Unfortunately, in Burkina Faso, there is a lack of pertinent and reliable data allowing a better appreciation of the national situation. There is no systematic monitoring of foods for local consumption and for export. It is therefore important to know the levels of the chemical contaminants in foodstuff consumed frequently, to make an assessment of the populations exposed to these harmful chemical contaminants with the aim of mastering the preventive actions to be taken.

## Mali

**Presentation**

Mali is a soudano-sahelian country with an agro pastoral economy. Approximately 80% of the population practice agriculture or fishing. The main food crops are cereals and principally millet, rice, sorghum, niébé (beans), corn, and groundnut. Cotton and mango represent the main export products.

The chemical contaminants found in cereals in Mali are pesticides, mycotoxins and heavy metals. Pesticides used in the storage process of cereals (mainly marathon and profenofos) may constitute a real hazard for consumers' health as well as herbicides and insecticides used in the primary production.

Rice with millet, sorghum and corn represent the major cereals consumed in Mali. The national production of rice is estimated at 600 000 tons, which doesn't meet the national needs of approximately 900 000 tons per annum, and also part of this national production is exported. Thus, more than the third of the rice consumed in Mali comes from import and generally from the industrialized countries such as Japan, United States, China, Thailand and India whose environment suffers from pollution by heavy metals. Also, the development of mining industry in Mali results in the production of a significant quantity of sterile materials and rock residues

constituting a potential source for pollution of the hydraulic resources and rivers by heavy metals such as lead and cadmium.

The climatic conditions in Mali are in favor of the development of aflatoxins in food, mainly in cereals; and aflatoxin B1 is the most harmful compound for human and animal health by its frequency and its toxicity; it is responsible for several cancers, in particular liver cancer.

**Potential chemical contaminations problems**

The occurrence of antibiotic residues in milk and meat becomes increasingly worrisome because of the self-medication practices and the non-respect of withdrawal periods (due to products residual) by stockbreeders. In addition, there is a diverted use of pesticides in the transformation and preservation of fish in Mali.

The weak training of the farmers by technical departments on good agriculture practices and fraudulent uses may cause an uncontrolled use of pesticides in cereal production, as well as in vegetables-farming and fruit-farming by the farmers; all these may constitute a real hazard for consumers' health.

In addition, the contamination by gossypol of the oil produced in Mali from cotton grains becomes alarming because, in 2005 at the Codex Alimentarius Committee session hold on Nutrition and Diet Plan in Germany, the cotton seed oil was withdrawn from infant food formulas because of the occurrence of this pigment. Mali was asked to bring scientific data proving harmlessness of this oil. The Malian Food Safety Agency completed a first study in 2008 entitled: "Evaluation of sanitary risks related to the presence of gossypol in the cotton seed oil consumed in Mali". The results of this study revealed the presence of gossypol at different concentrations, going from 5 to 14 mg/kg for total gossypol and lower than 5 mg/kg for free gossypol; there is a zero tolerance limit for gossypol. This problem requests a particular analysis by the regional TDS.

**Conclusion**

Food intoxication is a public health concern in Mali; thousands of people may suffer from serious complications or die after consuming contaminated foods. As no TDS was carried out in Mali so far, the planned TDS will enable the country to evaluate the exposure of the Malian population and on the other hand, it will provide a scientific database on contaminants and will make Malian foodstuffs competitive in the world market.

## Senegal

**Short Presentation**

The Republic of Senegal, with a surface of 196 200 $km^2$, is situated at the far west of the African continent, at the Atlantic Ocean front. This country is limited in the north by Mauritania, in the east by Mali, in the south by Bissau Guinea countries.

Senegal is a soudano-sahelian country with an agro pastoral economy like many others West African countries. Despite the short raining season (3 to 4 months), agriculture is practiced almost by 80% of the active population and contribute for 20% of the GDP estimated to 4 000 billion FCFA (about 8 billion USD) in 2004. The main food crops include peanuts, millet, sorghum, rice, corn, niebe beans, cassava, water melons, sugar cane, industrial tomatoes, gardening products and cotton. Horticulture plays an increasing role in the fight against poverty and commercial balance. This production should fit with international regulations and in particular with the EU directive on vectors for introducing invasive organisms.

**Food safety situation**

In Senegal, food safety system suffers from many dysfunctions that do not guarantee food quality:

- The involvement of multiple institutions (ministries, laboratories, private institutions, NGOs, consumers associations….),
- The lack of a coordinating body,
- The inadequacy of regulation and legislation
- The lack of human resources and finance
- The lack of an information and communication system

While the population continue to suffer from food-borne diseases and from economic losses as a result of rejected food exports due to shortcomings in food safety.

**Potential chemical contaminations problems**

The country is faced with a constant and important increase of the population leading to an increase use of chemicals to increase the yield of agricultural production (598 tons of solid pesticides and 1 336 560 liter of liquid ones per year). Among the 300 formulation of commercial pesticides available only 189 were approved par the CILSS in June 2002. The use of these pesticides can exceptionally increase notably in case of the insect invasions.

Many studies have been carried out in Dakar/Senegal to assess the level of POPs (PCBs, dioxins and furan) in the environment and in egg. Egg samples were collected from free-living chickens in the neighborhood of the waste discharge, suspected as a potential source of POPs in Senegal. The results showed a dioxin contents 11 times higher and a PCB content 1.7 times higher than the European normal background values.

Animal production is being intensified raising some concerns on the use of antibiotics and other growth promoters. The main health problem is due to penicillin, tetracycline, sulfonamide and chloramphenicol residues in meat which gives the raise of drug allergies and resistance.

Nitrates are widely used as fertilizers and are potential water and environment contaminants. When absorbed by young children and animals, they can be responsible of the methemoglobinemia.

**Conclusion**

This RTDS will provide Senegal with scientific data necessary to set up a process of risk management of food contaminants and related risk communication, not only to protect Senegalese population health but also to secure food products exported from Senegal to other regions of the world.

## Cameroun

**Presentation**

The Republic of Cameroon, located at the bottom of the Gulf Guinea in Central Africa is sometimes described as "Africa in miniature" because it exhibits all the major climates and vegetation of the continent: mountains, desert, rain forest, savanna grassland, and ocean coastland. Cameroon can be divided into five geographic zones. These are distinguished by dominant physical, climatic, and vegetative features. Cameroon's landmass is 181.252 sq mi (469.440 $km^2$), with 2.317 sq mi (6.000 $km^2$) of water. The highest point is Mont Cameroon in the southwest, and the largest cities are Douala, Yaoundé, and Garoua. Cameroon is home to over 230 different ethnic and linguistic groups. English and French are the official languages.

According to 2010 census figure, Cameroon counts 19.406.100 inhabitants, and has a mean population density of 40 inhabitants/$km^2$. About 57 % of this population lived in urban areas

and 50 % are under eighteen; infantile mortality rate is 74/1000 live births, life expectancy is around 52 years. Population growth is 2.2 % (BM, 2006), Rate of literacy (15 years and more): 67.9 % (2004) (PNUD). The part of the areas of activities in the Gross Domestic Product: - agriculture: 19 % - industry: 30 % - services: 49 % (BM, 2007) Growth rate: 3.8 % (2008).
The main industries include petroleum production and refining, aluminum production, food processing, light consumer goods, textiles, lumber, ship repair nevertheless large numbers of Cameroonians live in poverty as subsistence farmers.

**Food safety activities related to chemical contaminants**
In Cameroon a national committee was created in 2009 with the aim to coordinate, organize and improve *Codex Alimentarius* and Food Safety activities. The very recent TDS, carried out in Yaoundé, focused on pesticide residues in the urban area of Yaounde. The dietary exposure to authorized pesticides seems to be low in this area which needs to be confirmed for the other parts of the country. The development of the "urban agriculture" without professional framing for GAPs together with the existence of high amounts of prohibited pesticides is a potential concern for public health. For other chemicals no data are available for Cameroon, but analysis of minerals and heavy metals is underway of the TDS samples from Yaoundé.
The strategic priorities according to the above committee reports include: a)-mycotoxins because of the importance of cereals in the production and in the national consumption and because of the importance of cocoa and coffee for the economy of the country; b)-Heavy metals resulting of the development of industry and a poor organization of waste management are an emerging issue in urban areas; c)-POPs notably in the North part of the country were these substances were identified as stockpiles of obsolete pesticides or as combustion by-products.

**National consumption data available**
In Cameroon, national consumption data can be extracted from a national database of the second (2001) or of the third (2007) Cameroonian Household Budget Survey carried out by the National Institute of Statistics called "Enquête Camerounaise Auprès des Ménages, (ECAM II or III)". The objective of this survey was to evaluate household expenditures in order to assess and characterize the poverty line in the whole country. Expenditures food products of households can be transformed to 'foods as consumed' per adult equivalent (AE) using a price database, age and sex specific adult equivalent factors, and edible and yield coefficients.

**Description of the Centre Pasteur of Cameroun**
Centre Pasteur of Cameroon is a Public Administrative Institute endowed with a financial autonomy under the double tutelage of the Ministries of Public Health and Finance. This institution was created in 1959. It is also a member of The International Network of Pasteur Institutes and shares in her principal mission the fight against diseases. Towards this objective, it assures four missions which are strongly interwoven and have mutual potentials: service delivery, public health interventions, research and training.
The Service of Hygiene and Environment, physicochemical section of Centre Pasteur of Cameroon conducted in 2006 a TDS in Yaoundé-Cameroon, to estimate the dietary exposure of the population to pesticide residues. This study was made possible by a grant from the FAO and the French Food Safety Agency (AFSSA). On the other hand the FAO (Nutrition and Consumer Protection Division) in 2009, financed, with the collaboration of the AFSSA, the pursuit of the Yaoundé TDS to assess the dietary exposure to 20 heavy metals and minerals. This Service is also involved in the writing of the reference book on TDS worldwide in 2009 under the initiative of Drs Gerald G. Moy and Richard Vannoort.

The organization of the Regional training workshop was a great opportunity to share its experience with others countries in sub-Sahara Africa and to elaborate a common TDS project to be submitted to the STDF for funding.

## Nigeria

**Context**

Located in West Africa, Nigeria has a population of about 140 million people according to the 2006 census figure. Approximately 75% of the population is women and children, with over 70% residing and securing their livelihoods in the rural areas. Administratively, the country consists of 36 states, a federal capital territory and 774 local government areas (LGAs). A three-tier government system is being implemented: federal, state and local government levels. This administrative structure is meant to promote development at the community level. Nigeria is a nation with diverse cultures, ethnicity, and religious and political interests.

There are estimated to be over 250 ethnic groups. The largest groups are Edo, Fulani, Hausa, Ibibio, Idoma, Igbo, Ijaw, Kanuri, Tiv, and Yoruba. Nigeria covers a total area of 923,800 sq km (356,700 sq mi) with terrain that ranges from southern coastal swamps to tropical forests, open woodlands, grasslands, and semi-desert in the far north. The highest regions are the Jos Plateau 1,200-2,400 meters above sea level and the mountains along the border with Cameroon. The annual rainfall ranges from 381 cm along the coast to 64 cm or less in the far north. The most populous country in Africa, Nigeria accounts for over half of West Africa's population. Although less than 25% of Nigerians are urban dwellers, at least 24 cities have populations of more than 100,000. The variety of customs, languages, and traditions among Nigeria's 250 ethnic groups gives the country a rich diversity.
With a life expectancy of 46 years and under age 5 mortality rate of 197/1,000 live births, Nigeria’s environmental burden of diseases [DALY’s/1000] per year range from 34 for diarrhea, 25 for respiratory symptoms, 27 for malaria to 1.9 for intentional injuries.

Contaminated air, food and drinking water are particular environmental factors affecting children in developing regions of the world. An estimated 1.7 million deaths per year globally are attributed to unsafe water, sanitation, and hygiene; 9 out of 10 of these deaths occur in children, and nearly all of these occur in developing countries. Even if most of the determining processes leading to these diseases are multi-factorial, there is increasing evidence that these diseases are influenced by environmental factors.

In Nigeria, the data being currently used in nutrition circles are drawn from different surveys of diverse or different methodologies and techniques, or notably focused on specific aspects of nutrition. Some of such data come from the Nigerian Demographic and Health Survey (NDHS 1990), the Participatory Information Collection Study (PlC 1993), the Multiple indicator Cluster Survey (MICS 1995), and the Benchmark Survey (BMS 1996), among others. Some of these are often confined to a segment of the population, which may not include all groups most at risk. Inevitably, the design of any relevant action plan to mitigate the problem of contaminants and total dietary intake will be constrained by not knowing how many people are affected, who they are, their location in the country, or to what extent they are affected.

Vegetables, eaten fresh or boiled, are an important diet relished in many local Nigerian cuisines and delicacies. Increasing their production has therefore become a prime focus of governments in Nigeria. In the process of production, metals capable of impairing the health of consumers are inadvertently picked up. The levels of nickel in five different edible vegetables, *Talinum triangulare, Celosia trigyna, Corchorus olitorus, Venonia amygydalina and Telfaria accidentalis,* and the soils in which they were grown, from three industrial and three residential areas of Lagos City, Nigeria, have been determined. Flooding from heavy downpours may lead to horizontal leaching from dump sites causing metal uptake by roots of crops; the rest may find their way into open water areas and the entire aquatic ecosystem. Entry of these metals into the food chain leads to increased susceptibility and exposure to metal poisoning of the local population. As the dump sites occupy a very large part of people's farmlands, eating vegetables and fruits harvested from these farmlands could pose serious health risks.

Studies of metal contamination and infiltration profile into soil from solid waste disposal sites in Nigeria have been carried out by several researchers. Heavy metals in food samples have been found to be positively correlated with soil contamination. Solid waste dump sites also have an impact on food samples such as vegetables, spinach (*Amanthus hydbridus*), fluted pumpkin (*Telfairia occidentals*), root crops and cocoa yam (*Xanthosoma sagittifolium*) in Awka South East, Nigeria. This entry and eventual contamination of the food chain is a serious public health concern (Nduka *et al* 2008).

Orisakwe and co-workers (2004) reported high levels of lead in aerial fruit harvested near an industrial area in Nigeria. High levels of lead, cadmium and arsenic which have recently been reported in some canned and non-canned beverages in Nigeria are of public health importance (Maduabuchi *et al* 2006). There is therefore a need to carry out a total dietary survey in Nigeria in order to estimate the size of dietary contamination since what exists at the moment is a mere quantification of contaminants in individual/separate food substances.

**Justification**

Food contamination is an index of environmental pollution which no doubt hamper agricultural yield of crops. Timely intervention will ensure food security.

Early detection will not only lead to policy formulation and environmental remediation but will also suggest biomonitoring which will concomitantly improve the health of the population as environmental burden of diseases has been found to affect disability life adjusted years DALYS and life expectancy. The average life expectancy in Nigeria has plunged from 56 years at the turn of this millennium to about 43 years only recently.

The man-hours lost due to ill-health in Nigeria are feared to occur due to the fact that most times *"the things we eat are the things that eat us up"*. This study will provide a scientific framework to address this problem with the twin benefits for both the health and manpower generation.

# 8. Annex 4: Proposal for governance for a Total Diet Study in Sub – Saharan Africa

## Human resources

- ***The participants agreed on a coordinator.***
  - ❖ Marie Madeleine Gimou (Centre Pasteur du Cameroun)
- ***The management board (to be done) will involve***
  - ❖ One person from each country.
    - Public relations with the national administration
    - Paperwork with the administration
    - Finding support and/or funding
- **The study will include both scientists and decision makers in the field of food safety and/or public health.**
  - ❖ Scientific Advisory Board
    - External people selected for their competence
    - Reviewing the project
  - ❖ Drafting Board
    - Quantify the national contribution to the budget
    - Set up the national sampling plan

## General organisation

The project includes a coordinator, a management board, a scientific board and a drafting group. Their tasks are listed below.

- Coordinator: responsible for submitting the proposal, responsible to coordinate between countries.
- Management board: composed of 1 representative for each country, preferably from risk management side. Members of Responsible to bridge between the project coordination and the national authorities. Responsible for proposing the national strategic priorities to the coordinator.
- Scientific advisory board: composed of 5 experts from risk assessment or academic side. Responsible to check the technical feasibility of proposed strategic priorities. Responsible to advise the management board on the financial adequacy of the proposed priorities.
- Drafting group: composed of 1 representative for each country, preferably from risk assessment or academic side. Responsible to ensure the consistency and the homogeneity between the national proposals.

## Elaboration phase

After the meeting in Yaoundé the participants will propose to the coordinator a country representative to participate in the management board, the scientific board and the drafting group. Each of the advisory bodies should nominate a chairperson. The exchanges will occur only by emails. The participants in the Yaoundé meeting produced a first draft of the proposal.
The drafting group will revise the document prepared during the Yaoundé meeting. Each country representative member of the drafting group will circulate the draft at national level for comments. The second draft will be send to the coordinator, FAO and WHO for comments. The project should be finalized for the 30th of July 2010.

# 9. Annex-5: Draft proposal Project for a Total Diet Study in sub-Saharan Africa

## Consumption

A list of foods was established based on two convergent approaches:

- At regional level a list of 22 foods consumed in the region including Sorghum, Cassava, Millet, Maize, Wheat, Milks, Yams, Rice polished, Peas dry, Rice husked, Fruiting vegetables others than cucurbits, Soya bean (dry), Citrus fruit, Plantains, Oilseed, Sugar refined, Potatoes sweet, Meat (Mammalian), Bulb vegetables, Soya bean (immature seeds), Tomato, drinking water.

- At national level, a complementary list is to be added.
- The final food list for the TDS should be based, as much as possible, on local food consumption data.

**To be done** by the Drafting Group members:

- Define the number of national samples vs. regional samples.
- Convert "food as purchased" as "food as consumed". Check values for local use.
- Decide on foods for complementary lists.
- Build composite samples using Household Budget Survey (HBS) data.

**Population of interest: Target population**

No individual consumption surveys are available, therefore no age and sex differentiation can be done.

**Consumption Survey methodology (to be explained in more details)**

- 1. priority: Household budget surveys (HBS)
- 2. priority: Food balance sheets (FAO) or WHO cluster diets

**To be done** by the Drafting Group members:

- Get back the available data from HBS. Depends on the country where these data are available.
- Decide how many "regions".
- Difficult to focus on grown up or children because the HBS data do not permit to do that.

## Food sampling plan/design

Recall that for TDS we use foods "as consumed". Calculations were made for food selection.

**To be done** by the Drafting Group members:

- Define and document (written) national cooking methods for cooked foods.
- Establish percentages of each food item introduced in a composite food.
- Decide for brand names/varieties of foods.
- Decide on sampling points.
    - Select cities/regions/districts. Rather focus on urban centres because sampling costs can reduced due to the limited amount of funds.
    - Retail places, such as markets, shops, regional markets.

## Concentration

All documents sent by participants will be merged
**To be done** by the Drafting Group members:

- Check if they agree with the final document.
- And correct errors.

## Risk

Reminder: the objective of TDS is to identify national health problems.
The following pollutants are selected in order of priority

- **Mycotoxins as total aflatoxin (B &G).** Aflatoxin M1? Decision to be made depending on the price of the analysis. Maybe organise a probe on a limited number of samples.
  - *Ochratoxine A*, *zearalenone*, etc are discarded.
- **Heavy metals. Pb, Cd, Fe, Ni, Zn, etc**.
  - Hg and As can be added depending on the fish consumption: only predator fishes can be hazardous.
  - Se (?).
- **Pesticides**. It is assumed that the budget will too restricted for the analysis of
- **Drug residues**. Establish a collaboration with a laboratory specialized in controlling these molecules. Adapt the sampling plan in order to send samples to this lab.
- **POP: Only PCBs (+ organochlorine pesticides)** not dioxins or furans
- **Gossypol** in cotton oil. To be decided on the complementary list by each country.

## Analytical methods

Which laboratory?
Call for expression of interest
**To be done** by Coordinator:

- Prepare a preliminary call for offers for preparing a realistic budget for the project.
- Insist on analytical data quality and on the capacity for storage.
- Logistics capacity.
- Data interchange format and traceability.

## Budget

The total estimate cost of the project is between **200 000 -400 000 US$.**

## Economy

All documents sent by participants will be merged.
**To be done** by the Drafting Group members:

- Check if they agree with the final document.
- And correct errors.