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Inventory on the dietary assessment tools available and needed in Africa: a prerequisite for setting up a common methodological research infrastructure for nutritional surveillance, research and prevention of diet-related non-communicable diseases

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ABSTRACT

Objective: To carry out an inventory on the availability, challenges and needs of Dietary Assessment (DA) methods in Africa as a pre-requisite to provide evidence, and set directions (strategies) for implementing common dietary methods and support web-research infrastructure across countries.

Methods: The inventory was performed within the framework of the “Africa’s Study on Physical Activity and Dietary Assessment Methods” (AS-PADAM) project. It involves *International Institutional* and *African networks*. An inventory questionnaire was developed and disseminated through the networks. Eighteen countries responded to the dietary inventory questionnaire.

Results: Various DA tools were reported in Africa, 24-Hour Dietary Recall and Food Frequency Questionnaire were the most commonly used. Few tools were validated and tested for reliability. Face-to-face interview was the common method of administration. No computerised software or other new (web) technologies were reported. No tools were standardised across countries.

Conclusions: The lack of comparable DA methods across represented countries is a major obstacle to implement comprehensive and joint nutrition-related programmes for surveillance, programme evaluation, research and prevention. There is a need to develop new or adapt existing DA methods across countries by employing related research infrastructure that have been validated and standardised in other settings, with the view to standardizing methods for wider use.

Keywords: inventory, dietary assessment, tools, Africa, AS-PADAM

INTRODUCTION

Africa is currently experiencing a major health transition, attributable mainly to rapid urbanization and accompanied by the emergence of Non-Communicable Diseases (NCDs) and the Human Immunodeficiency Virus /Acquired Immune Deficiency Syndrome (HIV/AIDS)

pandemic, while under nutrition and other infectious diseases are still highly prevalent (Boutayeb, 2006; Delisle et al., 2011; Delisle et al., 2012; Pisa et al., 2012; Popkin, 2009; Popkin et al., 2012; Steyn et al., 2012; Vorster, 2002; Vorster et al., 2011). This transition is also associated with rapid changes in dietary and physical activity patterns in populations across Africa (Aounallah-Skhiri et al., 2011; Kruger et al., 2002; Vorster, 2002; Vorster et al., 2011). Although most NCDs have been reported to be preventable through appropriate diets and physical activity, both modifiable lifestyle factors (Lim et al., 2012; World Health Organization (WHO), 2004; World Health Organization (WHO), 2013), in sub-Saharan Africa, the prevalence of NCDs is increasing exponentially and expected to account for three-quarters as many deaths as communicable, maternal, perinatal and nutritional diseases by 2020 and to exceed them as the most common cause of death by 2030 (World Health Organization (WHO), 2013). Little is known about nutrition and physical activity as determinants for NCDs, including cancer, in Africa. One of the main drawbacks to implementing research on diet and/or physical activity-related NCDs is the lack of reliable dietary and physical activity methodologies. Furthermore, reliable and standardized tools are needed for measuring, monitoring, comparing the different stages of transition across countries and investigating their association with diseases in order to inform policies. Lack of reliable and comprehensive evidence on dietary intakes is a major constraint for guiding action and assessing trends in dietary patterns (Micha et al., 2012). The Dietary Exposure (DEX) assessment group at the International Agency for Research on Cancer (IARC) an integrated part of the World Health Organization , has been part of and has long-standing experience in the development, standardization, validation and implementation of dietary methods and analyses of dietary exposures in international epidemiological and

monitoring settings relevant for cancer and other NCD research and prevention in Europe (Al-Delaimy et al., 2005; Crispim et al., 2011a; Crispim et al., 2011b; Crispim et al., 2012; Crispim et al., 2013; de Boer et al., 2011; Huybrechts et al., 2011b; Slimani et al., 1999; Slimani et al., 2002; Slimani et al., 2007; Slimani et al., 2011). Through existing and newly initiated international and national partnerships (some that are existing and others still under development), this group (DEx) intends to support and address the major methodological and infrastructural challenges facing low and middle-income countries (LMIC) including those in Africa, and to support the implementation of a global nutritional surveillance system within the broader WHO action plans on the control and prevention of NCDs (World Health Organization (WHO), 2008). In 2011 with this objective in mind and building on its previous experience, DEX established Africa's Study on Physical Activity and Dietary Assessment Methods (AS-PADAM) project with several partners at National ("*African Network*") and International ("*International Institutional Network*") levels. This paper aims to report an inventory on the availability, challenges and needs of dietary assessment methods as a pre-requisite to develop strategies and approaches for the implementation of common dietary assessment methodologies, and to support e-research infrastructures across African countries for research, monitoring surveillance and prevention on diet-related NCDs. Ultimately, this initiative should provide decision makers, stakeholders and scientists, at national, regional and international levels, with more standardized dietary data sets being comparable across countries. In this paper, only the inventory on the dietary assessment methods and related issues are reported.

METHODS

The inventory was conducted through two complementary networks established within the AS-PADAM project: the “*International Institutional Network*” and the “*African Network*”. This inventory considered the main gaps and existing needs in Africa with respect to dietary assessment methods. The African Network included African collaborators and partners. This network currently includes 23 countries; composed and being represented mainly by invited academics, organizations and research groups with relevant experience in the areas of nutrition and physical activity research in African settings. This network was created mainly by the following procedures: (i) inviting different African scientists with known expertise in the areas of dietary and physical activity method research, (ii) inviting different African partners/researchers through the African Nutrition Leadership Programme (ANLP), (iii) using relevant search engines such as PubMed to identify and invite the relevant people currently working and those who have previously worked in this area of research in Africa, and (iv) inviting partners through other international institutional networks involved in the project (e.g. World Public Health Nutrition Association (WPHNA)). Their specific tasks in the inventory included completing a questionnaire inquiring on availability, quality and challenges of dietary assessment methods/devices in their countries and distributing it to other relevant partners, as appropriate.

Of the 23 African countries that initially accepted to be part of this initiative, 18 responded to the dietary inventory questionnaires and are grouped by region as follows: 1) ***North Africa***: Algeria, Egypt, Morocco and Tunisia; 2) ***West Africa***: Benin, Burkina Faso, Cameroon, Ghana, Nigeria and Senegal; 3) ***Southern Africa***: Malawi, Mozambique, Namibia, South Africa and Zimbabwe; and 4) ***East Africa***: Kenya, Sudan and Uganda.

At this stage of the project, the “*International Institutional Network*” had specific tasks to assist in and comment on the design and content of the dietary inventory questionnaire developed by DEX and to interpret the intermediate outcomes. This network is composed of international institutions and associations that have experience in the field of dietary assessment methods and/or experience in developing countries or African settings i.e. the ANLP, WPHNA, Food and Agriculture Organization (FAO), the Institute of Research for Development (IRD) (France), the Centre of Excellence for Nutrition (CEN) in Africa (South Africa), African Nutrition Society (ANS), The University of Montreal, Transition Nutritionnelle team (TRANSNUT) (Canada) and Alberta Health Services (Canada). All partners and institutions involved in the inventory received a detailed project proposal outlining the short, medium and long-term objective of the project before they formally agreed to take part in this initiative.

A comprehensive *ad hoc* inventory questionnaire (see supplemental file) on dietary assessment methods was developed and pre-tested within the International Institutional Network, before its wide circulation to the African Network for completion. The quality was further improved by taking into account the remarks and suggestions from selected experts in the African Network who evaluated the questionnaire. Its final version was then disseminated to the entire African Network. A thesaurus (see supplemental file) was included to define important terms used in the questionnaires to ensure a harmonised use of terminology amongst respondents. The questionnaire included open and closed questions and was structured into three sections that aimed to provide detailed information on:

- (i) “General information on the local situation” including major public health problems and challenges that nutrition research is facing;
- (ii) “Dietary assessment methods” currently being used in the countries of interest (the dietary assessment methods investigated were: food record/diary, dietary recalls, food frequency questionnaire, dietary history, direct observation, duplicated diets and biological assessments (biomarkers));
- (iii) “Research studies and/or monitoring surveys” that reported results of dietary assessment.

The questionnaire was developed and disseminated in French and English. It was sent to the International and African networks by electronic mail. Completed questionnaires were received and checked for completeness and comprehensiveness. Data were extracted into Excel databases and tables were created to summarise all findings. Summary tables were sent back to all participants and institutions to re-check, review for completeness and accuracy and to provide missing information. Since this inventory does not pretend to be ultimately exhaustive, it provides only a general indication of the current status on dietary assessment methods in African countries, as reported by the respondents.

RESULTS

Table 1 summarises general information on the dietary assessment methods, public health nutrition problems and research needs in the different African regions, as perceived and self-reported by the respondents and thus doesn't intend to be fully exhaustive. The main challenges affecting nutrition research reported were the lack of financial support, the lack of expertise

(skills), and the lack of infrastructure. Food Frequency Questionnaires (FFQ) and 24-Hour Dietary Recalls (24-HDR) were reported to be the most frequently used dietary assessment methods in the four regions. All 24-HDR reported, as well as all FFQs were paper and interview-based (except Ghana where FFQs were both telephone and face-to-face interviews).

Dietary assessment methods, Food Composition Tables (FCTs) and Food Based Dietary Guidelines (FBDGs)

Tables 2-5 provide details of the dietary assessment methods, FCTs and FBDGs used in each region. In summary, various DA tools are available, with FFQs and 24-HDRs reported to be the most predominantly used; no tools are standardised across countries; all questionnaires were paper and pencil-based; no nationally or regionally designed computerized tools nor web-based technologies; all tools were administered face-to-face by trained interviewers; the main reported barrier to self-administration was the low level of literacy; all interviewers were trained. Mostly interviews were conducted at home, but sometimes in care centres or at school. The most common way to estimate portion sizes was household measures whilst the main challenge for estimating portion size was communal food consumption in a shared bowl at household level. Most of the tools have been tested for feasibility but few have been validated (relative validity using a more precise method or objective validity using biomarkers) or tested for reproducibility/reliability.

All countries except Algeria reported a FCT, specific for their country or borrowed and/or adapted from one or more other countries. Only four out of the 18 countries reported having their own FBDGs. Details specific to a particular region are described below.

North Africa: Algeria, Egypt, Morocco and Tunisia (Table 2)

FFQs were reported in all countries and were applied to epidemiology. The reported FFQs were mainly used to assess usual intakes of nutrient or food groups. In total, six different FFQs were reported: one quantitative, three semi-quantitative, and two qualitative. All FFQs were structured by food groups. A large variation in time was reported to complete a single interview (5-30 minutes) and the reference time frame ranged between one week and one year. The number of food items varied between 8 and 268. Most foods included were based on previous dietary surveys. Only Tunisia and Morocco included recipes and dietary supplements. Three out of the six reported FFQs were validated [Tunisia: objective validation using biomarkers and relative validation using a more precise tool; Morocco: relative validation using a more precise tool] and tested for reliability (El Ati et al., 2004).

24-HDRs was used in all countries except Algeria and applied to epidemiology, monitoring and nutrition interventions. All reported 24-HDR were used to assess usual nutrient intakes. 24-HDR from Egypt and Morocco were structured by meal occasions and that from Tunisia by food groups. Duration of interview completion ranged from 10 to 30 minutes. Portion size estimation was conducted in all countries except from Tunisia, Algeria and from one reported in Morocco. Two out of the four reported 24-HDR were validated [Egypt and Morocco: both validated by empirical methods using Goldberg cut-offs] and none were tested for reliability. Dietary records reported in Tunisia were only applied to epidemiology and to semi-quantitative FFQ validation studies. Respondents were trained to record and the dietary record was structured by meal

occasions. Standardised scales and weighing were not used. Only visual estimations using picture books, bread shapes and household measures were used.

West Africa: Benin, Burkina Faso, Cameroon, Ghana, Nigeria and Senegal (Table 3)

FFQs were used in all countries and mostly applied to epidemiology, monitoring and surveillance. FFQs were mainly used to assess food habits and to estimate usual nutrient intakes. In total, seven FFQs were reported: one quantitative, two semi-quantitative, and four qualitative. All FFQs but one were structured by food groups but wide variations in time to complete a single interview (15-60 minutes) were also reported. The reference time frame reported varied from two days to one month. The number of food items also varies between 13 and 76 and dietary supplements. Only one FFQ in Benin included recipes. Most of the foods included were based on previous dietary surveys. Only in Benin and Burkina Faso, the FFQs were validated (relative validation) and only in Ghana and Benin the FFQs were tested for reliability.

24-HDR was reported in all countries and mainly applied to epidemiology, monitoring and intervention studies. Almost all recalls were structured by meal occasions and duration of completion ranged from 15 to 90 minutes. Three out of the nine reported recalls were validated and tested for reliability [Benin, Burkina Faso and Ghana, all relatively validated]. Two different dietary records were reported [one for both Benin and Burkina Faso and the other in Ghana]. The major domain of application reported was in observational studies in Burkina Faso and Benin. While in Ghana, respondents were trained to record dietary data. The records in Burkina Faso and Benin were structured by meal occasions, but the one in Ghana was not structured. In both records food was weighed. In Ghana in addition to weight individuals also used pictures of

household's measures to estimate portion sizes. The dietary record used in Ghana was validated (relative validation) but none of the records were tested for reliability.

In Benin, Ghana and Nigeria interviews were conducted by dietitians or nutritionists.

Southern Africa: Malawi, Mozambique, Namibia, South Africa and Zimbabwe (Table 4)

FFQs were reported in all countries except from Namibia and mainly applied to epidemiology. In total, five FFQs were reported: three quantitative, one semi-quantitative and one qualitative. All FFQs were structured by food groups and a large variation in time to complete a single interview (10-60 minutes) was reported. The reference time frame ranged from one week to one year. Only one FFQ, from South Africa, was validated using biomarkers that was urinary nitrogen and relatively against 24-HDR and tested for reliability. The number of food items varied between 25 and over 300. Most of the foods included were based on previous dietary surveys. Only Zimbabwe and South Africa's food lists included recipes.

24-HDR was also reported in all countries and mainly applied to epidemiology, surveillance and monitoring, clinical research and validation studies. All recalls included portion size estimation. Duration of completing interview ranged from 15 to 50 minutes. Visual aids, such as pictures of portion size and actual household utensils, were used for portion size estimation in all countries except from Namibia. Only one 24-HDR from South Africa was validated using biomarkers that was urinary nitrogen and tested for reliability.

Interviews in Malawi, Namibia, Mozambique and Zimbabwe were conducted by dietitians or nutritionists.

East Africa: Kenya, Sudan and Uganda (Table 5)

FFQs were reported in all 3 countries and mostly applied to epidemiology, intervention and monitoring. In total, four FFQs were reported: two quantitative, and qualitative. All FFQs were structured by food groups and a large variation in time to complete a single interview (20 minutes - 3 hours) was reported. Most of the foods included were based on previous dietary surveys. The reference time frame ranged from three days to one month. The FFQ reported for Kenya was not validated or tested for reliability. The qualitative FFQ reported for Uganda was only tested for reliability. Recipes were included for two of the FFQs. Only Sudan's FFQ included dietary supplements. Previous dietary surveys were the main methods used to select the most appropriate food list.

The Gibson and Ferguson 24-HDR (Gibson and Ferguson, 1999) was used in Kenya and Uganda. All the 24-HDR reported mainly applied to monitoring and intervention studies. Duration of completing an interview ranged from 30 minutes to 3.5 hours. In Uganda, portion sizes were estimated using visual aids, such as pictures, whilst in Sudan portion size were estimated using household measures. In Uganda the 24-HDR was tested for reliability. None of the reported tools were tested for validity.

Only Sudan reported the use of dietary record, which was structured by food items. The respondents were trained to record foods and used household measures to quantify them.

Monitoring surveys

Table 6 gives an overview of monitoring surveys conducted in countries represented in the AS-PADAM project with food or nutrient intake data collected at the individual level from 2002 to

2013. For all surveys, children and women were the main target population and 24-HDR and FFQ the main DA tools used. Most surveys reported were conducted at national level.

DISCUSSION

The main findings of this inventory of dietary assessment methods in Africa were that these tools were mainly used in epidemiology and monitoring (nutrition surveillance) and the most available DA tools were the 24-HDR and FFQ. However, few of these tools have been validated and/or tested for reproducibility. Indeed, of the DA tools reported in this inventory, only 12 (six FFQ; five 24-HDRs; one food record) out of a total of 49 tools assessing intakes at an individual level were validated either by objective (use of biomarkers) or relative measurements (against a more precise method) (Aounallah-Skhiri et al., 2011; El Ati et al., 2004; Korkalo et al., 2013; Landais et al., 2014; Macintyre et al., 2001a; Macintyre et al., 2001b; Macintyre et al., 2001c; Sharma et al., 1996). In addition, all tools reported have been administered face-to-face, except one FFQ administrated through telephone in Ghana; and none of them were computerised questionnaires or using other new (web) technologies. However, although the aim of the project was to achieve a good overall representativeness of the dietary assessment methods and local situations in the four main African regions, this inventory was by no means fully exhaustive. Therefore, other DA tools used in African countries were not reported in the present inventory (because of a lack of local capacity to collaborate on this project or a lack of response to our request for participation). Also, it is worth noting that other tools, out of the scope of the present inventory, are used across Africa to investigate specific aspects of the diet, such as sodium intake, dietary diversity and food security (Charlton et al., 2008; Dary and Jariseta, 2012; Leyna et al., 2008; Senekal et al.,

2009; Torheim et al., 2003). For example, an FAO dietary diversity Score (DDS) tool kit has been developed to assess dietary diversity at household and individual levels in resource limited countries (Food and Agriculture Organization (FAO), 2010). DDS tool is a qualitative method that has been validated to evaluate macro and micro-nutrient adequacy of diets of individuals (Diet quality) (Arimond et al., 2010), and household food accessibility (food security). The DDS questionnaire involves a recall of food consumed over the previous 24 hours at either household or individual level. The tool can be used in baseline and impact assessment in nutrition and food security programmes, national surveys and surveillance systems, monitoring and evaluation of programmes and policies, emergency, and routine food security analyses, etc...DDS can be translated into local languages and adapted to use in local contexts. The tool has already been adapted in numerous countries, such as Mozambique–Portuguese, Malawi–Chichewa, Kenya–Kiswahili, Mali–Bambara, and Tajikistan–Taji.

Another kind of dietary survey, although not a strictly speaking dietary assessment method, widely conducted in African countries is the Household Budget Surveys (HBS). HBS provide data on food availability at household level which can be used to compute a proxy of actual individual food consumption. Their major limitation is that they do not allow to capture information on the distribution of foods between individuals, wastes or food eaten out-of-home (Webster-Gandy et al., 2012).

This inventory also showed that to date no initiatives in Africa have been taken to standardise dietary methodologies across countries for monitoring surveys or other international nutritional projects, although several national or regional monitoring surveys were conducted in all regions

over the last 10 years. The lack of comparable tools for capturing information on the heterogeneous diets existing across African populations and the need for more support for these methods and the associated research infrastructure were unanimously reported as being the major gap and a priority by the participating partners.

Dietary assessment methods usually present difficulties for interviewers and respondents, and misreporting errors are common (Ngo et al., 2009). Indeed, diet is one of the most challenging exposures to assess that is particularly prone to errors coming from different sources (interviewers, study subjects, study design and logistics and dietary tools used). For short (one day, one week) or long-term (one month, one year) recall dietary methods, the errors can result from interviewer bias and need of study subjects to perform difficult cognitive tasks and to be literate. This source of error also includes respondent's ability to recall the type of food, the frequency of consumption and estimate the portion size of foods consumed over a reference period of time (Ngo et al., 2009) making the interviewing process a real challenge, particularly in settings lacking resources and skills. For those methods, portion size estimation was reported as one of the main challenges influencing misreporting (both under and over reporting), though most methods reported to use different models (i.e. visual aids, pictures books, household measures etc.) to help respondents to recall sizes accurately. Specific cultural practices in African countries including sharing food bowls are additional challenges to address for a proper estimate of individual dietary intakes (Hudson, 1995). Since all tools reported are paper and interview based, training of interviewers remains the most pivotal role in obtaining high quality and reliable data. Interviewers were reported to come from multi-disciplinary fields. Almost half of the countries reported using trained nutritionists and dieticians. However, different situations

exist in Africa concerning the availability of trained dietitians and nutritionists, which challenge the transfer of knowledge and training of field workers. All countries reported that they were satisfied with the level and intensity of training of interviewers. However whether this training effectively reduced bias could not be deduced from the questionnaires. Therefore, the transfer of knowledge, provisions of standard operating systems and highly standardised training on dietary methods and practices will be a major aspect to be addressed in any future joint initiatives in Africa.

Although reliable food composition tables are essential for deriving individual nutrient intakes from food intake (Ngo et al., 2009; Rutishauser, 2005; Thompson and Byers, 1994), this area is another major limitation to nutrition research and prevention of NCDs in Africa that will have to be addressed through broader initiatives. Indeed, most countries reported not having their own FCTs and adopting those from other proxy/neighbouring countries or using FAO food composition tables (Food and Agriculture Organization (FAO), 2012; Food and Agriculture Organization (FAO) and U.S.Department of Health, 1968). Countries having their own FCTs, rarely updated them because of a lack of resources and expertise on this complex methodological area. Although, the topic of FCT was not explored in-depth and was beyond the scope of this inventory, it is well covered by long-standing initiatives led by other networks (e.g. FAO, INFOODS). With an increasing influx of new foods into most African markets and countries, the FCTs need to be updated more regularly so as to have or incorporate most foods available on a market with an increasing availability of processed local and imported foods. Whilst Indigenous foods were reported in most of the FCTs used, dietary supplements were reported only in South African and Ghanaian FCTS.

No computerised questionnaires or other new (web) technologies were reported to assess dietary intakes in Africa, though there is a lot of potential in the near future to adopt this approach since there is an increase in access to the web and a wide use of cell phones. The application of information, communication and computer technologies (ICCT) in dietary assessment offers several potential advantages including improvement in data quality, consistency, accuracy and completeness (Illner et al., 2012; Ngo et al., 2009). ICCTs are cost effective in the long term as they reduce interviewer and respondent burden, ultimately increasing compliance and validity (Kroeze et al., 2006). Furthermore they reduce costs of training (Illner et al., 2012; Ngo et al., 2009) and save time in data coding and calculations since data are immediately stored (Evers and Carol, 2007; Lagerros et al., 2006). ICCTs enhance the interview process by simplifying it, making it less time consuming, thus increasing the respondent's motivation (Illner et al., 2012; Ngo et al., 2009). There is a need to explore new or adapt already existing applications of ICCTs to improve dietary assessment in Africa.

Across Europe, two standardised computer assisted dietary assessment methods are available to assess diets at individual level: the Young Adolescents Nutrition Assessment on Computer (YANA-C) (Vereecken et al., 2008) and GloboDiet software¹ (Slimani et al., 2011). These tools include both self and interviewer administered computerised methods. The YANA-C is a community self-administered computerised 24-HDR (Vereecken et al., 2010; Vereecken et al., 2005; Vereecken et al., 2008; Vereecken et al., 2009) developed for self-monitoring of foods intake by children and adolescents 11 years and older. This tool was well received by most adolescents from 10 different European countries (Vereecken et al., 2008), and it was also time

¹ Formerly EPIC-Soft

efficient (Vereecken et al., 2005). However, its weaknesses include requirements for computer skills, internet access and nutrition knowledge (Vereecken et al., 2005; Vereecken et al., 2008). The interviewer-administered GloboDiet software is a computer assisted 24-HDR that permits a very detailed description and quantification of foods, recipes, and supplements consumed in the course of the preceding day (de Boer et al., 2011; Slimani et al., 1999; Slimani et al., 2002; Slimani et al., 2011). This program, developed by the IARC has been validated in international epidemiological and monitoring settings in Europe (e.g. calibration, validation or dietary monitoring surveys) (Al-Delaimy et al., 2005; Crispim et al., 2011a; Crispim et al., 2011b; Crispim et al., 2012; Crispim et al., 2013; Huybrechts et al., 2011a; Slimani et al., 1999; Slimani et al., 2002; Slimani et al., 2011). Probing questions and entering consumed foods in chronological order aid the respondent's memory. Quantification of consumed foods is supported by the GloboDiet picture book that comprises coloured photographs of foods in different portion sizes. The software provides an automatic coding of food items and recipe ingredients as well as estimation of nutrient intake (de Boer et al., 2011; Slimani et al., 2002; Slimani et al., 2011; Voss et al., 1998).

Despite these features, computerised interviewer-based 24-HDR, are still relatively expensive to develop and to use as the main instrument large cohorts especially when the aim is to accurately estimate individuals' usual intakes and multiple measurements are required, (Crispim et al., 2011a; Illner et al., 2012; Schatzkin et al., 2009; Touvier et al., 2011).

Though several monitoring and demographic health surveys were reported in the last 10 years in all four African regions using 24-HDR, FFQ and dietary scores, the lack of standardised tools to assess intakes at individual levels across countries makes the collected data not comparable

across countries and regions and creates challenges for setting up of common cost-effective nutritional strategies in Africa. Considering the different cultures and populations across Africa, valid and standardised DA tools could provide a better understanding of ethnic differences in disease incidence, and ultimately lead to harmonised policies or health prevention programmes. Additionally, these tools can improve the way epidemiological transitions are monitored in Africa and enable better evaluation of public health intervention strategies designed to decelerate this transition (Pisa et al., 2011; Vorster et al., 2011).

The major public health nutrition challenges in Africa require increasingly coping with both under and over-nutrition situations (Asfaw, 2007; Delisle, 2008; Mendez et al., 2005). This double burden, largely driven by the nutrition transition is characterised by a trend of moving from traditional “prudent” diets to more western “industrialised” diets high in fat, energy, salt and alcohol (Pisa et al., 2011; Pisa et al., 2012; Popkin, 2009; Popkin et al., 2012; Vorster, 2002). This transition further extends to an increase in physical inactivity patterns and has been attributed to be the main cause in the emergence of NCDs in Africa for years (Popkin, 2003). The form and speed or rate of acceleration of this phenomenon varies across different African countries and sub-populations (e.g. children vs. adults) as industrialisation, urbanisation and economic development also varies across countries (Steyn et al., 2012). Monitoring this transition has become the most challenging exercise for Africa (Crush and others, 2011; Delisle et al., 2011). For reasons mentioned above, the interviewer administered software seems more feasible to adapt as common methodology across African settings and study populations (different age groups, gender, socio-economic status, languages), as compared to self-administration computerised tools.

Despite strong micronutrient fortification programmes in Africa, micronutrient malnutrition (hidden hunger) and notably anaemia was reported as a major concern in all regions. Various types of childhood under-nutrition, such as stunting, were reported as major concerns in most countries in all regions. It should be noted that communicable diseases including HIV/AIDS, tuberculosis and malaria still remain a major challenge (World Health Organization (WHO), 2006) and a need to balance between addressing emerging NCDs and current infectious diseases should be established. The main reported challenges affecting nutrition research included a lack of expertise (skills), infrastructure, financial support, cultural factors, religious obstacles and unstable political environments. In terms of needs and priorities to improve nutrition research training (i.e. transfer of skills), funding and methodological infrastructure were reported as the most important. Identifying the barriers and challenges plus assessing the opportunities available to steer the nutrition transition into a more positive direction is important (Pisa et al., 2011; Vorster et al., 2011).

This initiative is the first to our knowledge, to conduct an inventory on different dietary assessment methods being used at continental level. The strengths of this inventory include also selecting a total of 18 countries representing the four main African regions (Northern, Southern, Eastern and Western), thus allowing us to draw general conclusions from the findings.

Additionally, experts from Africa and other international networks with experience on dietary assessment methodologies were included in this initiative so as to limit or reduce the risk of this exercise to miss important aspects related to dietary assessment in Africa.”

This inventory had some limitations that are recognized. Not all African countries were included and some DA tools were definitely missed (e.g. amongst the six countries that were contacted

but did not send back their questionnaires, there were dietary assessment studies). Moreover, the inventory was conducted in English and French, which could have excluded Lusophone African countries. Thus bias could exist potentially due to the selection methodologies set for this study. Although this inventory did not intend to pretend to provide an exhaustive coverage of the specific and local situations, it was designed to provide a data-based, broad evaluation of the current situation in Africa pertaining to dietary methodologies and other related issues and provide conclusions and recommendations that could be easily extrapolated and generalised to other countries not represented in this inventory.

CONCLUSIONS

A need to improve and build the research infrastructure for dietary assessment methods based on either developing new or adapting existing international dietary methodologies/devices that have been validated and standardised in international settings should be a priority in Africa. These new or adapted tools should further be culturally sensitive and acceptable in African countries to facilitate cross-country comparisons and generalisations of research findings and to implement international action plans and policies. Currently one of the major challenges in nutrition and health research programs in Africa is the lack of high quality, validated and standardised tools, making it difficult to monitor the different phases and speed of the nutrition transition across countries. The outcomes of this inventory should ease the identification and prioritization of the international (new) methodologies and related web-infrastructure needed to support nutritional research in Africa. Developing such a tool would improve the quality of future Pan-African research in that could incorporate dietary exposure assessments into their multi-disciplinary

research and monitoring activities in a cost effective way. More critically, without these tools, Africa cannot reliably monitor progress on policies aimed at improving diet (nutrition) related health challenges.

Scientific evidence coming from the use of such international tools could be used to develop harmonised prevention guidelines for NCDs including lifestyle cancers (e.g. breast cancer) in Africa and design more targeted guidelines (with national and international stakeholders) in relation to diet and other lifestyle environmental factors. Additionally, and in a next step, such international tools could be used to establish a global nutritional surveillance system across Africa. Indeed, building on its longstanding experience on international dietary methodologies and their successful implementations in different settings, IARC as a WHO research institute, intends to play an active role and support broader initiatives, programmes and action plans to combat NCDs in close collaboration with WHO-HQ and other UN, Regional and National health organisations (World Health Organization (WHO), 2008) including in Africa.

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SUPPLEMENTAL MATERIAL

Supplemental data of this article can be accessed on the publisher's website,

www.tandfonline.com/bfsn

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Table 1: Summary of reported dietary assessment methods, public health problems and research needs as perceived and self-reported by the respondents, in different African regions

Region	EAST (N=3)	WEST (N=6)	NORTH (N=4)	SOUTH (N=5)
Countries	Kenya, Sudan, Uganda	Benin, Burkina Faso, Cameroon, Ghana, Nigeria, Senegal	Algeria, Egypt, Morocco, Tunisia	South Africa, Zimbabwe, Mozambique, Namibia, Malawi
Methods				
Food Frequency Questionnaire (N=22)	Qualitative (N=2) Quantitative (N=2)	Qualitative (N=4) Semi-Quantitative (N=2) Quantitative (N=1)	Qualitative (N=2) Semi-quantitative (N=3) Quantitative (N=1)	Qualitative (N=1) Semi-quantitative (N=1) Quantitative (N=3)
24-Hours Dietary Recall (N=23)	N=2	N=9	N=5	N=7
Food/Dietary Records (N=4)	N=1	N=2	N=1	N=0
All paper and interview-based (except Ghana with both telephone and face-to-face interviewing)				
All paper and interview based				
All paper based and used as proxy for sub-populations e.g. children. Whilst in Tunisia and Ghana respondent were trained to record their food intake, in Benin and Burkina food intake was recorded by an interviewer				
Major public health problems				
Micronutrient deficiencies				
Vitamin A deficiency	✓[Uga;Sud]	✓[Ben;Bur;Nig]	✓[Mor]	✓[RSA;Zim;Moz;Nam;Mal]
Vitamin B12 deficiency	✓[Uga]	NR	NR	✓[RSA;Zim;Nam;Mal]
Iron deficiency	✓[Uga]	✓[Ben;Bur;Cam;Gha;Nig;Sen]	✓[Egy;Mor;Tun]	✓[RSA;Zim;Moz;Nam;Mal]
Zinc deficiency	✓[Uga]	✓ [Nig]	NR	✓[RSA;Zim;Moz;Nam;Mal]
Calcium deficiency	✓[Uga]	NR	NR	NR
Iodine deficiency	✓[Uga;Sud]	✓[Nig;Sen]	✓[Mor]	✓[RSA;Zim;Moz;Nam;Mal]
Folate deficiency	NR	NR	✓[Mor]	NR
Nutritional status				
Childhood undernutrition	✓[Ken;Sud;Uga]	✓[Ben;Bur;Nig]	✓[Egy;Mor]	✓[RSA; Zim;Moz;Nam;Mal]
Anaemia	✓[Ken;Sud;Uga]	✓[Ben;Bur;Cam;Gha;Nig;Sen]	✓[Egy;Mor;Tun]	✓[RSA;Zim;Moz;Nam;Mal]

Overweight/obesity	✓[Ken;Uga]	✓[Ben;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor;Tun]	✓[RSA;Zim;Nam]
Non Communicable Diseases				
Cancer	✓[Ken;Uga]	✓[Ben;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor;Tun]	✓[RSA;Zim;Nam]
Cardivascular diseases	✓[Ken]	✓[Ben;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor;Tun]	✓[RSA;Nam]
Diabetes	NR	✓[Ben;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor;Tun]	✓[RSA;Zim;Nam]
Hypertension	NR	NR	✓[Alg;Egy;Mor;Tun]	✓[RSA;Zim;Nam]

Challenges and needs for research

Financial support	✓[Ken;Sud;Uga]	✓[Ben;Bur;Cam;Gha;Nig;Sen]	✓[Alg;Egy, Mor;Tun]	✓[RSA;Zim;Moz;Nam;Mal]
Expertise	✓[Ken;Sud;Uga]	✓[Ben;Bur;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor]	✓[Zim;Moz;Nam;Mal]
Infrastructure	✓[Ken;Sud;Uga]	✓[Ben;Cam;Gha;Nig]	NR [Egy]	✓[Zim;Moz;Nam;Mal]
Religious and cultural obstacles	NR [Ken;Uga] ✓[Sud]	✓[Cam;Gha;Nig]	NR [Alg;Egy;Mor;Tun]	NR [RSA;Zim;Moz;Nam;Mal]
Political factors	✓[Ken;Sud;Uga]	✓[Cam;Nig]	NR [Mor;Tun] ✓[Egy]	NR [RSA;Zim;Moz;Nam;Mal]
Other (need for adapted tools for specific populations)	✓[Ken;Sud]	✓[Ben;Cam;Gha;Nig;Sen]	✓[Alg;Egy;Mor]	✓[Zim;Moz;Nam]

Major findings across regions

Various tools available in Africa, with the 24-HDR and FFQ being the most dominant; No software or other technologies used; No tools are standardised across countries though some tools are used across countries; Lack of nutrition and cancer research and support infrastructures

Ken:Kenya; Sud:Sudan; Uga:Uganda; Ben:Benin; Bur:Burkina Faso; Cam:Cameroon; Gha:Ghana; Nig:Nigeria; Sen:Senegal; Alg:Algeria; Egy:Egypt; Mor:Morocco; Tun:Tunisia; RSA:South Africa; Zim:Zimbabwe; Moz:Mozambique; Nam:Namibia; Mal:Malawi; NR: Not Reported as a problem; ✓: A need exists/challenge exists

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Table 2: Summary of dietary assessment methods, Food Composition Tables and Food Based Dietary Guidelines by regions: NORTH AFRICA

Countries	Algeria	Egypt	Tunisia	Morocco
METHODS	Indicators			
Type	N=1 Qualitative	N=1 Semi-quantitative	N=1 Semi-quantitative	N=3 (a) Qualitative (b) Quantitative (c) Semi-quantitative
Domain of application	Epidemiology	Epidemiology	Epidemiology	Epidemiology
Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents, except in Tunisia where no barrier were reported.			
Interviewer	Non dieticians nor nutritionists	Dieticians or nutritionists	Dieticians or nutritionists	(a) Dieticians or nutritionists (b) Non dieticians nor nutritionists (c) Non dieticians nor nutritionists
FOOD FREQUENCY QUESTIONNAIRE (N=6)	Duration	10 minutes	15 minutes	30 minutes
Language	Questionnaire in French but interview in Arabic	Arabic	French and Arabic (Tunisian dialect)	(a) 15 minutes (b) 5 minutes (c) 20-25 minutes (a) and (b) Questionnaire in French but interview in Arabic (Moroccan dialect) (c) Arabic (Moroccan dialect)
Structure	Food groups	Food groups	Food groups	Food groups
Food list	All food lists reported to be appropriate for target populations			
Number of food items	19	100-110	235	(a) 31 (b) 8 (c) 268
Recipes	Not included	Included	Included	(a) and (c) Included (b) Not included

Dietary supplements	Not included	Not included	Not included	(a) Not included (b) and (c) Included
Data/Source/Methods used to compose food list	Usually main food groups described in literature	Previous dietary surveys; 24-HDR	Previous dietary surveys, stepwise regression, dietary records	(a) and (b) Previous dietary surveys (c) Other
Reference period	Past week	Past month	Past month	(a) and (c) Previous year (b) Past week
Frequency categories	Number of times per week to number of times per day	Number of times per day, week or month	From <1time/month to 4 and + times/day	(a) Number of times per day or per week or month (b) No pre-defined categories, number of times per day or per week (c) 8 categories from rarely to 4 times/day
Portion size estimation	N/A	In grams or litres as open questions-Actual cups, plates, etc.	For each item, the interviewer showed a reference portion size (median of the item intake) to participants who indicated if they consumed less, equal or more than the showed portion. The lowest and bigger portions represent the first and the third tertiles of the item intake	(a) N/A (b) Different standard portions-Part of picture book and photos (c) Standard portion sizes
Validation	Not performed	Not performed	✓ Relative and objective validation	(a) Not performed (b) and (c) ✓Relative validation
Reproducibility	Not performed	Not performed	✓	(a) Not performed (b)✓ Test-retest (c) ✓
<hr/>				
Description	NR	N=1 All age groups	N=1 Children (<5 years)	N=3 (a) Women (15-49 years) and children (<5 years) (b) Women (15-49 years) (c) Adults (>18 years)
Domain of application	N/A	Surveys	Epidemiology	(a), (b) and (c) Epidemiology
Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents			

24-HOUR DIETARY
RECALL (N=5)

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Interviewer	N/A	Dieticians or nutritionists	Dieticians or nutritionists	(a) Dieticians or nutritionists (b) and (c) Non dieticians nor nutritionists
Duration	N/A	30 minutes	10 minutes	(a) 30 minutes (b) 30 minutes (c) NR
Language	N/A	Arabic	French and Arabic (Tunisian dialect)	(a) Questionnaire in Arabic and French but interview in Arabic (Moroccan dialect) (b) Questionnaire in French but interview in Arabic (Moroccan dialect) (c) Arabic (Moroccan dialect)
Other	N/A	Recalls done every day of the week and all year	Recalls not done every day of the week and not done all year	(a) Recalls done every day of the week and not all year (b) Recalls not done every day of the week and not all year (c) Recalls done every day of the week
Structure	N/A	By meal occasions	By foods	(a), (b) and (c) By meal occasions
Portion size estimation	N/A	Household measures	N/A (the 24h recall is qualitative)	(a) No visual aids used (b) Visual aids and complete picture book, photo, household measures, known weights (c) No visual aids-Household measures and units
Validation	N/A	✓ Empirical approaches (using Goldberg cut-offs)	Not performed	(a) Don't know (b) ✓ Empirical approaches using arbitrary cut-off (c) Not performed
Reproducibility	N/A	Not performed	Not performed	(a) Don't know (b) and (c) Not performed
FOOD RECORDS (N=1)	Domain of application	N/A	Epidemiology N=1	N/A

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Description	N/A	N/A	3 days food record; Respondents trained to record; Records collected all year round	N/A
Structure	N/A	N/A	Meal occasions	N/A
Portion size estimation	N/A	N/A	Standardised scales and weighing not done/used—only visual estimations using picture books, bread shapes and household	N/A
Validation	N/A	N/A	Not performed	N/A
Reproducibility	N/A	N/A	Not performed	N/A
Availability	None	✓ Egypt FCTs	✓ Table de composition des aliments Tunisiens	✓ FCTs of foods consumed in Morocco
Number of food items; recipes	N/A	470;134	254;0	412;5
FOOD COMPOSITION TABLES				
Format (printed, disk, CD-ROM, onlir	N/A	Printed	Printed and CD-ROM	Printed and CD-ROM*
Languages	N/A	Arabic	Arabic, French, English	Arabic, French, English
Dietary supplements included	N/A	Not included	Not included	Not included
Indigenous foods included	N/A	Included	Included	Included
Frequency of update	N/A	Not updated	Recent 2013	Every 2 years
FOOD BASED DIETARY GUIDELINES			None of the countries have their own FBDGs	

NR: Not Reported; N/A: Not Applicable; FCTs: Food Composition Tables; FBDGs: Food-Based Dietary Guidelines

Available/Procedure performed
Moroccan FCT is to be released in 2014

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Table 3: Summary of dietary assessment methods, Food Composition Tables and Food Based Dietary Guidelines by regions: WEST AFRICA

Countries	Benin	Burkina Faso	Cameroon	Ghana	Nigeria	Senegal
METHODS	INDICATORS					
Type	N=2 (a) Qualitative* (b) Qualitative	N=1 Qualitative*	N=1 Quantitative	N=1 Semi-quantitative	N=2 (a) Semi-quantitative (b) Qualitative	N=1 Qualitative
Domain of application	(a) Epidemiology (b) Research	Epidemiology	Epidemiology	Nutrition monitoring, epidemiology and interventions	(a) and (b) Epidemiology, interventions, monitoring and surveillance	Epidemiology
Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents					
Interviewer	(a) and (b) Non dieticians nor nutritionists	Non dieticians nor nutritionists	Non dieticians nor nutritionists	Non dieticians nor nutritionists	(a) and (b) Non dieticians nor nutritionists	Non dieticians nor nutritionists
Duration	(a) 30 minutes (b) 60 minutes	30 minutes	NR	15 minutes	(a) 20-35 minutes (b) 10 minutes	15 minutes
Language	(a) and (b) French and different local languages	French and different local languages	French and local languages	Local languages	(a) English and local languages (b) Igbo and English	Questionnaire in French but interview in local language (Wolof)
Structure	(a) Food groups (b) Food groups and food items	Food groups	Food groups	Food groups	(a) and (b) Food groups	Food groups
Food list	Food lists reported to be appropriate for target populations					
Number of food items	(a) 13 (b) Variable according to study aim	13	76	30	(a) 70 (b) 67	37
Recipes	(a) Not included (b) Included	Not included	Included	Not included	(a) and (b) Not included	Not included
Dietary supplements	(a) and (b) Not included	Not included	Not included	Not included	(a) and (b) Not included	Not included
Data/Source/Methods used to compose food list	(a) and (b) Previous dietary surveys; 24- HDR	Previous dietary surveys; 24-HDR	Previous dietary surveys; and 2 day food diaries	Previous dietary surveys; 24-HDR	(a) and (b) Previous dietary surveys; 24-HDR	Previous dietary surveys

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**FOOD
FREQUENCY
QUESTIONNAIRE
(N=7)**

Reference period	(a) Past week (b) Past month	Past week	Previous 12 months	Past week	(a) Past week (b) Past month	Past week
Frequency categories	(a) From 0 to several times per week (b) From 0 several times per day	From 0 to several times per week	NR	NR	(a) No of days per week (b) Never, Sometimes (1/2/month), Often (1-2 days/week), Frequently (4-7days/week)	From 0 to 1 and + times/day
Portion size estimation	N/A	N/A	Household measures and food models	Different standard portions; household handy measures-- Different standard portions; household handy measures	(a) In grams or litres as open questions; Different standard portions--No visual aids used (b) N/A	N/A
Validation	✓ (a) and (b) Relative validation	✓ Relative validation	Don't know	Not performed	(a) and (b) Don't know	Not performed
eproducibility	(a) Not performed (b) Performed	Not performed	Don't know	✓	(a) and (b) Don't know	Not performed
Description	N=2 (a) Adults* (b) Variable according to study	N=3 (a) Adults* (b) Women and children (c) Women and children	N=1 Children (24-72 months)	N=1 Women, children, men	N=1 Women, children, men	N=2 (a) Healthy adult men (b) Public school children (5-17 years)
Domain of application	(a) Epidemiology (b) Epidemiology; Interventions	(b) and (c) Epidemiology (cross sectional)	Epidemiology; Interventions	Nutrition monitoring; Clinical research	Epidemiology; Interventions: monitoring and surveillance	(a) Epidemiology (cross sectional) (b) Epidemiology
Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents					
Interviewer	(a) Dieticians or nutritionists (b) and (c) Non dieticians nor nutritionists	(a), (b) and (c) Non dieticians nor nutritionists	Non dieticians nor nutritionists	Dieticians or nutritionists	Non dieticians nor nutritionists	(a) Non dieticians nor nutritionists (b) Dieticians or nutritionists
Duration	(a) 60 minutes (b) 30 minutes	(b) and (c) 60-90 minutes	NR	15-20 minutes	45-60 minutes	(a) 30-45 minutes (b) 15-30 minutes
Language	(a) and (b) French and several local dialects	(b) French (c) French and other local dialects	French	Local languages	English and local languages	(a) English (b) Local language (Wolof)

24-HOUR DIETARY RECALL (N=9)

Other	(a) Recalls done every day of the week and but not all year (b) Recalls done every day of the week and all year	(b) and (c) Recalls done every day of the week and but not all year	Recalls done every day of the week and not done all year	Recalls done every day of the week and all year	Recalls not done every day of the week and but done all year	(a) and (b) Recalls not done every day of the week and not all year
Structure	(a) and (b) By meal occasions	(b) and (c) By meal occasions	Meals and snacks	Multiple pass method	By meal occasions	(a) and (b) By meal occasions
Portion size estimation	(a) Previously calibrated local household measures and visual aids (b) Visual aids- Households measures, bread shapes	(b) Household measures (c) Household measures, play dough replicates, photos, weight, volumes, bread shapes	Household measures made by the mothers	Visual aids - Pictures of household measures, Rulers, using handy measures which have already been estimated	Visual aids - Complete picture book, Ruler, Pictures of household measures, Bread shapes	(a) Visual aids - Ruler, Pictures of household measures, bread shapes, pictures of spreadable fat on bread (b) Visual aids - Prices, photo of food portion size, household measures
Validation	(a) Not performed (b) ✓ Relative validation	(a) and (c) Not performed (b) ✓ Relative validation	Don't know	✓ Relative validation	Don't know	(a) and (b) Not performed
Reproducibility	✓ (a) and (b)	(a) ✓ (b) and (c) Not performed	Don't know	✓	Don't know	(a) and (b) Not performed
Domain of application	Epidemiology (cross sectional)		N/A	Epidemiology and clinical research	N/A	N/A
Description	N=1 Investigators stay in for a day and record; Respondents not trained to record; Records not collected all year round		N/A	N=1 Respondents trained to record; Records not collected all year round	N/A	N/A
Structure	Meal occasions		N/A	Not pre-defined	N/A	N/A
Portion size estimation	Through weighing		N/A	Pictures of household measures	N/A	N/A
Validation	Don't know		N/A	✓ Relative validation	N/A	N/A
Reproducibility	Not performed		N/A	Not performed	N/A	N/A
FOOD COMPOSITION TABLES	Availability	✓ Mainly Malian FCT* (b) West Africa FCT from FAO	✓ FCTs for Southern Cameroon	✓ Food Research Institute- Council for Scientific and Industrial Research	✓ N=2 (a) Composition of selected foods from west Africa (b) Nutrient Composition of selected foods eaten in Nigeria	✓ N=2 (a) WorldFood 2 (b) West Africa FCTs

FOOD RECORDS (2)

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Number of food items; recipes	268; 186	(a) 268; 186 (b) 472;0	172;2	329;0	(a) 472;0 (b) 262; 32	(a) 311;0 (b) 472;0
Format (printed, disk, CD-ROM, online)	Printed	(a) and (b) Online and printed	Printed	Printed	Printed	(a) and (b) Online and printed
Languages	English, French and Bambara	(a) English, French and Bambara (b) English and French	French	English	English and French	(a) English (b) English and French
Dietary supplements included	Not included	Not included	Not included	Included	Not included	Not included
Indigenous foods included	Included	Included	Included	Included	Included	Included
Frequency of update	Updated, but frequency NR	Updated, but frequency NR	Not updated, but frequency NR	Not updated	Rarely	Updated, but frequency NR

**FOOD BASED
DIETARY
GUIDELINES**

Only Nigeria reported use of their own FBDGs

NR: Not Reported; N/A: Not Applicable; FCTs: Food Composition Tables; FBDGs: Food-Based Dietary Guidelines

- ✓ Available/Procedure performed
- * Same tool used in different countries

Table 4: Summary of dietary assessment methods, Food Composition Tables and Food Based Dietary Guidelines by regions:**SOUTHERN AFRICA**

Countries	Malawi	Mozambique	South Africa	Zimbabwe	Namibia	
METHODS	Indicators					
Type	N=1 Semi-quantitative	N=1 Qualitative	N=2 (a) Quantitative (b) Quantitative	N=1 Quantitative	NR	
FOOD FREQUENCY QUESTIONNAIRE (N=5)	Domain of application Interviews	Epidemiology Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents	Epidemiology	(a) and (b) Epidemiology	Epidemiology	N/A
Interviewer	Dieticians or nutritionists	Non dieticians nor nutritionists	(a) Non dieticians nor nutritionists (b) Dieticians or nutritionists	Dieticians or nutritionists	N/A	
Duration	10 minutes	About 10 minutes	(a) 40-60 minutes (b) 45 minutes	15-20 minutes	N/A	
Language	English	Portuguese	(a) Local languages (b) Written in English but administered in local languages	English and local languages (i.e. Shona)	N/A	
Structure	Food groups	Food groups	(a) and (b) Food groups	Food groups	N/A	
Food list		Food list reported to be appropriate for target populations				
Number of food items	25-35	43	(a) >300 (b) 214	>100	N/A	
Recipes	Not included	Not included	(a) and (b) Included	Not included	N/A	
Dietary supplements	Not included	Included	(a) and (b) Included	Not included	N/A	
Data/Source/Methods used to compose food list	Previous dietary surveys; 24-HDR, diet histories/derived from food composition tables					

Reference period	Past month	Past week	(a) Past month and 6 months (b) Past week	Past year	N/A
Frequency categories	From never to daily	From never to 7 times/week	(a) Per day, week, month and seldom (b) Times/week and times/day	From never to 4-5 times/day	N/A
Portion size estimation	Different standard portion size options; In grams or litres as open question-Pictures of household measures	Portion sizes not estimated (method not used to calculate food quantities or energy intakes)	(a) and (b) Standard portion size; Household measures; Complete picture book; Pictures of household measures; Ruler; Bread shapes; Pictures for spreadable fat on bread; Food models, tins (and packaged examples) of often eaten processed foods	Standard portion size; Complete picture book; Pictures for spreadable fat on bread	N/A
Validation	Not performed	Not performed	(a) ✓ Relative and objective validation (b) Not performed	Don't know	N/A
Reproducibility	Not performed	Not performed	✓ (a) and (b)	Don't know	N/A
Description	N=1 Children (<5 years)	N=2 (a) Girls (15-18 years) (b) Mother-child pairs	N=2 (a) All sub-groups in SA population (b) Children (0-2; 2-5 years), primary school children and women	N=1 Adults (35-70 years)	N=1 Children (6-59 months) and mothers
24-HOUR DIETARY RECALL (N=7)					
Domain of application	Epidemiology and clinical	(a) Epidemiology (b) Surveillance	(a) Epidemiology and surveillance (b) Monitoring and surveillance	Epidemiology	Epidemiology
Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents				
Interviewer	Dieticians or nutritionists	(a) Dieticians or nutritionists (b) Non dieticians nor nutritionists	(a) and (b) Non dieticians nor nutritionists	Dieticians or nutritionists	Dieticians or nutritionists
Duration	30 minutes	(a) 20 minutes (b) Not known	(a) 30-50 minutes (b) 30 minutes	20 minutes	15 minutes
Language	Local language (Chichewa)	(a) Portuguese (b) Portuguese and local languages	(a) and (b) English and local languages	English and local languages (i.e. Shona)	English and local languages
Other	Recalls not done every day of the week and not all year	(a) and (b) Recalls not done every day of the week and not all year	(a) and (b) Recalls not done every day of the week and but all year	Recalls done every day of the week and but not all year	Recalls not done every day of the week and not all year

	Structure	No pre-defined structure	(a) No pre-defined structure (b) Multiple pass method	(a) and (b) Per meal, food eaten, preparation method/ what was added, amount	No pre-defined structure	No pre-defined structure
	Portion size estimation	Local food models; common (standardised) household measures	(a) Visual aids-food photographs and household utensils--Complete picture book (b)Visual aids - direct weighing, determining volume equivalent using bakers with marked volume, using play dough models and measuring water volume displacement, photographs, dimensions	(a) and (b) Visual aids - Part picture book; Ruler; Bread shapes; Pictures for spreadable fat on bread; different sizes of spoons, food models; cups, glasses; three-dimensional sponge models; empty containers of frequently consumed foods; participant uses dry oats to identify the amount that resembles the amount of food eaten, empty tins	Visual aids - complete picture book; Pictures of household measurements; Pictures for spreadable fat on bread	Local food models; common (standardised) household measures
	Validation	Not performed	(a) Not performed (b) Don't know	(a) ✓Relative and objective validation (b) Don't know	Don't know	Don't know
	Reproducibility	Not performed	(a) Not performed (b) Don't know	(a) ✓ (b) Don't know	Don't know	Don't know
FOOD RECORDS (N=0)	Domain of application	N/A	N/A	N/A	N/A	N/A
	Description	N/A	N/A	N/A	N/A	N/A
	Structure	N/A	N/A	N/A	N/A	N/A
	Portion size estimation	N/A	N/A	N/A	N/A	N/A
	Validation	N/A	N/A	N/A	N/A	N/A
	Reproducibility	N/A	N/A	N/A	N/A	N/A
FOOD COMPOSITION TABLES	Availability	✓ Use of multiple FCTs	✓ N=2 (a) FCTs for Mozambique. Version 2 (b) Tabela de composicao de alimentos	✓ South African Food Composition Database*	✓Zimbabwe FCTs	✓ South African Food Composition Database*
	Number of food items; recipes Format (printed, disk, CD-ROM, online)		(a)206;14 (b) 119;0 (a) Online (b) Printed	1472;413 Printed, online and software	183;0 Printed	1472;420 Printed and online

Languages	English	(a) English (b) Portuguese	English	English	English
Dietary supplements included	Not included	(a) and (b) Not included	Included	Not included	Included
Indigenous foods included	Included	(a) Included (b) Not included	Included	Included	Included
Frequency of update	Rarely	(a) and (b) Not updated	Constantly updated, but frequency of release NR	Not updated	Updated, but frequency NR

**FOOD BASED
DIETARY
GUIDELINES**

South Africa, Namibia and Malawi reported use of their own FBDGs

NR: Not Reported; N/A: Not Applicable; FCTs: Food Composition Tables; FBDGs: Food-Based Dietary Guidelines

✓ Available/Procedure performed; * Same tool used in different countries

Table 5: Summary of dietary assessment methods, Food Composition Tables and Food Based Dietary Guidelines by regions: EAST AFRICA

Countries		Uganda	Kenya	Sudan
METHODS	Indicators			
	Type	N=2 (a) Qualitative (b) Quantitative	N=1 Qualitative	N=1 Quantitative
	Domain of application	(a) Interventions (b) Monitoring	Epidemiology; Clinical research; Interventions	Monitoring; Research
	Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents and access to some regions (transport problems)		
	Interviewer	(a) Dieticians or nutritionists (b) Non dieticians nor nutritionists	Non dieticians nor nutritionists	Dieticians or nutritionists
	Duration	(a) 60 minutes (b) 3 hours	20-30 minutes	30-45 minutes
FOOD FREQUENCY QUESTIONNAIRE (N=4)	Language	(a) English, Ateso, Ngakarimojong, Luganda, Lugbara, Luo, Runyankole-Rukiga, and Runyoro-Rutoro (b) English	English and Kiswahili	Arabic and English
	Structure	Food groups	Food groups	Food groups
	Food list	(a) Food list reported to be appropriate for target populations (b) Food list reported not be appropriate for target populations	Food list reported to be appropriate for target populations	Food list reported to be appropriate for target populations
	Number of food items	(a) 245 (b) 52	Fluctuates with researcher/area. Mainly includes common household foods	>16
	Recipes	(a) Included (b) Not included	Not included	Included
	Dietary supplements	(a) and (b) Not included	Not included	Included
	Data/Source/Methods used to compose food list	(a) and (b) Previous dietary survey; 24-HDR, diet histories/derived from FCTs	Previous surveys; 24-HDR, other sources such as FAO guidelines on Dietary Diversity Score	Previous surveys; 24-HDR

	Reference period	(a) and (b) Past week	Usually 3 or 7 days recall	Past month
	Frequency categories	(a) From 0 to 6 and more times/day (b) NR	From daily to 1 time/week	NR
	Portion size estimation	(a) Different standard portion size options; In grams or litres as open questions -Pictures of household measurements; Ruler; Pictures for spreadable fat on bread (b) No visual aids - In grams or litres as open questions; Price estimate	N/A	Household measures
	Validation	(a) and (b) Don't know	Not performed	Don't know
	Reproducibility	(a) Not performed (b) Don't know	Not performed	Don't know
	Description	N=1 Gibson and Ferguson method Kenya: all population subgroups (children <5 years) Uganda: adults, women of reproductive age and children (6-59 months)		N=1 All age groups
	Domain of application	Monitoring and interventions		Monitoring
	Interviews	Interviewers are highly trained; Mostly interviews are conducted at home (but sometimes in care centre or at school); The main reported barrier to administration is the low level of literacy of the respondents and transport to access areas with bad terrain		
	Interviewer	Dieticians or nutritionists (plus other health professionals)	Non dieticians nor nutritionists	Dieticians or nutritionists
24-HOUR DIETARY RECALL (N=2)	Duration	2-3.5 hours	60 minutes	30-45 minutes
	Language	English, Luganda and Runyakitara	English and local languages	Arabic and English
	Other	Recalls done every day of the week and all year	Recalls not done every day of the week and not all year	Recalls done every day of the week but not all year
	Structure	Multiple pass method	Multiple pass method	By meal occasions
	Portion size estimation	Visual aids - Complete picture book; Pictures of household measures; Pictures for spreadable fat on bread; Food replicas	Not always used. Except in small scale studies	Household measures
	Validation	Don't know	Don't know	Don't know
	Reproducibility	✓	Don't know	Don't know
FOOD RECORDS (N=1)	Domain of application	N/A	N/A	NR

Description	N/A	N/A	N=1 5 days food record; Respondents trained to record; Records not collected all year round
Structure	N/A	N/A	By food items
Portion size estimation	N/A	N/A	Household measures
Validation	N/A	N/A	Don't know
Reproducibility	N/A	N/A	Don't know

FOOD COMPOSITION TABLES	Availability	✓N=3 (a) Tanzania FCTs (b) Harvest Plus composition table for Uganda (c) Kenya Wild food species	✓National FCTs and the Planning of Satisfactory Diets	(a) Tanzania FCTs (b) USDA FCTs
	Number of food items; recipes	(a) 400;250 (b) 727;494 (c) 157;0	350;20	(a) 400;250 (b) 8,463 food items
	Format (printed, disk, CD-ROM, online)	(a) Disk (b) Online (c) Disk	Printed	(a) Disk (b) Online
	Languages	(a), (b) and (c) English	English	(a) and (b) English
	Dietary supplements included	(a), (b) and (c) Not included	Not included	(a) Not included (b) Included
	Indigenous foods included	(a), (b) and (c) Included	Included	(a) and (b) Included
	Frequency of update	(a), (b) and (c) Updated once	Irregular	(a) Updated once (b) Constantly updated

FOOD BASED DIETARY GUIDELINES

None of the countries have their own FBDGs

NR: Not Reported; N/A: Not Applicable; FCTs: Food Composition Tables; FBDGs: Food-Based Dietary Guidelines

✓ Available/Procedure performed

* Same tool used in different countries

Table 6: Overview of monitoring surveys with food or nutrient intake data from 2002 onwards*

Countries	Survey	Year	Target population	Sample size	Dietary methods used	Level	Reference
Egypt	Diet, nutrition and Prevention of Chronic Non-Communicable Diseases	2003-2004	Adolescents (12-18 years)	6,000	Dietary history	National	Ismail (2005). Diet, nutrition and Prevention of Chronic Non-Communicable Diseases
	Demographic and Health Survey	2005	Women and children	22,807 households, 12,131 children (< 5 years), 10,990 girls (10-19 years), 19,565 women (including 11,998 mothers)	24-HDR and FFQ	National	El-Zanaty, Fatma and Ann Way. 2006. Egypt Demographic and Health Survey 2005. Cairo, Egypt: Ministry of Health and Population, National Population Council, El-Zanaty and Associates, and ORC Macro
	Demographic and Health Survey	2008	Women and children	Main Survey: 19,968 households, 7,632 pre-school children (<5 years), 17,383 adolescents (10-19 years), 16,527 ever-married women (15-49 years)	24-HDR and FFQ	National	El-Zanaty, Fatma and Ann Way. 2009. Egypt Demographic and Health Survey 2008. Cairo, Egypt: Ministry of Health, El-Zanaty and Associates, and Macro International
	Food consumption pattern among children under five in selected villages in Upper Egypt	2009-2010	Children (<5 years)	2418 children (1179 males and 1139 females)	24-HDR and FFQ	Local	National Nutrition Institute and UNICEF

	Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, Volet Alimentaire	2005	All age groups	6,500 households	Food Record	National	Institut National de la Statistique (2008). Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages 2005. Ministère du Développement et de la Coopération Internationale. Vol 2: Alimentation, 127p. [in arabic]. Available: http://www.ins.nat.tn/indexfr.php
Tunisia	Children Vitamin A status	2006	School-aged children (5-7 years)	7,407 children	FFQ	Regional	El Ati J, Kaâbachi N, Fekih M, et al., Statut en vitamine A de l'enfant Tunisien. Ed 2007, Tunis: INNTA/UNICEF/Laboratoire de Biochimie de la Rabta, 2007; 102p. [in french]. Available: http://www.institutdenutrition.rns.tn/images/rapport_vitA.pdf
	Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages, Volet Alimentaire	2010	All age groups	6,500 households	Food Record	National	Institut National de la Statistique (2013). Enquête Nationale sur le Budget, la Consommation et le Niveau de Vie des Ménages 2010. Ministère du Développement et de la Coopération Internationale. Volet Alimentation. Available on line: http://www.ins.nat.tn/indexfr.php
Cameroon	Comprehensive Food Security and Vulnerability Analysis	2011	All	6,300 households	Food Record	National	Programme alimentaire mondial. Analyse globale de la sécurité alimentaire et de la vulnérabilité au Cameroun. Rome: PAM, 2011.
Ghana	Ghana Demographic and Health Survey	2003	Women and men	5,691 women and 5,015 men - 6,251 households	Vitamin a rich foods consumed 7 days preceding the survey	National	Ghana Statistical Service (GSS), Noguchi Memorial Institute for Medical Research (NMIMR), and ORC Macro. 2004. Ghana Demographic and Health Survey 2003. Calverton, Maryland: GSS, NMIMR, and ORC Macro

	Ghana Demographic and Health Survey	2008	Women and men	11,778 households, 4,916 women and 4,566 men	Fruit and vegetables rich in Vitamin A consumed 24 hours before the survey	National	Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF Macro. 2009. Ghana Demographic and Health Survey 2008. Accra, Ghana: GSS, GHS, and ICF Macro
Nigeria	National Food Consumption and Nutrition Survey (NFCNS)	2001-2003	Women and their children (<5 years)	6,480 households (5,325 mothers, a subpopulation of 1,080 of pregnant women)	24-HDR	National	B. Maziya-Dixon, I.O. Akinyele, E.B. Oguntona, S. Nokoe, R.A. Sanusi, and E. Harris. Nigeria Food Consumption and Nutrition Survey 2001–2003 Summary. International Institute of Tropical Agriculture (IITA). 2004. pages 1-67
	Nigerian Demographic and Health Survey	2008	Women and men	33,385 women and 15,486 men	Types of food consumed by mothers with children <3 during the day and night preceding the interview	National	National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. Nigeria Demographic and Health Survey 2008. Abuja, Nigeria: National Population Commission and ICF Macro
Malawi	National Micronutrient Survey	2009	2 Children (<5 years), women (15-49 years) and men (20-55 years)	166 children, 234 women and 173 men	Fortification Rapid Assessment Tool (FRAT) that includes simplified 24-HDR and FFQ	National	Malawi Government (2011). A report for the national micronutrient survey 2009. Lilongwe, Malawi.
Mozambique	Mozambique Demographic & Health Survey	2003	Children (<3 years)	> 5,000	A) food consumption (yes/no) of food and complementary food groups during past 24 hours. B) food consumption during past 7 days (number of days in which a food group was consumed)	National	Instituto Nacional de Estatística, Ministério da Saúde, and ORC Macro (2005). Moçambique Inquérito Demográfico e de Saúde 2003. http://www.measuredhs.com/pubs/pdf/FR161/FR161.pdf

	WHO Stepwise/Mozambique	2005	Adults (25-64 years)	3.323	Frequency and daily portion of fruit and vegetable consumed in a typical week	National	Padrão P et al. Low fruit and vegetable consumption in Mozambique: results from a WHO STEPwise approach to chronic disease risk factor surveillance. Br J Nutr. 2012 Feb;107(3):428-35. doi: 10.1017/S0007114511003023. Epub 2011 Jul 15. AND also see: http://www.who.int/chp/steps/mozambique/en/index.html
	Mozambique Demographic & Health Survey	2011	Children (2 years)	> 4,000	Food consumption (yes/no) of food groups during past 24 h	National	Ministério da Saúde, Instituto Nacional de Estatística, and ICF International (2013). Moçambique Inquérito Demográfico e de Saúde 2011. Calverton, Maryland: Ministerio da Saude, Instituto Nacional de Estatística, ICF International. http://www.measuredhs.com/pubs/pdf/FR266/FR266.pdf
	1st National Youth Risk Behaviour Surveys	2002	Youths	10.699	Frequency and consumption of various food types during the past 7 days	National	Reddy SP, Panday S, Swart D, Jinabhai CC, Amosun SL, James S, Monyeki KD, Stevens G, Morejele N, Kambaran NS, Omdien RG, Van den Borne HW. Umthenthe Uhlaba Usamila – The South African Youth Risk Behaviour Survey 2002, Cape town: South African Medical Research Council, 2003
South Africa	Demographic and Health Survey	2003	Households (children and adults)	7,756 households	Nutrient Index (N-Index) that consists of a short 30 item food frequency questionnaire reflecting specified micronutrients and 7 questions concerning fat intake (Senekal and Steyn, 1997)	National	Department of Health, Medical Research Council, OrcMacro. 2007. South Africa Demographic and Health Survey 2003, Pretoria: Department of Health

	2nd National Youth Risk Behaviour Surveys	2008	Youths	10,270 youths	Frequency and consumption of various food types during the past 7 days	National	Reddy SP, James S, Sewpaul R, Koopman F, Funani NI, Sifunda S, Josie J, Masuka P, Kambaran NS, Omardien RG. Umthente Uhlaba Usamila – The South African Youth Risk Behaviour Survey 2008. Cape Town: South African Medical Research Council, 2010
	South African Social Attitudes Study (SASAS)	2009	Adults	3,286 adults (for nutrition module)	Recall of all foods and drinks consumed the previous day (calculation of dietary diversity scores)	National	Labadarios D, Steyn NP, Nel J. How diverse is the diet of adult South Africans? Nutrition Journal 2011,10:33
	South African National Health and Nutrition Examination Survey (SANHANES)	2012	Children and adults	8,168 households	Recall of all foods and drinks consumed the previous day (calculation of dietary diversity scores)	National	Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Dhansay A, Reddy P, Parker W, Hoosain E, Naidoo P, Hongoro C, Mchiza Z, Steyn NP, Dwane N, Makoe M, Maluleke T, Ramlagan S, Zungu N, Evans MG, Jacobs L, Faber M, & SANHANES-1 Team. South African National Health and Nutrition Examination Survey (SANHANES-1). Cape Town: HSRC Press, 2013.
Zimbabwe	Zimbabwe Non-communicable disease risk factor survey	2005	Adults (≥ 25 years)	3,081 (75% female)	FFQ and fortification rapid assessment tool	Regional (Midlands, Mashonaland Central and Matabeleland South)	http://www.who.int/chp/steps/STEPS_Zimbabwe_Data.pdf
	Zimbabwe Demographic and Health Survey	2005	Women (15-49 years) and men (15-54 years)	8,907 women and 7,175 men	Unclear-survey reports data was collected over a 24 hour period	National	http://www.measuredhs.com/pubs/pdf/FR186/FR186.pdf
	Zimbabwe Demographic and Health Survey	2010	Women (15-49 years) and men (15-54 years)	9,171 women and 7,480 men	Dietary Diversity	National	http://www.measuredhs.com/pubs/pdf/FR254/FR254.pdf

	Zimbabwe National Nutrition Survey	2010	Household s, children (0-59 months)	21,006 households, 38,332 children	Number of food groups consumed during the previous day to calculate dietary diversity for children	National	http://www.sadc.int/fan/aims/rvaa/Documents/Zimbabwe/Zimbabwe%20Nutrition%20Survey%202010%20Report.pdf
Namibia	Namibia demographic health survey	2006/2007	Children (6-59 months), adults (15-49 years)	5,457 children and 8,803 women	Food consumed in 24 hours preceding the survey interview	National	Ministry of Health and Social Services: NamibiaDemographic Health survey 2006/2007
	Household Consumption and Expenditures Survey	2005-2006	All	7,421 households	FFQ 7-day recall	National	
	Uganda Food Consumption Survey	2008	Children (<5 years) and women (15-49 years)	957 households, 957 women (15-49 years), 437 women with children (6-23 months) and 510 women with children (24-59 months)	24-HDR and household food frequency	Regional	http://www.gainhealth.org/reports/2008-uganda-food-consumption-survey
Uganda	Comprehensive Food Security and Vulnerability Analysis	2008	Children (<5 years) and women (15-49 years)	7,271 households	Food frequency	National	www.ubos.org
	Uganda National Housing Survey	2010	Children (<5 years) and women (15-49 years)	6,800 households	Food frequency	National	www.ubos.org
	Household Consumption and Expenditures Survey	2010-2011	All	6,775 households	FFQ 7-day recall	National	http://catalog.ihsn.org/index.php/catalog/2119/download/36380

	Uganda Demographic and Health Survey	2011	Children (<5 years), women (15-49 years) and men	9,033 households, 8,674 women and 2,350 children	24-HDR	National	http://www.measuredhs.com/publications/publication-pr18-preliminary-reports.cfm
	Kenya Demographic Health Survey	2003	Children (<5 years)	5,906 children	Qualitative FFQ	National	Central Bureau of Statistics (CBS) [Kenya], Ministry of Health (MOH) [Kenya] and ORC Macro. 2004. Kenya Demographic and Health Survey 2003: Calverton, Maryland, USA: CBS, MOH and ORC Macro
	8th National iodine survey	2003/2004	School-age children	2,114 children	FFQ	National	Mwaniki, D.L.Nyandieka, L.N., Muniu ,E.M et al 2006: Iodine Nutrition Situation in Kenya and Trends in the Control of Iodine Deficiency. Final Draft. KEMRI, UNICEF, MOH, UON. Kenya 2006
Kenya	Kenya Demographic Health Survey	2008	Children (<5 years)	5,470 children	Qualitative FFQ	National	Kenya National Bureau of Statistics (KNBS) and ICF Macro. 2010. Kenya Demographic and Health Survey 2008-09. Calverton, Maryland: KNBS and ICF Macro.
	National Micronutrient survey	2011	Children (6-59 months and 5-14 years) and women (15-59 years)	2,960 households	24-HDR and FFQ	National	Final report yet to be released
Sudan	Food and Nutrition Security Assessment in Sudan	2009	All age groups	households	recall over the last 7 days	National	Food and Nutrition Security Assessment in Sudan. Analysis of 2009 National Baseline Household Survey (NBHS). Southern Sudan Centre for Census, Statistics and Evaluation Central Bureau of Statistics. http://img.static.reliefweb.int/report/sudan/food-and-nutrition-security-assessment-sudan-analysis-2009-national-baseline-household

* only the survey including dietary intake at the individual level were taken into account, therefore data such as Food Balance Sheets and Household Budget Surveys were excluded

24-HDR: 24-Hour Dietary Recall; FFQ: Food Frequency Questionnaire