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A REVIEW OF FOOD-BASED DIETARY GUIDELINES IN AFRICA: OPPORTUNITIES TO ENHANCE THE HEALTHINESS AND ENVIRONMENTAL SUSTAINABILITY OF POPULATION DIETS

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ABSTRACT

Food-based dietary guidelines (FBDGs) are important tools for promoting healthy eating and nutrition education at the population level. Currently, more than 100 countries worldwide have developed FBDGs with majority of existing FBDGs in high-income countries. However, there are a few countries in Africa which have developed FBDGs. This review describes and compares the characteristics of existing FBDGs in Africa. Data were extracted from all existing FBDGs from African countries which have been archived in the Food and Agriculture Organization's (FAO) *online* repository of FBDGs. In addition, supporting documentation from other sources linked to the identified FBDGs were also reviewed. Extracted data were coded and synthesized to describe the purpose of the FBDGs, the process for developing the FBDGs, and how healthy diets were expressed in the FBDGs. In addition, the FBDGs were examined for content on considerations for planetary health, and non-dietary recommendations. A checklist was used to extract the evidence in the identified documents. Of the 47 African countries in the WHO Africa region, only eight FBDGs were identified from seven countries. South Africa had two FBDGs (including a FBDG for young children). Multi-disciplinary technical working groups were convened in developing majority of the FBDGs. The working groups utilised scientific evidence on diet-related diseases and nutrient requirements as a basis for recommendations. All the FBDGs were intended as a tool for promoting healthy diets among the lay population. The FBDGs that were reviewed included between six and sixteen dietary messages. Diet diversification was promoted as the most common recommendation across African country FBDGs. The recommendations often promoted consumption of four to six food groups communicated using text as well as images (food guide). Local availability and cultural acceptability were important values promoted as part of an optimal diet in some of the countries. However, none of the recommendations addressed environmental sustainability. Apart from South Africa, none of the FBDGs had been evaluated or revised. Across Africa, there is a need for increased focus on developing new FBDGs or revising existing ones as a tool for meeting the dietary information needs of populations at risk of malnutrition in all its forms.

Key words: Food-based, Dietary, Guidelines, diversity, Africa, Health, Non-communicable, Sustainability

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INTRODUCTION

Unhealthy diets are a major avoidable risk factor for mortality and morbidity across the lifespan [1,2]. One in five deaths, globally, has been linked to unhealthy diets [1]. On the other hand, optimal diets and regular physical activity can help people achieve and maintain good health and are linked to reduced risk of diet-related non-communicable diseases (DR-NCDs) including obesity, cardiovascular disease, diabetes, and some types of cancers throughout all stages of the lifespan [3]. Growing concerns around human and planetary health currently motivate the integration of nutritional and environmental sustainability dimensions in nutrition guidelines [4,5]. Thus, public health interventions designed to encourage the consumption of healthy, environmentally sustainable diets are needed to limit the population-level risk of DR-NCDs and protect planetary health.

Dietary behaviour is influenced by a range of factors across social, physical and macro food environments, as well as cognitive factors at an individual level, such as knowledge, attitudes and beliefs [6]. These factors either constrain or promote healthy dietary behaviours. Food-based dietary guidelines (FBDGs) are a component of population-level strategies to guide consumption of appropriate diets, and healthy behaviours [7]. Such guidelines are intended to be simple, easy to comprehend, culturally appropriate and easy to adopt within the context of the local food environment in which they are to be promoted [8,9,10]. Food-based dietary guidelines aim to provide evidence-based, context-specific recommendations for consuming a sustainable and feasible health-promoting diet and are designed to encourage the population to achieve dietary adequacy through the consumption of an appropriate variety of foods. They serve as a guide for communicating optimal dietary behaviour to the lay public and provide an opportunity to convey relevant health-promoting recommendations that are not only diet-related but also influence other outcomes linked with diets [11]. As a result, the language used as well as the presentation format is often simplified for this purpose [12].

Food-based dietary guidelines are also a useful tool for dietitians, nutritionists, other health professionals, consumer organisations, and the food industry, for educational purposes and to guide the development of food products, especially when the food industry aims at marketing foods with improved nutrient profile [13,14,]. Food-based dietary guidelines can help governments by guiding policy development linked with food-based programmes, including cash transfers and school meal programmes [13,14]. Thus, the process for the development of FBDGs should involve the use of evidence-based, transparent, and best available evidence [15]. If designed and implemented appropriately, FBDGs can limit the risk of morbidities originating from poor diets [16], as promoting a nutritious diet has the potential to prevent DR-NCDs, as well as micronutrient deficiencies.

In the last few decades, the nutrition landscape in sub-Saharan Africa has been dominated by policies and programmes designed to address undernutrition and micronutrient deficiencies [17]. However, the situation is rapidly changing as many African countries are undergoing nutrition transition [17,18]. Considering the rapid

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socio-economic transformation occurring on the continent, increasing income and urbanization, rapidly growing technological exposure, and the attendant lifestyle changes, it is important to provide appropriate guidance that limits the risk of micronutrient deficiencies and DR-NCDs to the population [17,18]. Thus, FBDGs development has become a priority for many governments in the region. However, no effort has been made to review the rationales motivating the development of the FBDGs within the African continent, their conceptualization of diet, and planetary health; neither are there attempts to compile, describe and compare their attributes.

The purpose of this review was to describe and compare characteristics of existing FBDGs from African countries, as a basis for informing development of FBDG in other African continent countries. The specific elements including this review included identifying what is conceptualized as healthy diets in the guidelines, identifying the stated purpose of the guidelines, the process used to develop the guidelines, dietary and non-dietary recommendations, as well as the graphical representations used to promote the food groups. The review also assessed whether environmental sustainability was considered in the guidelines.

MATERIALS AND METHODS

The review included all available national FBDGs from countries in the WHO Africa region. The FAO *online* repository of food-based dietary guidelines [11] was searched for relevant dietary guidelines that were added before March 1, 2020. Additional sources included supporting publications, supplementary documents, peer-reviewed and grey literature, and technical support papers from the FAO and FBDGs task teams in the Africa region. Data were extracted from any additional texts (leaflets, booklets accompanying FBDGs) that provided further information and advice that had been developed by the task teams. All guidelines reviewed met the following inclusion criteria: promoting dietary information; focussing on food consumption for a healthy population; providing recommendations expressed in simple, non-technical language, and seeking to promote health and prevent disease. An Excel data extraction tool was created and used to collate data from each of the selected FBDGs. All data were extracted independently by two researchers (NNA and JQ) and subsequently discussed to harmonize any discordance. Data extracted included dietary guidelines with corresponding graphical images, food groups depicted in the images, the themes portrayed by the images, the format of dietary messages, and the intended audience. Data collected also included information and advice on the types and quantities of foods indicated in the guidelines. Information on other health behaviours included in the guidelines, such as alcohol intake, physical activity, smoking, and body weight control were also extracted.

RESULTS

General description of existing FBDGs in Africa

Out of the 47 African countries identified in the WHO Africa region, only eight FBDGs were identified from seven countries (Benin, Kenya, Namibia, Nigeria, Seychelles, Sierra Leone and South Africa); South Africa had two FBDGs (Table 1);

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one was specifically developed for children between the ages of 0-7 years. All African FBDGs were published before March 2020 [18]. Apart from South Africa, none of the FBDGs reviewed has been revised; also there is no report of any being evaluated.

Almost all the FBDGs were written in English; Nigeria's FBDG was also published in three native languages (Hausa, Yoruba, and Igbo) and Benin's FBDG was published in French. The FBDGs were mostly designed for the healthy population. Kenya, Nigeria and Sierra Leonne FBGDs focused on recommendations across various life stages. South Africa's FBDG is for persons aged 5 years or older and the paediatric FBDGs for children seven years or younger. Only Nigeria and Kenya had guidelines for people over 60 years. Benin's FBDG is intended for urban and semi-urban dwellers. Kenya and Seychelles included policymakers, programme designers and implementers, nutritionists, health practitioners, teachers, social workers, food caterers, manufacturers and the media, community educators, and agricultural extension workers as the intended audience.

Purpose and food groups included in the food-based dietary guidelines

Table 2 indicates the purpose for each country's FBDGs. Diet improvement was the most commonly indicated purpose. The FBDGs from Benin, Seychelles, Nigeria, Kenya, and Namibia were also designed to address diet-related NCDs. Sierra Leone's guideline was aimed at guiding food-related policies and programmes. None of FBDGs focused on sustainable diets. The guidelines reviewed recommended between four and eight food groups; four in Namibia; five in Benin, Nigeria and Seychelles, six in Sierra Leone, seven in South Africa and eight in Kenya. All the FBDGs recommended varied diets and transitioning to healthier food and beverages.

Recommendations on consumption of animal source foods

A range of recommendations on animal source foods (ASF) were identified (Table 3). Typically, fish and lean meat were recommended. Only Kenya recommended insects as ASF. Lean meat was recommended by Kenya, Nigeria and South Africa). None of the guidelines recommended reducing meat intake. Eggs were part of the key messages for Sierra Leone and South Africa. Dairy products were recommended by Kenya, Seychelles, Sierra Leone, and South Africa. Further, Seychelles, Kenya, South Africa, and Nigeria promoted breastfeeding in their guidelines.

Plant source food recommendations in the dietary guidelines

Table 4 summarizes plant source food recommendations in the FBDGs reviewed. All the FBDGs analysed, recommended starchy staples as part of daily meals. Some countries further recommended whole/unprocessed grain and staple foods. Daily consumption of fruits and vegetables was recommended by almost all countries. Other countries promoted consumption of fruits and vegetables in season. Kenya emphasizes intake of variety of vegetables, and fruits. Legumes, pulses, beans, lentils and nuts were included in the key messages of all the guidelines except for South African.

Recommendations regarding foods to limit

Table 5 summarises the foods which were to be limited. The FBDGs from all countries recommended limiting calories from added sugars, carbonated drinks, sugar-sweetened

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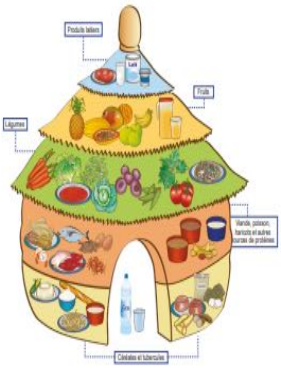
beverages and saturated fats. Specified unhealthy fats to limit included, animal fat (Benin, Nigeria) or solid fat (Kenya). Benin recommended avoiding multiple cooking with the same oil, Seychelles recommended removing fats on meat before cooking and South Africa recommended choosing vegetable oils rather than hard fats. Further, Kenya promoted the use of fortified oils. There were also recommendations to reduce consumption of salt and foods that are high in salt (such as salted fish, stock bouillon cube, and salty seasoning). Iodized salt was recommended to be used in moderation by Kenya, Namibia and Sierra Leone. None of the FBDGs reported a daily upper limit for salt. Benin, Namibia, South Africa, and Seychelles had key messages for limiting the intake of alcoholic beverages. In Seychelles, the FBDGs recommended practising good hygiene when handling food, Benin also recommended weight and blood pressure monitoring.

Graphical display of dietary guidelines

All the FBDGs, except for Kenya, used graphical representations to express dietary recommendations (Figure 1). Benin used a traditional hut with a pyramidal roof to communicate relative proportions of food group to be consumed. Nigeria also used a pyramid to demonstrate food group proportions. The other countries used varying formats of different plate sizes to demonstrate food group proportions that should constitute the diet. In Namibia, it was a tray filled with four food groups; in Seychelles, a disc displaying five food groups (Seychelles); in Sierra Leone, an ellipse with six differently-sized circles; and seven differently-sized food group circles on a square base in South Africa (Figure 1).

Graphical representation	Food groups represented	Graphical representation	Food groups represented
Benin Hut  **a**	<u>Five Food groups and water</u> Cereals and tubers Plant and animal protein (meat, fish, beans) sources Legumes and vegetables Fruits Dairy products Water	Seychelles Plate  **b**	<u>Five Food groups</u> Fruits and vegetables Rice, bread, cereals, pasta and tubers Fish, meat, eggs, fish/meat alternatives Milk products are eaten regularly Fat and sugar-rich products eaten in small amounts 8 glasses of water/day recommended

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Namibia Tray  **c**	Four Food Groups Cereals and cereal products Vegetables and fruits Animal source foods and beans Fats, oils and sugar The Ministry of Health and Social Services officially endorsed the guidelines.	Sierra Leone Ellipse  **d**	Six Food groups 1. Grains and tubers including rice, cassava 2. Dark green, orange, yellow, purple vegetables 3. Fruits 4. Animal proteins e.g., fish, poultry, meat, milk or eggs: 5. Pulses e.g., beans, peas and lentils 6. Oil, nuts and seeds
Nigeria Pyramid  **e**	Five food groups and water Bread, grains and tubers Vegetables and fruits Eggs, fish, meat and dairy Oils and fats Confectionery	**South Africa** Food group circles  **f**	Seven food groups Starchy foods Vegetables and fruits Dry beans, peas, lentils and soya Chicken, fish, meat and eggs Milk, *maas*, yoghurt Fat and oil. Water The South Africa Department of Health formally adopted the set of FBDGs

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Kenya (no graphical representation provided)	Food groups: Starchy foods Fruits and Vegetables Legumes, Pulses, nuts and seeds Meat, fish and animal protein Milk and milk products Fats and oils Sugar and Sweets Condiments, Spices and beverages	

Figure 1: Graphical representation and food groups of African countries' Food-based dietary guidelines

Generally, the size of each segment of the graphics reflects the proportion each group should contribute to the total daily healthy diet [20]. Starchy staples made up a relatively large part of all the recommended diet, followed by fruits and vegetables. The smallest food category in all FBDGs was fats and oils. None of the graphical representations appearing in the FBDGs visually expressed messages on physical activity.

Process of developing food-based dietary guidelines

Table 4 shows the types of working groups or committees that were formed for developing FBDGs in each of the countries. Seychelles FBDGs was developed by its national nutrition unit. Benin, Kenya, Namibia, Nigeria and Seychelles, Sierra Leone and South Africa used working groups representing different stakeholders to develop their guidelines, as recommended by the Food and Agriculture Organisation/ World Health Organisation (FAO/WHO) consultation group. Benin, Kenya, Namibia, Nigeria and Seychelles did not carry out consumer testing of their FBDGs to assess the appropriateness, comprehension, applicability, cultural acceptability, interpretation and implementation. Sierra Leone employed the services of a consultant (with the help of FAO) to develop their guidelines.

DISCUSSION

The current study was aimed at describing and comparing published FBDGs in African countries. The key finding from the study is that there are only a handful of FBDGs in Africa. There is, therefore, a huge unmet need for developing FBDGs across majority of African countries in the WHO Africa region to meet the diet information needs of the lay population as well as the need for an appropriate policy tool for diet decision making by government and non-government agencies. Even among the countries where

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FBDGs exist, there is a need to evaluate these guidelines to determine whether they are serving the purpose for which they were developed as well as for the evaluation to determine whether there is need for revision of the ones that were developed several years ago.
The stated purpose of FBDGs was to help countries communicate healthy diets, as well as provide direction for policies and programmes on food [21]. This review presents the existing official national FBDGs in Africa, the processes used to develop them, and the recommended steps for developing FBDGs. Eight FBDGs were included in this review and were generally intended for the healthy population and aimed at addressing healthy eating, dietary adequacy, active living, and the prevention of diet-related diseases. Some of the guidelines were focused on the entire lifecycle and took account of various age groups, physiological groups (including pregnant and lactating women), and vulnerable groups. Nutrient needs vary throughout the life cycle, by age, sex, physiological state, activity level, health, and nutritional status, and even among physiologically comparable individuals [22]. The elderly, early childhood, adolescent girls, and women of reproductive age living in resource-poor settings are particularly at high risk of inadequate micronutrient intakes when diets lack diversity and are dominated by staple foods [22,23]. The findings demonstrate the diversity of processes and the outcome across countries and the need for countries contemplating development of FBDGs to ensure the process and the outcome is appropriate for their context.

In general, there was a high level of similarity across the reviewed guidelines on several of the dietary recommendations. The guidelines promoted the consumption of a variety of foods from the different food groups, especially nutrient-dense foods, including increased consumption of fruits and vegetables (≥5 servings a day), the inclusion of starchy staples, legumes, nuts, and seeds as part of a healthy diet. In addition, ASFs including meat, fish, poultry, eggs, and milk products are encouraged in the dietary guidelines. The guides also promote proportionality in the diet. There were messages on foods to limit, avoid or reduce, and these included red meat and processed meat, salt, sugar, and fat. The guidelines also recommended altering certain food preparation methods including frying, using lean meat, cutting off fats from meats, eliminating repeated use of the same oil for cooking. Other recommendations included replacing animal and plant sources of saturated fatty acids with polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids. These guidelines are in line with FAO/WHO recommendations on foods to limit.

Eating a wide variety of foods, especially nutrient-dense foods across and within all food groups, will ensure that individuals achieve a nutritionally adequate intake of essential nutrients, and, in turn, this will lead to better diet quality and optimal health outcomes [24]. The 2015–2020 Dietary Guidelines for Americans defined *diet variety* as a diverse assortment of foods and beverages across recommended food groups [25]. Increased intake of fruits and vegetables is associated with a reduced risk of chronic disease [26,27,28,29,30,31]. ASFs including milk products constitute an essential part of the human diet and provide nutrients that are limiting in plant-source foods alone [32,33]. Inadequate consumption of ASFs can lead to serious health problems, including micronutrient deficiency such as anaemia, and stunting [34].

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However, diets based on crop food products have lower GHGE compared to ASFs [35]. Over-consumption of red and processed meats contributes to an increased risk of obesity and chronic diseases such as heart disease and colorectal cancer [36, 37,38]. From an environmental point of view, dairy and meat production systems and practices are under increased scrutiny due to their substantial negative environmental impacts such as high greenhouse gas emissions (GHGE), large land requirements, and ethical considerations concerning animal welfare [38,39,40]. Ruminant sources, in particular, contribute more emissions than poultry [35]. Moderate consumption and increasing access to ASFs for the poorest and most nutritionally vulnerable populations are encouraged. There are also low-resource alternatives, such as insects in the Kenyan guidelines. Other low-resource alternatives to ASFs are protein-rich plant-source foods. However, since dairy products and plant-based dairy alternatives differ in their nutrient composition and health impact, the nutritional aspects of such a switch need to be considered [39].

The incorporation of sustainability concepts into FBDGs

Globally there is a growing interest in the development of guidelines that align nutritional health with environmental sustainability goals. None of the countries had integrated environmental sustainability into their FBDGs and none of the guidelines explicitly included issues of sustainable diets. However, all the countries promoted "eating locally grown foods". For example, Benin promoted traditional cuisine with the message "preserve your traditional cuisine and teach it to your children for them to appreciate and protect their health and food culture. By purchasing local, food travels fewer miles and fresher produce that has higher nutritional quality is consumed. Eating local also supports local farmers, increases the resilience of the local food systems and local economies, and makes communities more self-reliant. Current food systems, from farm to fork, contribute about one-quarter to one-third of GHGE and pose major risks in terms of deforestation, freshwater use, soil and water pollution, and biodiversity loss [5,39] and are insufficiently effective at feeding people adequately [39]. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe, and healthy, while optimizing natural and human resources [42]. Changing food production, processing, and distribution, as well as dietary patterns, may lead to substantial reductions in GHGE and potentially improve the overall sustainability of the diet [43]. Promoting a shift toward more plant-based diets, particularly, those which have noticeable beneficial effects on health may contribute to reducing both GHGE and morbidity/mortality related to dietary factors [5, 44,45,46].

Development of FBDG

The FAO/WHO and the European Food Safety Authority (EFSA) have outlined a stepwise approach to developing FBDGs (Figure 2) [14,16,47,48,49]. A key requirement is the formation of a working group or committee. Dietary guidelines are developed by interdisciplinary teams of experts, including, agriculture, health, education, nutrition, and food science, consumers, non-governmental organizations, the food industry, communications, and anthropology. The process requires extensive evidence gathering on food availability, nutrients of public health importance, and foods relevant for FBDG. It also requires information on food consumption patterns,

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major nutrition-related health problems for which dietary guidelines could be useful [16,49], the current state of scientific knowledge on nutrient requirements, population-level nutrient and food intake, adequacy, excess, nutritional status of the population, and socio-cultural and economic factors that influence diets [48,49].

The evidence-gathering process should lead to the setting of nutrition and health objectives and dietary goals needed to improve the overall health of the population and reduce the risk of diet-related disease. There is a need to regularly review and update the FBDGs and develop FBDGs for special population groups like infants, young children, and the elderly. In situations where neighbouring or similar countries have already developed dietary guidelines, these can be utilized and adapted to form part of the basis of the new guidelines, but, the new guideline must be modified for suitability, acceptability, compatibility and to fit the disease problems, and food preferences and availability of each country [50]. Testing for adequacy, comprehension, local relevance and acceptability, confidence and knowledge is followed by integration and use of the guidelines. Testing is necessary before education materials are developed for specific target groups [51]. In addition to the guidelines, a graphical representation of the guidelines which serves as a reminder to build healthy eating patterns by making healthy choices across the food groups is needed. Strategies for the dissemination of FBDG messages and promotional materials should be developed and funds should be committed to ensuring that FBDG messages can be communicated through a wide selection of media

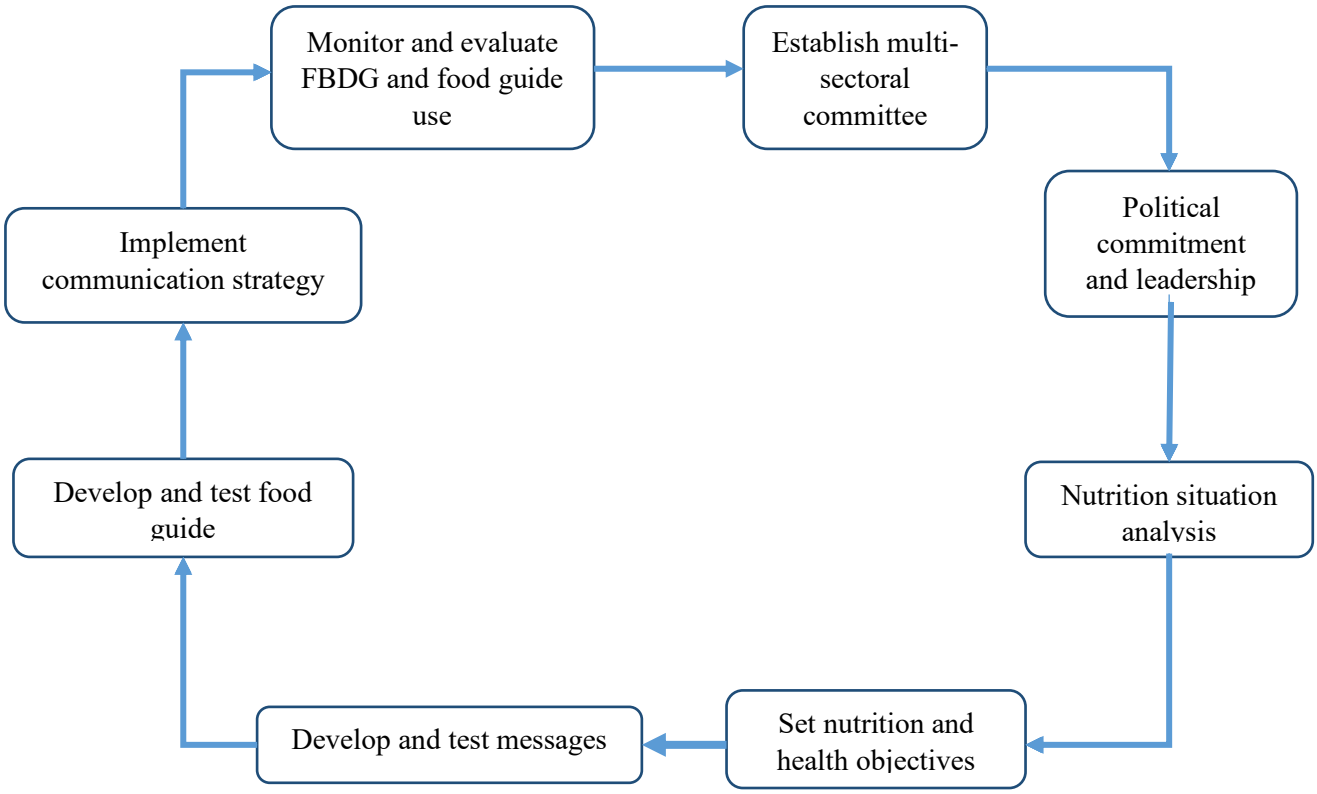

Figure 2: FAO/WHO recommended steps for developing

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Alignment with FAO/WHO steps for developing FBDGs

A multi-disciplinary approach creates greater awareness and increases the likelihood of acceptance of the guidelines among populations [52]. It is also important to follow the process as recommended by the FAO/WHO and, where necessary, adaptations are made to suit local conditions. Dietary guidelines which are rooted in sound evidence provide context-specific advice and principles on healthy diets and lifestyles [11]. The development of FBDGs is motivated by prevailing health risk factors and changes in dietary patterns and nutrient intakes that increase the risk of DR-NCDs [53,54]. Typically, drafted FBDGs and statements are publicly disseminated for consultation and comments. Finally, revisions are made based on the comments received, and finalising, adapting, and disseminating the final FBDGs. Dietary guidelines should be expressed through short, clear, and specific messages that provide guidance and promote good health among populations [55]. To be culturally acceptable, the choice of foods and colours used in illustrations should be culturally appropriate, be sensitive to religious and other cultural considerations, especially those of minority groups. The guidelines should be flexible for use by people with different lifestyles as well as people of different ages and with different physiological conditions. The wording and presentation should make use of appropriate dialects and language. It is also important to avoid radical changes in current dietary practices. Dietary guidelines must address dietary patterns, should be positive, and encourage the enjoyment of appropriate diets. Social, economic, agricultural, and environmental conditions, including high food prices, growing inflation, may restrict food choices and affect eating patterns. This can leave those who are already vulnerable and less endowed, more exposed to the associated health implications of a nutrient-deficient diet. These key concepts need to be considered particularly when planning to visualise FBDGs since visualization is the major mode of information transfer and the first – and quite frequently the only – contact the public has with the guidelines. The graphical representation used must be clear and easily understood to be successful. Testing of the FBDGs is essential before dissemination.

CONCLUSION

The WHO has described FBDGs as “the expression of the principles of nutrition education mostly as foods”. It is important to formulate FBDGs in a way that makes them a truly practical means of assisting people to achieve appropriate nutritional goals. Individual countries need to identify their specific nutritional challenges and develop FBDGs tailored to the needs of specific groups. It is important to ensure evidence-informed standardized processes, steps, or methodologies are followed in the development, implementation, and evaluation of FBDGs. Food-based dietary guidelines can be used in nutrition education, agriculture planning, and implementing food policies and should be part of an integrated strategy to improve food security, food safety, nutrition, and health. The guides need to be revised periodically to reflect changing health patterns and food systems. Countries developing new FBDGs or updating their guidelines should consider integrating environmental sustainability aspects of diets in their guidelines. Countries should also consider aligning the development of their guidelines with the FAO/WHO recommended methods of

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developing FBDGs. Given that the included FBDGs did not specify aspects of dietary diversity that may be beneficial or detrimental to a healthy weight and planetary health, it is appropriate to promote a healthy eating pattern that emphasizes adequate intake of plant foods, protein sources, low-fat dairy products, vegetable oils, and nuts and limits consumption of sweets, sugar-sweetened beverages, and red meats.

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Table 1: A summary of publications dates, language of publication and intended audience of FBDG

Country	Name of FBDG	Date of publication	Language	Intended audience (age)	Intended audience
Benin	Guide alimentaria du Bénin	2015	French	≥2y	The healthy population, 2 years and over, primarily in urban and semi-urban settings. Includes separate food group recommendations (serving sizes) for different population groups disaggregated by gender: children 2-13 years, adolescents 14-18 years, adults 19 years and over, and pregnant and lactating women. Has recommended portions by age.
Kenya	National Guidelines for Healthy Diets and Physical Activity	2017	English	All ages	Lifecycle focused. The general population, with key messages provided for each stage of the life cycle. Includes separate nutritional requirements and key messages for women during pregnancy; women during lactation; early childhood nutrition (0-59 months) subdivided into 0-6 months, 6-23 months, 24-59 months; late childhood (5-9 completed years); adolescents (10 - 19 years); adults (20–59 years); older persons (above 60 years).
Namibia	Food and nutrition guidelines for Namibia	2000	English	≥2y	The healthy population aged 2 years and older. The recommendations are not appropriate for children below the age of two years, or for groups with special nutritional needs. No recommendations for specific age groups or physiological groups.
Nigeria	Food-based dietary guidelines for Nigeria – a guide to healthy eating	2001, reprinted 2006 (but not revised)	Hausa, Yoruba, Igbo and English	All ages	Lifecycle focused. Healthy Nigerians and include recommendations for different population groups. Targeted groups include, infants 0-6 months, infants 6-12 months, toddlers 12-24 months, children 25-60 months, school age children 6-11 years, adolescents 12-18 years, adults, pregnant women, breastfeeding months and the elderly.

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Seychelles	The Seychelles Dietary Guidelines	2006	English, Seychellois Creole	≥2y	Healthy individuals aged 2 years and over.
Sierra Leone	Sierra Leone Food-Based Dietary Guidelines for Healthy Eating	2016	English	All ages	Lifecycle focused. The healthy general public. Additional information provided for sub population groups, such as pregnant and lactating mothers, infants and young children, school-aged children and adolescents. No lower age limits stated
South Africa	Food-based dietary guidelines for South African	2013	English	≥5y	People 5 years and older.
	Paediatric food-based dietary guidelines for South Africa	2013	English	≤7y	The paediatric FBDGs target children 0–7 years. - Exclusive breastfeeding (0-6 months) - Complementary feeding (6-12 and 12-36 months) - Responsive feeding (6-12 and 12-36 months) - Oral health (0-5 years) - Hygiene and sanitation (0-5 years)

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Table 2: Stated purposes of the dietary guidelines

Country	Stated purpose of dietary guideline	Types of messages/ recommendations in the FBDG
Benin	Promotion of healthy diet and prevention of obesity and diet-related NCDs	Dietary Physical activity, Lifestyle, Portion size,
Kenya	To promote healthy eating and active living as preventive measures that can help reduce the double burden of malnutrition, as well as diet and physical inactivity related to non-communicable diseases.	Dietary Physical activity Lifestyle Portion size
Namibia	To help people develop and practise healthy eating habits. Meant to advice the population about healthy food choices in order to contribute to a healthy lifestyle, which in turn helps to reduce the risk of developing diet-related diseases.	Dietary Lifestyle Body weight Hygiene
Nigeria	To provide information and knowledge on good nutrition that is essential in the prevention and management of NCDs.	Dietary Physical activity
Seychelles	To guide the population to consume a balanced diet which would meet the dietary goals that are critical for promoting well-being and preventing diet related diseases.	Dietary Body weight Hygiene Breastfeeding
Sierra Leone	To influence nutritional outcomes and aimed towards improving knowledge and skills on healthy eating patterns. Also aimed at helping policy makers in the development and implementation of food and nutrition-related policy and programmes.	Dietary Physical activity
South Africa	To inform, educate and empower South African consumers to change their eating behaviour. To address both dietary adequacy and prudency (Vorster, 2013).	Dietary Physical activity Hygiene
South Africa paediatric	To meet the nutritional needs of children with regard to growth and development, and the diet-related public health issues specific to South African children.	

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Table 3: Animal source food consumption promoted in FBDGs

Country	Meat	Lean meat	Fish	Egg	Poultry/chicken	Milk/milk products	Seafood	Insects
Benin								
Kenya								
Namibia								
Nigeria								
Seychelles								
Sierra Leone								
South Africa (main)								
South Africa (paediatric)								

Legend

	Daily
	Eat regularly/frequently
	5 days/ week
	At least twice/week
	No indication of frequency
	Replacement in absence of other ASF

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Table 4: Summary of plant source food recommendations

Country	Fruits and vegetables	Legumes, pulses, beans, nuts, and lentils	Starchy staples
Benin	Eat plenty of fruits and vegetables every day	Recommended as replacement for fish and meat where there is no fish and meat	Not specified. Instead "traditional cuisine or food" is listed.
Kenya	Eat plenty of fruits and vegetables every day	Eat regularly (at least four times a week).	Whole or unprocessed starchy foods as part of meals.
Namibia	Eat plenty of fruits and vegetables every day	Eat regularly	Wholegrain products
Nigeria	Liberal consumption of whatever fruit	The diet should contain as wide a variety of foods including legumes	Cereals, roots/tubers
Seychelles	Consume at least 5 portions of fruit and vegetables every day.	At least 4 times a week.	Wholegrains and other high-fibre starchy foods at least 3 times a week
Sierra Leone	Eat plenty of fruits, vegetables especially green leaves at every meal	Eat every day	Rice, cassava or other whole grains, roots or tubers
South Africa (main)	Eat plenty of fruits and vegetables every day	Eat regularly	Make starchy foods part of most meals.
South Africa (paediatric)	Eat plenty of fruits and vegetables every day	Not specified	Make starchy foods the basis of a child's main meals

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Table 5: Summary of food groups to limit or reduce

Country	Meals and products high in salt	Foods with added sugar	Carbonated drinks, sugar-sweetened beverages	Fats and oils	Alcoholic beverages
Benin	Avoid	Not specified	Drink in moderation	Limit the amount of oil/fat. Avoid multiple cooking with the same oil	Do not consume more than one drink a day.
Kenya	Use sparingly. Use iodized salt	Use sparingly.	Not specified	Use in moderation in meals. limit solid fat. Use fortified oil.	Not specified
Namibia	Use less. Use iodized salt	Not specified	Not specified	Not specified	Avoid drinking alcohol
Nigeria	Limit	Limit	Not specified	Limit intake from animal foods	Not specified
Seychelles	Small amounts	Minimal amounts	Minimal amounts	Reduce oil, fats and fatty foods. Remove fats on meat. Limit frying of foods to only once a week.	Do not exceed recommended amounts
Sierra Leone	Moderation. Use iodized salt.	Moderation	Moderation	Moderation	Not specified
South Africa (main)	Use sparingly	Use sparingly	Use sparingly	Use sparingly	Not specified
South Africa (paediatric)	Not specified	Offer small amounts with meals	Offer small amounts with meals	Not specified	Not applicable

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Table 6: Formation of a working group or committee

Country	Working group
Benin	Government agencies, academic institutions, international organizations and civil society
Kenya	Broad consultative process, led by the Nutrition and Dietetics Unit within the Ministry of Health and collaborators from other divisions, including, the Ministry of Health, the Ministry of Agriculture, Livestock and Fisheries, and academia and with support from the WHO, FAO, Micronutrient Initiative, and World Food Programme (WFP)
Namibia	Experts from several national ministries and institutions in collaboration with the FAO, the United Nations Children's Fund (UNICEF) and the WHO
Nigeria	Ministries of Health, Agriculture and Rural Development and Information; universities, the WHO, Helen Keller International, International Institute of Tropical Agriculture, and paediatric and nutrition societies
Seychelles	Nutrition Unit of the Ministry of Health
Sierra Leone	Sierra Leone's FBDG was initiated by the FAO, and they used the services of an independent consultant to provide technical direction in the drafting of the FBDGs, under the overall supervision of the FAO Chief Technical Adviser and FAO Representative in Sierra Leone, and the technical guidance of the Nutrition Unit of FAO's Nutrition and Food Systems Division in Rome. The consultant worked in collaboration with a task force including representatives from the Ministries of Agriculture, Forestry and Food Security and Health and Sanitation, as well as other key stakeholders in the country
South Africa	The South African guidelines was initiated by the Nutrition Society of South Africa (NSSA). A multi-sectoral effort involving the NSSA, the Department of Health, the Medical Research Council, academics, food producer organizations and United Nations agencies worked together. The South African national working group has also drafted a paediatric FBDG

REFERENCES

1. **GBD 2016 Risk Factors Collaborators.** Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 2017; vol **390 (10100):**1345-1422.

2. **GBD 2017.** Diet Collaborators Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, 2019: 393: 1958–72.

3. **Melaku YA, Renzaho A, Gill TK, Taylor AW, Dal Grande E, de Courten B, Baye E, Gonzalez-Chica D, Hyppönen E, Shi Z, Riley M, Adams R and Y Kinfu** Burden and trend of diet-related non-communicable diseases in Australia and comparison with 34 OECD countries, 1990-2015: findings from the Global Burden of Disease Study 2015. Eur J Nutr., 2019; **58(3)**:1299-1313. Epub 2018. *PMID*: 29516222. https://doi.org/10.1007/s00394-018-1656-7

4. **Lawrence M, Burlingame B, Caraher M, Holdsworth M, Neff and L Timotijevic** Public health nutrition and sustainability. *Public Health Nutrition,* 2015: **18(13)**: 2287-2292. https://doi.org/10.1017/S1368980015002402

5. **Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, Jonell M, Clark M, Gordon LJ, Fanzo J, Hawkes C, Zurayk R, Rivera JA, De Vries W, Sibanda LM, Afshin A, Chaudhary A, Herrero M, Agustina R, Branca F, Lartey A, Fan S, Crona B, Fox E, Bignet V, Troell M, Lindahl T, Singh S, Cornell SE, Reddy KS, Narain S, Nishtar S and CJL Murray** Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet, 2019: **393**: 447–492.

6. **Osei Kwasi HA, Mohindra A, Booth A, Laar A, Wanjohi M, Pradeilles R, Graham F, Cohen E and M Holdsworth** Factors influencing dietary behaviours in urban food environments in Africa: a systematic mapping review. *Public Health Nutrition*, 2020. https://doi.org/10.1017/S1368980019005305

7. **FAO/WHO.** International conference on nutrition: World Declaration and Plan of Action for Nutrition. 1992: WHO, Rome, December, 41 pp.

8. **Green H** Should foods or nutrients be the focus of guidelines to promote healthful eating? *Nutr Bull*., 2015: **40(4)**:296-302.

9. **Koenig JS** Visualization of Food-Based Dietary Guidelines – Examples. *Ann Nutr Metab.,* 2007: **51(2)**:36–43. https://doi.org/10.1159/000103566

10. **Levesque S, Delisle H and A Agueh** Contribution to the development of a food guide in Benin: linear programming for the optimization of local diets. *Public Health Nutrition*, 2014: 18(4), 622–631 https://doi.org/10.1017/S1368980014000706

11. **FAO.** Food-based dietary guidelines. Development process. 2021: Available: http://www.fao.org/nutrition/education/food-dietary-guidelines/background/development-process/en/ *Accessed 11 June 2021.*

12. **WHO.** Food based dietary guidelines in the WHO European Region. *Europe.* Available at: https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/publications/technical-documents/dietary-recommendations-and-nutritional-requirements/food-based-dietary-guidelines-in-the-who-european-region Copenhagen: WHO. *Accessed June 11, 2021.*

13. **Aranceta-Bartrina J, Partearroyo T, López-Sobaler AM, Ortega RM, Varela-Moreiras G, Serra-Majem L, Pérez-Rodrigo C and The Collaborative Group for the Dietary Guidelines for the Spanish Population (SENC)** Updating the Food-Based Dietary Guidelines for the Spanish Population: The Spanish Society of Community Nutrition (SENC) Proposal. *Nutrients*, 2019: **11**, 2675. https://doi.org/10.3390/nu11112675

14. **EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA).** Scientific Opinion on establishing Food-Based Dietary Guidelines. *EFSA J.*, 2010; **vol 8**: 1460.

15. **Blake P, Durão S, Naude CE and L Bero** An analysis of methods used to synthesize evidence and grade recommendations in food-based dietary guidelines. *Nutr Rev.,* 2018; vol **76(4)**: 290–300.

16. **FAO.** Plates, pyramids, planet Developments in national healthy and sustainable dietary guidelines: a state of play assessment. 2016: https://www.oxfordmartin.ox.ac.uk/downloads/academic/plates-pyramids-planets.pdf. *Accessed June 11, 2021.*

17. **Bosu WK** An overview of the nutrition transition in West Africa: implications for non-communicable diseases. *Proc Nutr Soc*., 2015; **vol 74(4)**:466-77.

18. **Vorster HH, Kruger A and BM Margetts** The Nutrition Transition in Africa: Can It Be Steered into a More Positive Direction? *Nutrients*, 2011; **3**: 429-441.

19. **Canagarajah S** Negotiating the Local in English as a Lingua France. *Annual Review of Applied Linguistics,* 2006; **26**:197-218.

20. **Vorster HH, Badham JB and CS Venter** An introduction to the revised food-based dietary guidelines for South Africa. *S Afr J Clin Nutr*., 2013; **26(3) (Supplement**): S5-S12.

21. **World Health Organization [WHO] and Food and Agriculture Organization [FAO] of the United Nations.** Preparation and Use of Food-Based Dietary Guidelines. 1996: Available: http://www.fao.org/docrep/X0243E/x0243e00.htm *Accessed June 11 2021.*

22. **de Pee S** Nutrient Needs and Approaches to Meeting Them. In: de Pee S., Taren D., Bloem M. (eds) Nutrition and Health in a Developing World. Nutrition and Health. Humana Press, Cham. 2017. https://doi.org/10.1007/978-3-319-43739-2_8

23. **Arimond M, Wiesmann D, Becquey E, Carriquiry A, Daniels MC, Deitchler M, Fanou-Fogny N, Joseph ML, Kennedy G, Martin-Prevel Y and LE Torheim** Simple Food Group Diversity Indicators Predict Micronutrient Adequacy of Women's Diets in 5 Diverse, Resource-Poor Settings, *The Journal of Nutrition*, 2010; **140 (11)**: 2059S–2069S. https://doi.org/10.3945/jn.110.123414

24. **Marshall TA, Stumbo PJ, Warren JJ and X-J Xie** Inadequate Nutrient Intakes Are Common and Are Associated with Low Diet Variety in Rural, Community-Dwelling Elderly. *The Journal of Nutrition*, 2001; **131(8)**: 2192–2196. https://doi.org/10.1093/jn/131.8.2192

25. **US Department of Health and Human Services and US Department of Agriculture.** 2015–2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/ *Accessed June 11, 2021.*

26. **Liu RH** Health-Promoting Components of Fruits and Vegetables in the Diet, *Advances in Nutrition*, 2013; **4(3)**: 384S–392S. https://doi.org/10.3945/an.112.003517

27. **Naude CE** "Eat plenty of vegetables and fruit every day": a food-based dietary guideline for South Africa. *S Afr J Clin Nutr*., 2013; **26(3):** (Supplement): S46-S56.

28. **He F, Nowson C and M Lucas** Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: meta-analysis of cohort studies. *J Hum Hypertens*, 2007; **21**: 717–728. https://doi.org/10.1038/sj.jhh.1002212

29. **Lim M and J Kim** Association between fruit and vegetable consumption and risk of metabolic syndrome determined using the Korean Genome and Epidemiology Study (KoGES). *Eur J Nutr*., 2020; **59(4)**: 1667-1678. https://doi.org/10.1007/s00394-019-02021-5

30. **Mozaffari H, Lafrenière J and A Conklin** Does Eating More Variety of Fruits and Vegetables Reduce Risk of Cancer? Findings from a Systematic Review and Meta-Analysis. *Current Developments in Nutrition*, 2020; **4(2)**: June 2020, Page 339. https://doi.org/10.1093/cdn/nzaa044_038

31. **Xian J, Jiang H, Daqiang S, Ru D, Jicheng W and Z Zhuo** Increased Consumption of Fruit and Vegetables Is Related to a Reduced Risk of Cognitive Impairment and Dementia: Meta-Analysis. *Frontiers in Aging Neuroscience*, 2017; **9**. https://doi.org/10.3389/fnagi.2017.00018

32. **Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M and M Ezzati** Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet,* 2013; **382(9890):** 427–451.

33. **Dewey KG, and S Adu-Afarwuah** Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Maternal & Child Nutrition*, 2008; **4(1)**: 24–85.36.

34. **Pathak H, Jain N, Bhatia A, Patel J and PK Aggarwal** Carbon footprints of Indian food items. *Agric Ecosyst Environ*., 2010; **139(1–2)**: 66–73.

35. **You W and M Henneberg** Meat consumption providing a surplus energy in modern diet contributes to obesity prevalence: An ecological analysis. *BMC Nutrition*, 2016; **2(1)**: 22.

36. **Bouvard V, Loomis D, Guyton KZ, Grosse Y, El Ghissassi F, Benbrahim-Tallaa L, Guha N, Mattock H, Straif K, and International Agency for Research on Cancer Monograph Working Group** Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology,* 2015; **16(16)**: 1599–1600.

37. **Röös E, Garnett T, Watz V and C Sjörs** The role of dairy and plant based dairy alternatives in sustainable diets. *SLU Future Food Reports*, 2018: **3**.

38. **Fanzo J, and R McLaren** An Overview of the Ethics of Eating and Drinking. In: Meiselman H. (eds) Handbook of Eating and Drinking. Springer, Cham. 2020: https://doi.org/10.1007/978-3-030-14504-0_82

39. **Haas R, Schnepps A, Pichler A and O Meixner** Cow Milk versus Plant-Based Milk Substitutes: A Comparison of Product Image and Motivational Structure of Consumption. *Sustainability*, 2019; **11**: 5046.

40. **Wu S, Fisher-Hoch, SP, Reininger B and JB McCormick** Recommended Levels of Physical Activity Are Associated with Reduced Risk of the Metabolic Syndrome in Mexican-Americans. *PLoS One*, 2016; **11**: e0152896.

41. **FAO.** Sustainable Diets and Biodiversity: Directions and solutions for policy, research and action. 2012. http://www.fao.org/3/i3004e/i3004e00.htm *Accessed June 11, 2021.*

42. **Garnett T** Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy*, 2011; **36**: S23–S32.

43. **Lindgren E, Harris F and AD Dangour** Sustainable food systems—a health perspective. *Sustain Sci*., 2018; **13:** 1505–1517. https://doi.org/10.1007/s11625-018-0586-x

44. **Springmann M, Mason-D'Croz D, Robinson S, Garnett T, Godfray HC, Gollin D, Rayner M, Ballon P and P Scarborough** Global and regional health effects of future food production under climate change: a modelling study. The Lancet, 2016; **387**: 1937–1946. https://doi.org/10.1016/S0140-6736(15)01156-3

45. **Meybeck A, Redfern S, Paoletti F and C Strassner** Assessing sustainable diets within the sustainability of food systems. Mediterranean diet, organic food: new challenges. In *Proc. International Workshop,* (eds Meybeck, A. et al.). 2014: 167–173.

46. **FAO/WHO.** Preparation and Use of Food-based Dietary Guidelines: Report of a Joint FAO/WHO Consultation. WHO Technical Report Series. 1998: 880.

47. **FAO.** Developing Food-based Dietary Guidelines - A manual from the English-speaking Caribbean. 2007. http://www.fao.org/docrep/pdf/010/ai800e/ai800e00.pdf *Accessed June 11, 2021.*

48. **WHO.** Joint FAO/WHO Consultation on Preparation and Use of Food-Based Dietary Guidelines (1995: Nicosia, Cyprus) & World Health Organization. (1998). Preparation and use of food-based dietary guidelines / report of a joint FAO/WHO consultation. World Health Organization. https://apps.who.int/iris/handle/10665/42051 *Accessed June 11, 2021.*

49. **WHO.** Preparation and use of food-based dietary guidelines. Report of a joint FAO/WHO consultation Nicosia, Cyprus. 1996: Available: http://www.fao.org/3/x0243e/x0243e00.htm *Accessed June 11, 2021.*

50. **Vorster H** Revised food-based dietary guidelines for South Africa: challenges pertaining to their testing, implementation and evaluation. *S Afr J Clin Nutr.*, 2013; S2. **26(3)**.

51. **Montagnese C, Santarpia L, Buonifacio M, Nardelli A, Caldara AR, Silvestri E, Contaldo F and F Pasanisi** European Food-Based Dietary Guidelines: A Comparison and Update. *Nutrition,* 2015; **31**: 908-915.

52. **Vorster H and JB Badham** An introduction to the revised food-based dietary guidelines for South Africa. *S Afr J Clin Nutr.,* 2013; **26(3)**: (Supplement): S5-S12.

53. **Labadarios D, Steyn NP and E Maunder** The National Food Consumption Survey (NFCS): children aged 1-9 years, South Africa, 1999. Pretoria: Department of Health; 2000.

54. **Love P, Maunder E, Green M, Ross F, Smale-Lovely J and KE Charlton** South African food-based dietary guidelines: testing of the preliminary guidelines among women in KwaZulu-Natal and the Western Cape. *S Afr J Clin Nutr.,* 2001; **14 (1)**: 9-19.

55. **Vorster HH, Love P and C Browne** Development of food-based dietary guidelines for South-Africa – the process. S Afr J Clin Nutr., 2001; **14**: S3–S6.