

Nutritional adequacy in Africa: The basis for planning sustainable and diverse food supply

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Introduction

The relative increase in the regional and global cereal production for the last half a century is paralleled by slower rate of legume and vegetable production which might affect the nutrient balance of the daily diet. This imbalance could have resulted in the simplification of diets, lack of dietary diversity, the nutrition transition phenomenon and the coexistent of hunger, malnutrition, and obesity related diseases. It is therefore imperative to test the adequacy of the diets of some selected countries in Africa so that the state of the matter reveals the direction for improvement.

Materials and methods

Africa is a large continent with diverse ethno-cultural and biophysical set up which influence the type of diets prepared from over 100 types of food ingredients. It is not possible to find a single representative diet for Africa. However, the diets of eight arbitrarily selected countries (Algeria, Egypt, Ethiopia, Kenya, Zimbabwe, South Africa, Cameroon and Ghana) are expected to indicate the nutritional adequacy.

The data on the national availability of the main food ingredients for consumption provide a valuable insight into the diets of each country. The FAO regularly produces such data. The data of 2007, which was the latest on the onset of this study, formed one part of the equation used to analyse the national nutritional adequacy (1).

Daily nutrient requirement varies according to gender, age, body size and physical activity level. The median of age and physical activity level of each gender are considered to calculate the mean nutrient requirement of the population (2).

The amount of per capita foodstuffs available for consumption and the characteristics of the major class of the population (working age: 15 – 65 years old, and the median physical activity level) are entered in the NutriSurvey computer program to test the adequacy of the diets (3).

Results and discussion

The major types of food ingredients available for consumption in each country, their nutritional characteristics, the level of consumption and the nutritional adequacy are analysed.

Diet composition

The available foodstuffs are categorized into ten classes based on their similarity in nutrient content (Table 1). Cereals are rich in carbohydrates and chemical energy but deficient in protein and micronutrients. Roots and tubers are good sources of carbohydrates, high in moisture content and low in protein with relatively better biological value than the proteins of cereals.

Table 1. Major classes of food in Africa

Classes of food	Foodstuffs (food type)
I. Cereals & sugars	Wheat, maize, rice, sorghum, barley, sorghum, millet, rye, oats, teff
II. Roots, tubers & sugar crops	Potatoes, sweet potatoes, cassava, yam, sugar cane, sugar beet, enset
III. Pulses, nuts & oil crops	Beans, peas, chick peas, lentils, soybeans, groundnuts, almonds, walnuts, coconuts, linseeds, sunflower seed, sesame seed
IV. Vegetables	Cabbages, spinach, salad, tomatoes, onions, carrots, cucumber, pumpkin
V. Fruits	Banana, orange, mandarin, appel, pine appel, plantains, dates, grappes, limons, grapefruits
VI. Meat, poultry, fish	All sorts of meat, fish, egg
VII. Milk excluding butter	Liquid milk from all sorts of farm animals, skim milk, yoghurt
VIII. Fat	Vegetable oil and butter
IX. Spices & stimulants	Salt, spices, tea, coffee
X. Beverage	Alcoholic drinks

Pulses are in general better suppliers of protein than cereals; they are also better sources of minerals and vitamins; but they are poor in riboflavin. Some of the foodstuffs in this group (nuts, soy bean...) are rich in oil content.

Table 2. Mean (range) nutrient composition in 100g food ingredient

Nutrient	Cereals	Pulses	Vegetables	Fruits	Meat
Energy (kcal)	340 (332 - 357)	403 (344 - 498)	28 (18 - 43)	55 (43 - 62)	262 (122-418)
Proteins (g)	10.0 (8.7 - 10.9)	20.7 (17 - 26.2)	1.98 (1 - 3.5)	0.6 0.2 - 1.4	19 (16-21)
Ca (mg)	25.8 (7 - 54)	116.4 (51 - 277)	40.9 (10 - 135)	13.9 (5 - 40)	15 (11-22)
Fe (mg)	2.78 (0.8- 4.72)	9.18 (4.98 - 15.7)	0.59 (0.3 - 0.86)	0.26 (0.1 - 0.42)	3.7 (1.8-4.8)
Zn (mg)	10.5 (2 - 35)	19.8 (2 - 58)	27 (3 - 69)	2.07 (0 - 16)	4.2 (1.9-5.4)
Se (mcg)	23.7 (2.8 - 89.4)	9.28 (3.1 - 17.8)	0.76 (0 - 2.5)	0.31 (0 - 0.6)	
β carotene (mcg)			416 (15 - 1430)	105 (25 - 310)	
Riboflavin (mg)	0.14 (0.1 - 0.22)	0.18 (0.16 - 0.24)	0.08 (0.04 - 0.13)		
Ascorbic acid (mg)				34.2 (1 - 74)	

Sources: FAO. Food Composition Table for Use in Africa. USDA Food Composition Database

Vegetables are diverse in their botanic structure and nutritive properties but similar in their low energy and protein concentration. They are variably good suppliers of vitamin C, beta carotene and folic acid. Fruits are also markedly variable in nature, but they all own pleasant and attractive flavour. They have low nutrient concentration because of the high proportion of moisture but they are rich in vitamin C. Among them bananas contain relatively higher amount of carbohydrates and they sometimes count to the part of the staple food of some African communities.

Meat, fish and eggs are good sources of quality protein. Meat is particularly rich in iron, zinc, riboflavin, niacin and cyanocobalamin; and fish exceeds in its vitamin A, vitamin D, iodine

and essential fatty acids content. The energy value of meat can fluctuate based on its fat fraction.

Food ingredients available for consumption

Cereals form the major component of the diets in North, East and South Africa whereas roots and tubers are predominant in West Africa (Table 3). Both cereals and roots and tubers are diverse in nature and the level of use in the different regions is variable. In North Africa wheat is the major cereal (70%), followed by coarse cereals (~20%). In East Africa coarse cereals (maize, barley, sorghum) account for about 66% of the cereals; Teff, which is relatively high in iron, is additionally important cereal in Ethiopia. Similar to that in East Africa, the dominant cereals in South Africa are coarse cereals (67%), with maize accounting for about 60% of the group. In Ghana cassava and yam account for about 90% of the roots and tubers, whereas in Cameroon cassava (64%) is the major crop in the category roots and tubers; followed by potatoes, sweet potatoes and yams at the level close to 20%. Rice is an important complement to the staple foods in West Africa, Egypt, and South Africa.

Table 3. Food ingredients available for consumption (kg/capita/ Day)

	Cereals	R&t*	Pulses	Vege.s.	Fruits	Meat	Fat	Milk	Sugars*	Others
Algeria	228	43	9	119	64	30	15	118	33	8
Egypt	230	29	8	203	100	42	7	62	24	5
Ethiopia	145	76	17	13	12	9	2	17	6	18
Kenya	119	47	18	50	54	21	8	98	18	14
Zimbabwe	161	18	12	14	14	23	11	28	28	37
S. Africa	186	32	6	36	34	64	15	58	31	69
Cameroon	113	131	20	73	84	17	8	13	11	49
Ghana	98	378	15	36	146	44	10	8	12	24
Mean	160	94	13	68	64	31	10	50	20	28

*R&t = root and tubers; Sugars = cane sugar, beet sugar and honey

Dry legumes, tree nuts and oilseeds are classified as pulses because of the low contributions of the oilseeds and tree nuts to the diets of most countries and because of similarity in protein content. In North and East Africa the major pulses are dry legumes (eg. beans, peas and chickpeas) whereas in Ghana the oilseeds (eg. peanut, coconut) are predominant. The proportions of legumes, oilseeds and tree nuts in the pulses of North Africa are - 78%:13%:9% respectively; in East Africa 90%:6%:4%; in South Africa 46%: 50%:4%; and in Ghana 5%:88%:7%.

Food consumption

The level of food consumption is highly variable ranging between 852g/capita/day (1914kcal/capita/day) in Ethiopia to more than 2000g/capita/day (3000kcal/capita/day) in Egypt and Ghana (Table 4). The global average for the years 2000 – 2015 is estimated at 2803 – 2940 kcal/capita/day; with an average of 2681 kcal/capita/day for developing countries and 3380 kcal for industrial countries (6).

North Africa and Ghana excel the global average daily food consumption in terms of gravimeter by about +30% and in terms of calorie meter by +24%terms; whereas East Africa underlies by about -30% in gravimeter and -25% in calorie meter. Egypt has higher per capita daily intake in grams but lower calorie intake than Algeria. The discrepancy can be attributed to the differences in energy or moisture concentration of the foodstuffs, which in turn affect the nutrient supply in the diet.

Table 4. Apparent food consumption in different regions of Africa

Country	Apparent food intake		Dietary energy Conc. kcal/kg
	g/capita/day	kcal/capit/day	
Algeria	1827	3491	1911
Egypt	2059	3369	1636
Ethiopia	852	1914	2246
Kenya	1294	2253	1741
Zimbabwe	946	2304	2436
S. Africa	1454	2858	1965
Cameroon	1489	2457	1650
Ghana	2140	3522	1645
Mean	1508	2771	1904

Nutritional adequacy

North Africa and Ghana are exposed to over nutrition while East Africa is largely affected by under nutrition; but under weight coexists with overweight because of unequal access to food. A sample survey in Egypt indicated that the daily per capita dietary energy intake varied between 1500 kcal for the lowest 17% and more than 3500 kcal for the highest 18% of the population (7).

Table 3. Test of nutritional adequacy: % fulfilment of the recommended intake

	Energy	Protein	Vit.A	Vit. E	Vit. B1	Vit. B2	Folic acid	Vit. C	Ca	Fe	Zn
Algeria	138	202	205	313	370	147	117	158	84	197	348
Egypt	133	217	533	245	388	148	124	282	72	218	367
Ethiopia	76	106	29	56	68	53	25	44	26	79	103
Kenya	89	104	258	189	138	106	53	121	51	69	166
Zimbabwe	91	111	102	174	201	97	53	33	24	85	220
S. Africa	113	178	307	249	240	144	70	88	42	118	312
Cameroon	97	114	263	205	203	93	88	211	33	140	192
Ghana	139	123	123	207	180	97	114	428	54	170	227

The diets of all eight countries are deficient in calcium probably because of low level of pulses, vegetables, milk and milk products. Excluding the diets of the North African countries and Ghana, folic acid is lacking in the diets of the other five countries. In view of the low availability of foodstuffs and the predominance of staple foods, it may not be surprising to encounter relatively high rates of micronutrient deficiency in East Africa. Calcium, folic acid, riboflavin, ascorbic acid and iron deficiency are outstanding.

Conclusion

As the foodstuffs of plant origin differ considerably in their nutrient concentration, it is essential to maintain the proportion of staples, pulses and vegetables at the level where they satisfy the micronutrients requirement. This study reveals the consumption of mineral rich legumes in all countries is low. Even if the optimum level of pulses in the daily diet is yet to be set, some 100g of pulses is known to cover half of the daily iron requirement. At least 400g/day of vegetables and fruits is recommended as a component of a healthy diet (8)

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