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## Conference on ‘Food and nutrition security in Africa: new challenges and opportunities for sustainability’

### An overview of the nutrition transition in West Africa: implications for non-communicable diseases

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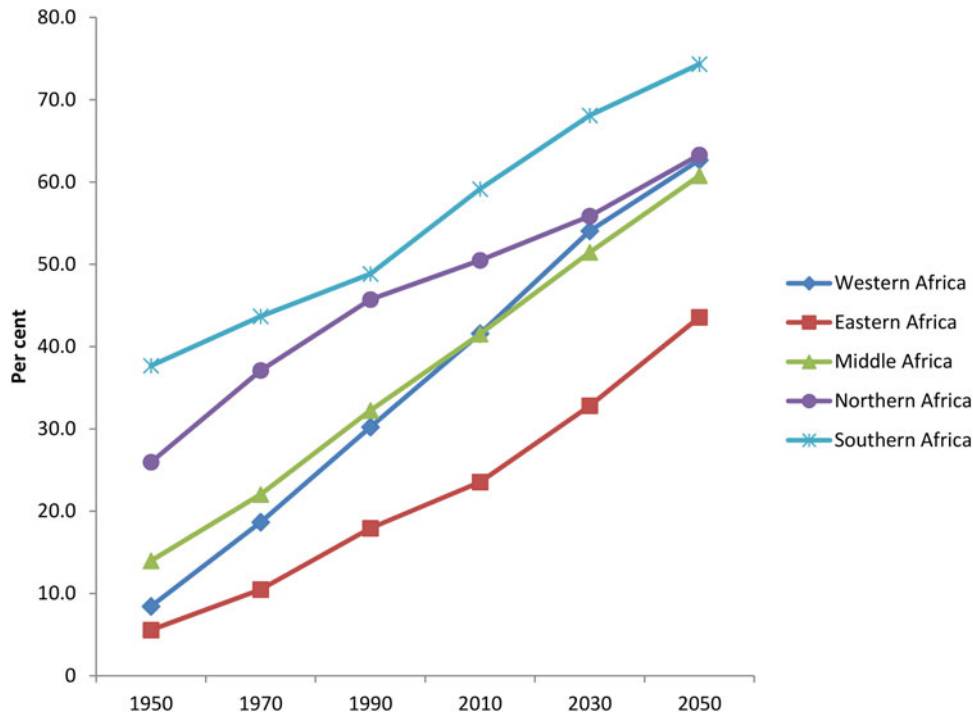
The nutrition landscape in West Africa has been dominated by the programmes to address undernutrition. However, with increasing urbanisation, technological developments and associated change in dietary patterns and physical activity, childhood and adult overweight, and obesity are becoming more prevalent. There is an evidence of increasing intake of dietary energy, fat, sugars and protein. There is low consumption of fruit and vegetables universally in West Africa. Overall, the foods consumed are predominantly traditional with the component major food groups within recommended levels. Most of the West African countries are at the early stages of nutrition transition but countries such as Cape Verde, Ghana and Senegal are at the latter stages. In the major cities of the region, children consume energy-dense foods such as candies, ice cream and sweetened beverages up to seven times as frequently as fruit and vegetables. Adult obesity rates have increased by 115 % in 15 years since 2004. In Ghana, the prevalence of overweight/obesity in women has increased from 12.8 % in 1993 to 29.9 % in 2008. In Accra, overweight/obesity in women has increased from 62.2 % in 2003 to 64.9 % in 2009. The age-standardised proportion of adults who engage in adequate levels of physical activity ranges from 46.8 % in Mali to 94.7 % in Benin. The lingering stunting in children and the rising overweight in adults have resulted to a dual burden of malnutrition affecting 16.2 % of mother–child pairs in Cotonou. The prevalence of hypertension has been increased and ranges from 17.6 % in Burkina Faso to 38.7 % in Cape Verde. The prevalence is higher in the cities: 40.2 % in Ougadougou, 46.0 % in St Louis and 54.6 % in Accra. The prevalence of diabetes ranges from 2.5 to 7.9 % but could be as high as 17.9 % in Dakar, Senegal. The consequences of nutrition transition are not only being felt by the persons in the high socioeconomic class, but also in cities such as Accra and Ougadougou, where at least 19 % of adults from the poorest households are overweight and 19–28 % have hypertension. Concerted national action involving governments, partners, private sector and civil society is needed to re-orient health systems and build capacity to address the dual burden of malnutrition, to regulate the food and beverage industry and to encourage healthy eating throughout the life course.

#### Nutrition transition: Overweight: Physical activity: Non-communicable diseases: West Africa

West Africa is one of the world’s poorest regions. With the exception of Cape Verde and Ghana, all the other fourteen countries in the region are in the bottom thirty-three countries of United Nations’ Human Development Index ranking of 186 countries<sup>(1)</sup>. Not surprisingly, the

region has often been in the global news because of the food and nutrition insecurity. According to the Global Burden of Disease Study in 2010, child undernutrition has been the leading risk factor of premature deaths and disability since 1990<sup>(2)</sup>. Three other nutritional risk

**Abbreviations:** DES, daily energy supply; DHS, Demographic and Health Survey; NCD, non-communicable disease; SSA, sub-Saharan Africa; SSB, sugar-sweetened beverages; WAHO, West African Health Organisation.  
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**Fig. 1.** (colour online) Trends in the proportion of urban population in different regions of Africa, 1950–2050. Source: UN Population Division.

factors such as suboptimal breastfeeding, iron deficiency and vitamin A deficiency, feature among the leading risk factors. Of the fifty-two million children under aged 5 years in the region, an estimated 36.4 % are stunted, 21.8 % are underweight and 10.4 % are wasted<sup>(3)</sup>. Nearly three-quarters of them are anaemic, this being the worst in the world. Justifiably, undernutrition has been a major priority in the region. However, only slow progress has been made. Worldwide, sub-Saharan Africa (SSA) achieved the least (16.7 %) decline in the global hunger index between 1990 and 2012<sup>(4)</sup>. Stunting rates in West and Central Africa had declined by only 11 % from 44 to 39 % between 1990 and 2011<sup>(5)</sup>. On the whole, Africa will experience the slowest decline in stunting globally up until 2025<sup>(3)</sup>.

In contrast, with the slow decline in child undernutrition, Africa is experiencing a rapid increase in childhood overweight, with the prevalence rising from 4.0 % in 1990 to 8.5 % in 2010 and projected to reach 12.7 % in 2020<sup>(6)</sup>. Adult obesity has also increased in recent decades with an attendant increase in the burden of cardiometabolic diseases or chronic non-communicable diseases (NCD)<sup>(7)</sup>. Unhealthy diets along with physical inactivity, obesity and smoking are established risk factors for chronic diseases<sup>(8,9)</sup>. The present paper reviews evidence of changing diet practices in West Africa and examines some of its effects such as obesity, hypertension and diabetes.

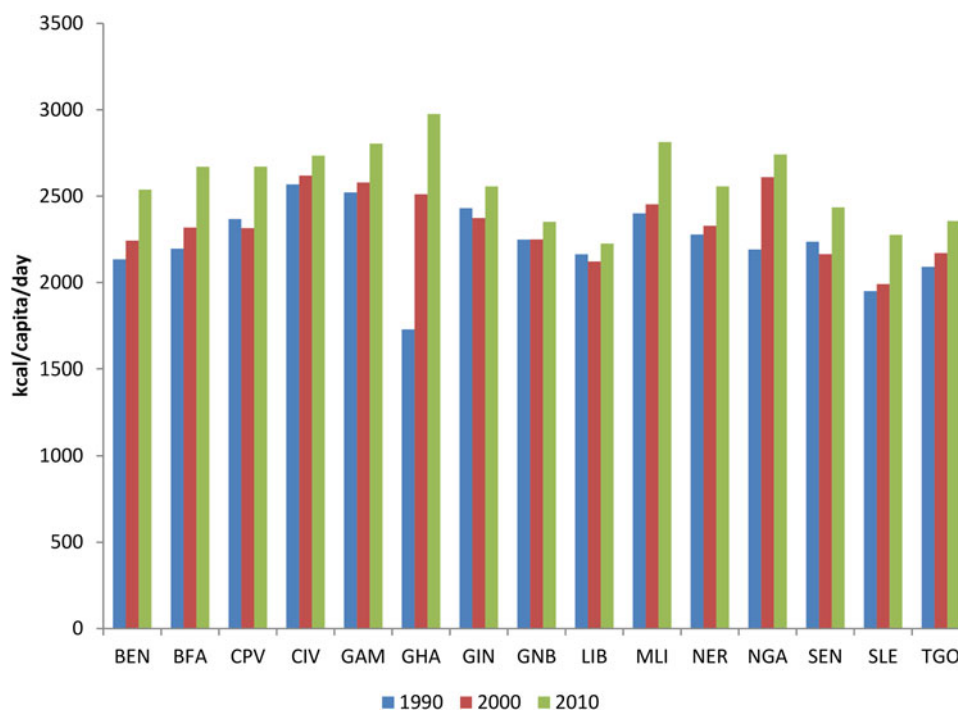
### Urbanisation

The urban proportion of the West African population doubled from 18.7 % in 1970 to 41.6 % in 2010

(Fig. 1)<sup>(10)</sup>. It is projected to reach 62.7 % by the year 2050, representing an 80 % increase in 50 years. West Africa is experiencing the most rapid increase in urbanisation in Africa (Fig. 1). The increase in population is derived from the natural increase within the urban centres and the in-migration from the rural areas. There are variations between and within countries. The fraction of the population living in urban areas in 2010 ranged from 17.5 % in Niger to 61.8 % in Cape Verde.

Urbanisation has been associated with changes in the quality and quantity of foods eaten, where meals are eaten with proportion to the cost of the foods<sup>(11)</sup>. There are both demand-side and supply-side changes. The increased incomes, little time to prepare meals, and the individual preferences contribute to the increased demand and consumption of energy-dense processed foods and fast foods which may be eaten inside or outside the home<sup>(12)</sup>. In West Africa, the consumption of fast foods by children has also become a social class status symbol<sup>(13)</sup>. On the supply-side is the rapid increase in the number of fast-food chains, supermarkets and transnational food corporations as well as in the volume of food imports<sup>(14,15)</sup>. The marketing strategies have also evolved to become more aggressive. Unhealthy foods or drinks are sometimes presented as good or glamorous.

Urbanisation is also associated with changes in stress and physical activity. As technology and labour-saving devices at the office, workplace, home and public spaces have increased, urban residents have become less physically active. These devices could be as innocuous as a remote control or a swivel chair or as sophisticated as motorised vehicles, escalators or washing machines.



**Fig. 2.** (colour online) Per capita daily energy supply in West African countries, 1990–2010. BEN, Benin; BFA, Burkina Faso; CPV, Cape Verde; CIV, Cote d'Ivoire; GAM, The Gambia; GHA, Ghana; GIN, Guinea; GNB, Guinea-Bissau; LIB, Liberia; MLI, Mali; NER, Niger; NGA, Nigeria; SEN, Senegal; SLE, Sierra Leone; TGO, Togo. Source: Food and Agricultural Organisation.

Many cities in West Africa are not well planned with well-defined bicycle or pedestrian lanes. The limited availability of recreational parks, gyms, and reliable transportation systems hinder programmes to encourage physical activity. It is increasingly common for children to travel to schools in cars rather than on foot or by bicycle. Watching television for >3 h daily has been associated with overweight among adolescents in the region<sup>(16)</sup>.

### Dietary changes

The available energy supply (as a proxy for intake) in West Africa has been increasingly steady. According to the food balance sheets from the Food and Agricultural Organisation, per capita daily energy in the region increased from 8376.4 kJ (2002 kcal) in 1985 to 11292.6 kJ (2699 kcal)<sup>(17)</sup>. The energy supply has increased in all the countries in the region, particularly in Burkina Faso, Nigeria and Ghana (Fig. 2). The component energy supply from the food groups have all been on an upward trend. The per capita daily fat supply increased from 46.0 to 61.6 g over the same period, whereas protein increased from 48.0 to 64.2 g. These available energy and component values are much lower than those of other regions.

Despite the increasing energy supply and overweight statistics, the dietary composition has remained essentially the same over the past 40 years (Table 1)<sup>(17)</sup>. About 70 % of the total daily energy supply (DES) is

obtained from carbohydrates, 10 % from protein and the remaining 20 % from fat. In contrast, in the European Union and North America twice as much of the total DES is obtained from fat to that of West Africa. Only half of the daily energy intake is obtained from carbohydrates. Furthermore, only about 5 % of the DES is obtained from animal sources in West Africa compared with one-third in Western countries. Animal fat appears to be an insignificant component of the fat supply in West Africa.

Overall, the total per capita DES and the dietary composition are not consistent with any significant nutrition transition at the national level. Abrahams *et al.* applied a scoring system based on six indicators to assess the extent of nutrition transition in 40 sub-Saharan countries<sup>(18)</sup>. These indicators were based on the expectation that, in countries well advanced in nutrition transition, dietary energy intake will be high, with a significant intake of fat; adult overweight levels will be high, while child stunting will be low; the proportion of the population living on ≤US\$1 will be low, so will be the infant mortality rate. Their results showed that most West African countries were in the very early stages of transition. Of the four countries in the final stages of transition, two were in West Africa (Ghana and Cape Verde), one in Central Africa (Gabon) and the other in southern Africa (South Africa). Gambia and Senegal were into the middle stages of the transition.

Some household surveys in the region provide empirical evidence of the early stage of transition. Sodjinou *et al.* found that two-thirds of adults in Cotonou ate

**Table 1.** Dietary patterns from food balance sheets for West Africa, European Union, Western Europe and North America

Indicator	West Africa				Western Europe	European Union	North America
	1980	1990	2000	2010	2010	2010	2010
Total energy (Cal/d)	1945	2199	2501	2699	3515	3410	3515
Protein (g/d)	46.8	52.2	58.2	64.2	106.5	104.8	106.5
Fat (g/d)	46.4	49.4	55	61.6	151	142.4	151
Carbohydrate (Cal/d)	1340.2	1545.6	1773.2	1887.8	1730	1709.2	1730
Protein (Cal/d)	187.2	208.8	232.8	256.8	426	419.2	426
Fat (Cal/d)	417.6	444.6	495	554.4	1359	1281.6	1359
Total energy from animal products (kcal/d)	130	109	111	138	1123	997	1123
Animal fats (g/d)	1	0.9	0.9	1.1	28.6	20.9	28.6
Fruits and veggie (kcal/d)	116	110	125	136	177	191	177
Sugars and sweeteners (kcal/d)	87	62	83	100	444	362	539
% Energy from animal products	6.7	5.0	4.4	5.1	31.9	29.2	31.9
% fat as animal fats	2.2	1.8	1.6	1.8	18.9	14.7	18.9
% Energy from carbs	68.9	70.3	70.9	69.9	49.2	50.1	49.2
% Energy from protein	9.6	9.5	9.3	9.5	12.1	12.3	12.1
% Energy from fat	21.5	20.2	19.8	20.5	38.7	37.6	38.7

Source: Food and Agricultural Organisation.

traditional diets, whereas one-third ate transitional diets<sup>(19)</sup>. Those on the transitional diet ate significantly higher amounts of white bread, local roots and tubers, potatoes, nuts and seeds, meat, eggs, milk and milk products, fats and sweets and significantly lower amounts of fruits. Compared with the traditional diet, the transitional diet was more diversified but less healthy with 80 % higher amounts of cholesterol (136.6 v. 76.1 mg/d). Residents who ate transitional diets were from a higher socioeconomic status than those who ate the traditional diets.

A similar finding was reported in Ouagadougou, where the diet was largely traditional comprising cereals, vegetables and vegetable source fats<sup>(20)</sup>. Among the population who ate 'modern' type foods, there was a higher prevalence of overweight.

### Unhealthy eating in childhood

The indicators pointing to very early stage of nutrition transition in West Africa should not give grounds for celebration. Unhealthy eating in West Africa begins early in life. Only 4 % of fifth-grade children aged 12 years in Ouagadougou reported eating fruit or vegetables daily, whereas nearly five times as many ate ice pop daily<sup>(21)</sup>. Those reporting daily consumption of cakes or candies were twice those eating fruit, vegetables or legumes daily. About 17–25 % of children had not eaten any fruit, legumes, vegetables, fish or meat during the week preceding the survey. The consumption of unhealthy foods was influenced by their availability and peers' eating habits.

In Ghana, 20 % of junior and senior high school students aged 12–18 years reported as not eating any fruit at breakfast during the week preceding a survey, and 13 % did not eat any vegetables<sup>(22)</sup>. Only 43 and 52 % of the adolescents ate fruit or vegetables at breakfast respectively during the preceding week of the survey.

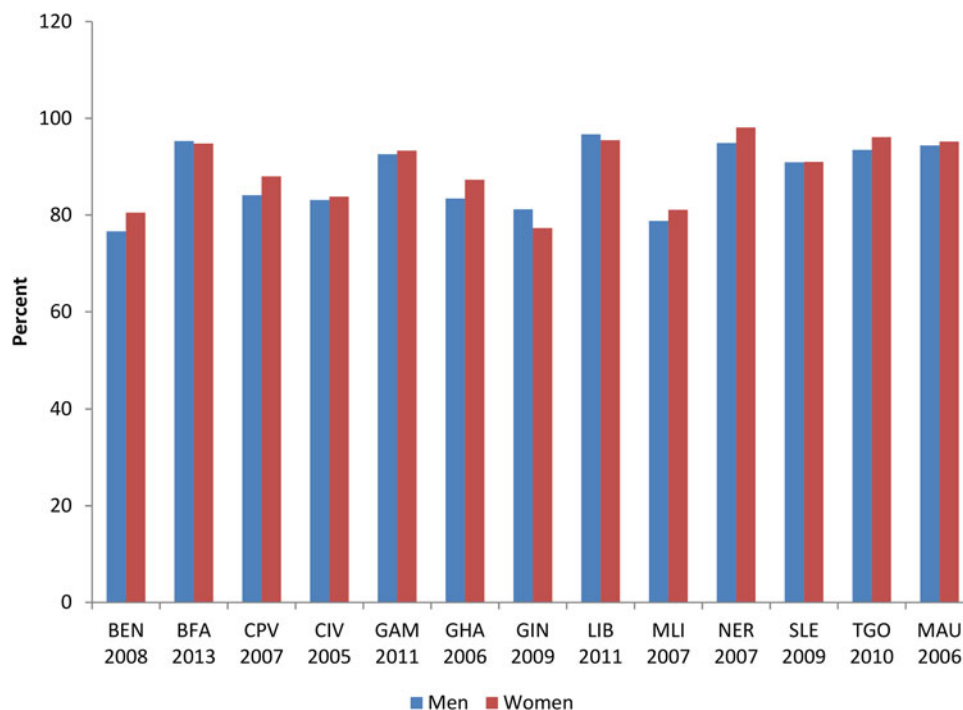
In multivariate analysis, having a father or mother with primary education, a mother with low-grade employment (skilled or unskilled manual work) and high school performance were significantly associated with fruit intake. Having a father with tertiary education and high school performance were the factors independently associated with the vegetable intake.

Among adolescents aged 10–19 years in Cotonou, Benin in 2007, the mean daily amount of fruit and vegetables per child was 97 g compared with 304 g sweet foods, including sweet beverages, candies and chocolate<sup>(23)</sup>. Overall, 45.7 % of the total energy intake of the children were obtained from out-of-home foods. The total energy intake obtained from fat (31 %) was higher than the 15–30 % recommended by WHO/Food and Agricultural Organisation<sup>(24)</sup>.

In Nigeria, most children aged between 6 and 18 months are weaned on pap, often sweetened with sugar<sup>(25)</sup>. However, the majority of children are also given sugar-sweetened beverages (SSB) such as chocolate drinks and soda. About 8–16 % of babies consumed these SSB daily, whereas 65 % ate biscuits frequently each day. The consumption of SSB and sugar snacks in babies and toddlers is relatively common in Africa and Asia<sup>(26)</sup>. A recent systematic review of prospective studies showed that the consumption of SSB in children and adults is generally associated with an increased risk of weight gain, increased BMI, and cardiometabolic diseases<sup>(27–30)</sup>. Conversely, reducing the intake of SSB has been associated with a lowering of BMI<sup>(31)</sup>. Some studies, particularly those funded by the beverage industry have challenged this conclusion<sup>(32)</sup> even though the weight of the evidence favours the obesogenic effects of SSB<sup>(33)</sup>.

### Intake of fruit and vegetables

The Food and Agricultural Organisation food composition tables indicated that the per capita DES from



**Fig. 3.** (colour online) Proportion of adults consuming less than five servings of fruit and vegetables daily in West Africa. BEN, Benin; BFA, Burkina Faso; CPV, Cape Verde; CIV, Cote d'Ivoire; GAM, The Gambia; GHA, Ghana; GIN, Guinea; LIB, Liberia; MLI, Mali; NER, Niger; SLE, Sierra Leone; TGO, Togo; MAU, Mauritania. Source: WHO STEPS Country Reports.

fruit and vegetables in West Africa increased from 364 kJ (87 kcal) in 1980 to 418.4 kJ (100 kcal) in 2010 (Table 1)<sup>(17)</sup>. This compares with 1857.7 kJ/d (444 kcal/d) in Western Europe or 5394.2 kJ/d (539 kcal/d) in North America.

WHO recommends the intake of at least five servings of fruit and/or vegetables daily or  $\geq 400$  g daily<sup>(24)</sup>. Several national and sub-national surveys have demonstrated the low consumption of fruit and vegetables in West Africa<sup>(19,23)</sup>. Results from the STEPS surveys from fifteen West African countries show that the majority of adults, ranging from 79 % in Guinea to 96 % in Niger do not consume adequate amounts of fruit and vegetables daily (Fig. 3)<sup>(34)</sup>. Except for three countries, females tend to more frequently consume inadequate amounts of fruit and/or vegetables than males, although the sex differences were minimal.

In Ghana, the fifth round of the Demographic and Health Survey (DHS) had a module on regenerative health that covered fruit and vegetable intake along with vigorous physical activity, duration of rest and type of cooking used<sup>(35)</sup>. Among women aged 15–49 years, 64 % reported consuming fruit at least 3 d during a typical week: 35.4 % ate fruit 3–6 d per week, while 28.4 % ate fruit every day. The corresponding figures for the 61 % of men who reported eating fruit in a typical week was 40.1 and 20.9 %. Among women and men who reported consuming fruit during a typical week, only 3.2 and 1.0 %, respectively, ate five or more servings on a typical day. Similarly, among women and men who

consumed vegetables weekly, only 1.7 and 1.1 %, respectively, consumed at least five servings on a typical day.

The mean number of fruit servings consumed by women per week (7.5, 95 % CI 7.3, 7.7) was slightly higher than that of men (6.2, 95 % CI 6.0, 6.4)<sup>(36)</sup>. Similarly, women consumed a slightly higher number of vegetable servings than men (8.1, 95 % CI 7.8, 8.3 v. 7.9, 95 % CI 7.7, 8.2). Among females, living in the forest zone, older age group, having higher education, working as a professional or in the sales and services industry, as well as reading a newspaper or magazines or listening to the radio at least once weekly, were all independently associated with consuming higher amounts of fruit. Among men, residence in the forest zone or rural area, living in the poorest households, having higher education, aged 40–44 years, working in sales/services, reading newspapers or magazines daily and watching television less than once weekly were independently associated with higher amounts of fruit consumption. These differences between men and women in relation to fruit intake are not intuitive.

In the World Health Survey (2002–2003) involving fifty countries, proportion of men and women aged 18 years or older who consumed less than five servings of fruit and vegetables daily, ranged from 36.6 % of men and 38 % of women in Ghana; 97.0 % of men and 98.5 % of women in Mauritania<sup>(37)</sup>. In a pooled analysis across all the countries, the prevalence of low fruit and vegetable consumption decreased with increasing wealth quintile. Except for Cote d'Ivoire and Mauritania, this



relationship reached statistical significance in the other West African countries in the survey (Burkina Faso, Ghana, Mali and Senegal).

Thus, male sex, lower socioeconomic status, non-availability, non-affordability and access have barriers to consume adequate amounts of fruit and vegetables. Other studies in West Africa have found additional barriers, such as the presence of pesticide residues<sup>(38)</sup>, and less knowledge of their protective benefits<sup>(39)</sup> and food safety<sup>(40)</sup>.

### Exposure to famine in childhood and later cardiometabolic risk

The developmental origins of adult health and disease are now well recognised in public health policy leading to an advocacy for a life course approach for the NCD interventions<sup>(41,42)</sup>. In Nigeria, persons born during the famine of 1968–1970 associated with the Biafran War who were nearly three times as likely to have systolic hypertension (adjusted 2.87; 95 % CI 1.90, 4.34) as those born after the war (1971–1973), when follow-up was done in 2009<sup>(43)</sup>. Other parameters of cardiometabolic diseases, including overweight (OR 1.41; 95 % CI 1.03, 1.93), raised blood glucose and impaired glucose tolerance were found higher in the cohort born during the civil war. Other studies report similar elevated cardiometabolic risk in adult life for children exposed to the Chinese<sup>(44)</sup> or Dutch famine<sup>(45)</sup>.

### Trade and urbanisation

Transnational food companies such as supermarkets, fast-food chains and beverage industries have established themselves in most of the major cities of West Africa<sup>(46)</sup>. In several African countries such as Cape Verde, Kenya and Rwanda, transnational food corporations are among the top three largest companies<sup>(47)</sup>. As is the case elsewhere, their aim is to influence the food habits of consumers, particularly children in favour of processed foods, snacks, SSB and fast foods. The increased access of the urban population to these transnational companies has contributed to the nutrition transition in developing countries<sup>(48,49)</sup>. The number of local fast-food industries has also been increasing in the cities. The transnational food corporations have the capacity to lower the prices of the fast foods or soft-drinks in order to make them more affordable and reach a larger segment of the market<sup>(47)</sup>. This competitive edge leads to a situation in which healthier foods can be more expensive than unhealthier foods, as has been reported in urban poor South Africa<sup>(50)</sup>.

The Euromonitor International database shows that Nigeria has been increasing importing most of its foods including beverages, cereal and cereal products, sugar products and honey, dairy products and fruit and vegetables<sup>(15)</sup>. Steep increases in imports were observed between 1998 and 2009. It was only with fruit and vegetables that Nigeria's exports matched its imports. The annual sales

of grocery retailers increased from \$10.1 billion in 2001–2003 to 26.8 billion in 2010–2012. The picture is quite different for Kenya which is a net exporter of several products such as beverages, fish, meat, dairy products, fruit and vegetables.

Market deregulation has facilitated the spread of fast-food chains<sup>(51)</sup>. Increased access to fast-food restaurants is associated with childhood obesity<sup>(52)</sup>. It has been estimated that one unit increase in fast-food consumption is associated with an increase in the age-standardised per capita BMI of 0.023 kg/m<sup>2</sup> in high-income countries<sup>(51)</sup>. Consequently, the researchers have called for a stricter control of the markets in order to control the obesity epidemic.

### Physical inactivity

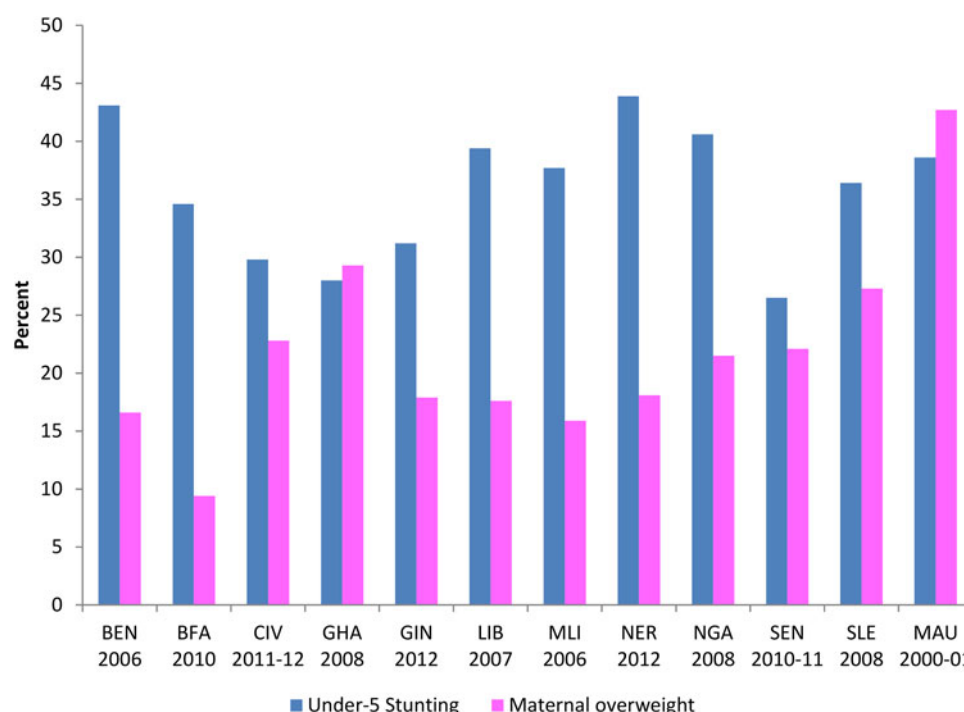
Another characteristic of the nutrition transition has been the prevailing physical inactivity. There are structural, systemic, cultural and individual reasons that influence physical inactivity. Some of the deficiencies with respect to poor urban planning, absence of paved pedestrian lanes, recreational parks and public sports facilities have already been mentioned. The inefficient and unpredictable public transport system is disincentive for individuals to abandon their cars in favour of mass transportation.

In a meta-analysis of fifteen studies published between 1966 and 2007, Abubakari *et al.* estimated that 13 % (95 % CI 9.0, 18.0) of West African adults were physically inactive<sup>(53)</sup>. Urban residents, females and older persons were more likely to be physically inactive. Urban residents were twice as likely as rural residents to be inactive (prevalence ratio 2.04, 95 % CI 1.58, 2.63). Much lower levels of physical activity were reported from the STEPS surveys. The proportion of adults who were not engaged in vigorous physical activity ranged from 31.0 % in Sierra Leone to 93.0 % in Cote d'Ivoire<sup>(54)</sup>. The age-standardised prevalence of adults who met the WHO recommendations ( $\geq 30$ -min of moderate-intensity activity on  $\geq 5$  d of the week or  $\geq 20$  min of vigorous-intensity on  $\geq 3$  d of the week) ranged from 46.8 % in Mali to 94.7 % in Benin<sup>(55)</sup>.

In the major cities, young adults are less physically active than their parents were at their age<sup>(13)</sup>. Among young university students, aged young to adults between 16 and 39 years in Nigeria, 41 % were found to be inactive<sup>(56)</sup>. Females, overweight students, those of the Hausa ethnicity and those whose parents were from a lower income group were most likely to be physically inactive.

### Double burden of malnutrition

The emerging phenomenon of double burden of malnutrition has been described at the national and household levels. The latest available DHS results show that the prevalence of adult female overweight ranges from 9.1 % in Burkina Faso to 29.3 % in Ghana<sup>(57)</sup>. Under-five stunting prevalence rates, on the other hand, range from 26.5 %



**Fig. 4.** (colour online) Prevalence of stunting in children under aged 5 years and overweight/obesity in mothers aged 15–49 years in West African countries from the latest available Demographic and Health Survey. BEN, Benin; BFA, Burkina Faso; CIV, Cote d'Ivoire; GHA, Ghana; GIN, Guinea; LIB, Liberia; MLI, Mali; NER, Niger; NGA, Nigeria; SEN, Senegal; SLE, Sierra Leone; MAU, Mauritania. Source: <http://statcompiler.com/>

in Senegal to 43.9 % in Niger. Thus, with the exception of Burkina Faso, all the West African countries have a situation in which the maternal overweight exceeds 15 %, whereas at the same time stunting rates exceed 25 % (Fig. 4).

In a survey of cardiovascular risk factors among men and women aged  $\geq 15$  years in The Gambia, it was found that 18 % were underweight while 4 % were obese<sup>(58)</sup>. A household consumption and expenditure survey in Cape Verde identified 18 % of households as underweight (with at least one underweight member), 41 % as overweight (with at least one overweight member) and 14 % as dual burden (with at least one underweight and one overweight member)<sup>(59)</sup>.

Double burden of malnutrition has also been assessed among adult residents aged between 25 and 60 years in Ouagadougou, Burkina Faso using an expanded definition, which included a biochemical assessment of micro-nutrients, and the presence of cardiometabolic risk factors (overweight or obesity or abdominal obesity, hypertension, hyperglycaemia or insulin resistance or diagnosed diabetes and dyslipidaemia)<sup>(60)</sup>. Nearly one quarter of the respondents had at least one nutritional deficiency and one cardiometabolic risk factor. The prevalence of double of malnutrition was significantly higher in women than men (30.4 % v. 16.1 %,  $P = 0.008$ ); in persons with high-school education than in those with no formal education (32.0 % v. 15.1 %,  $P = 0.002$ ); and in persons from low-income households than those in high-income households (32.1 % v. 13.3 %,  $P = 0.005$ ). Overall, the

prevalence of overweight/obesity was 24.2 %, metabolic syndrome 10.3 %, iron-deficiency anaemia 15.7 % and vitamin A deficiency 25.7 %.

Among mother–child pairs in Cotonou, Benin, the prevalence of maternal overweight and acute or chronic child malnutrition was 16.2 %<sup>(61)</sup>. It was only in 20.3 % of the pairs that both the child and its mother had normal weights. Overall, 39.1 % of mothers were overweight/obese and 27.7 % of children undernourished.

### Childhood obesity

A recent systematic review of anthropometric analysis of body weight of SSA school children aged between 5 and 17 years concluded that there was an evidence of overweight/obesity transition<sup>(62)</sup>. The overweight/obesity prevalence across eighty-two studies published between 1987 and 2013 was 10.6 % (overweight 8.1 %, obesity 2.5 %). The prevalence was higher in girls than boys (15.4 % v. 7.6 %). It was also higher among urban residents, children from higher socioeconomic class, and older children. Among the West African countries represented in the review, the prevalence of overweight (excluding obesity) ranged from 2.7 % among children aged 6–12 years in Nigeria to 17.1 % among children aged 10–17 years from another study in Nigeria. In both boys and girls in SSA, there was an increasing trend of overweight/obesity over a 30-year period. Among the children

in the studies reviewed, the weighed prevalence of underweight children was 17.6 % (boys 25.0 %, girls 8.3 %).

### Adult obesity

The increasing prevalence of overweight in adults is one of the most visible manifestations of the nutrition transition. In an analysis of DHS results from two different time points, at least 10 years apart in seven countries (Burkina Faso, Ghana, Niger, Senegal, Kenya, Malawi and Tanzania), Ziraba *et al.* observed 35.5 % increase in overweight/obesity from 23.2 to 31.4 % between the surveys in their urban populations<sup>(63)</sup>. The obesity component increased by 41.7 % from 17.9 to 25.4 %. These changes were statistically significant. The increase in overweight/obesity among women from the poorest households (+50 % from 13.7 to 20.5 %) was much higher than those from the richest households (+7 % from 35.4 to 37.9 %). In multivariate analysis, urban women from Ghana and Niger were respectively 40 and 49 % more likely than those in Burkina Faso to be overweight or obese (OR 1.4 95 % CI 1.24, 1.58 for Ghana; OR 1.49, 95 % CI 1.32, 1.67 for Niger). Those from the richest households were three times as likely as those from the poorest households to be overweight/obese (OR 3.2, 95 % CI 2.92, 3.51). Overall, the annual rate of increase of overweight/obesity was 5.0 %.

Among West African countries that have completed at least three rounds of DHS and have data on women's BMI, the most rapid increase in overweight/obesity has occurred in Ghana where the prevalence increased from 12.8 % in 1993 to 29.2 % in 2008<sup>(57)</sup>. The slowest rise has occurred in Burkina Faso where prevalence rose from 6.5 % in 1993 to 11.2 % in 2010. In Nigeria, the prevalence has remained essentially the same at 22.9 % in 1999 and 22.1 % in 2008.

The findings from the DHS are consistent with those of a meta-analysis of published studies from 1966 to 2007 which showed that the pooled prevalence of obesity from rural and urban communities increased by 114 % from 7.0 % (95 % CI 5.0, 10.0) to 15.0 % (95 % CI 13.0, 18.0) over the 15-year period from 1990 to 2004. The greatest contribution to the increase was from urban female residents in whom the prevalence increased from 8.0 to 22 % over the same period.

The prevalence of overweight/obesity has been higher in the major West African cities than those at the national level. In Ouagadougou, the capital of Burkina Faso (the country with the lowest prevalence of female overweight/obesity), one-third of residents aged 45–54 years were overweight/obese<sup>(64)</sup>. Similarly, the prevalence in women aged 18 years and older increased from 62.2 % in 2002–2003 to 64.9 % in 2008–2009 over the two waves of the Women's Health Study of Accra<sup>(65,66)</sup>. In a longitudinal study, among 541 men and women aged 25–60 years without a previous diagnosis of diabetes or CVD in Cotonou, Ouidah and surrounding rural communities, the prevalence of obesity increased significantly from 7.2 to 11.3 % after a 4-year follow-up<sup>(67)</sup>. The mean BMI

increased from 24.3 to 25.1 kg/m<sup>2</sup> over the same period. The incidence of metabolic syndrome was 8.2 %.

The prevalence of obesity in both men and women, from STEPS surveys, ranged from 3.2 % in Niger to 22.0 % in Liberia<sup>(54)</sup>. Countries in which the prevalence exceeded 10 % were Cote d'Ivoire (10.5 %), Nigeria (10.9 %), The Gambia (12.1 %), Mali (17.9 %), Mauritania (20.9 %), Liberia (22.0 %) and Ghana (26.9 %)<sup>(34)</sup>.

The determinants of overweight and/or obesity include female sex, older age, urban residence, duration of exposure to urban residence, higher education, and higher wealth index<sup>(68–70)</sup>. Breast-feeding and physical activity are protective. Overweight, obesity or BMI have consistently been independent risk factors for hypertension in studies in the region<sup>(64,71–73)</sup>.

### Hypertension

Where as the age-standardised prevalence of adult hypertension declined or remained the same in the WHO Regions, that for Africa and South-East Asia increased between 1980 and 2008<sup>(74)</sup>. With an estimated prevalence of 36.8 %, the WHO African Region has the highest prevalence of hypertension globally. Direct evidence from the longitudinal studies or cross-sectional studies to demonstrate an increasing trend of hypertension consistent with the increase in overweight/obesity in West Africa is scarce. In Cameroon, the age-standardised prevalence of hypertension increased significantly in both men and women in the same rural and urban communities over a 10-year period from 1994 to 2003<sup>(75)</sup>. Among men in urban Yaounde, the prevalence rose from 24.4 to 39.6 % and in women, from 20.1 to 37.2 %. Similarly, the prevalence in rural Evoudoula rose sharply from 13.8 to 44.0 % in men and from 14.6 to 34.1 % in women over the same period. All the increases were statistically significant.

Indirect evidence of an increasing trend comes from a systematic review in Nigeria, which showed a pooled prevalence of hypertension that increased from 8.9 % in studies published in 1970–1979 to 15.0 % in those published in 1990–1999 and to 22.5 % in those published in 2000–2009<sup>(76)</sup>. Empirical data from a repeat survey in the rural Mangu Local Government Area, Nigeria showed an increase in the crude prevalence of hypertension from 7.4 % in 1991 to 20.9 % in 2008<sup>(77)</sup>. Although the population groups were different, it is intriguing that several cardiometabolic risk factors, including age, urban exposure, total cholesterol and BMI had increased over the period. On the other hand, alcohol and tobacco use, and blood sugar decreased over the same period. A similar increase in rural hypertension was observed in rural communities in the Greater Accra Region, Ghana after 28 years<sup>(78)</sup>.

In many West African cities, more than 25 % of adults have hypertension<sup>(76,79)</sup>. This is the case, for example, with Ouagadougou (40.2 %)<sup>(64)</sup>, St Louis (46 %)<sup>(80)</sup>, Accra (54.6 %)<sup>(73)</sup>, Dakar (27.5 %)<sup>(81)</sup> and Lome (26.6 %)<sup>(82)</sup>. The independent risk factors associated with hypertension from various studies include older age,



overweight/obesity, physical inactivity and higher socioeconomic status<sup>(72,79,83)</sup>. Similar determinants have been reported from other parts of Africa<sup>(84)</sup>. Physical activity is protective for obesity, hypertension and cholesterol<sup>(85)</sup>.

In the major cities undergoing rapid transition, the consequences are evident in persons in the high socioeconomic class. In urban poor Accra where households had an average monthly income of US\$79, 28.3 % of adults (women 25.6 % and men 31.0 %) had hypertension<sup>(86)</sup>. In Ouagadougou, the prevalence of obesity/overweight among the poorest income tertile households was 19.3 %, hypertension 19.3 %, hyperglycaemia 32.1 % and low HDL-cholesterol 34.9 %<sup>(60)</sup>.

### Diabetes

A recent review of type 2 diabetes in SSA covering 1990–2011 included data from three West African countries: Ghana, Guinea and Nigeria<sup>(87)</sup>. The prevalence of diabetes ranged from 2.5 % to 7.9 %. With respect to other risk factors, the prevalence was higher in urban than in rural areas. A much higher prevalence of 9.1 and 9.7 % has been reported among workers in Accra, Ghana<sup>(72)</sup>, and in Dakar, Senegal<sup>(88)</sup> respectively and of 17.9 % in a representative sample of adults in Dakar, Senegal<sup>(89)</sup>. The Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group estimated that the age-standardised prevalence of diabetes increased by about 10 % in men and about 35 % in women in SSA between 1980 and 2008. The International Diabetes Federation estimates that Africa will record the highest increase of 98.1 % globally in the number of adults with diabetes from 2010 to 2030.

### Some challenges and perspectives

West Africa faces immense challenges that limit its ability to manage the growing nutrition transition and its consequences. The health systems are typically oriented towards undernutrition and acute infections<sup>(90,91)</sup>. Within the health sector, plans and programmes are often fragmented to the extent that national plans for nutrition and chronic NCD control are developed separately. Available plans do not sufficiently address the major NCD risk factors<sup>(92)</sup>. There is limited reliable information for surveillance and routine monitoring of inputs and outcomes. There is a weak human resource capacity at all levels. Current training approaches for nutrition are not well aligned to prevailing health problems, particularly chronic NCD<sup>(93)</sup>.

NCD have usually not received sufficient priority in the public health agenda of developing countries. The increasing nutrition-related risk factors and chronic NCD in West Africa justify the calls for increasing investment and re-orienting health systems to tackle both under and overnutrition<sup>(94)</sup>. Food habits are difficult to change, especially in the West African setting where they are also influenced by sociocultural beliefs. The facilitating factors at the national level such as the trade policies and the individual factors

such as preference for quick foods are likely to persist. Food and beverage industries continue to sponsor highly visible national and international programmes, including sporting and entertainment events. There is weak regulation of the food and beverage industry and so they continue to target children in their aggressive advertising.

The West African Health Organisation is a specialised agency of the Economic Community of West African States (ECOWAS). It comprises fifteen Member States and has a mandate to safeguard and promote optimal health of persons living in the region. It has a unique capacity to garner political support through an annual Assembly of Health Ministers meeting, which it organises. Ministers of Health have passed resolutions on nutrition and NCD in recent years. West African Health Organisation (WAHO) also organises a biennial forum, the ECOWAS Nutrition Forum, which has become a flagship programme in the region during which major stakeholders from the government ministries, training institutions and development partners share experiences on progress and best practices for improved nutrition. WAHO has supported several Member States to develop nutrition and integrated NCD plans and to set up multisectoral coordinating mechanisms. WAHO, WHO and technical experts have released a consensus statement on the reduction of the dietary salt intake<sup>(95)</sup>. WAHO, Food and Agricultural Organisation and other Partners have also developed a food composition table for West Africa<sup>(96)</sup>.

The multisectoral platform Scaling Up Nutrition Movement, the momentum from the Global Nutrition for Growth Compact, the United Nations Political Declaration on NCD in 2011, the global targets for maternal, infant and young child nutrition, and the WHO Global Action Plan on NCD 2013–2020 are the international initiatives that provide opportunities to address the nutrition transition. Regionally and nationally, the improving educational level in the urban centres can be exploited as countries implement the 'Codex Alimentarius' and the population becomes more interested in food labelling<sup>(97)</sup>.

### Conclusions

Most West African countries are at an early stage of nutrition transition. However, countries such as Cape Verde, Ghana and Senegal appear to have reached the latter stages of the transition. The major cities in the region are experiencing the consequences of transition, including overweight/obesity, hypertension and diabetes. Affected persons are not only those in the higher socioeconomic strata but also the urban poor and uneducated who are already disadvantaged by poor sanitation and infectious diseases. Improved intra- and inter-sectoral collaboration is required to address the changing nutrition profile and the rising chronic NCD burden in the region.

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None.

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W. K. B. reviewed the literature and wrote the manuscript.

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