

# **Current state of nutrition in West Africa and projection to 2030**

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3 **Abstract**

4 The rapid growth of the human population in West Africa makes malnutrition a pressing issue. This  
5 paper highlights the foreseen nutritional issues in West Africa by 2030. Data were extracted from the  
6 FAOSTAT 2019 database and national nutritional reports. Countries were clustered based on the  
7 prevalence of different forms of malnutrition. The trends of the different forms of malnutrition were  
8 used to estimate nutritional issues in West Africa by 2030 for each country. Four clusters of countries  
9 were identified based on malnutrition indicators. These clusters are different in terms of the prevalence  
10 of childhood overweight (cluster 1), stunting (cluster 2), anemia (cluster 3) and wasting (cluster 4).  
11 Overall, most countries are not on track in meeting global targets of addressing malnutrition by 2030,  
12 especially for anemias.

13 **Keywords:** stunting, wasting, anemia, overweight, nutritional trends

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15 **1. Introduction**

16 The various forms of malnutrition are intertwined throughout the life cycle and between generations,  
17 with undernutrition in the foetal stage, stunting in early life and a higher risk of overweight and chronic  
18 diseases such as diabetes later in life [1]. The first 1000 days of life are considered the critical window of  
19 opportunity for preventing undernutrition and its long-term consequences [2]. Despite the progress  
20 made in reducing these problems, ending malnutrition in all its forms as stated in the Sustainable  
21 Development Goals (SDGs) remains a global challenge [3-5]. The prevalence of undernutrition globally  
22 has been on the rise since 2015 with the greater burden in Africa, West Asia and Latin America. 1 in 9  
23 people – 820 million worldwide are hungry or undernourished.[6-9].

24 In Africa, 256 million people are affected by hunger, and the situation is more pressing in the sub-  
25 Saharan African region [7]. Moreover, hunger is on the rise in almost all African subregions, making  
26 Africa the region with the highest prevalence of undernourished, estimated at 20 percent [1]. These  
27 situations underscore the immense challenge of achieving the Zero Hunger target by 2030 [1]. Many  
28 global actions have been implemented to foster cooperation for attaining the SDG 2. They include  
29 among others, the first Global Parliamentary Summit against Hunger and Malnutrition, held in Madrid,  
30 that engaged more than 200 parliamentarians from countries around the world and the “Think 20”, a  
31 network of research organizations and “Think tanks” from the G20 countries [7].

32 The SDGs explicitly layout a challenge of linking agriculture to nutrition and therefore health.  
33 Specifically, the second SDG is to achieve food security and improve nutrition while promoting  
34 sustainable agriculture [4]. Zero Hunger aims not simply to “eradicate hunger” but also to “ensure  
35 access by all people to safe, nutritious and sufficient food all year round” (SDG Target 2.1) and to  
36 “eradicate all forms of malnutrition” (SDG Target 2.2) [10]. These forms of malnutrition are summarized  
37 in box 1. FAO, IFAD [6] summarized SDG2 as follows: “By 2030, end hunger and ensure access by all

38 people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious  
39 and sufficient food all year round". Nevertheless, the burden of hidden hunger may persist if country-  
40 level policies are not complemented by more specific and targeted interventions that operate at the  
41 community, household, or individual level [11].

42 Achieving the SDGs then requires political commitment and knowledge about the types of actions that  
43 can help to effectively reduce different forms of hunger [11]. Accordingly, many actions have been  
44 undertaken through several policies and programs by several countries, including sixteen (16) West  
45 African countries. Examples of such actions in some countries in the West African region are as follows:  
46 Benin elaborated its Strategic Plan for the Development of Food and Nutrition and its Results-based  
47 National Food and Nutrition Program 2012-2021[12]. Burkina-Faso developed its National Food and  
48 Nutrition Security Policy, which aims to ensure sustainable food and nutritional security by 2025 [13].  
49 Ghana developed its National Nutrition Policy 2013-2017, which aimed to promote optimal nutrition as  
50 an essential component of health and development among all people living in Ghana [14]. All these  
51 policies and programs invariably will contribute to the achievement of the 2012 World Health Assembly  
52 (WHA) global targets for six indicators by 2030. These targets are (i) reduce the number of stunted  
53 children under five by 50 percent, (ii) reduce anaemia among women of childbearing age by 50 percent,  
54 (iii) reduce low birth weight by 30 percent, (iv) reduce and maintain childhood overweight to less than  
55 3%, (v) increase the rate of exclusive breastfeeding in the first six months up to at least 70% and (vi)  
56 reduce and maintain childhood wasting to less than 3%.

57 The rate of stunting among children globally, has declined by 10 percent over the past six years.  
58 However, the pace of reduction, is too slow to achieve the 50% target of reducing childhood stunting  
59 by 2030 [1]. In 2018, 7.3 percent of children were wasted, and this must be reduced by more than half  
60 to reach the target of less than 3 percent by 2030. Anaemia currently affects 33 percent of women of  
61 reproductive age, more than double the 2030 target of 15 percent [1]. These trends could vary across  
62 different regions of the world and countries. Therefore, the present review aims to identify nutritional  
63 issues in countries in West Africa by 2030. It will provide a benchmark for countries in West Africa to  
64 identify their nutritional issues, assess their efforts and design complementary policies and programs  
65 to accelerate the achievement of targets by 2030.

## 66 **Box 1**

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]. Food insecurity refers to limited access to food, at individual or household level, due to lack of money or other resources. The severity of food insecurity is measured using among other data collected with the Food Insecurity Experience Scale survey module [15]. The forms of malnutrition by deficiency are: acute malnutrition (wasting), chronic malnutrition (stunting), underweight, thinness, anemia, vitamin A, zinc, calcium and iodine deficiencies while the forms of malnutrition by excess are: overweight, obesity leading to noncommunicable diseases (NCDs) such as type II diabetes, high blood pressure and cardiovascular disease [12]. Stunting (low height for age) is an indicator of linear growth retardation and cumulative growth deficits in children [16]. Stunting is the most prevalent form of childhood undernutrition and is now recognized as a key indicator of overall children's well-being and a reflection of social inequalities [17]. Stunted children who have impaired behavioural development in early life tend to achieve lower grades and have poorer cognitive ability than nonstunted children [18]. It has been reported that stunting has long term effects on individuals and societies, including: morbidity and mortality, diminished neurodevelopmental, cognitive and physical development, reduced productive capacity and poor health, and elevated risk of chronic disease in adulthood such as hypertension, cardiovascular type 2 diabetes, especially when aggravated by rapid weight gain and obesity after age of 2 years [16, 18, 19]. Stunting more pervasively has the potential to impact cognitive

function and adult economic productivity and is therefore considered as the best surrogate marker of child health inequalities [18].

Wasting measures body mass in relation to height and describes current nutritional status [16]. It results from an interplay among poverty, disease, caring practices and diets [20]. Children suffering from wasting have weakened immunity, are susceptible to long term developmental delays, and face an increased risk of death, particularly when wasting is severe [21]. Briend, Khara [22] reported that the immediate underlying and basic causes of malnutrition seem to be common to both wasting and stunting and then suggest any intervention that is designed to have an effect on one form of malnutrition should also have an effect on the mortality risk associated with the other.

Underweight is defined among adults as a Body Mass Index less than 18.5Kg/m<sup>2</sup>. It reflects a current condition resulting from inadequate food intake, past episodes of undernutrition or poor health conditions [23]. In children under five years of age, underweight is defined as weight-for-age less than 2 standard deviations below the WHO Child Growth Standards median and is thus a manifestation of low weight for height [16]. Overweight and obesity are defined as the body weight that is above normal for height as a result of an excessive accumulation of fat. It is usually a manifestation of expending fewer calories than consumed. In adults, overweight is defined as a BMI of more than 25 kg/m<sup>2</sup> but less than 30 kg/m<sup>2</sup>, and obesity as a BMI of 30 kg/m<sup>2</sup> or more while in children under five years of age, overweight is defined as weight-for-height greater than 2 standard deviations above the WHO Child Growth Standards [23]. Childhood overweight is currently recognized as a global public health problem with important consequences for incidence of acute and chronic diseases, healthy development, and the economic productivity of individuals and societies [17].

Anemia still exist and are major public health concerns worldwide, especially in many developing and low-income countries [24]. It is a condition in which hemoglobin (Hb) concentration and/or red blood cell (RBC) numbers are lower than normal and insufficient to meet an individual's physiological needs [25]. Iron deficiencies anemia is defined as low body iron stores that lead cause of anemia and has been associated with adverse psychomotor, cognitive, and socioemotional development [26]. The most vulnerable group in developing countries regarding anemia due to iron deficiency are women of childbearing age and children under five. In low - income and middle - income countries are typically grouped into three broad categories: nutritional deficiencies, infectious diseases, and genetic hemoglobin disorders [27].

The birthweight is defined as the first weight of the foetus or newborn obtained after birth. For live births, birthweight should preferably be measured within the first hour of life, before significant postnatal weight loss has occurred. However, the low birthweight is defined as birthweight less than 2,500 g (up to and including 2,499 g) [28] and the very low birth weight and extremely low birth weight as birthweight less than 1500g and 1000 g, respectively [29].

## 67 2. Materials and Methods

### 68 2.1. Country grouping criteria

69 Data on the prevalence of malnutrition (prevalence in stunting, wasting, overweight, anemia) were used  
70 to group fifteen of the sixteen countries of West Africa according to their similarity to these indicators  
71 (Cape Verde was not included because very little data were available for this country). These key  
72 indicators were chosen for two main reasons. First, the prevalence of stunting, wasting and overweight  
73 among children under five years old is considered a key indicator for the assessment of country  
74 nutritional status according to FAO, IFAD [1]. Second, the prevalence of anemia among women of  
75 reproductive age is a key indicator of malnutrition. These data were collected by two different  
76 approaches. The FAO databases (<http://www.fao.org/faostat/fr/#data>) were primarily used and then  
77 supplemented with data from (i) reports on nutritional status (DHS, global nutritional report, National  
78 nutrition report) at the country level and (ii) published reports from other organizations working in  
79 respective countries. These data considered the period from 1999 to 2018. Specifically, 83 reports were  
80 used to fill in a database complementary to that obtained on the FAO databases. Based on the prevalence  
81 of malnutrition, hierarchical clustering using the unweighted pair group method with arithmetic mean  
82 (UPGMA) method under the *phangorn* package was performed to group countries that have similar  
83 nutritional status, i.e., clusters of countries with similar prevalence in stunting, wasting, overweight and  
84 anemia.

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## 87 2.2. Estimation methods of nutritional issues by 2030

88 The data on nutritional status per country from 1999 to 2018 were used to establish a predictive model  
89 for each nutritional status indicator. These models were then used to predict the values of the respective  
90 indicators by 2030. Data on wasting, stunting and overweight were collected on a four-year basis, while  
91 anemia was collected on a yearly basis.

92 For the predictive models, we tested two regression approaches, namely, linear regression and  
93 nonlinear regression (i.e., generalized additive model). We selected the best model using predictive  
94 power and the Akaike information criterion (AIC).

95 The dependent variable was the prevalence of each nutritional indicator (prevalence in stunting,  
96 wasting, overweight among children and anemia among women of reproductive age), while year was  
97 the predictive variable.

98 The linear regression model was:

$$99 \quad y = a + bx + \varepsilon \quad (1)$$

100 where  $y$ : dependent variable;  $x$ : predictor;  $a$  and  $b$ : regression coefficients; and  $\varepsilon$ : the error term.

101 The nonlinear regression model was:

$$102 \quad y = \alpha + f(x) + \varepsilon \quad (2)$$

103 where  $y$  is the dependent variable;  $x$  is the predictor;  $\alpha$  is the constant; and  $f(x)$  is the smoother. The  
104 smoother has the form:

$$105 \quad f(x_i) = \sum_{j=1}^p \beta_j * b_j(x_i) \quad (3)$$

106 where  $b_j$  are known basis functions, usually chosen for the good approximation theoretical properties  
107 of the model, and  $\beta_j$  are coefficients of the model to be estimated as part of model fitting.

108 The equations of these models estimated the annual marginal increase/decrease of each nutritional  
109 status indicator. The established equations were then used to predict the values of each nutritional status  
110 indicator by 2030. Regression equations were displayed, and the predictive power of the models was  
111 computed (see appendix). Subsequently, the target values were calculated using 2012 as baseline (the  
112 year in which the targets were defined).

## 113 3. Results and discussion

### 114 3.1. Countries clustering according to malnutrition forms

115 Disparities exist between West African countries in terms of the food and nutrition situation and even  
116 within countries. The bottom-up hierarchical classification clustered the 15 West African countries into  
117 4 groups (Table 1, Figure 1). This grouping accounted for 77.14% of the variability of the information in  
118 the starting matrix. Group 1, involving Benin, Guinea Bissau and Sierra Leone, was mainly

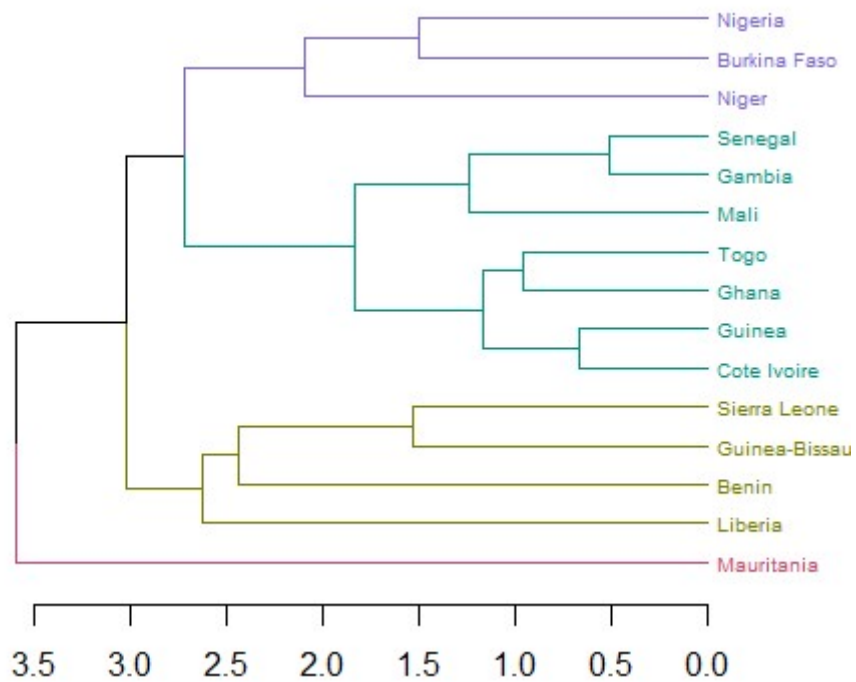
119 characterized by a high prevalence of childhood overweight (6.06%) compared to the others and a  
 120 relatively high prevalence of stunting (38.8%). Group 2, including Nigeria, Niger and Burkina Faso, was  
 121 mainly characterized by the highest prevalence of stunting (40.08%) and a relatively high prevalence of  
 122 anaemia (51%). Group 3, composed of Senegal, Gambia, Mali, Togo, Ghana, Guinea, and Côte d'Ivoire,  
 123 was mainly characterized by a high prevalence of anemia (54.08%). Only Mauritania was characterized  
 124 by a high prevalence of wasting (12.8%) and low overweight (2%) in group 4.

125 This means that during the last 20 years, countries such as Benin, Guinea Bissau, and Sierra Leone had  
 126 a relatively higher overweight prevalence than other countries in the subregion; Nigeria, Niger and  
 127 Burkina Faso had a higher stunting prevalence than other countries in the subregion; and Senegal,  
 128 Gambia, Mali, Togo, Ghana, Guinea, and Côte d'Ivoire had the highest prevalence of anaemia.  
 129 Mauritania, which alone constitutes Group 4, stood out from other countries by its high prevalence in  
 130 wasting and low prevalence in overweight. These conclusions could be explained by conditions specific  
 131 to these countries that are found in the same country group or that these countries developed similar  
 132 policies to address malnutrition.

133 **Table 1:** Characteristics of country groups based on nutritional indicators from 1999 to 2018

Groups from the cluster analysis	Wasting	Stunting	Overweight	Anaemia
G1: <i>Liberia, Benin, sierra Leonne, Guinea-Bissau</i>	7.713	38.837	6.061	48.873
G2: <i>Niger, Burkina-Faso, Nigeria</i>	12.510	40.085	3.694	51.560
G3: <i>Cote d'ivoire, Guinea, Ghana, Togo, Mali, Gambia, Senegal</i>	8.924	28.039	3.098	54.079
G4: <i>Mauritania</i>	12.800	28.500	2.133	39.058
Coefficient of variation (CV (%))	24.23	20.61	45.69	10.46
p values (Anova)	0.003	0.002	0.018	0.022

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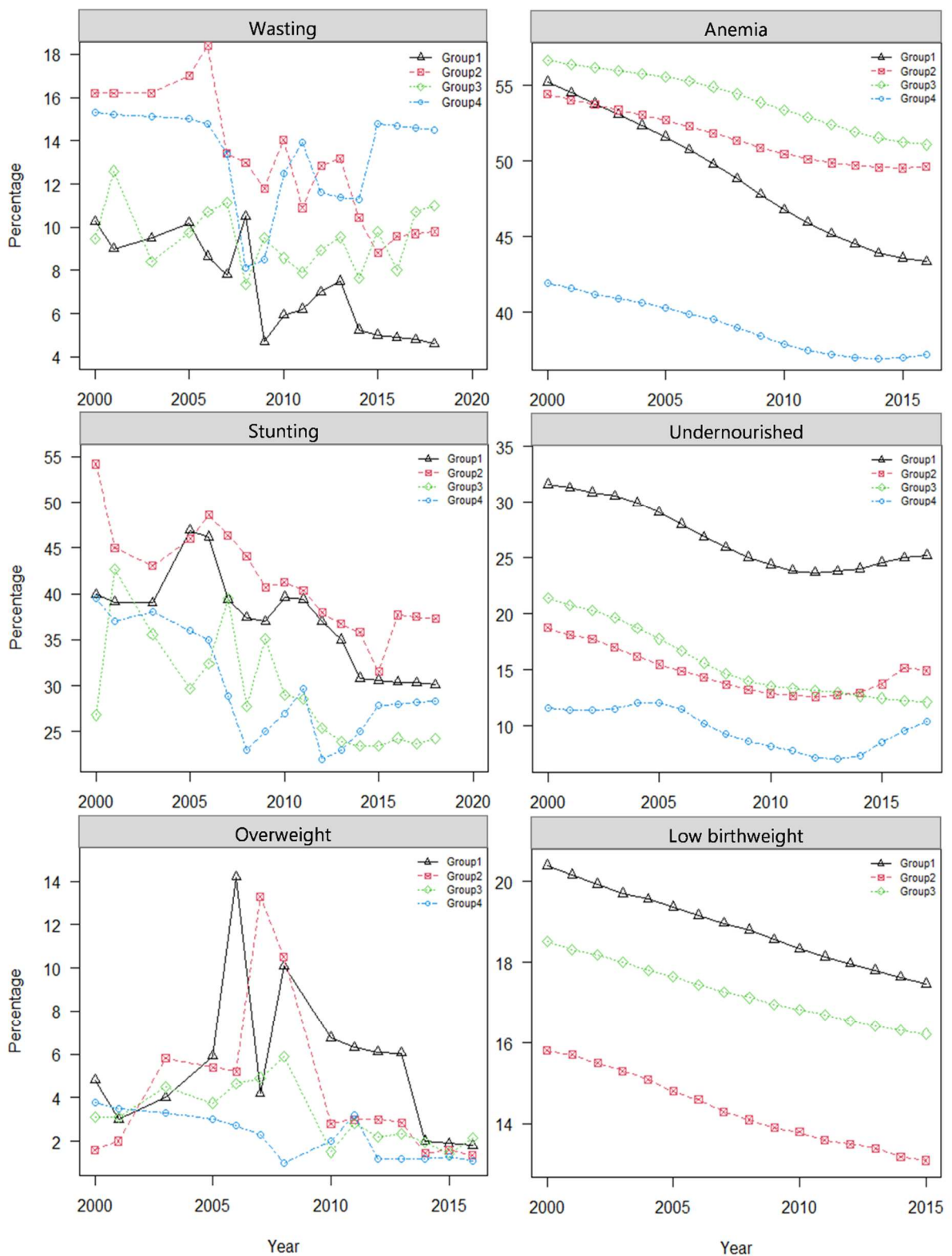


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136 **Figure 1:** West African countries classified by nutrition indicators from 1999 to 2018

137 **3.1.1. Historical profile of malnutrition in West African countries**

138 Figure 2 shows the trends of the six malnutrition indicators over the study period (1990-2018) per cluster  
 139 of countries. All groups of countries have made progress in reducing malnutrition indicators over the  
 140 past 20 years. This progress is more remarkable for some groups and depends on the indicator  
 141 considered. For example, Group 1 considerably reduced the prevalence of wasting (from 10% in 1999 to  
 142 less than 5% in 2018), even though this trend remained unstable. Groups 2 and 4 still have that  
 143 prevalence above 10%. Group 3 gradually reduced its stunting prevalence and reached a threshold of  
 144 less than 25% in 2018. It is followed by Group 4, which did the same. The prevalence of overweight was  
 145 very noticeable in groups 1 and 2 between 2005 and 2008. However, all countries reduced the  
 146 overweight prevalence to less than 4% by 2018. This prevalence remains a true concern in Groups 2 and  
 147 3. Similarly, Group 4 has the lowest prevalence of undernourished people in the last 20 years  
 148 (approximately 10%). Additional efforts are needed in group 1 for that indicator. Group 2 has the lowest  
 149 prevalence of low birthweight.



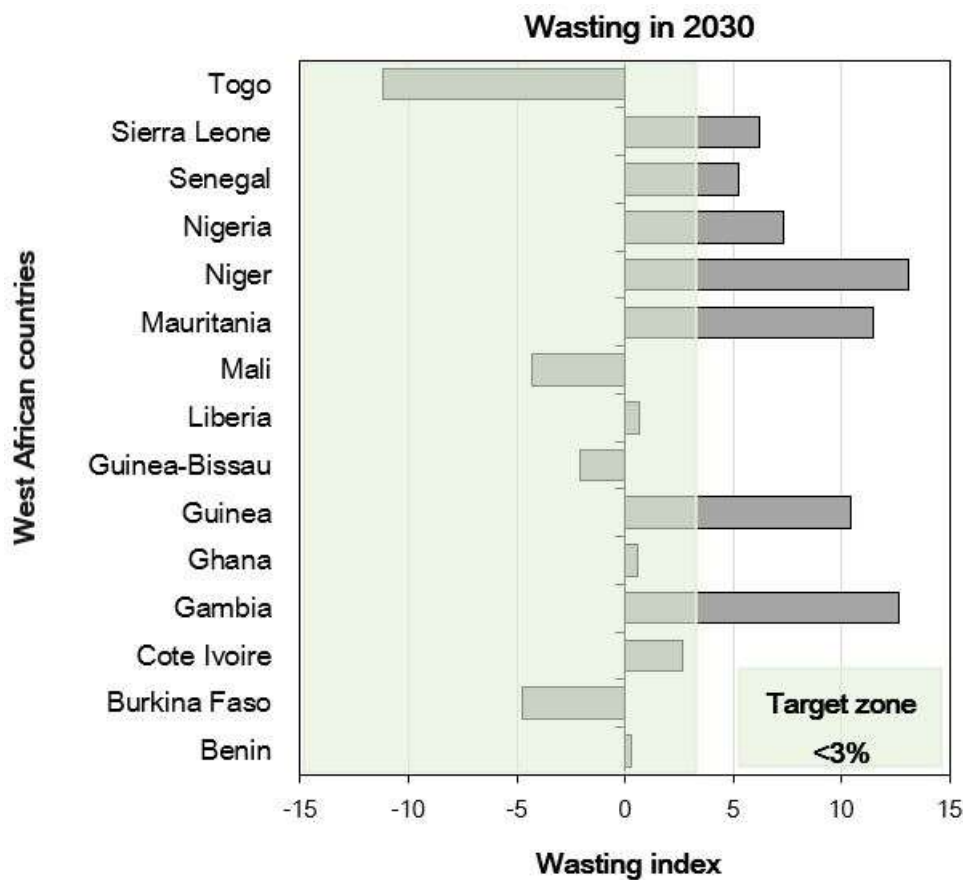
150  
 151 **Figure 2:** Evolutionary trends in six malnutrition indicators over time (1999-2018) regarding the realized  
 152 clusters of countries in West Africa (**G1:** Liberia, Benin, Sierra Leone, Guinea Bissau, **G2:** Niger,  
 153 Burkina, Nigeria **G3:** Côte d'Ivoire, Guinea, Ghana, Togo, Mali, Gambia, Senegal, **G4:** Mauritania)



154 **3.2. Projection of nutritional issues by 2030**

155 **3.2.1. Projection of wasting in 2030**

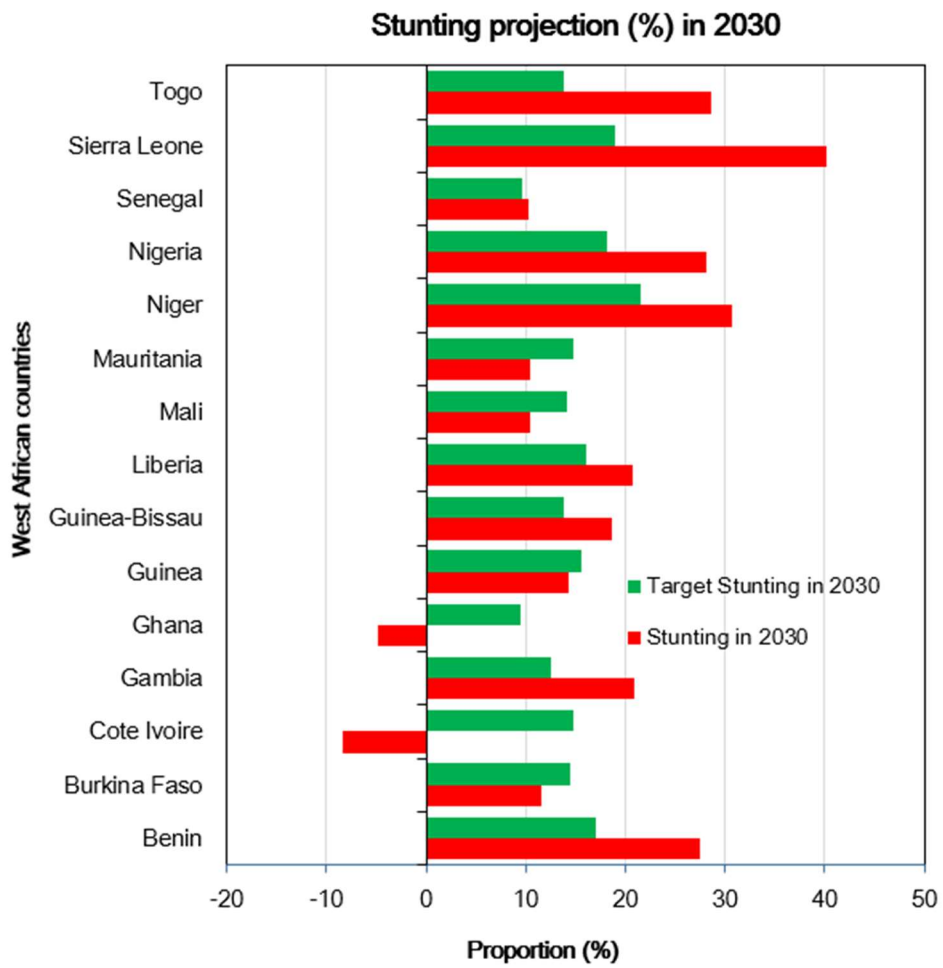
156 Figure 3 shows the projected prevalence of wasting by 2030. The countries that could reach the target of  
157 reducing and maintaining child wasting below 3% are Burkina Faso, Togo, Benin, Guinea-Bissau, Cote  
158 d'Ivoire, Mali, Ghana, and Liberia if actions are maintained following the trends from 1999-2018. These  
159 trends could be explained by the strategies implemented in these countries. For example, in Benin, the  
160 Health Sector Policy for Nutrition 2016-2025 aimed at reducing and maintaining wasting below 5%  
161 among children under five years of age [12]. This trend observed in Benin enables us to hypothesize  
162 that the actions undertaken in this country are appropriate in reducing wasting among children. A  
163 similar policy was also developed and implemented in Côte d'Ivoire through their National Nutrition  
164 Policy [30]. Despite the above listed countries being on course to reaching the target of reducing and  
165 maintaining child wasting below 3% by 2030, they need to take additional actions to ensure the  
166 effectiveness of meeting this target. They could maintain policies/programs and possibly develop  
167 additional programs to accelerate the attainment of the goal. Countries with projected wasting rates  
168 under 0 by 2030 could reach the target before the target period of 2030 if their actions were maintained.  
169 It is clear that this trend could be changed according to the unique situations that may occur in these  
170 countries. For example, the global pandemic of COVID-19 is a situation that could impair the attainment  
171 of the target. Actions are needed to adjust the programs or policies in each country to meet the unique  
172 issue that each country is facing.



173 **Figure 3: Projection of wasting prevalence in 2030 and target zones in West African countries**  
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175 **3.2.2. Projection of stunting by 2030**

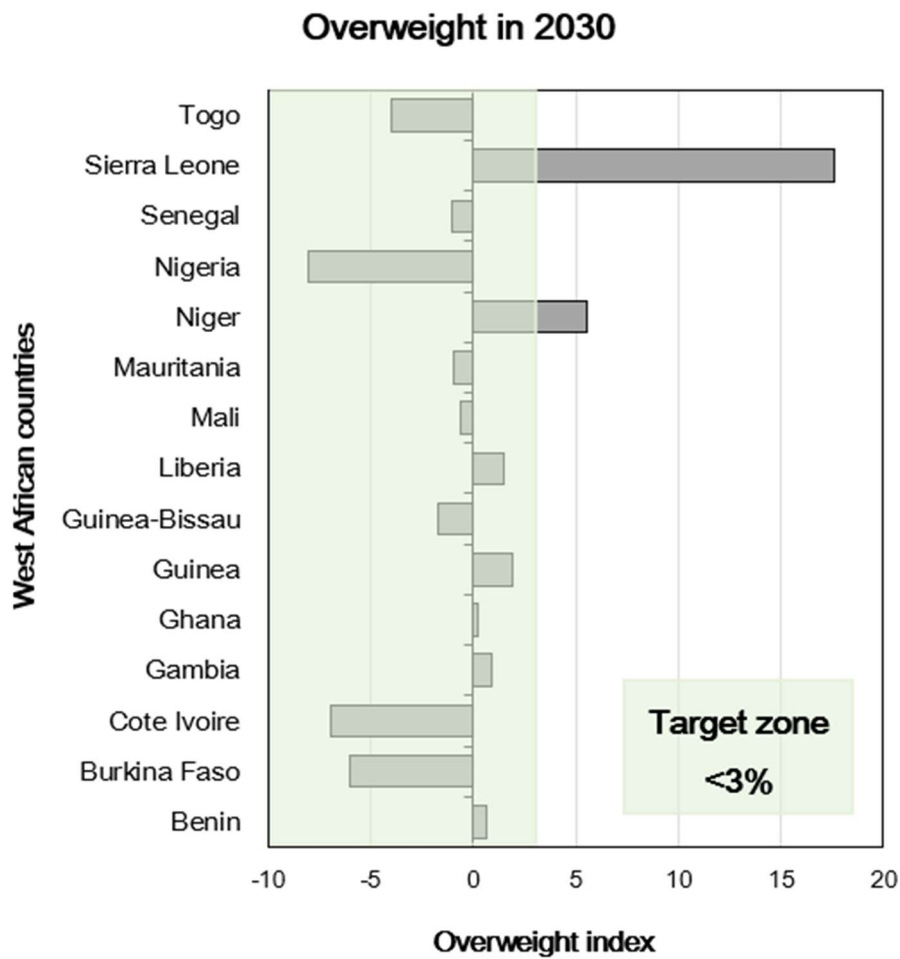
176 As shown in Figure 4, many countries are not on track to meet the target of reducing stunting in children  
177 under five years of age by 40 percent in 2030. The countries that could meet the requirement of this  
178 target by 2030 are Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Mali, and Mauritania. It is also noticed  
179 that half of the countries whose projections indicated a positive trend to meet the target of wasting by  
180 2030 will also meet the target for stunting. This underlined a link between these two malnutrition  
181 indicators. Briend et al. [22] reported that any intervention that is designed to have an effect on one form  
182 of malnutrition should also have an effect on the other. Among the 16 West African countries, only 6  
183 countries (approximately one-third) are on track to meet the target of reducing stunting in children  
184 under five years of age by 40 percent. More actions are needed to save children from stunting. Stunting  
185 is a major public health priority [18] considering its impact on children's development [16, 18, 19], thus,  
186 specific actions are required to reach the 2030 target. Despite different strategies implemented in most  
187 countries, the issue of stunting remains a major concern. This could be explained by the unsuitability of  
188 the policies/programs or projects implemented in the countries and the scope of the projects/programs  
189 ( in most case not nationwide). The chronic nature of stunting makes it a difficult parameter to change  
190 over time. Indeed, children with low height for their age will not catch up easily. However, care should  
191 be taken so that stunting is prevented during the first 1000 days of life. Alternatively, the poor  
192 multisectorial character of some programs does not allow us to address the issue efficiently. In addition,  
193 when the policies are good, their implementation is not correct, and most programs do not consider the  
194 local resources. At the end of their program, implemented actions disappear in a short time.



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 196 **Figure 4:** Projection of stunting prevalence in 2030 and targeted stunting in 2030 in West Africa  
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198 **3.2.3. Projection of overweight in 2030**

199 Apart from Sierra Leone and Niger, all West African countries are on track to reach the goal of reducing  
 200 childhood overweight to less than 3% (Figure 5). Sierra Leone and Niger need more efforts to reach this  
 201 goal. Programs involving health and nutrition could be specifically developed to address this issue,  
 202 especially in Sierra Leone, where the trend is far away from the target. Activities of nutritional  
 203 education, especially for pregnant women in Sierra Leone, should be increased as a way to improve the  
 204 quality of the diets.



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**Figure 5:** Prevalence of overweight in 2030 and targeted overweight in 2030 in West Africa

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#### 3.2.4. Projection of anaemia by 2030

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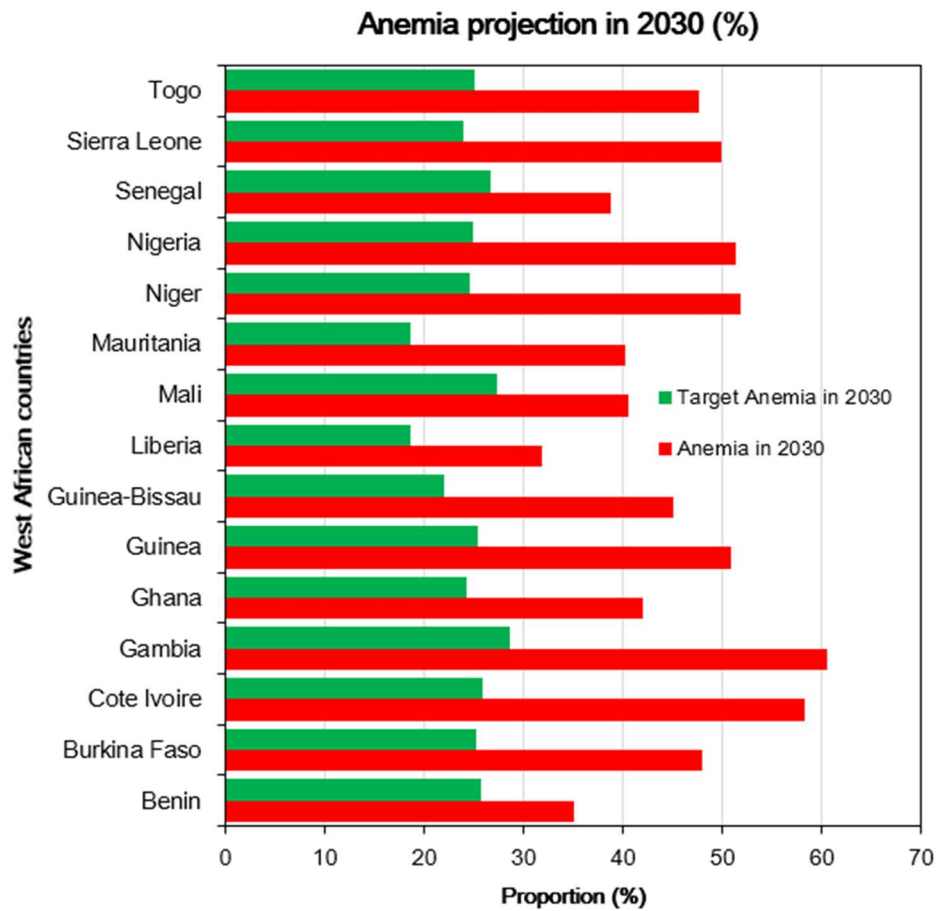
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No country would meet the target of reducing anaemia among women of reproductive age by 50 percent (Figure 6). Cote d'Ivoire and Gambia will continue to have the highest prevalence of anaemia among women of reproductive age by 2030. Senegal and Liberia are the countries that are the most likely to meet the anaemia target by 2030. These results show that enough actions are needed to reach the target, especially by considering the different causes of anaemia. The different actions undertaken by several countries to reduce anaemia are not enough or not adapted.

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**Figure 6:** Prevalence of anemia in 2030 and targeted anaemia in 2030 in West Africa

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The projections show that most countries will not meet the nutrition targets by 2030. Factors such as inadequate funding for nutrition activities, human resource capacity, sociocultural barriers to adopting effective solutions, and structural barriers such as low access to services and low service coverage may explain the situation.

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According to [31], most West African countries have inadequate funding for nutrition activities, and most nutrition activities depend in many cases on donor resources. These financial resources are often unsustainable and unpredictable for nutrition interventions [32]. For example, in Nigeria, inadequate funding was one of the major problems identified in the implementation of the national feeding program. The annual budget provision for the implementation of the program across the nation was inadequate and thus affected the implementation of the program [33]. Additionally, in Guinea, inadequate funding from the government has been blamed for the poor scale-up of nutrition activities [34].

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In some West African societies, women and children are prohibited from eating certain foods due to ethnic or cultural beliefs and taboos, which may include micronutrient-rich foods [35]. The authors reported that food taboos often target pregnant women to prevent what is perceived as harmful effects of these foods on the newborn. For example, in Benin, catfish, crabs, eggs, pork and African eggplant are tabooed, especially for pregnant women [36]. In southeastern Nigeria, snails and cane rat meat are

236 tabooed among pregnant women and eggs among children [37]. In Guinea, it has been shown that many  
237 foods that are rich in protein are prohibited for pregnant women. It is believed that because protein  
238 helps the body to grow, if a woman consumes many protein in her pregnancy, then the baby will grow  
239 too big, leading to complications during labour [38].

240 Social and cultural barriers to the use of reproductive health services are also present in all West African  
241 countries, although the degree and extent vary by country [39]. Economic access was also reported to  
242 be a major contributory factor for the use of services by women, depending upon the socioeconomic  
243 status of women seeking care, household wealth status, and the cost-of-service provision at the point of  
244 use. The situation of reproductive health services is especially challenging in countries recovering from  
245 civil war and instability, such as Senegal and Sierra Leone [39]. In Nigeria, Ghana, Mali and Sierra  
246 Leone, the effects of women's educational status and knowledge of risk factors were associated with  
247 decisions to adopt reproductive health services [39]. Women's education is an important factor in child  
248 health promotion. Women's education plays an important role in reducing infant mortality, increasing  
249 the life expectancy of future generations, improving child rearing and development, and leading to  
250 more knowledge and understanding of hygiene, child and mother nutrition control and prevention of  
251 disease, family planning, general health practices and child care [40]. However, in Ghana, as in many  
252 West African countries, educational and economic opportunities for women are limited, and a  
253 significant number of women experience genital cutting as well as early and/or arranged marriages [41].  
254 In addition, the traditional family settings in West Africa view the family as a single unit governed by  
255 the single head, which is the man [39].

256 Investing in nutrition training is one of the strategies for strengthening the human resource base in  
257 nutrition and building a critical mass of nutrition professionals in West Africa [42]. However, in West  
258 African countries, there is an increase in the price of tuition fees for nutrition training. It is also noted  
259 that training institutions in West African countries are facing critical human and financial challenges  
260 (critical shortage of faculty members, lack of public funding, lack of equipment and infrastructure, etc.)  
261 which hamper their abilities to provide quality nutrition training [42]. In this condition, with the  
262 increase in tuition fees, many students will be denied access to nutrition education. In view of the above,  
263 it is important to continue with the nutritional education of the population as a tool to change the  
264 perceptions of populations. Additionally, governments have an important role to play by allocating  
265 funds for nutrition interventions through national budgets, as international funds for nutrition actions  
266 are not often suitable regarding the local context in each country or in a specific area in a country. The  
267 issue of nutrition needs to be addressed using multiple approaches, including nutrition-sensitive and  
268 nutrition-specific interventions. There is also a need either to reorient the policies developed and/or to  
269 improve program implementation and follow-up according to policies. Most West African countries are  
270 affiliated with the Scaling Up Nutrition (SUN) movement. In this framework, the council of nutrition  
271 was created in most countries to coordinate, supervise, control, follow-up, and orient all types of actions  
272 in the sector of Nutrition. With such figures, it is good to draw the attention of those councils on the  
273 efficacy and efficiency of their coordinating and follow-up work which is essential to reach the various  
274 targets.

275 Anaemia was found to be the indicator that had the most critical trend. Indeed, by 2030, many countries  
276 could not reach the target for anaemia. These results obtained from anaemia projections in 2030 could

277 be explained by the fact that the different causes of anaemia were not fully considered through  
278 programs. Indeed, according to Ayoya, Bendech [43], several factors contribute either alone or jointly  
279 to the high rates of maternal anaemia in West and Central Africa, such as widespread nutritional  
280 deficiencies; high incidence of infectious diseases; low access to and poor quality of health services; low  
281 literacy rates; and poverty, among others. According to Semedo, Santos [44], anaemia is also associated  
282 with nutritional deficiencies, especially iron deficiency, in association with deficiencies in folate, vitamin  
283 B12 and vitamin A. In West African countries, many pregnant women, especially those living in rural  
284 areas, suffer from night blindness, a clinical sign of vitamin A deficiency [43]. These results show that  
285 despite the multiple efforts made by these various countries to reduce other forms of malnutrition  
286 (acute, chronic and overnutrition), anaemia will remain a challenge for these countries by 2030. This  
287 may imply that the various programs implemented in these countries against anaemia are not tackling  
288 the issue as it should be. Among recognized programs widely implemented in developing countries,  
289 micronutrients (iron, vitamin A, etc.) supplementation, food fortification and dietary diversification [45]  
290 are very common. Over the past decade, several programs have been developed for micronutrient  
291 supplementation and food fortification. These various programs have mainly targeted iron, zinc,  
292 vitamin A, etc. Indeed, classical food fortification provides a quick positive output, but its several  
293 constraints hinder its sustainability [46]. More recently, food fortification programs using local iron-rich  
294 food resources such as moringa are encouraged, and feeding populations with locally available foods  
295 from local biodiversity is being promoted. Local biodiversity includes local foods of plant and animal  
296 origin. As such, fish are a very good source of micronutrients, but their price remains high for the  
297 purchase power of most communities. Sources of animal proteins such as edible insects are good  
298 alternatives to gradually integrate into the cultural food habits of vulnerable populations.

299 By 2030, only Niger and Sierra Leone will not be able to meet the target trends for undernutrition  
300 (wasting and stunting among children), overweight among children and anemia among women of  
301 reproductive age. These results mean that by 2030, the double burden of malnutrition may exist in these  
302 countries among children (undernutrition and overweight), at the household level (anemia among  
303 women of reproductive age and undernutrition or overweight among children), or at the population  
304 level (all three forms in the same population at the same time). Various factors were associated with the  
305 double or triple burden of malnutrition among mother-child pairs, namely, age of the mother, education  
306 level of the mother, child age, wealth index, place of residence, and regions of residence [47]. Therefore,  
307 both countries need an effective implementation of nutrition programs targeting undernutrition and  
308 overweight among children and anemia among women of reproductive age. Policies and programs  
309 must provide nutritional education by considering the specific needs and priorities of mothers and  
310 children separately [47].

### 311 **Limitation of the study**

312 One of the limitations of this study is linked to the unavailability of nutritional data for some countries  
313 (e.g., Cape Verde, was not included in some of the analyses because, very little data were available).  
314 However, as most West African countries were included in our analysis, the findings do provide  
315 interesting insights into the regional situation of malnutrition. Data availability for a longer period could  
316 provide more accurate estimations.

317 A second major limitation is linked to the fact that the results of the nutrition-specific and nutrition-  
318 sensitive interventions were not always available, somewhat limiting some of our analyses. In the same  
319 way, all national or regional policies for better nutrition are not always published by the countries, and  
320 accordingly, they have not been well considered to better explain the observed trends.

## 321 5. Conclusions

322 This review highlighted nutritional issues in West Africa by 2030. From 1999 to 2018, malnutrition  
323 indicators decreased in West African countries but at a very slow pace. Most African countries are not  
324 on track to meet the WHO target fixed for 2030 for stunting, wasting, childhood overweight and  
325 especially anaemia among women of reproductive age. The trends observed underscore that efforts to  
326 achieve the SDG2 relative to ending hunger are not sufficient. These trends are mainly due to  
327 inadequacy funding for nutrition activities, human resource capacity, sociocultural barriers to adopting  
328 effective solutions, structural barriers such as low access to services and low service coverage. The  
329 situation of the global COVID-19 pandemic could also impair the attainment of the targets. Anaemia  
330 among women of reproductive age was shown to have the most critical trend among the targeted  
331 indicators as a result of low iron intake and other nutritional deficiencies (folate, vitamin B12 and  
332 vitamin A); high incidence of infectious diseases; low access to and poor quality of health services; low  
333 literacy rates; and poverty. It is also believed that where iron deficiencies exist, zinc deficiencies will  
334 possibly occur, which leads to multiple micronutrient deficiencies. Food fortification using  
335 micronutrient-rich local food ingredients could be promoted as an effective sustainable approach to  
336 tackle this issue. The local populations therefore need to be trained on food combinations for optimal  
337 nutrition among rural communities, which are known to be the most affected by undernutrition,  
338 including hidden hunger. Accordingly, countries through their respective governments need to reorient  
339 the policies developed and/or to improve program implementation and follow-up according to policies.  
340 This review provided a benchmark for countries in West Africa to identify their nutritional issues, assess  
341 their efforts and design complementary policies and programs to accelerate the achievement of targets  
342 by 2030. Suggestions were made to the WHO to review or update the targets. For West African  
343 governments, we recommend the following:

- 344 - allocate special budgets to nutrition activities, or if this already exists, the nutrition-related  
345 activity budgets must be improved;
- 346 - draw attention to nutrition councils on the efficacy and efficiency of their coordinating and  
347 follow-up work, which is essential to reach the various targets;
- 348 - sponsor training in nutrition for students and professionals to build a pool of qualified nutrition  
349 specialists;
- 350 - promote the local-rich food resources in school feeding programs;
- 351 - include nutrition education in school curricula;
- 352 - implement a wide nutritional education campaign throughout countries to tackle some social  
353 barriers that affect the nutritional performance of the populations.

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355 contributed to the study design. M. Affonfere, E. Sacla Aidé and F. K. Fassinou performed data  
356 collection from different literature sources. E. Sacla Aidé and K.V. Salako performed statistical analyses.



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