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Determinants of stunting in children aged 0–59 months in three regions of Burkina Faso

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Abstract

The Sahel is a region particularly characterized by undernutrition in several forms. In Burkina Faso, where several interventions have been carried out across the past several years, the nutritional situation of children under five years of age is still characterized by persistent stunting in the Est, Sahel, and Cascades regions. This study aims to understand the factors associated with the high prevalence of chronic malnutrition in these regions. National nutrition survey data as well as data from the Ministry of Water and Sanitation were used for bivariate and multivariate statistical analyses to identify factors statistically associated with stunting in children aged 0–59 months who participated in the national nutritional surveys from 2009 to 2019. Around one in ten mothers in all regions had no schooling at all. The improving of IYCF practice has a positive impact on the reduction of the prevalence of chronic malnutrition among children in the Cascades, Est and Sahel regions. In the three target regions, gender and province were significantly associated with stunting. Fever, diarrhea, vitamin A supplementation, household size, and maternal education level were also associated with stunting but only in the Sahel and Cascades regions. Overall, the results of the study show that the fight against stunting must be carried out in a multisectoral approach and target certain provinces particularly because stunting is not uniformly present in all provinces.

Keywords Stunting, Region, Factors, Cascades, Sahel, Est

Introduction

Malnutrition in children under five years of age is a major public health problem because of its scope and severity throughout the world, and particularly in developing countries [1]. It is the cause of 54% of infant mortality, in the countries of the South where the health system

is precarious [2]. The low level of knowledge of malnutrition by parents as well as the inaccessibility of health centers in certain areas are the main causes of numerous cases of abandonment of child care [3]. Indeed, the Food and Agriculture Organization of the United Nations (FAO) in its report on the state of food security and nutrition in the world in 2019, estimated that 21.3% (144 million) of children under five (5) years suffered from stunting, 6.9% (47 million) from emaciation and 5.6% (38.3 million) from overweight, while at least 340 million children suffered from micronutrient deficiencies. Between 2000 and 2019, the global prevalence of stunting in children decreased by one-third [4]. However, the world is not on track to meet global nutrition goals by 2030, including those related to stunting (40% reduction

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in the number of stunted children under five), wasting (reduction and maintenance of wasting in children below 5%), and overweight children [4]. Furthermore, countries in the Sahelian belt such as Nigeria in 2005, Burkina Faso in 2012, have been faced with food and nutrition crises [5]. However, in recent years, Burkina Faso has experienced successive shocks that have increased the vulnerability of the population, resulting in high prevalence of chronic malnutrition in the Sahel, Est, Nord, Boucle du Mouhoun and Centre-Nord regions. According to the National Nutritional Survey (NNS), from 2009 to 2019, the prevalence of acute malnutrition (AM) has gone from 11.3 to 8.1%, that of chronic malnutrition (CM) from 35.1 to 25.4% and that of underweight (UW) from 26 to 17.3% among children under five (5) years of age [6]. The food and nutrition situation in this country is therefore marked by chronic undernourishment, the concrete manifestations of which are a high endemicity of acute and chronic malnutrition as well as high prevalence of certain micronutrient deficiencies, in particular iron, iodine and vitamin A deficiencies.

Stunting is persistent in the Cascades, Est and Sahel regions since 2009 through high rates of malnutrition in all its forms. Indeed, in 2019 the prevalence of acute malnutrition in the three regions was 6.8%, 7.5% and 9.7%, respectively; that of underweight was 16.7%, 20.4%, 25.3%; and for chronic malnutrition, they were 33.5%, 31.6%, and 36.7% respectively [7]. Chronic malnutrition in these regions is above the critical threshold according to the 2006 WHO classification, which is 30%.

In its strategy to fight malnutrition, the Government of Burkina Faso has placed nutrition among the public health priorities. Since 2009, a monitoring system of the evolution of nutritional situation has been set up through a regular organization of national nutritional surveys (NNS) by the Standardized Monitoring and Assessment on Relief and Transitions (SMART) methodology which is a rapid survey of the nutritional situation of children under five (5) years of age. In these regions, numerous nutrition and hygiene education actions, implementation of primary health care programs, and integrated community nutrition programs have been undertaken by the government of Burkina Faso and non-governmental organizations to improve the nutritional status of the population. However, there is still a high prevalence of chronic malnutrition in these regions. To better act on the factors likely to promote malnutrition in children, it is important to analyze the evolution and determinants of chronic malnutrition in children aged 0–59 months in these regions in order to have reliable information for a better orientation of the actions to be taken. This is what justifies the present study, the objective of which is to describe and analyze the determinants of chronic malnutrition in the Cascades, East and Sahel regions.

Methodology

Study area

Burkina Faso is a landlocked country in West Africa, subdivided into 13 regions, 45 provinces, 350 departments, 351 communes (including 49 urban and 302 rural) and 8228 villages. According to the general population census carried out by the National Institute of Statistics and Demography, Burkina Faso's population is characterized by strong growth and youth. Women account for 51.7% of the total population [8].

The Cascades region comprises two provinces: Comoé and Léraba. The Cascades region covers an area of 18,424 km², or 6.7% of the national territory. It is a region of diversified plant cover, with stands of borassés and various mango tree, cashew and citrus orchards, as well as classified forests. The region has a population of 812,062 (420,370 women and 3,969,692 men) in 2019. The average household size is 5.6, compared with 5.2 nationally. Economically speaking, the Region occupies a favorable geographical position for trade, as it is crossed by both the Abidjan-Niamey road and the Abidjan-Ouagadougou rail link. The population relies on family farming, and most of them manage to cover their cereal needs [8]. Since 2020, the security situation has been particularly worrying in this region.

The East region comprises the provinces of Gnagna, Gourma, Kompienga, Komandjoari and Tapoa. It is bordered to the north by the Sahel region, to the south by Togo and Benin, and to the east by Niger. It occupies around 17% of the national territory and covers an area of 47,434 km². The East region's greatest economic opportunities currently lie in agriculture and livestock breeding, and to a lesser extent in wildlife, fishing and industry. In economic terms, the Eastern region is essentially agricultural. Agriculture is the primary occupation of the rural population. Demographically, the East region has a population of 1,942,805 in 2019, or 9.5% of the total population of Burkina Faso [8]. Since 2017 the security situation has been of particular concern in this region.

The Sahel region comprises four provinces: Oudalan, Séno, Soum and Yagha. It occupies 13.2% of the national territory and covers an area of 36,166 km². It is bordered to the north by the Republic of Mali and to the north-east by the Republic of Niger. Economically, the Sahel region is essentially pastoral. Several gold-panning sites are located in the region, the most important of which is Essakane in the Gorom-Gorom department. Demographically, in 2019 the Sahel region has a population of 1,098,177, or 5.4% of the total population of Burkina Faso. Soils are predominantly sandy and slightly acidic. It has a hot, semi-arid climate [8]. Since 2016 the security situation has been of particular concern in this region.

Data sources

The basic data for this study come from the National Nutritional Surveys carried out by the Nutrition Directorate from 2009 to 2019. These surveys provide information on the nutritional status of children aged 0 to 59 months and women aged 15 to 49 years. They also present information on food consumption of women of child-bearing age within households. This provides updated data for better planning of nutrition interventions in Burkina Faso. Also, this study considered data from the Ministry of Water and Sanitation from 2013 to 2019. For this study, these two databases were used for secondary analysis to answer the question relevant to this analysis.

For all the data collected on the different variables, the proportions of missing data being less than 5% were considered of good quality after verification by the national platform on nutrition information, or Plateforme Nationale d'Information sur la Nutrition (PNIN) in French, and the national institute for statistics and demographics, or Institut National de la Statistique et de la Démographie (INSD) teams.

Type and period of study

This was a cross-sectional study based on secondary analysis of data with the purpose of describing and analyzing the determinants of chronic malnutrition in the Cascades, Est and Sahel regions. The data used for this study are those of the NNS, the databases of the nutrition department, and the Ministry of Water, Sanitation and Hygiene. The study ran from March 2019 to December 2021.

Study population

The number of children to be surveyed in each region was calculated using the July 2015 version of "ENA for Smart" software, using as expected prevalence the upper bounds of the 2018 national nutrition survey prevalence confidence intervals. A precision of 3 to 4% depending on the stratum prevalence and a cluster effect of 1.5 were used to calculate the sample size in number of children. All children aged 0–59 months who participated in the various National Nutritional Surveys (NNS) from 2009 to 2019 were included in this study. For the study of determinants, the children concerned were those who

participated in the 2019 NNS (Table 1). For ethical reasons, a request to obtain and use the databases was sent respectively to the Directorate of Studies and Sectoral Statistics of the Ministry of Water and Sanitation and to the Directorate of Nutrition. Having obtained a favorable response, these databases were used for the various analyses as outlined below.

Dependent variable

The chronic malnutrition in children is the dependent variable in this study. The height and age of the child were used to obtain the height-age index (H/A) which constitutes the indicator of chronic malnutrition. According to the WHO 2006 growth standards, a child with an H/A index between -1 and $+1$ standard deviation (SD) from the mean is considered normal. If the H/A index is less than -2 SD, the child is considered to have moderate growth retardation. If his H/A index is less than -3 SD, he is considered to have severe growth retardation [9].

The H/A index less than -2 standard deviations denotes chronic global malnutrition in the child. It has been divided into two modalities. A child suffering from chronic malnutrition is designated by "1" and otherwise by "0".

Independent variables

The independent variables that can explain the stunting (chronic malnutrition) are multiple and were selected on the basis of the literature on the potential determinants of chronic malnutrition. They include data related to the socio-demographic characteristics of the household, the nutritional status of the child, and the accessibility of drinking water and sanitation. This study is particularly interested in the following factors:

Factors related to the child

These factors include gender, age, early initiation of breastfeeding, colostrum intake, exclusive breastfeeding, introduction of complementary food, continued breastfeeding until two (2) years of age, dietary diversity, minimum feeding frequency, minimum acceptable feeding, occurrence of diarrhea, fever, coverage of Vitamin A supplementation, and coverage of deworming products supplementation (mebendazole).

Table 1 Study participants numbers by region

	Cascades	Est	Sahel
Total number of children surveyed aged 0 to 59 months	1063	2506	1650
Total number of children surveyed aged 0 to 23 months	365	857	596
Total number of children surveyed aged 24 months or more	676	1534	975
Total number of children surveyed aged 6 to 23 months	293	654	478
Total number of children surveyed aged 0 to 5 months	72	205	118
Total number of children surveyed aged 6 to 8 months	43	77	75
Total number of children surveyed aged 9 to 23 months	250	575	403

Vitamin A supplementation coverage is the proportion of children aged 6–59 months who have received vitamin A supplementation in the last 6 months.

Deworming coverage is the proportion of children aged 12–59 months who have been dewormed in the last 6 months.

Household factors

These factors include the mother's level of education, the size of the household, and the number of children aged 0–59 months in the household.

Socio-environmental factors

These factors consist of geographic location (province of residence) and WASH indicators.

The rate of access to drinking water in households is the proportion of households with access to drinking water in accordance with the standards and criteria in force in relation to the total number of estimated households.

The household sanitation access rate is the proportion of households using an improved family latrine where the total number of daily users is less than or equal to 10.

Statistical analysis of data

SPSS software (IBM SPSS Statistics V.23) was used to analyze the data. Univariate (frequency), bivariate (associated factors) and multivariate (binary logistic regression) analyses were performed. The univariate descriptive analysis focused on the variables of the different data related to the socio-demographic characteristics (of the mother and the household), and environmental characteristics (place of residence). In addition, data on morbidity (incidence of diarrhea and fever), health coverage (vitamin A supplementation and deworming), and finally, data on Infant and Young Child Feeding (IYCF) practices (breastfeeding and complementary feeding practices), derived from the NNS from 2019 in the Cascades, Est and Sahel regions. The descriptive bivariate analysis using the Chi-2 test between the dependent variable and the different independent variables allowed us to identify the different associated factors for a threshold of 5%. The variables selected for the binary logistic regression were those that showed a $p < 0.2$. The entry method was used for logistic regression and 5% is the threshold for the associated variables in the logistic model.

Results

Sociodemographic characteristics

In this study, 61.15%, 51.56%, and 62.40% of households were composed of six or fewer individuals in the Cascades, Est, and Sahel, respectively (Table 2). In the Cascades, the majority of households had two or fewer children under the age of five (43.55%). On the other hand, in the Est and Sahel regions, 42.80% and 51.90%

of households, respectively, had at most one (1) child under the age of five (5). The majority of mothers in the 3 regions (91.40% in the Cascades, 91.82% in the Est and 87.00% in the Sahel), did not attend school.

Evolution of chronic malnutrition

Evolution of chronic malnutrition in the regions and at the national level

Chronic malnutrition, at both the regional and national levels, has been steadily decreasing (Fig. 1). From 2009 to 2019, it went from 35.10 to 25.40% at the national level. In the same period, it went from 43.10 to 33.50% in the Cascades, 43.00–31.60% in the Est and 42.90–36.70% in the Sahel. The highest prevalence was observed in 2010 in the Cascades (45.50%), in 2012 in the Est (44.80%) and in 2015 in the Sahel (46.60%).

Vitamin A supplementation and deworming (mebendazole) of children under 5 years of age in the Cascades, Est and Sahel regions

In each region the trends in vitamin A supplementation and deworming products coverage are declining, except for the Sahel region. Indeed, vitamin A supplementation coverage rate fell from 83.10 to 64.30% and from 83.10 to 74.50% during the period 2013 to 2019 in the Cascades and Est regions. On the other hand, in the Sahel, the rate increased from 79.10 to 81.90% over the same period. Similarly, the deworming products coverage rate fell from 77.80 to 63.10% in the Cascades and from 75.00 to 74.60% in the Est. It rose in the Sahel region from 67.00 to 81.80%. The stunting curve also shows a downward trend and remains practically below that of vitamin A supplementation and deworming products (mebendazole) (Fig. 2).

Chronic malnutrition and WASH indicators evolution

Access to drinking water in rural and urban areas as well as the evolution of the stunting rate over a decade, in urban areas, access to drinking water in the Cascades has remained practically stable (around 95.00%) from 2009 to 2019, while access in rural areas has increased from 49.10 to 59.90% over the same period. In the Est region, the rate of access to drinking water in urban areas rose from 77.00% in 2013 to 74.40% in 2019, compared with 48.10–54.50% in rural areas. In the Sahel region there has been a clear improvement into drinking water in rural areas, which has risen from 35.30% in 2009 to 58.20% in 2019. From 2013 to 2019, access to drinking water in urban areas increased from 67.00 to 90.90%. The graphs show a reduction in stunting possibly due to better rates of access to drinking water in all regions (Fig. 3).

The rate of access to sanitation in urban areas is changing in the Cascades and Est region. Indeed, the Cascades region recorded a sanitation access rate of 23.00% in 2014

Table 2 Socio-demographic characteristics of mothers and households in the Cascades, Est and Sahel regions

Characteristics	Modalities	n	Percentage (%)
Cascades Region			
Household size	≤6	650	61.15
	7–82	413	38.85
Number of children less than 5 years old	≤1	441	41.49
	2	463	43.55
	3 or more	159	14.96
Mother’s level of education	None	972	91.40
	Primary	59	5.60
	Secondary	31	2.90
	Higher	1	0.10
Est Region			
Household size	≤6	1292	51.56
	7–82	1212	48.36
	≥83	02	0.08
Number of children less than 5 years old	≤1	1072	42.80
	2–2	1010	40.30
	≥3	424	16.90
Mother’s level of education	None	2301	91.82
	Primary	146	5.83
	Secondary	58	2.31
	Higher	1	0.04
Sahel Region			
Household size	≤6	1029	62.40
	≥7	621	37.60
Number of children less than 5 years old	≤1	857	51.90
	2–2	645	39.10
	≥3	148	9.00
Mother’s level of education	None	1436	87.00
	Primary	172	10.40
	Secondary	40	2.40
	Higher	2	0.10

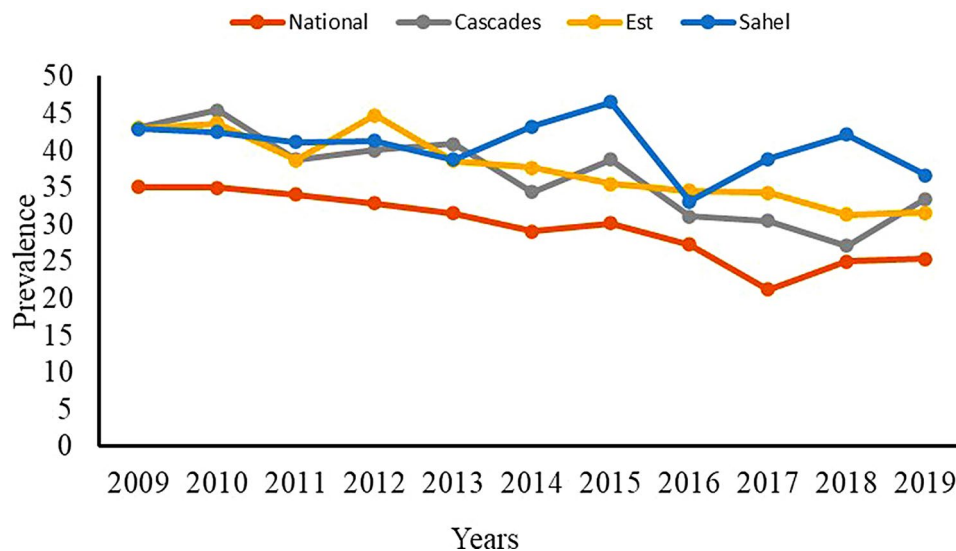


Fig. 1 Evolution of chronic malnutrition in the three regions and at the national level

and 24.30% in 2019. As for coverage in urban areas, it has evolved from 28 to 31.10% over the period from 2010 to 2019. In the Sahel region, data on urban sanitation was not available. This rate is also changing in rural areas in

the three regions. It increased from 0.50 to 14.30%, from 0.40 to 14.20% and from 1.00 to 13.90% respectively in the Cascades, Est and Sahel regions in the period 2010 to 2019. Despite these changes in sanitation indicators,

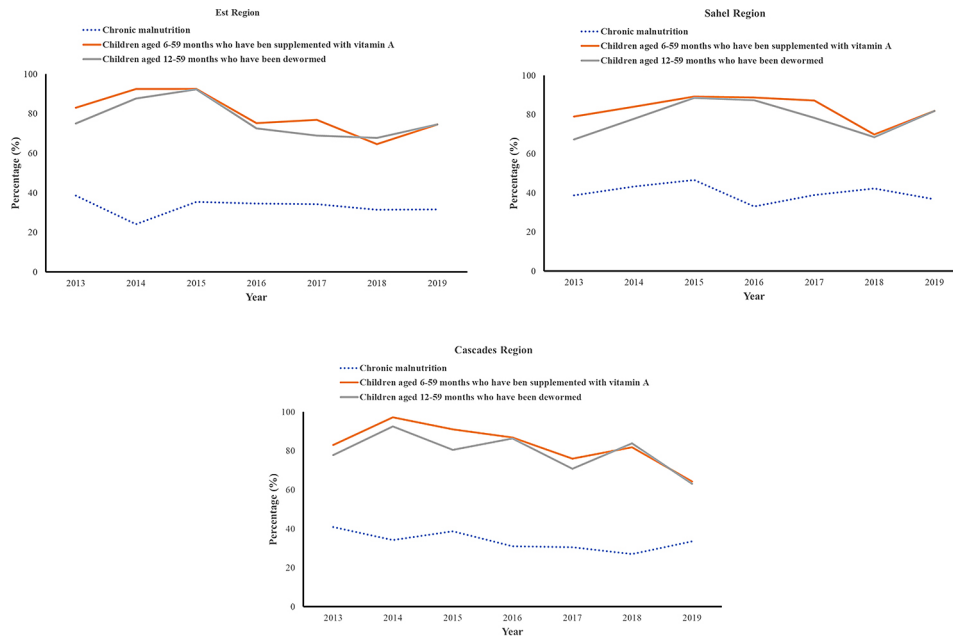


Fig. 2 Trends in chronic malnutrition and coverage of vitamin A supplementation and deworming in the Cascades, Est and Sahel

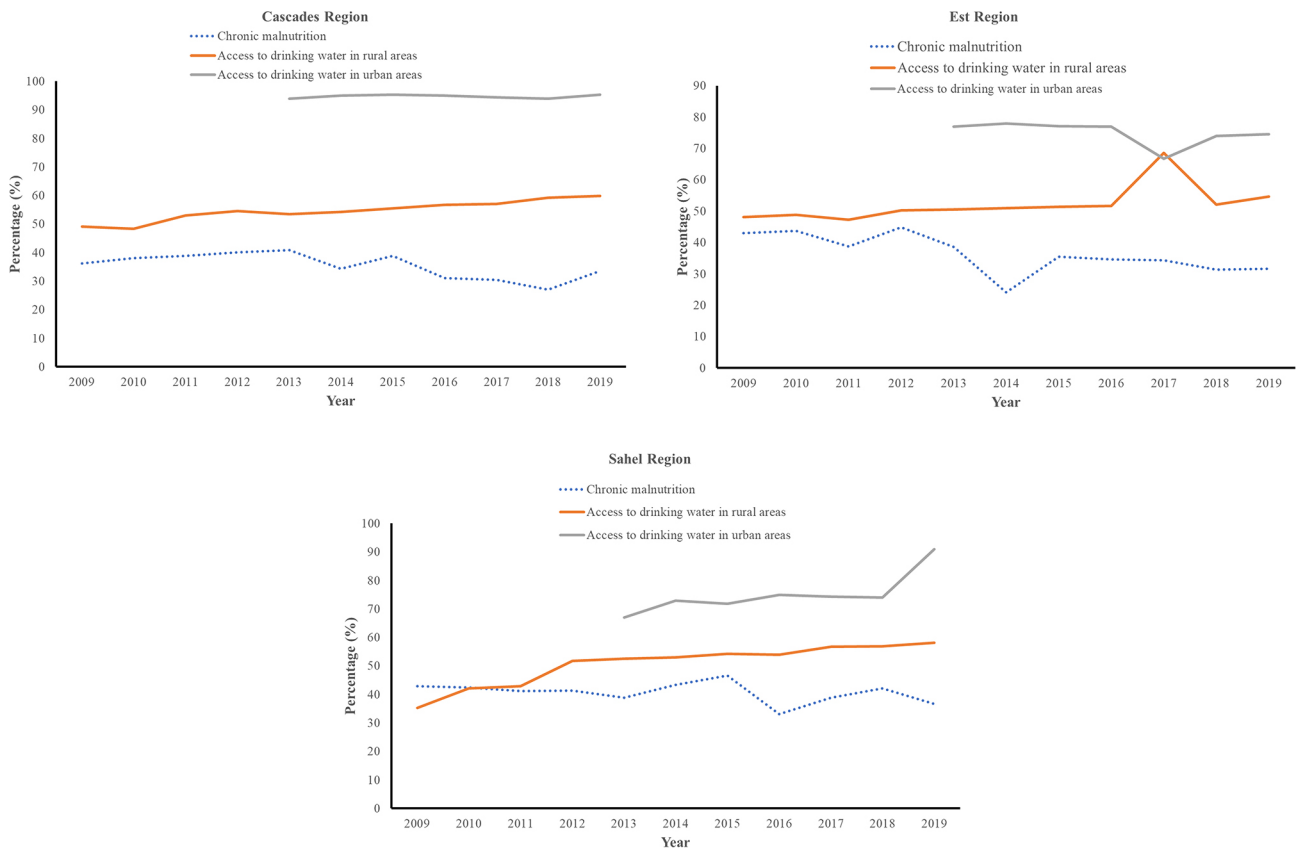


Fig. 3 Trends in chronic malnutrition and access to drinking water in rural and urban areas in the Cascades, Est and Sahel

the prevalence of stunting in these regions remains high, even though it is generally decreasing (Fig. 4).

Evolution of chronic malnutrition and IYCF indicators specific to supplementary feeding

The overall trend in IYCF practices is improving. The evolution of these practices has a positive impact on the reduction of the prevalence of chronic malnutrition among children in the Cascades, Est and Sahel regions.

The timely introduction of supplementary feed decreased in the Cascades region from 66.00% in 2012 to 45.30% in 2019. It increased from 60.90 to 70.00% and from 67.30 to 69.70% respectively in the Est and Sahel regions. The practice of minimum meal frequency according to the age of the child is increasing in all three regions; it rose during the period from 2013 to 2019 from 64.40 to 81.20% in the Cascades, 73.30–78.90% in the Est region and 52.10–74.20% in the Sahel.

Concerning dietary diversity of children aged 6–23 months, although it has increased from 2.40% in 2012 to 31.90% in 2019 in the Cascades, 3.00% in 2012 to 21.00% in 2019 in the Est and 6.60% in 2012 to 22.80% in 2019 in the Sahel region, it remains very low in all these regions (Fig. 5).

Factors associated with chronic malnutrition in 2019

In order to identify the factors associated with chronic malnutrition in children, associations were made between the dependent variable and the explanatory variables (Table 3). The factors associated with the chronic malnutrition in 2019 are, among others, the level of education of mothers and household size in the Cascades region. In the Est region they are province and gender. In the Sahel province, gender, diarrhea, fever, and vitamin A supplementation were identified as factors associated with chronic malnutrition in children aged 0–59 months.

Determinants of chronic malnutrition in 2019

Province was a common determinant of the chronic malnutrition in all three regions (Table 4). In addition to this common determinant, household size was identified in the Cascades region. Gender, age, and vitamin A supplementation were identified, in addition to province, as determinants of chronic malnutrition in children under five years of age in the Sahel region.

The odds ratios at the provincial level show that children in Comoé province were 33% more likely to be chronically malnourished (OR: 1.332; CI90%: 1.019–1.740) than those in Léraba province with a non-significant risk. Children in Gnagna, Gourma, Komandjari and

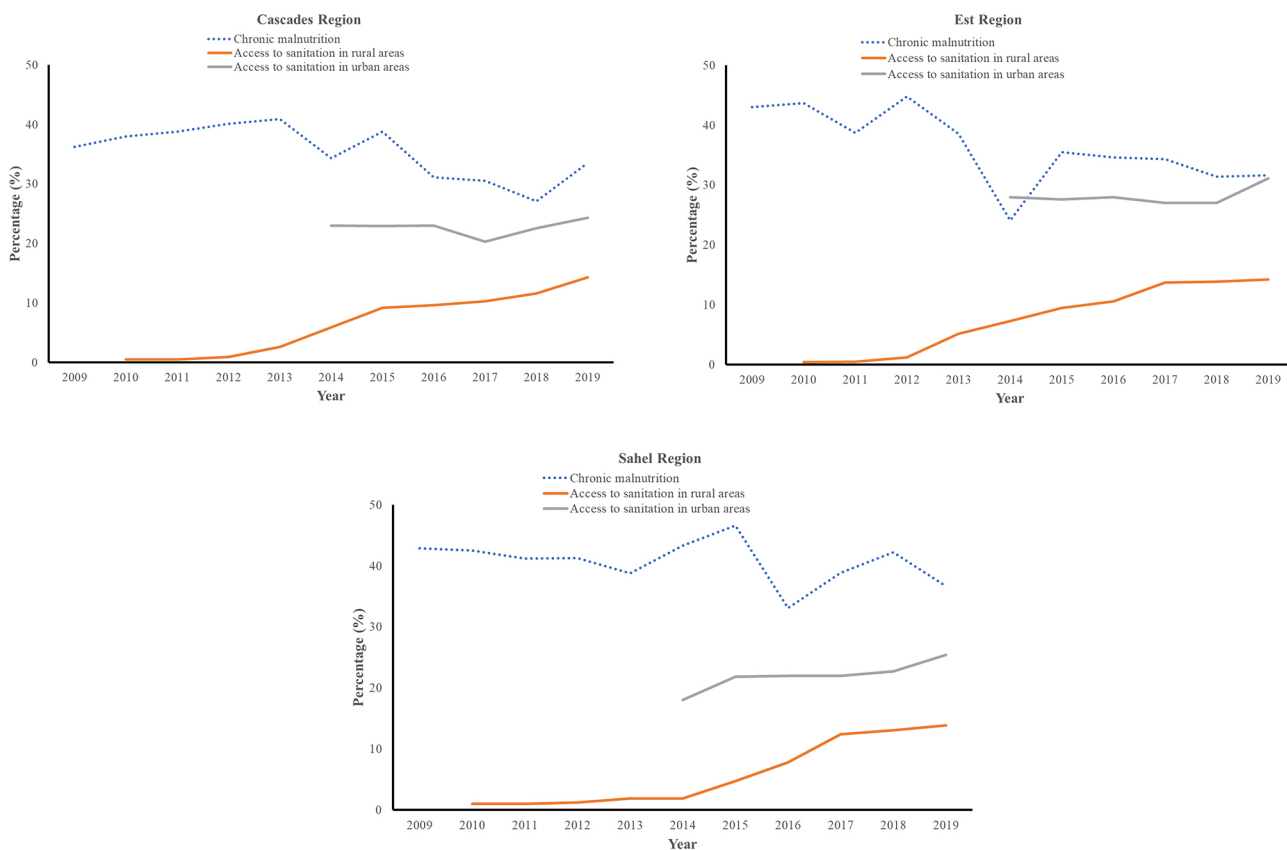


Fig. 4 Trends in chronic malnutrition and access to sanitation in rural and urban areas in the Cascades, East and Sahel regions

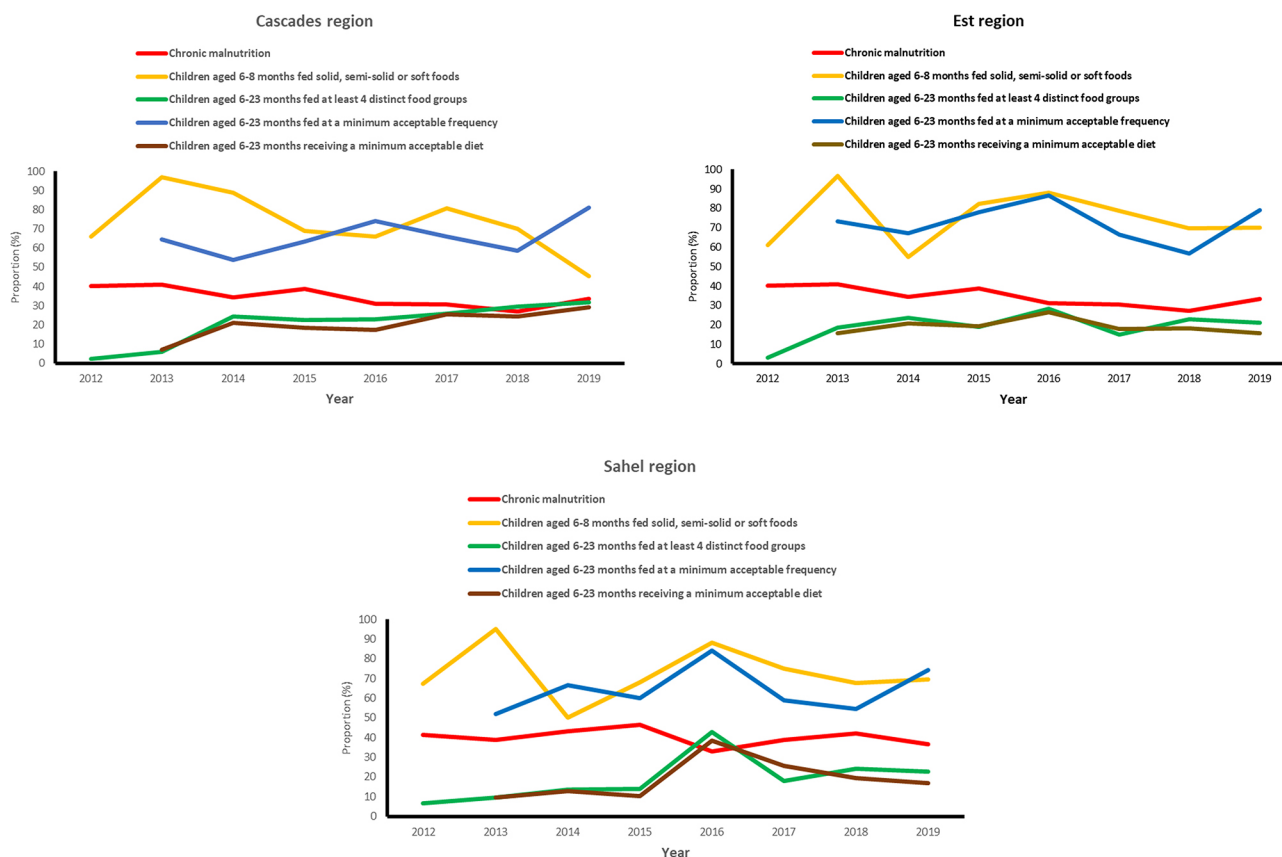


Fig. 5 Evolution of chronic malnutrition and indicators of IYCF practices specific to supplementary feeding in the Cascades, Est and Sahel

Kompienga provinces are less likely to be stunted than those in Tapoa. However, children in Komandjari (OR: 0.674 (0.363–1.250)) were more likely to be stunted than those in Gourma (OR: 0.577 (0.328–1.016)) but this risk was not significant. In Gnagna (OR: 0.526 (0.299–0.925)), children are 0.10 times more likely to be stunted than those in Kompienga (0.425 (0.208–0.867)). These two provinces have significant risks the order of $P=0.026$ for Gnagna and $P=0.019$ for Kompienga. In the Sahel region, children in the provinces of Oudalan (OR: 0.327; CI: 0.174–0.615), Seno (OR: 0.839; CI: 0.499–1.410) and Soum have a lower risk of being chronically malnourished than children in Yagha province.

In the Cascades region, children living in households with 6 or fewer people are 44% more likely to be chronically malnourished than those living in households with seven or more people. In the Sahel region, children aged 24 months and over are more likely to be chronically malnourished than younger children. In the same region, boys are 64% more likely to be chronically malnourished than girls (OR: 1.642 [1.099–2.453]). Children who did not receive vitamin A supplements were two times more likely to be chronically malnourished than those who did (OR: 2.235 [1.267–3.944]).

Discussion

Socio-demographic characteristics

Sociodemographic characteristics were very similar in all three regions. Indeed, the majority of households were composed of six individuals or less in these regions, a result comparable to that reported in the fifth general population census at the national level, where the average household size was 5.2 individuals [8]. Also, the level of education of mothers was very low in the regions concerned. This result corroborates that of

Thombiano, who reported in his study that eight out of ten women, or 82%, had no education in Burkina Faso [10]. In addition, the study on household food consumption in the Nord region mentioned that the majority of the population surveyed (83.3%) was illiterate [11]. In [12] the Centre-Ouest region, 74.4% of women of childbearing age had no education. In another study conducted in Mali, it was reported that nine out of ten mothers had no education (90.6%) [13]. On the other hand, at the Marcory General Hospital in Côte d’Ivoire, only 14% of the mothers of infants did not attend school [14]. This high illiteracy rate could have a negative impact on the nutritional status of children. Furthermore, the majority of households had at most one child under the age of five (05).

Table 3 Factors associated with chronic malnutrition in the Cascades, Est and Sahel regions in 2019

Characteristics	Modalities	n	Chronic malnutrition		p-value
			Yes	No	
Cascades Region					
Province	Comoé	528	175 (33.1)	353 (66.9)	0.082*
	Léraba	535	151 (28.2)	384 (71.8)	
Gender	Males	524	174 (33.2)	350 (66.8)	0.077*
	Females	539	152 (28.2)	387(71.8)	
Mother's level of education in a formal school	None	972	309 (31.8)	663 (68.2)	0.036**
	Primary	59	12 (20.34)	47 (79.66)	
	Secondary	31	4 (12.90)	27 (87.10)	
	Higher	1	0 (0.0)	1 (100.0)	
Household size	≤ 6	648	216 (33.33)	432 (66.66)	0.013**
	7–82	415	109 (26.27)	306 (73.73)	
Est Region					
Province	Gnagna	574	158 (27.53)	416 (72.47)	0.000**
	Gourma	475	111 (23.40)	364 (76.30)	
	Komandjari	428	118 (27.57)	310 (72.43)	
	Kompienga	383	118 (30.80)	265 (69.20)	
	Tapoa	646	247 (38.24)	399 (61.76)	
Gender	Males	1282	417 (55.50)	865 (49.30)	0.005**
	Females	1224	335 (44.50)	889 (50.70)	
Vitamin A Supplementation	Yes	1596	518 (73.90)	1078 (71.00)	0.154*
	No	624	183 (26.10)	441 (29.00)	
Mother's level of education in a formal school	None	2301	708 (30.77)	1593 (69.23)	0.114*
	Primary	146	32 (21.92)	114 (78.08)	
	Secondary	58	15 (25.86)	43 (74.14)	
	Higher	1	0 (0.00)	1 (100.0)	
Consumption of colostrum	Yes	903	229 (25.36)	674 (74.64)	0.183*
	No	28	4 (14.29)	24 (85.71)	
Minimum frequency of meals	Yes	176	42 (23.86)	134 (76.14)	0.101*
	No	389	119 (30.59)	270 (69.41)	
Sahel Region					
Province	Oudalan	474	362 (76.40)	112 (23.60)	0.000**
	Seno	535	288 (53.80)	247 (46.20)	
	Soum	286	208 (72.70)	78 (27.30)	
	Yagha	355	182 (51.30)	173 (48.70)	
Gender	Masculine	859	512 (59.60)	347 (40.40)	0.003**
	Feminine	791	528 (66.80)	263 (33.20)	
Diarrhea	Yes	429	246 (57.30)	183 (42.70)	0.005**
	No	1221	794 (65.00)	427 (35.00)	
Fever	Yes	515	297 (57.70)	218 (42.30)	0.002**
	No	1135	743 (65.50)	392 (34.50)	
Breastfed yesterday	Yes	630	440 (69.80)	190 (30.20)	0.059*
	No	29	15 (51.70)	14 (48.30)	
Mother's level of education in a formal school	None	1436	876 (61.00)	560 (39.00)	0.08*
	Primary	172	127 (73.80)	45 (26.20)	
	Secondary	40	36 (90.00)	4 (10.00)	
	Higher	2	1 (50.00)	1 (50.00)	
Minimum frequency 6 to 23 months	Yes	150	87 (58.00)	63 (42.00)	0.06*
	No	277	186 (67.10)	91 (32.90)	
MAD	Yes	206	129 (62.60)	77 (37.40)	0.072*
	No	459	329 (71.70)	130 (28.30)	
Vitamin A Supplementation	Yes	1238	733 (59.20)	505 (40.80)	0.000**
	No	265	191 (72.08)	74 (27.92)	

**: Significance at 5% *: Significance at 20%

Table 4 Determinants of chronic malnutrition in the Cascades, Est and Sahel regions in 2019

Variables	Modalities	Chronic malnutrition Adjusted OR (IC 95%)	P-value
Cascades Region			
Province	Comoé	1.332 (1.019–1.740)	0.036*
	Léraba ^o	1	-
Gender	Males	1.248 (0.958–1.627)	0.101
	Females ^o	1	-
Mother's level of education	None	1,119,693,323	1.000
	Primary	521955450.1	1.000
	Secondary	327732090.0	1.000
	Higher ^o	1	-
Household size	≤ 6	1.448 (1.098–1.909)	0.009*
	7–82 ^o	1	-
East Region			
Province	Gnagna	0.526 (0.299–0.925)	0.026*
	Gourma	0.577 (0.328–1.016)	0.057
	Komandjari	0.674 (0.363–1.250)	0.211
	Kompienga	0.425 (0.208–0.867)	0.019*
	Tapoa ^o	1	-
Gender	Males	1.426 (0.979–2.077)	0.064
	Females ^o	1	-
Vitamin A Supplementation	Yes	0.713 (0.461–1.103)	0.128
	No ^o	1	-
Mother's level of education	None	6.824(0.878–53.054)	0.066
	Primary	5.577(0.573–54.256)	0.139
	Secondary ^o	1	-
Consumption of colostrum	Yes	1.192(0.376–3.784)	0.765
	No ^o	1	-
Minimum frequency 6 to 23 months	No	1.180(0.760–1.192)	0.461
	Yes ^o	1	-
Sahel Region			
Province	Oudalan	0.327 (0.174–0.615)	0.003*
	Seno	0.839 (0.499–1.410)	0.001*
	Soum	0.631 (0.321–1.240)	0.508
	Yagha ^o	1	-
Gender	Males	1.642 (1.099–2.453)	0.015*
	Females ^o	1	-
Vitamin A Supplementation	No	2.235 (1.267–3.944)	0.005*
	Yes ^o	1	-
AMA	No	1.068 (0.925–2.511)	0.759
	Yes ^o	1	-
Age	0–5 months	0.303 (0.203–0.449)	0.017*
	6–8 months	0.309 (0.206–0.464)	0.006*
	9–23 months	0.459 (0.328–0.568)	0.007*
	24 months and above ^o	1	-
Fever	Yes	1.061 (0.639–1.761)	0.819
	No ^o	1	-
Diarrhea	Yes	0.959 (0.584–1.572)	0.867
	No ^o	1	-

^o: Reference ^{*}: Significance at 5%

Evolution of stunting at the national and regional levels

Over the period from 2009 to 2019, the prevalence of stunting has decreased both at national and regional levels. This reduction in stunting could be explained by the various reforms of the health system with the integration of malnutrition management activities into the minimum package of activities of the health and social promotion

centers (CSPSs), the scaling up of the IYCF interventions in 2013, the development of the national protocol for the management of malnutrition in 2014, and the implementation of free maternal and childcare since 2016. However, prevalences at the regional level remain at critical thresholds. This is attributable to low dietary diversity in these regions. Specifically, the highest prevalences

of stunting were found in the Cascades region in 2010 with 45.5%, in the Est region in 2012 with a prevalence of 44.8%, and in 2015 in the Sahel region with 46.6%. According to the National Food and Nutritional Security Policy (PNSAN), which states that: “In view of the statistical data, it appears that the food supply is quite significant, but still insufficient to meet needs. In terms of physical accessibility and stability, Burkina Faso is characterized by the isolation of the main production areas (Boucle du Mouhoun, Hauts-Bassins, Cascades, Sud Ouest, Est) and the remoteness of the so-called consumption areas located in the North of the country. This situation hinders the supply of these areas, especially during rainy periods” [15].

Evolution of stunting as well as vitamin A supplementation and deworming products supplementation

The key nutrition interventions of vitamin A supplementation and deworming of children have good coverage in the regions. These interventions have a positive impact on reducing stunting. In Madagascar, Remonja found that parasitic *Trichuristrichiura* infections are potential risk factors for chronic malnutrition [16]. In addition, vitamin A is involved in child growth, and deworming allows children to benefit from the large proportion of nutrients, hence the impact of these interventions on reducing chronic malnutrition.

Evolution of stunting and access to drinking water and sanitation

Safe drinking water and a healthy environment are basic elements of good health for children. Access to safe drinking water and sanitation in both urban and rural areas has improved significantly since 2009 in the Cascades, Est and Sahel. According to Diallo, inaccessibility to safe water and inadequate sanitation were factors associated with child malnutrition in Mali [17]. Also, the Action Contre la Faim (ACF) NGO [18] mentioned that the family environment in which children develop and grow is strongly correlated with their nutritional status. A study in Cambodia using DHS 2010 data found that children living in communities in which households deposit excreta in the wild are 50% smaller than other children [19]. Direct and indirect pathways exist between the WASH sector and stunting.

Evolution of stunting and IYCF indicators

Indicators of IYCF specific to complementary feeding have improved from 2012 to 2019, however the low dietary diversity in the different regions impacts complementary feeding which remains poor despite some improvements. This could be due to late introduction of complementary foods for children, despite high agricultural productivity in some of these regions. A study

conducted in the Cascades on this subject reported that mothers said “giving solid food very early (less than 8 months) to a child can be detrimental to his health and growth [20]. The decline in the rate of timely introduction of complementary foods in these areas has been influenced by increasing insecurity leading to population movements and loss of farmland.

Factors associated with chronic malnutrition in the Cascades, Est and Sahel regions

Factors associated with the chronic malnutrition in 2019 include maternal education and household size in the Cascades region; province and gender in the Est region; and province, gender, diarrhea, fever, and vitamin A supplementation in the Sahel region. This result is similar to that of Traore in Mali who found that region of residence, namely the rural and urban environment, is strongly associated ($p=0,03<0,05$) with the nutritional status of children (OR=0,11, CI=0,02 et 0,75) [21]. This difference could be explained by the unavailability and lack of diversity of food products on the markets, the low socioeconomic levels and the lack of health infrastructure in the provinces in question. It was also reported by Ouedraogo, in his study that during the recovery period, the place of residence of the household was associated with the low dietary diversity of children aged 24–59 months [22]. Another study in Mali noted that the area of residence was a determinant factor ($p\text{-value}=0,000$) of malnutrition [23].

In addition, Binta Sall, had reported in here study that, although the majority of malnourished children had mothers who did not attend school, there was no significant relationship between the malnutrition and the level of schooling of the mothers [24]. In the present study, the chronic malnutrition was significantly associated with household size. Edoun in 2020 noted that the prevalence of chronic malnutrition increased with increasing household size [25]. Thus, in this study, dietary diversity is low and this situation is still evident. In the Cascades, children from families with fewer people (≤ 6) were 45% more likely to be chronically malnourished (OR: 1.448; 90% CI: 1.098–1.909) than those from households with more than six (6) people with a high significant difference ($P: 0.009$). This result is contrary to Bougma in 2018 who noted a significant association of large size (at least 15 persons) with stunting. He found that children with a household size of 1 to 4 people are at lower risk of stunting (OR=0.23; $p=0.03$) [26]. This discrepancy could be due to the inclusion of wage-gaining laborers in large households or to the presence of internally displaced people in these families who are able to move to regions with greater food availability, and thus are able to contribute to the children’s diets.

Conclusion

The main objective of this study was to analyze the determinants of chronic malnutrition in children under five (5) years of age in the Cascades, Est and Sahel regions. Indeed, the aspects studied of an environment favorable to the reduction of chronic malnutrition in children under five (5) years of age in these different regions show important challenges that the country must take up in order to initiate its socio-economic development and reverse the current unfavorable trends.

In addition, this study revealed a downward trend in the prevalence of chronic malnutrition in the three regions during the period from 2009 to 2019 but remains at critical thresholds according to the WHO 2006 standards (30%).

In addition, children are subjected to a low-quality diet in terms of both diversity and frequency of meals in the regions. However, with good coverage of vitamin A supplementation and deworming, chronic malnutrition rates decrease. The descriptive and analytical methods of analysis allowed us to achieve the objective of identifying the determinants of chronic malnutrition in children aged 0–59 months. These determinants are province for all regions, household size for the Cascades, age, vitamin A supplementation and gender for the Sahel region.

Overall, the results of the study show that the fight against stunting must be carried out in a multisectoral approach and target certain provinces particularly because stunting is not uniformly present in all provinces.

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Data availability

The database used in this study can be supplied by the corresponding author on request.

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