Dembele B. 2025. "Sex differences in child stunting in sub-Saharan Africa: A meta-analysis of twenty countries from 2010 to 2016." *World Nutrition, 16*(1), March, 2–10.
https://doi.org/10.26596/wn.20251612-10

Research

Sex differences in child stunting in sub-Saharan Africa: A meta-analysis of twenty countries from 2010 to 2016

Bernard Dembele[1,*]

[1] Institut national de la statistique et de la Démographie, 09 bp 598 Ouagadougou, Burkina

Keywords: child, stunting, Africa, gender, sex, factors

https://doi.org/10.26596/wn.20251612-10

World Nutrition 2025;16(1): 2-10

Abstract

Globally, the prevalence of child stunting is almost the same for both sexes. However, in developing countries, boys are more likely to be shorter than the norm for their age and sex. In sub-Saharan Africa, there is a need to understand this widespread phenomenon in order to help reduce the high prevalence and low decreasing level of stunting observed, in comparison to other parts of the world. In this perspective, we used pooled data from the demographic and health surveys conducted in twenty sub-Saharan countries. On the basis of 134,814 children under the age of five years with a valid anthropometric index constituted, the prevalence of child stunting obtained is 33.4%, with 35.4% (CI=[34.7%; 36.1%]) for boys and 31.3% (CI=[30.6%; 32.0%]) for girls; the largest gender gaps are found in the Great Lakes countries (Rwanda (8.1 points) and Burundi (8.9 points)). It appears that the gender gap in stunting in sub-Saharan Africa is more related to the size of the child at birth, the number of siblings, the birth assistance and wasting. Intensified action on these modifiable factors could help to reduce the observed gender differences and ultimately improve the overall nutritional status of children.

INTRODUCTION

Stunting is the result of cumulative long-term effects of inadequate feeding and/or poor health. It is an indicator not only of poor nutritional status, but also of limited access to basic needs and thus of absolute poverty (OMS 1995). Globally, its prevalence has been declining steadily from 40.2% in 1990 to 22.3% in 2022. At 44,7%, Africa had one of the highest prevalence of any continent. Even though Africa also experiences the downward trend, the decline rate is so slower that the gross number of stunted children continues to increase (Unicef et al. 2023).

A study of 81 countries suggests that stunting risk is higher for boys than for girls, although this is not significant (OR=1.14; CI=[0.83-1.53]) (Black et al. 2013). On the other hand, Kothari (2015) found from 35 developing countries analysed, 30 had a higher prevalence of stunting in males. Using a meta-analysis of 38 studies, Thurstans et al. (2020) also reached to the fact that boys had higher odds of stunting than girls (pooled OR=1.29; CI=[1.22; 1.37]). Wamani et al. (2007) found that boys were more affected in 10 sub-Saharan countries. In Asia and in the Middle East, the pattern may often be reversed. Sri Lanka, India, Pakistan and Egypt show a higher prevalence among girls. The case is similar in some Latin American countries, such as Guatemala and Bolivia (Arnold 1997).

These meta-analyses aimed at understanding this gender differences have generally proceeded by one-dimensional approach. Wamani et al. (2007) considered only household living standards as the main driver of the observed differences. Arnold (1997) focused on child nutrition through breastfeeding and childhood morbidity. Harttgen et al. (2013) attempted to establish a parallel with the level of country economic development based on Gross domestic product. Torchin and Ancel (2016) focused on differences in birth weight and prematurity. Garenne (2003) and Muenchhoff & Goulder (2014) focused on prevalence of infectious diseases. These authors analysed variations in stunting by cross-referencing individual data with their parameter of interest. Morrisson and Linskens (2000) performed multidimensional analyses, but considered every country individually. The present study improved this approach. However, it uses pooled data from recent Demographic and Health Surveys (DHS) of 20 sub-Saharan

* Corresponding author: dembele_b@yahoo.com

countries to generate more robust results. This enables the identification of the main explanatory factors in considering gender and its interactions in the overall context of sub-Saharan Africa. The objective is then to identify the determinants of the sex difference of child stunting at the sub-Saharan level, based on the main factors of stature deficit of each sex.

METHODS

The study uses DHS data from twenty sub-Saharan countries. The country choice was based on information availability on infant and child nutrition. It was also guided by a balance in terms of representation of large geographical areas: 10 countries in West Africa, 5 countries in East Africa, 4 countries in Central Africa and 1 country in Southern Africa. Overall, the total population of the selected countries represents 53% of sub-Saharan population (United Nations et al. 2015). The scope of the surveys was national and the data collection periods were between 2010 and 2016 (Table 1 below).

Table 1. Characteristics of the demographic and health surveys included

Country	Year of collection	Number of households	Response rate of households	Response rate of eligible women	Size of children's sample
Burkina Faso	2010	14947	99.2	98.4	15044
Burundi	2010	9030	99.1	96.4	7742
Cameroun	2011	15050	99.0	97.3	11732
Chad	2014-15	17892	98.9	96.1	18623
Congo Brazzaville	2011-12	11727	99.8	98.0	9329
Cote d'Ivoire	2011-12	10413	98.1	92.7	7776
Gabon	2012	10049	99.3	98.2	6067
Ghana	2014	12831	98.5	97.3	5884
Guinea Conakry	2012	7200	99.5	98.0	7039
Kenya	2014	39679	99.0	96.6	20964
Liberia	2013	9677	99.4	97.6	7606
Mali	2012-13	10743	98.4	95.9	10326
Namibia	2013	11004	96.9	91.6	5046
Niger	2012	11900	98.0	95.4	12558
Nigeria	2013	40320	99.0	97.6	31482
Rwanda	2014-15	12793	99.9	99.5	7856
Senegal	2014	4400	98.7	96.1	6935
Tanzania	2015-16	13360	98.4	97.3	10233
Togo	2013-14	9899	99.1	97.8	6979
Zambia	2013-14	18052	97.9	96.2	13457
Total		**290966**			**222678**

The surveys followed a standardised procedure, albeit with some adaptations for each country. They utilized a two-stage statistical sampling process. The sample is stratified to ensure its representativeness by place of residence and administrative regions in each country. For the first stage of sampling, clusters are drawn from an exhaustive list of enumeration areas delimited during the most recent national population census. The selection is a systematic proportional method according to number of households. Once all households in each cluster are counted, about 25 households are randomly drawn in a second stage. On this basis, household sample sizes ranged from 7,200 in Guinea to 40,320 in Nigeria (Table 1). The lowest household response rate was recorded in Namibia (96.9%) and the highest in Rwanda (99.9%). The sample size for children ranged from 6,935 in Senegal to 31,482 in Nigeria. In general, anthropometric measures were collected for all eligible women and children aged 0-59 months in a sub-sample of every second household. These subsamples, pooled, constitute the analysis dataset.

In the analyses for the present study, the complexity of the sample is taken into account by introducing weighting factors in the calculation of estimates and confidence intervals. A coefficient was introduced to ensure consistency between sample sizes and population size across countries, based on 2015 United Nations estimates. These various parameters were incorporated into the analysis using Stata's svyset procedure. The first step in the analysis was to cross-tabulate the dependent variable with the independent ones in order to select the significant ones for the multivariate model. The significance testing for cross-tabulation used chi-square and analysis of variance (t-student, Fischer). In a second step, the explanatory model used was the logistic regression to assess the adjusted influence of significant factors issued from cross-tabulation. The third step searched for explanatory factors of sex differences in stunting using Blinder-Oaxaca decomposition method (Jann 2008). It is used to analyse outcome differences between two groups. The difference is explained in two dimensions: a part that is "explained" by the variation of structure or frequencies of variables and an "unexplained" part that account for the differences in influences or performance of modalities between the two groups. For diagnostic and precision of models, the tests used are those presented by Long & Freese

(2001). The R^2 of Nagelkerke indicates the proportion of variance in the dependent variable explained by all the variables included in the model. The Hosmer and Lemeshow Test is used to designate the degree of overlap between the probability curve predicted by the model and the logistic curve. In this case, the expected decision is the non-significant p-value.

The dependent variable, stunting status, is assessed using child's data on height, age and sex. The index obtained is the height-for-age z-score, which compares the observed height with the norm for the same age and sex (2006 WHO norm). It is the ratio of the difference between the child's height and the median height of the reference population of the same age and sex to the standard deviation of the height of the same reference population. These calculations were made using WHO Anthro software version 3.2.2 (de Onis et al. 2009). On this basis, stunting is considered as severe if the z score is lower than -3, and moderate if the value is between -3 and -2. Chronic overall malnutrition includes these two forms. The child's height is considered normal if the value is greater than -2 (Maire and Delpeuch 2004).

The non-monetary approach of Filmer & Pritchett (1998) is used to assess the household living standard. It is based on characteristics of the dwelling and the availability of facilities. It also includes household ownership of durable goods. The result is an ordinal variable with the following modalities: Poorest, Poor, middle class, well-off and rich. Due to its construction, this variable reflects not only the level of well-being but also the quality of living environment, in particular level of sanitation.

For social characteristics, the sex of the child is used in the assessment of nutritional status and also as the main independent variable. To this end, its ability to modify or confound the effects on stunting has been assessed. The child's age was also included in the model and is expressed in months, especially as anthropometry changes rapidly in childhood and stunting is cumulative with age. The birth weight is based on the mother's assessment of the child's size at birth (Blanc and Wardlaw 2005). In addition, births were recorded as assisted by skilled personnel or not. To estimate the effect of birth intervals, we considered the succeeding interval after the index child. To avoid loss of the last children in these analyses, we used their age to represent succeeding interval. Obviously, while this option reduces the bias, it underestimates the length of birth interval, as it focuses only on the current situation, without any perspective on the possibility or timing of future birth.

Maternal nutritional status was categorized using body mass index (defined as weight (kg) divided by height (metres) squared) as chronic energy deficiency (<18.5 kg/m²), normal ([18.5 - 25[kg/m²), overweight/obese (≥25 kg/m²) (Maire and Delpeuch 2004). Maternal height was divided into three categories: <155 cm (short stature), 155-165 cm (medium stature), > 165 cm (tall stature) (Duncan 1994). To capture her gender attitude, the mother's stated fertility preference was included in the analysis. Gender preference is captured by the difference between the ideal number of boys and girls the mother would have liked to have if she were at the beginning of her reproductive life. Her age at the child birth expressed in years was also included in the analyses. Her education level was grouped into four items: none, primary, secondary and superior.

RESULTS

DESCRIPTIVE ANALYSIS

For all twenty countries included in this analysis, the height-for-age z-score child curve shows a significant shift to the left in comparison to the 2006 WHO norm (Figure 1). This indicates that children in the sample countries are stunted. The overall prevalence of stunting, the proportion of children below the threshold of -2 z-score H/A, is 33.4% (Table 2), which is considered "high" according to WHO classification (Maire and Delpeuch 2004). Furthermore, the prevalence was significantly higher in boys, 35.4% (CI=[34.7%; 36.1%]) versus girls, 31.3% (CI=[30.6%; 32.0%]) . This difference was statistically significant in Burkina Faso, Burundi, Cameroon, Nigeria, Kenya, Rwanda, Senegal, Tanzania and Zambia. In the other countries, except for Congo-Brazzaville, male prevalence was still higher among boys, although the difference is no longer significant. The greatest differences were found in the Great Lakes countries, with Burundi at 8.9 percentage points difference and Rwanda at 8.1 percentage points difference.

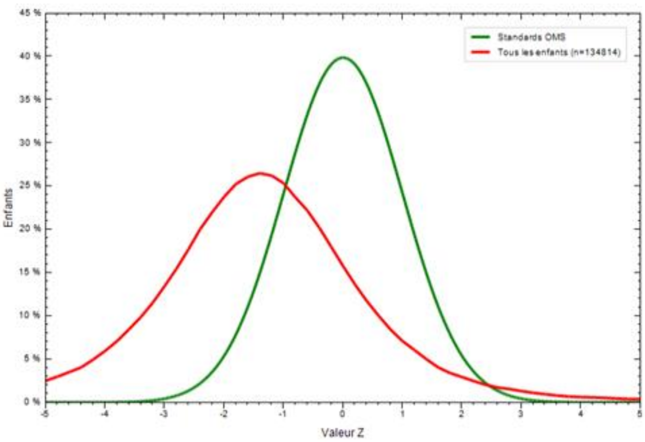

Figure 1. Curve of distribution of height for age z-score of under-five year children

EXPLANATORY ANALYSIS

The results of the logistic regression indicate that the risk of additional stunting linked to being a boy is 7%, controlling for other variables (Table 3 below). The lower the child birth weight, the higher the stunting risk in childhood (aOR=1.09). In other words, low birth weight predisposes to stunting during the first 5 years of life. The risk is lower if the birth is assisted by skilled personnel (aOR=0.78). The risk decreases as the household economic well-being increases (aOR=1.12 for poor households and aOR=0.76 for the rich). The risk also increases with child age. An additional sibling has no significant effect (aOR=1.001). There is a dose-response effect of maternal education on child stunting. The risk is significantly reduced when passing from primary to secondary and then to higher education (aOR=0.76; aOR=0.54; aOR=0.53 respectively), compared to those whose mother has no education. Rural children are more affected (aOR=1.16). As for the mother's age at child's birth, each additional year reduces the risk of stunting (aOR=0.978). The risk of stunting decreases as the nutritional status of the mother improves; if mother has a normal BMI, the risk is -

Table 2. Determinants of child stunting status by sex with logistic regression

Modality/Variable	Boy		Girl		Overall	
	aOR	P-value	aOR	P-value	aOR	P-value
Age of child	0.979	0.000	0.986	0.000	0.982	0.000
Succeeding birth Interval	1.027	0.000	1.035	0.000	1.031	0.000
Age at child birth	0.979	0.000	0.978	0.000	0.978	0.000
Number of siblings	1.001	0.000	1.001	0.000	1.001	0.000
Wasting	1.179	0.000	1.284	0.000	1.226	0.000
Number of twins	1.350	0.000	1.217	0.016	1.290	0.000
Child size at birth	1.102	0.000	1.089	0.000	1.095	0.000
Diarrhoea						
Yes (Ref)	1.000		1.000		1.000	
No	0.683	0.000	0.697	0.000	0.689	0.000
Education of mother (Ref)						
No education (Ref)	1.000		1.000		1.000	
Primary	0.790	0.000	0.731	0.000	0.761	0.000
Secondary	0.576	0.000	0.498	0.000	0.538	0.000
Superior	0.346	0.000	0.316	0.000	0.332	0.000
Height of mother						
165cm+ (Ref)	1.000		1.000		1.000	
<155cm	3.838	0.000	3.972	0.000	3.891	0.000
155-165cm	1.724	0.000	1.941	0.000	1.827	0.000
BMI of mother						
Too thin for height (Ref)	1.000		1.000		1.000	
Normal	0.696	0.000	0.706	0.000	0.700	0.000
Overweight/obese	0.457	0.000	0.459	0.000	0.459	0.000
Place of residence						
Urban (Ref)	1.000		1.000		1.000	
Rural	1.191	0.001	1.136	0.018	1.162	0.000
Living standard						
Middle (Ref)	1.000		1.000		1.000	
Lower	1.084	0.136	1.158	0.009	1.123	0.003
Low	1.084	0.147	1.108	0.070	1.097	0.019
Well-off	0.803	0.000	0.858	0.017	0.830	0.000
Rich	0.756	0.000	0.754	0.001	0.756	0.000
Child Sex preferred						
No preference (Ref)	1.000		1.000		1.000	
Girl Preferred	1.033	0.541	1.002	0.972	1.014	0.702
Boy Preferred	1.035	0.431	0.928	0.128	0.987	0.695
Assistance at birth						
No (Ref)	1.000		1.000		1.000	
Yes	0.817	0.000	0.738	0.000	0.779	0.000
Sex of child						
Girl (Ref)					1.000	
Boy					1.071	0.017
Constant	1.380	0.06	0.785	0.177	1.018	0.883
Hosmer–Lemeshow Test	0.855		0.098	=	0.444	
Pseudo R2 Nagelkerke	0.079		0.283		0.087	

aOR: adjusted odds ratio

aOR=0.70, if she is overweight/obese, the risk is lower (aOR=0.46), compared to children of mothers too thin for their height. Children who did not suffer from diarrhoea in the past two weeks have a lower risk of stunting (aOR=0.69), suggesting that it does function as a proxy for longer-term morbidity. In the models by sex, the results follow the same trends as in the model for overall children. However, the model fit is higher for girls (R^2=0.2825) than for boys (R^2=0.0794). Given all the Hosmer Lemeshow tests are not significant, the models follow the logistic curve as expected.

The Oaxaca-Blender model comparing the results of the logistic regressions for stunting in boys and girls shows that the importance of the characteristics (variation of frequencies) exceeds that of the coefficients (performance or influences of modalities) (Table 4 below). The characteristics of the variables included in the model accounted for 74.2% of the explanation of the difference between girls and boys expressed by the model. The coefficient effect was only one third of that of the characteristics (25.8%) (Analyses not included in the table). In terms of the most contributing variables, it appears that the number of siblings and the child's height at birth make a significant contribution to the variation in the characteristics. Number of siblings increases the gap in stunting between sexes, whereas size at birth reduces it. In terms of coefficients, wasting and assisted birth were the most significant in explaining the prevalence difference between the sexes.

Table 3. Estimation of explained and unexplained parts of under-five year-old children gender difference in sub-Saharan Africa

Overall	Coefficient	P-value
Girl	.3710182	**0.000**
Boy	.402213	**0.000**
Difference	-.0311947	**0.000**
Explained	-.0080511	0.113
Un-explained	-.0231436	**0.009**

Table 4. Factors of gender difference of stunting in under-five year old children

Variable/Modality	Explained Coefficient	P-value	Un-explained Coefficient	P-value
Age of child	0.00027	0.550	0.02277	0.603
Succeeding Interval	-0.00141	0.136	0.03392	0.196
Mother age at birth	-0.00006	0.865	0.03095	0.414
Number of siblings	-0.01019	**0.008**	-0.01016	0.433
Wasting (WHZ)	-0.00078	0.503	-0.00324	**0.018**
Number of twins	5.59e-06	0.960	-0.00094	0.441
Size at birth	0.00240	**0.000**	-0.01248	0.508
No diarrhoea	-0.00019	0.471	0.02286	0.404
Primary	0.00030	0.574	-0.00141	0.791
Secondary	0.00067	0.423	-0.00457	0.341
Superior	-0.00039	0.584	0.00064	0.790
165cm+	0.00122	0.270	-0.00018	0.945
<155cm	-0.00089	0.269	0.01455	0.394
BMI normal	-0.00013	0.828	0.00687	0.702
Overweight/obese	-0.00051	0.653	0.00527	0.467
Rural	1.72e-06	0.958	-0.00387	0.784
Lower living standard	-0.00003	0.945	0.00510	0.346
Low	0.00039	0.216	0.00249	0.637
Well-off	-0.00017	0.537	-0.00075	0.862
Rich	0.00076	0.134	0.00498	0.307
Girl preferred	-0.00023	0.658	-0.00251	0.421
Boy preferred	0.00053	0.337	-0.00074	0.843
Birth non-assisted	0.00039	0.428	-0.01472	**0.038**
Sick	-1.47e-06	0.986	-0.00084	0.850
Constant			-0.11714	0.086

WHZ: weight-for-height Z-score; BMI: body mass index

DISCUSSION

Using Demographic and Health Surveys of twenty sub-Saharan countries, this study has first identified the main drivers of stunting in under-five year old children. Thanks to a standardised approach and consolidated, unified technical support, these surveys provide high-quality, continent-wide data on anthropometric assessment of child malnutrition. Using robust statistical methods, the identified determinants allow to better target interventions, basing on the characteristics of the children and their caregivers. With regard to the sex difference in prevalence of children, the predominant role of four factors was highlighted: assistance at birth, wasting, birth size and sibling number. Addressing these factors, irrespective of gender, would reduce the observed gap and improve overall children's stature. However, an inherent limitation of merging multiple data collections is the constraint of referring to common parameters available in all datasets, which impedes the inclusion of factors that are specific to some datasets, but which have compelling effects. This is the case for ethnicity, for which it is not possible to establish common modalities for all the twenty countries, given the multiplicity of entities available.

The prevalence of stunting among boys (35.4%; CI=[34.7% ; 36.1%]) in our dataset is significantly higher than that of girls (31.3 ; CI=[30.6 ;32.0]). Wamani et al. (2007) also found this significant difference in 16 DHS surveys from 10 countries, but at quite different levels (40% for boys and 36% for girls). Earlier, Svedberg (1990), also found only one of 10 sub-Saharan countries with a higher prevalence for girls, but also two with equal prevalence. Morrisson & Linskens (2000), looking only at sub-Saharan Africa, with 20 countries not very different from ours, found a significant difference in favour of girls in 12 countries. These differences with ours may be due to the fact that we used prevalence in terms of percentages below a given threshold, which is less sensitive in comparison to the significant negative coefficient for male children in the linear regression of z-scores for each country.

In the present analysis, number of siblings increases the gender gap in stunting. Arnold (1997) attributes this to the larger average size of households to which girls belong as a result of male child preference. This quest for a child of opposite sex is less pronounced after the birth of boys. Thus, the proportion of households with girls is higher than that of households with boys. This situation increases the resource competition for girls, who find themselves in larger households. As a result, they are at greater risk of stunting. This imbalance favours the youngest boys, who receive more help and support from older sisters who have been trained as mothers than the youngest girls receive from their brothers (Engebretsen et al. 2008).

Birth weight is an important determinant of a child's future growth. If a child is born with a low birth weight, the risk of stunting is almost tripled (OR=2.92; CI=[2.56-3.33]) (Parul et al. 2013). Due to developmental sexual dimorphism during pregnancy, boys are bigger at birth (Torchin and Ancel 2016). The larger male size is linked to a greater amount of lean body mass in boys, whereas the amount of fat mass is similar in both sexes (Thurstans et al. 2020). The larger size of the male foetus leads to a higher prevalence of prematurity in males (Peelen et al. 2016). The implications for their later health are not negligible. Lung immaturity at birth, combined with slower lung development, often contributes to respiratory distress syndrome (Fleisher et al. 1985). The frequent prematurity of boys increases their morbidity, independent of gestational age and obesity (Green 1992).

Concerning differentiated assistance at childbirth, the limited use of medical imaging, especially in peripheral health centres, means that few mothers know their child’s sex before delivery. It cannot therefore be a conscious decision based on prior knowledge of the new-born’s sex to improve or to discourage rigorous monitoring of the mother and foetus. The greater corpulence of boys at birth could mean that caesarean interventions are needed more often, which could lead mothers to seek more medical monitoring for male births. This would imply a reverse causation. Another explanation for the sex difference in the effect of non-assisted births on stunting could be the greater resilience of girls in face of difficult living conditions. Harris (2009), who analysed child’s height in England and Wales during the 19th and 20th centuries, found that the general improvement in living conditions led to a significant increase in the height of boys. This may reflect their greater dependence on environmental conditions, in contrast to girls, who tend to have more stable height growth. Conversely, this would explain the high stunting prevalence in boys, compared with the biological resilience of girls observed in developing countries where pregnancy care is problematic (Burchi 2010). Boys would therefore be more vulnerable to environmental stress during pregnancy, birth and childhood, while girls would have a more stable health status (Torchin and Ancel, 2016). Navarro bases his explanation on biological anthropology and emphasises the eco-stability of girls in face of nutritional stress during growth and adulthood. Boys, on the other hand, are eco-sensitive and show greater difficulties, when facing prolonged external shocks (Díez Navarro 2018). For Marcoux (2002), this differential resilience explains the better nutritional status of girls better than gender-specific eating behaviours.

The differential impact of wasting on stunting may be due to the fact that boys are more vulnerable to wasting. This excessive vulnerability of boys to wasting has been observed by Harding et al. (2018) who found an additional risk for boys compared to girls ranged from 16% to 36%. In a meta-analysis of 20 studies by Thurstans et al. (2020), the odds ratio of wasting for a pooled dataset was estimated at OR=1.26 (CI=[1.13 ;1.40]) for boys. Boys proportionally suffer more from severe acute malnutrition with complications (Camara et al. 2021). As a result, even if wasting is a consequence of a short-term shock and stunting is more gradual, repeated episodes of wasting eventually prevents proper height growth (Dewey et al. 2005). This process is accelerated by the fact that, in addition to the higher male prevalence, boys have a greater degree of severe acute malnutrition. Severe wasting affects 3.9% of boys compared with 2.5% of girls ($p<0.001$) (Díez Navarro 2018). The higher prevalence and severity of wasting in boys therefore has a greater impact on stature growth in boys.

CONCLUSION

This study highlighted the multidimensional nature of the social, cultural and biological determinants of the significant sex gap in young child stunting in sub-Saharan Africa. In sub-Saharan Africa, interventions on stunting need to be in tune with the contexts involved in causing it to be more prevalent in the male gender.

Targeting the identified factors will help to design strategies that may reduce the gender gap in prevalence and to improve child nutrition in general. On this basis, it is important to expand antenatal care in terms of financial, geographical and social access to the health centre, adherence to the schedule and quality of care provided, including caesarean sections when necessary. The management of cases of severe acute malnutrition, but also of moderate malnutrition, by increasing the number of children nutrition recovery centres, is essential for those in disadvantaged or conflict-affected areas, as can be seen in many parts of the continent. The integration of case detection into immunisation programmes and their referral by specific data-collections is commendable. However, this needs to be followed up by effective care, especially on an outpatient basis, to enable the mother to care for the other siblings. In the same vein, this study reiterates the importance of multiparity, which is favoured by the curtailing of the reproductive interval and increases the risk of malnutrition due to the maternal physiological exhaustion and the competition for food and other resources between children in the same household. Thus, women who wish should be offered birth planning options during antenatal or postnatal consultations, so that they can adapt their fertility to their expectations and satisfy their unmet needs.

CONFLICT OF INTEREST

The author declares that he has no competing interest

ACKNOWLEDGEMENTS

None.

FUNDING

None

Received: November 19, 2024; **Revised:** December 5, 2024; **Accepted:** February 8, 2025; **Published:** March 31, 2025.

REFERENCES

Arnold F. 1997. Gender preference for children (Comparative studies no 23). Calverton, Maryland, USA : Macro-International. **Full text here**.

Black R.E., Victora C.G., Walker S.P., Bhutta Z.A., Christian P., and De Onis M. 2013. 'Maternal and child undernutrition and overweight in low-income and middle-income countries'. *The Lancet*, 382 (9890): 427-451. https://doi.org/10.1016/S0140-6736(13)60937-X

Blanc A.K. and Wardlaw T. 2005. 'Monitoring low birth weight: an evaluation of international estimates and an updated estimation procedure'. *Bulletin of the World Health Organization,* 83 (3): 178-185. **Full text here**.

Burchi F. 2010. 'Child nutrition in Mozambique in 2003: The role of mother's schooling and nutrition knowledge'. *Economics & Human Biology,* 8 (3): 331-345. https://doi.org/10.1016/j.ehb.2010.05.010.

Camara E., Diop M., Barry I., Conde I., Barry A., and Bah M. 2021. Malnutrition Aigüe Sévère avec Complications chez les Enfants de 0 à 59 Mois : Aspects Épidémiologique, Clinique et Thérapeutique au Service de Pédiatrie de Labé. *Health and Science Disease,* 22 (7). **Full text here**.

De Onis M., Garza C., Onyango A.W., and Rolland-Cachera M.-F. 2009. 'Les standards de croissance de l'Organisation mondiale de la santé pour les nourrissons et les jeunes enfants'. *Archives de Pédiatrie,* 16 (1): 47-53. https://doi.org/10.1016/j.arcped.2008.10.010.

Dewey K.G., Hawck M.G., Brown K.H., Lartey A., Cohen R.J., and Peerson J.M. 2005. 'Infant weight-for-length is positively associated with subsequent linear growth across four different populations'. *Maternal and Child Nutrition* 1 (1): 11-20. https://doi.org/10.1111/j.1740-8709.2004.00004.x.

Díez Navarro A. 2018. 'Ecoestabilidad femenina y malnutrición severa infantil: Evidencia a partir de intervenciones de ayuda humanitaria de Acción Contra el Hambre en países africanos, asiáticos y latinoamericanos'. *Nutricion Clinica y Dietetica Hospitalaria,* (4): 127-134. https://doi.org/10.12873/374dnavarro.

Duncan T. 1994. 'Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height'. *The Journal of Human Resources,* 29 (4): 950. https://doi.org/10.2307/146131

Engebretsen I.M.S., Tylleskär T., Wamani H., Karamagi C. and Tumwine J.K. 2008. 'Determinants of infant growth in Eastern Uganda: A community-based cross-sectional study'. *BMC Public Health*, 8 (1). https://doi.org/10.1186/1471-2458-8-418

Filmer D. and Pritchett L. 1998. 'Estimating Wealth Effects without Expenditure Data -- or Tears: An Application to Educational Enrolments in States of India (Policy Research Working Paper no 1994)'. Washington, DC: The World Bank. **Full text here**.

Fleisher B., Kulovich M.V., Hallman M., and Gluck L. 1985. 'Lung profile: Sex differences in normal pregnancy'. *Obstetrics & Gynecology,* 66 (3): 327-330. **Full text here**

Garenne M. 2003. 'Sex differences in health indicators among children in African DHS surveys'. *Journal of Biosocial Science*, 35 (4): 601-614. https://doi.org/10.1017/S0021932003006047

Green M.S. 1992. 'The male predominance in the incidence of infectious diseases in children: A postulated explanation for disparities in the literature'. *International Journal of Epidemiology*, 21 (2): 381-386. https://doi.org/10.1093/ije/21.2.381.

Harris B. 2009. 'Anthropometric history, gender and the measurement of well-being. In : Harris B, Galvez L, and Machado H, eds. Gender and wellbeing in Europe : Historical and contemporary perspectives. Farham: Ashgate', p.59-83. **Full text here**.

Harttgen K., Klasen S., Vollmer S. 2013. 'Economic growth and child undernutrition in Sub-Saharan Africa. *Population and Development Review*, 39 (3): 397-412. https://doi.org/10.1111/j.1728-4457.2013.00609.x

Jann B. 2008. 'A Stata implementation of the Blinder-Oaxaca decomposition'. *The Stata Journal,* 8 (4): 453-479. **Full text here**.

Kothari M. 2015. 'Update on Nutritional Status of Women and Children [Synthesis]. Synthesis presented at Using DHS Data to Monitor and Evaluate Nutrition Programs', JSI Washington, D.C. office. **Full text here**.

Long J.S. and Freese J. 2001. Regression models for categorical dependent variables using stata. College Station, Texas: Stata Press, 341 p. **Full text here**.

Maire B. and Delpeuch F. 2004. 'Indicateurs de nutrition pour le développement (Guide de référence] no Y7553)'. Rome: FAO. **Full text here**.

Marcoux A. 2002. 'Sex differentials in undernutrition: A look at survey evidence'. *Population and Development Review,* 28 (2): 275-284. https://doi.org/10.1111/j.1728-4457.2002.00275.x

Morrisson C. and Linskens C. 2000. 'Les facteurs explicatifs de la malnutrition en Afrique subsaharienne (OECD Development Centre Working Papers no 167)'. **Full text here**.

Muenchhoff M. and Goulder P.J.R. 2014. 'Sex differences in pediatric infectious diseases. *Journal of Infectious Diseases*, 209 (suppl 3): S120-S126. https://doi.org/10.1093/infdis/jiu232.

OMS. 1995. Utilisation et interprétation de l'anthropométrie: Rapport d'un comité d'experts OMS. Genève, 498 p. **Full text here**.

Parul C., Lee S.E., Donahue Angel M., Adair L.S., Arifeen S.E., and Ashorn P. 2013. 'Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries'. *International Journal of Epidemiology,* 42 (5): 1340-1355. https://doi.org/10.1093/ije/dyt109.

Peelen M.J.C.S., Kazemier B.M., Ravelli A.C.J., De Groot C.J.M., Van Der Post J.A.M., and Mol B.W.J. 2016. 'Impact of fetal gender on the risk of preterm birth: A national cohort study'. *Acta Obstetricia et Gynecologica Scandinavica*, 95 (9): 1034-1041. https://doi.org/10.1111/aogs.12929

Svedberg P. 1990. 'Undernutrition in Sub-Saharan Africa: Is there a gender bias'? *Journal of Development Studies*, 26 (3): 469-486. https://doi.org/10.1080/00220389008422165

Thurstans S., Opondo C., Seal A., Wells J.C., Khara T., and Dolan C. 2020. 'Boys are more likely to be undernourished than girls: A systematic review and meta-analysis of sex differences in undernutrition'. *MedRxiv*. https://doi.org/10.1101/2020.09.19.20196535.

Torchin H. and Ancel P.-Y. 2016. 'Épidémiologie et facteurs de risque de la prématurité. *Journal de Gynécologie Obstétrique et Biologie de la Reproduction'*, 45 (10): 1213-1230. https://doi.org/10.1016/j.jgyn.2016.09.013.

Unicef, WHO, IBRD. 2023. Levels and trends in child malnutrition: UNICEF / WHO / World Bank Group Joint Child Malnutrition Estimates: Key findings of the 2023 edition (no CC BY-NC-SA 3.0 IGO). New York: United Nations Children's Fund, World Health Organization, International Bank for Reconstruction and Development/The World Bank.

United Nations, Department of Economic and Social Affairs, Population Division. 2015. 'World Population Prospects: The 2015 Revision, DVD Edition. Monitoring global population trends'. **Full text here**

Wamani H., Åstrøm A., Peterson S., Tumwine J.K., and Tylleskär T. 2007. 'Boys are more stunted than girls in Sub-Saharan Africa: a meta-analysis of 16 demographic and health surveys'. *BMC Pediatrics,* 7 (1): 17. https://doi.org/10.1186/1471-2431-7-17.