Received: 2 July 2023 | Revised: 19 January 2024 | Accepted: 11 April 2024

DOI: 10.1002/hsr2.2071

ORIGINAL RESEARCH

Health Science Reports Open Access WILEY

Socioeconomic determinants of the double burden of malnutrition among women of reproductive age in sub-Saharan Africa: A cross-sectional study

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Abstract

Background and Aim: The positioning of eliminating all forms of malnutrition within the spirit of the Sustainable Development Goals and the adoption of the United Nations resolution for a Decade of Action on Nutrition are a testament to strong global commitment to combat the double burden of malnutrition (DBM). Yet, there is a knowledge gap in sub-Saharan Africa (SSA) regarding the influence of socioeconomic status on DBM. We investigated the associative effect of socioeconomic status on DBM in SSA.

Methods: Data for the study were extracted from the most recent Demographic and Health Surveys (DHS) of 29 countries in SSA conducted from 2010 to 2020. Bivariate and multivariate logistic regression models were fitted to examine the association between socioeconomic status and DBM. The results were presented using adjusted odds ratio (aOR) and 95% confidence interval (CI).

Results: Children of obese mothers were less likely to be stunted compared to those born to mothers who were not overweight/obese [aOR = 0.70; 95% CI = 0.66–0.77]. The odds of stunting increased with wealth index, with children born to poorest mothers having the highest odds compared to those born to richest mother [aOR = 1.79; 95% CI = 1.64–1.95]. The odds of stunting among children was highest among those born to mothers with no formal education compared to those whose mothers had higher education [aOR = 2.73; 95% CI = 2.34–3.18].

Conclusion: DBM among children in SSA is predicted by maternal level of education, and wealth status. These results underscore the urgency of tailored interventions and policies that address DBM among women of reproductive age, with a particular focus on the socioeconomic disparities in SSA. To effectively combat this pressing public health issue, it is imperative to direct efforts towards empowering women to attain higher levels of education and to implement strategies that consider the specific needs of women across varying socioeconomic statuses.

KEYWORDS
malnutrition, public health, socioeconomic, stunting

1 | INTRODUCTION

In the last few decades, there has been a significant shift in the quality and quantity of human diet globally, which has been influenced by economic and income growth, urbanisation, and globalisation.[1] The rapid nutritional changes across the globe is precipitating the double burden of malnutrition (DBM). DBM refers to the coexistence of undernutrition with overweight and obesity, or with the nutrition-related noncommunicable disease across the life course.[1,2] In this context, undernutrition denotes stunting and wasting.[3]

The World Health Organization (WHO) reported that in 2016, nearly 41 million children below age five were either overweight or obese, with a corresponding 155 million children under five also falling within the category of chronically undernourished.[4] Similarly, 24% of global overweight children were reported in sub-Saharan Africa (SSA).[5] This high incidence of DBM is a public health concern due to its significant implications for morbidity and mortality. Reports from the WHO[4,6] have shown that nutrition-related factors contribute to nearly 45% of childhood mortality worldwide. Other studies have also revealed that DBM exacerbates the likelihood of impaired physical and cognitive development, as well as greater susceptibility to infectious diseases.[7,8]

The positioning of eliminating all forms of malnutrition within the spirit of the Sustainable Development Goals (SDGs) and the adoption of the United Nations resolution for a decade of action on nutrition, which is expected to span from 2016 to 2025, are a testament to the strong global commitment to combat DBM.[4,9,10] For sub-Saharan African countries to achieve the targets of both SDG target 2.2 and the Rome Declaration on nutrition, it is imperative to understand which category of children are at high risk of DBM and the factors that contribute to the exacerbation of DBM at the population level. Some studies have been conducted on DBM in SSA.[11–13] However, these aforementioned studies were limited in several areas. For instance, Kimani-Murage et al.'s[11] study was restricted to a single country, hence, does not reflect the overall situation in SSA. Although Neupane et al.'s study[12] used data from 32 sub-Saharan African countries, it only focused on overweight and obesity; this defies the entire concept of DBM. Similarly, Amugsi et al.[13] examined the correlates of DBM in SSA; however, their study was restricted only to women from five sub-Saharan African countries. Thus, there is a knowledge gap in SSA regarding the influence of socioeconomic status on DBM. The present study, therefore, investigates the associative effect of socioeconomic status on DBM in SSA using data from 29 countries.

2 | METHODS

2.1 | Data source and study design

Data for the study were extracted from the most recent Demographic and Health Surveys (DHS) of 29 countries in SSA conducted from 2010 to 2020. We pooled the data from the women's recode files of each country. The DHS is a comparatively nationally representative survey conducted in over 85 low-and-middle-income countries worldwide.[14] DHS employed a cross-sectional design. Respondents for the survey were recruited using a multistage sampling approach. Detailed sampling techniques have been highlighted in the literature.[14] Standardized structured questionnaires were used to collect data from the respondents on health indicators of malnutrition.[14] A total of 97,529 women of reproductive age were included in the study. Only the women with complete cases of variables of interest were included in the analysis. We relied on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement guidelines in reporting our study.[15]

2.2 | Variables

2.2.1 | Outcome variable

The outcome variable was DBM among women and their children in SSA. The outcome variable looked at the number of overweight mothers who have children who are stunted. Overweight/obese status was defined as a BMI equal to or greater than 25·0 kg/m^2.[16] BMI was calculated by dividing the mother's weight (in kg) by the square of her height in metres. Mother's BMI was categorized as follows: <18.5 as underweight, 18.5–24.9 as normal, and ≥25 as overweight/obese. Stunting was defined as "children with height-for-age z-scores less than minus 2 (2.0) standard deviations (SD) less than the mean on the reference standard (moderately or severely stunted) and children with height-for-age z-scores less than minus 3 (3.0) SD less than the mean on the reference standard (severely stunted)." Children were classified as "normal" if their height-for-age z-scores were higher than minus 2 (2.0) SD above the mean on the reference standard.

For this study, the BMI and stunting were dichotomised. Mothers whose BMI were 25.0 and above was coded as "1"—overweight/obese while those whose BMI were below 25.0 was coded as "0"—not overweight/obese. Similarly, children with height-for-age z-scores less than minus 2 (−2.0) SD less than the mean on the reference standard were coded as "1"—stunted while those with height-for-age z-scores more than minus 2 (−2.0) SD less than the mean on the reference standard were coded as "0"—not stunted. DBM was a composite variable, which was created with the two malnutrition statuses (a child's stunting status and mother's overweight/obesity status). The variable was categorised as "0"—no and "1"—yes.

2.2.2 | Explanatory variables

The key explanatory variable was socioeconomic status. Mother's level of education and wealth index were used as proxy measures for socioeconomic status. In the DHS, educational level was categorised as no formal education, primary, secondary, and higher. The wealth index was categorized as poorest, poorer, middle, richer, and richest. Apart from these variables, employment status, mother's age, cigarette smoking, place of residence, child's age, and sex of child were included in this study as covariates.

2.3 | Data analyses

Data for the study was analysed using Stata version 16.0. The analysis was carried it in four (4) steps. The first step of the analysis was the estimation of the prevalence of child stunting and DBM across the 29 countries (Figures 1 and 2). Next, the weighted frequencies and percentages for the key explanatory variables and the covariates were presented (Table 1). Then, we presented the bivariate results on the distribution of DBM across the key explanatory variables and the covariates (Table 1). Also, a chi-square test of independence was conducted to examine the relationship between the DBM and the explanatory variables (Table 1).

The first regression analysis assessed the association between the key explanatory variables and the child's stunting status, controlling for the covariates. The first model, Model I, looked at the association between the mother's BMI and socioeconomic status and the child's stunting status. In Model II, the mother's variables/characteristics were added to the key explanatory variables in Model I while in the third model, Model III, the child variables/characteristics were added to the variables in Model I. In the last Model IV, which is considered as the complete model, all the explanatory variables in the study were included.

Similarly, the second regression analysis examined the association between socioeconomic status and DBM, controlling for the covariates. Model I examined the association between socioeconomic status and DBM alone. Model II contained the variables in Model I and the mother's variables/characteristics. Model III

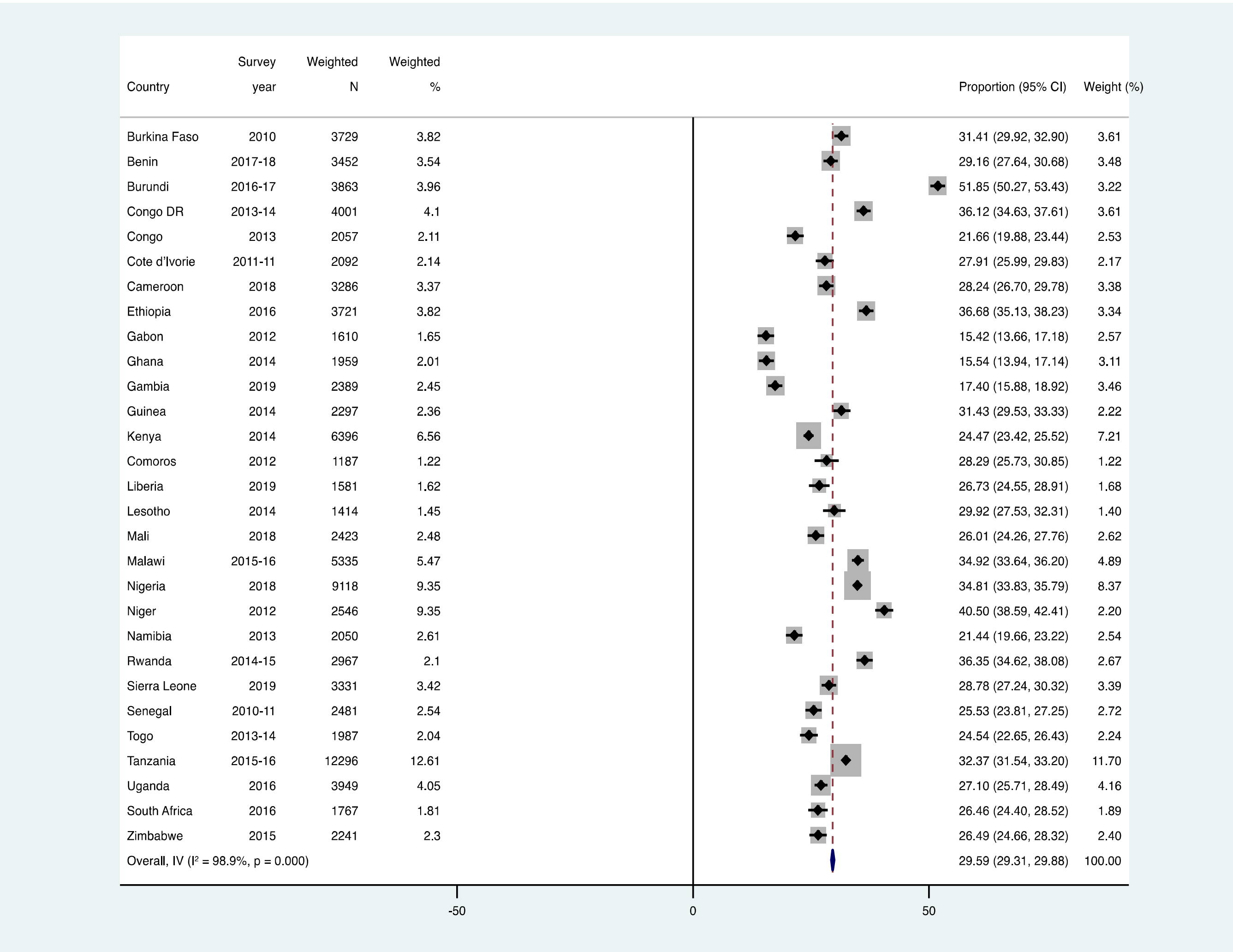

FIGURE 1 Proportion of stunted children in sub-Saharan Africa.

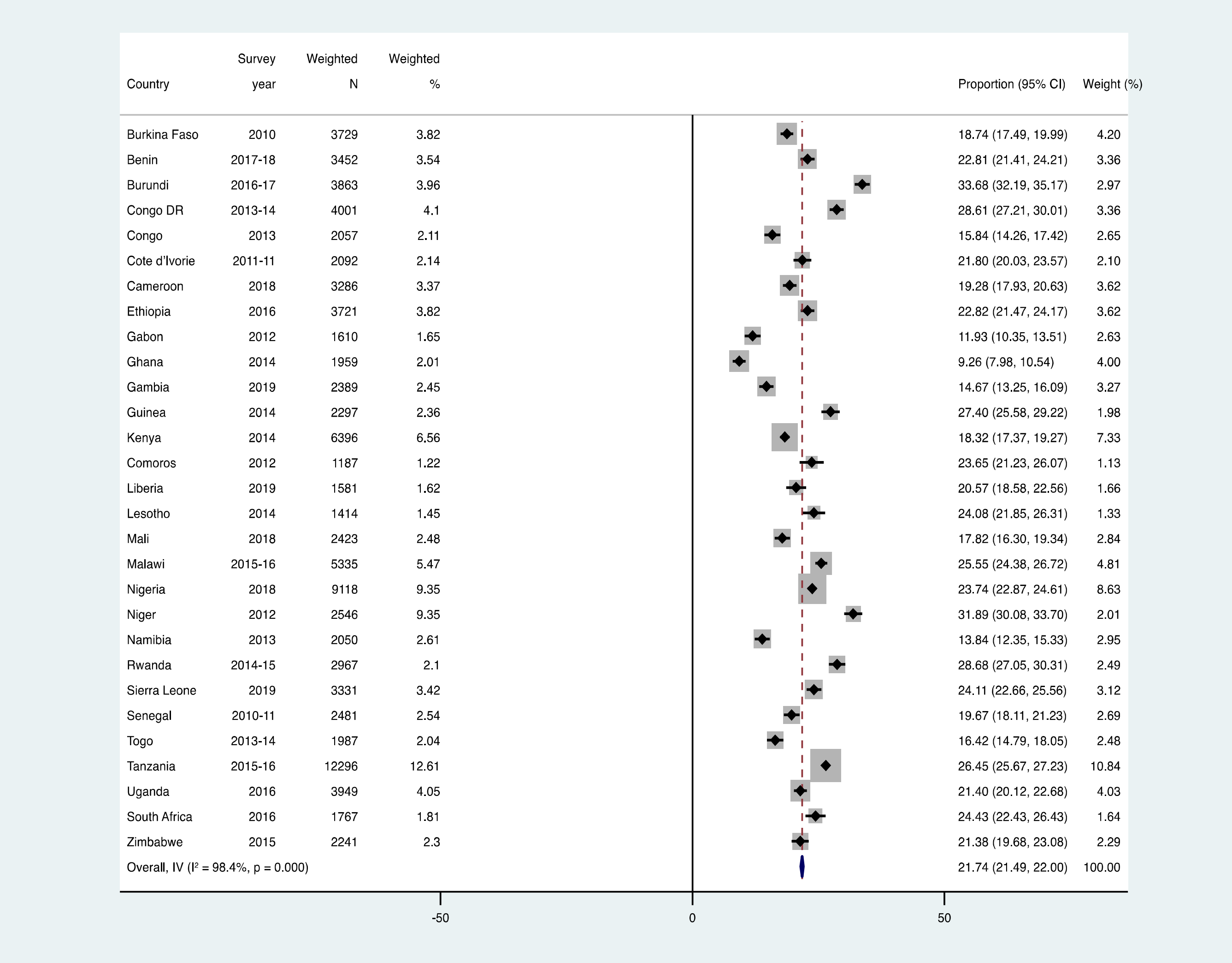

FIGURE 2 Proportion of stunted children born to overweight/obese mothers in sub-Saharan Africa.

included the variables in Model I and the child's variables/characteristics. The final model, Model IV, which is considered the complete model, contained the variables in Model I and all the covariates (Table 3). The results were presented as adjusted odds ratio (aOR) with their respective 95% confidence interval (CI). All the analyses were weighted while the survey command (svy) was used to adjust for the complex sampling structure of the data in the analyses. We restricted our analysis to complete cases, therefore, all missing values were dropped.

3 | RESULTS

3.1 | Prevalence of DBM across countries in su-Saharan Africa

Figures 1 and 2 show the prevalence of stunted children and DBM in SSA, respectively. The prevalence of childhood stunting was 29.59% [95% CI: 29.31, 29.88], which varied from 15.42% [95% CI: 13.66−17.18] in Gabon to 51.85% [95% CI: 50.27-53.43] in Burundi (Figure 1). Also, the prevalence of DBM was 21.74% [95% CI: 21.49−22.00]. This was lowest in Ghana (9.26% [95% CI: 7.98-10.54) and highest in Burundi (33.68% [95% CI: 32.19-35.17]) (Figure 2).

3.2 | Proportion of DBM across explanatory variables

Table 1 shows the proportion of DBM across explanatory variables. Of the 20,774 respondents who lived in households with poorest wealth index ($n = 8040$; 38.7%) had stunted children and 32.0% ($n = 6648$) has stunted children with overweight mothers. For level of education, out of the 33,256 mother-child pairs, 37.2% ($n = 12,371$) of the children were stunted and 28.1% ($n = 9345$) of stunted children had overweight mothers. Wealth status, highest educational level, and all the covariates had significant associations with stunting and DBM. However, employment status and cigarette smoking were not significantly associated with DBM.

TABLE 1 Proportion of stunted children, mothers body mass index, and double burden of malnutrition across explanatory variables.

Variables			Stunted children		Stunted children with overweight mothers	
			Percentage	Chi-square/*p* Value	Percentage	Chi-square/*p* Value
Mother's BMI				9.124/ < 0.001		
Not overweight/obese	71,855	73.7	33.7			
Overweight/obese	25,674	26.3	21.9			
Wealth status				5.1.24/ < 0.001		415.301/ < 0.001
Poorer	20,774	21.3	38.7		32.0	
Poorest	20,481	21.0	35.6		29.0	
Middle	19,603	20.1	31.6		25.4	
Richer	19,213	19.7	26.9		20.9	
Richest	17,458	17.9	17.7		14.6	
Highest educational level				5.718/ < 0.001		399.504/ < 0.001
No education	33,256	34.1	37.2		28.1	
Primary	35,070	36.0	32.5		25.7	
Secondary	25,413	26.0	22.0		17.4	
Higher	3790	3.9	11.2		9.9	
Employment status				82.326/ < 0.001		1.860/0.173
Not working	24,761	25.4	28.0		21.2	
Working	72,768	74.6	31.4		22.1	
Age				66.682/ < 0.001		24.417/ < 0.001
15–19	6584	6.7	31.0		26.8	
20–24	21,212	21.7	31.6		24.8	
25–29	25,380	26.0	29.5		22.0	
30–34	20,291	20.8	29.2		20.1	
35–39	14,686	15.1	30.3		20.6	
40–44	7102	7.3	33.6		23.6	
45–49	2274	2.4	35.3		21.5	
Smokes cigarette				10.974/0.001		0.008/0.928
No	96,884	99.3	30.5		21.9	
Yes	645	0.7	34.9		23.3	
Child's age				14.953/ < 0.001		576.987/ < 0.001
0	29,176	29.9	17.1		12.4	
1	27,594	28.3	35.6		26.5	
2	19,631	20.1	41.8		28.6	
3	12,723	13.1	35.4		24.4	
4	8405	8.6	27.1		18.0	
Sex of child				353.231/ < 0.001		55.891/ < 0.001
Male	49,413	50.7	33.2		23.8	
Female	48,116	49.3	27.8		19.9	

(Continues)

TABLE 1 (Continued)

Variables			Stunted children Percentage	Chi-square/*p* Value	Stunted children with overweight mothers Percentage	Chi-square/*p* Value
Place of residence				8.175 < 0.001		234.608/ < 0.001
Urban	32,380	33.2	21.7		17.5	
Rural	65,149	66.8	34.9		26.9	

3.3 | Association among mother's BMI status, socioeconomic status and stunting in sub-Saharan Africa

Table 2 shows the results on the association between mother's BMI status, socioeconomic status, and stunting in SSA. Children of overweight/obese mothers were less likely to be stunted compared to those born to mothers who were not overweight/obese [aOR = 0.70; 95% CI = 0.66–0.73]. The odds of stunting decreased with wealth index, with children born to poorest mothers having the highest odds compared to those born to richest mother [aOR = 1.79; 95% CI = 1.64–1.95]. Similarly, the odds of stunting among children was highest among those born to mothers with no formal education compared to those whose mothers had higher education [aOR = 2.73; 95% CI = 2.34–3.18]. The effect of socioeconomic status on stunting was similar among the sub-sample of stunted children whose mothers were overweight (Table 3).

4 | DISCUSSION

The present study examined the prevalence and predictors of DBM among children in SSA. Stunting and overweight were the key indicators of DBM in this study. From the results, it is indicative that the overall DBM was prevalent in SSA with variations across the countries included in the study. This is consistent with Amugsi et al.'s[13] study that also found variations in the prevalence of DBM in SSA. Moreover, there were some differences in the prevalence of DBM across the 29 countries. The analysis shows that Ghana reported the lowest prevalence of child stunting with an obese mother whereas Burundi reported the highest prevalence. It is unclear the reasons for these between country differences. However, we posit that Ghana's implementation of the free maternal healthcare policy as well as the community-based health planning and services may account for the low prevalence of stunting with an obese mother.[17] Nonetheless, the results highlight the existing variations in the implementation of maternal and child health nutrition programmes across countries in SSA.

Wealth status was inversely associated with DBM. That is, the higher the household wealth status, the less likely a child is to experience DBM. This observation is inconsistent with the findings from previous studies conducted in SSA[13] and India[18] that had reported a positive association between wealth status and DBM. Nevertheless, our findings align with a study from Indonesia[19] that showed that children born to poorer households were more likely to be stunted compared to those born in richer households. A plausible explanation for this could be poorer households may lack the needed economic or financial resources to consume high-quality nutritional foods and access health care that will support the nutritional development of the child. The findings, thus, challenge the perception that increasing wealth status exacerbates DBM. Thus, emphasising a need for more poverty reduction strategies such as women's livelihood empowerment initiatives. The implementation of such an intervention is likely to offset the effects of wealth disparities on DBM in SSA.

It is also indicative from the findings that education has an inverse association with the risk of DBM. Children born to mothers with no formal education were significantly more likely to experience DBM compared to those with higher educational attainment. This result is corroborated by a related study that found maternal education to be significantly associated with the risk of DBM.[20] Other studies conducted in Indonesia[14] and China[21] have also found higher maternal educational attainment to be associated with significantly lower risk of DBM. This seemingly protective effect of maternal education on DBM could be explained from the point that women with higher educational attainment tend to have a comprehensive understanding about health and nutrition. Thus, informing mothers to make healthier dietary choices that reduces the child's risk of stunting, and the mother's risk of obesity. Moreover, having higher educational attainment opens up opportunities for mothers to have access to more financial resources that facilitate their accessibility to healthier diets.[22,23] Hence, protecting the child against stunting and mother against obesity.

We found that the risk of stunting was significantly low among mothers who were obese compared to those who were not obese. The result aligns with prior studies conducted in Nigeria[24] and Bangladesh[25] that have found a lower risk of stunting among those children born to obese mothers than those born to mother who were thin. Possibly, the observed association could be due to the point that obese mothers may have access to abundant food, hence, they are less likely to experience food insecurity that is, often reported among mothers of lower BMI.

TABLE 2 Binary Logistic regression on the predictors of stunting among children in sub-Saharan Africa.

Variables	Model I AOR (95% CI)	Model II AOR (95% CI)	Model III AOR (95% CI)	Model IV AOR (95% CI)
Mother's BMI				
Not overweight/obese	Reference (1.0)	Reference (1.0)	Reference (1.0)	Reference (1.0)
Overweight/obese	0.70*** (0.67-0.74)	0.70*** (0.67-0.74)	0.68*** (0.65-0.72)	0.70*** (0.66-0.73)
Wealth status				
Poorest	1.92*** (1.79-2.07)	1.91*** (1.77-2.05)	2.01*** (1.87-2.18)	1.79*** (1.64-1.95)
Poorer	1.80*** (1.67-1.93)	1.77*** (1.65-1.91)	1.83*** (1.70-1.98)	1.63*** (1.50-1.77)
Middle	1.60*** (1.49-1.72)	1.59*** (1.47-1.71)	1.63*** (1.51-1.76)	1.48*** (1.36-1.60)
Richer	1.40*** (1.30-1.51)	1.39*** (1.29-1.50)	1.41*** (1.30-1.52)	1.33*** (1.23-1.44)
Richest	Reference (1.0)	Reference (1.0)	Reference (1.0)	Reference (1.0)
Highest educational level				
No education	2.71*** (2.33-3.15)	2.73*** (2.35-3.17)	2.80*** (2.40-3.27)	2.73*** (2.34-3.18)
Primary	2.34*** (2.02-2.72)	2.34*** (2.02-2.92)	2.33*** (2.00-2.72)	2.27*** (1.95-2.65)
Secondary	1.66*** (1.43-1.93)	1.68*** (1.45-1.95)	1.66*** (1.42-1.93)	1.56*** (1.42-1.93)
Higher	Reference (1.0)	Reference (1.0)	Reference (1.0)	Reference (1.0)

Note: Model I: Model with mother's BMI, wealth status, highest education level, and the outcome variable; Model II: Included maternal factors: employment status, mother's age, cigarette smoking, type of place of residence as covariates; Model III: Included child factors: child's age and sex of child as covariates; Model IV: Included all the covariates.

***$p < 0.001$.

TABLE 3 Binary Logistic regression on the predictors of double burden of malnutrition in sub-Saharan Africa.

Variables	Model I AOR (95% CI)	Model II AOR (95% CI)	Model III AOR (95% CI)	Model IV AOR (95% CI)
Wealth status				
Poorer	2.10*** (1.82-2.43)	2.06*** (1.79-2.38)	2.14*** (1.85-2.48)	1.98*** (1.68-2.34)
Poorest	1.91*** (1.67-2.19)	1.88*** (1.63-2.15)	1.89*** (1.65-2.17)	1.76*** (1.50-2.05)
Middle	1.66*** (1.45-1.90)	1.64*** (1.43-1.87)	1.65*** (1.44-1.89)	1.56*** (1.34-1.80)
Richer	1.38*** (1.22-1.56)	1.37*** (1.21-1.55)	1.36*** (1.20-1.55)	1.32*** (1.16-1.51)
Richest	Reference (1.0)	Reference (1.0)	Reference (1.0)	Reference (1.0)
Highest educational level				
No education	2.38*** (1.89-3.00)	2.40*** (1.90-3.03)	2.46*** (1.95-3.10)	2.44*** (1.93-3.08)
Primary	2.26*** (1.80-2.85)	2.22*** (1.76-2.79)	2.22*** (1.76-2.79)	2.20*** (1.74-2.76)
Secondary	1.56*** (1.24-1.96)	1.50*** (1.19-1.88)	1.59*** (1.18-1.87)	1.49*** (1.18-1.87)
Higher	Reference (1.0)	Reference (1.0)	Reference (1.0)	Reference (1.0)

Note: Model I: Model with wealth status, highest education level, and the outcome variable; Model II: Included maternal factors: employment status, mother's age, cigarette smoking, type of place of residence as covariates; Model III: Included child factors: child's age and sex of child as covariates; Model IV: Included all the covariates.

***$p < 0.001$.

4.1 | Strength and limitations

The inclusion of large, nationally representative samples is a key strength of our study since it increases the ability of the findings to be generalised to the wider SSA context. Moreover, the use of a multicountry data makes it possible to unearth disparities and similarities in the ways that different countries' correlates affect DBM. Yet, it is impossible to draw causal inferences from the results due to the cross-sectional nature of the DHS. Also, the analysis of DBM was limited to the population level even though literature shows that the phenomenon can occur at the individual and household level.

4.2 | Policy implications

The result on the association between wealth status and the risk of DBM underscores a need for policy makers and implementers to be specific in the formulation and implementation of policies and programmes targeted at the phenomenon of DBM. The findings suggest that policies and programmes aimed at reaching individuals of higher wealth status must be tailored to combating overweight and its related issues, whereas programmes and policies targeting those of poorer wealth status must deliberately focus on addressing issues of stunting which may arise from food insecurity or inability to afford proper diet to meet the essential dietary requirements.

5 | CONCLUSION

DBM is prevalent in SSA and its predict by maternal level of education, and wealth status. These results underscore the urgency of tailored interventions and policies that address DBM among women of reproductive age, with a particular focus on the socioeconomic disparities in SSA. To effectively combat this pressing public health issue, it is imperative to direct efforts toward empowering women to attain higher levels of education and to implement strategies that consider the specific needs of women across varying socioeconomic statuses.

AUTHOR CONTRIBUTIONS

Joshua Okyere: Conceptualization; formal analysis; writing—original draft; writing—review and editing. **Eugene Budu**: Conceptualization; formal analysis; writing—original draft; writing—review and editing. **Richard Gyan Aboagye**: Conceptualization; formal analysis; writing—original draft; writing—review and editing. **Abdul-Aziz Seidu**: Formal analysis; methodology; writing—original draft; writing—review and editing. **Bright Opoku Ahinkorah**: Formal analysis; investigation; writing—original draft; writing—review and editing. **Sanni Yaya**: Conceptualization; data curation; formal analysis; methodology; project administration; supervision; writing—original draft; writing—review and editing.

ACKNOWLEDGMENTS

The authors thank the MEASURE DHS project for their support and for free access to the original data.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data for this study were sourced from Demographic and Health surveys (DHS) and available here: http://dhsprogram.com/data/available-datasets.cfm.

ETHICS STATEMENT

Ethical clearance was not sought for this study since the data set used is freely available in the public domain. Before the survey, institutional permission was sought from either the Ministry of Health in the selected countries. The DHS follows the standards for ensuring the protection of respondents' privacy. Inner City Fund International ensures that the survey complies with the US Department of Health and Human Services' regulations for the respect of human subjects. Detailed information about the DHS data usage and ethical standards is available at http://goo.gl/ny8T6X.

TRANSPARENCY STATEMENT

The lead author Sanni Yaya affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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How to cite this article: Okyere J, Budu E, Aboagye RG, Seidu A-A, Ahinkorah BO, Yaya S. Socioeconomic determinants of the double burden of malnutrition among women of reproductive age in sub-Saharan Africa: a cross-sectional study. *Health Sci Rep*. 2024;7:e2071. doi:10.1002/hsr2.2071