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Sibling gender dynamics and childhood stunting in Ghana

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Abstract

Background Stunting remains a public health concern in sub-Saharan Africa. Despite the evolving awareness of the effect of family composition on child health outcomes, the influence of sibling gender on stunting has seldom been consistent. The current study investigated the association between sibling composition and stunting among children under five years in Ghana.

Methods This cross-sectional study utilized data from the most recent Ghana Demographic and Health Survey (GDHS 2022), focusing on 5416 mother-child dyads. Stunting prevalence was assessed through descriptive analysis, while logistic regression analysis was employed to examine the association between sibling composition and identify other risk factors associated with stunting.

Results The prevalence of stunting among children under five years of age was 18%. It was observed from the male sex-stratified model that having male siblings and having a combination of male and female siblings increased male children's odds of being stunted. In contrast, having siblings of either gender or having a combination of male and female siblings may not pose any stunting threats to female children as observed in the female sex-stratified model. Furthermore, being a male child (OR: 1.54; 95% CI: 1.25, 1.90) and never being breastfed (OR: 2.07; 95% CI: 1.31, 3.21) increased children's likelihood of stunting.

Conclusion This study concludes that the extra nutrients boys require for healthy growth and development may increase their competition for nutrients, especially in households with limited resource. Parents and guardians are advised to be consciously aware of the subtle and apparent competition between male children and take appropriate measures to prevent children's deprivation of nutrition by their male siblings.

Keywords Childhood stunting, Sibling composition, Sex of siblings

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Background

The evidence provided in the literature regarding the economic and public health burden of childhood malnutrition is staggering. Childhood stunting annually costs the private sector in 95 low- and middle-income countries (LMICs) a minimum of USD 135.4 billion in sales, while private sector workers in East Asia and the Pacific alone lose approximately USD 16.5 billion due to stunting [1]. From a broader perspective, it is estimated that childhood malnutrition among children can cost countries 4–11% of their GDP [2]. Childhood stunting can cause irreparable and long-lasting damage to the cognitive function and neurodevelopment of children while impacting them later in adulthood. Compared to a stunted child's growth, a well-nourished child achieves a greater number of years in education, gains improved learning outcomes, and reaches higher income levels in adulthood, thus increasing the likelihood of avoiding poverty [3].

Globally, of the 21% (149 million) of stunted children under the age of five, more than 90% live in LMICs [1]. Although sub-Saharan Africa (SSA) is making headways toward stemming childhood stunting in the region, the trend is believed to be too slow to meet global targets [4]. Currently, the average prevalence of stunting among children under five years of age is 40% in SSA [5]. Similarly, evidence from the Ghana Demographic and Health Survey over the years suggests a consistent decrease in the prevalence of stunting in the country. However, the evidence further indicates that aside from the significant decline observed between 2008 and 2014 (from 28 to 19%) [6, 7], the period between 2014 and 2022 witnessed a marginal decline (from 19 to 18%) [7, 8] in stunting prevalence. The evidence on stunting prevalence in Ghana is troubling, particularly amid numerous interventions to address it.

The literature on the correlates of stunting in SSA has predominantly focused on maternal and broader inter and intra-household factors, with little focus on the sex composition of a child's siblings. The argument for the consideration of the sibling gender effect in stunting research is based on findings from previous research suggesting that sibling composition influences a child's health outcomes [9, 10]. Previous research has attempted to provide reasons for siblings' gender considerations in child nutritional studies. For instance, in their first-of-its-kind study of sibling rivalry and child health outcomes in Ghana, Garg and Morduch found that the concept of "spillover/reference effects" matters significantly in explaining patterns of child health [11]. They further explain that there may be a spillover effect when parents attempt to instil more masculine traits (enhanced physical activity and greater self-confidence) in their daughters when they have at least one brother. This influences the treatment given to girls with brothers compared to girls with sisters. On the other hand, the reference effect may occur such that different treatment is given to girls with only brothers compared to girls with at least one sister. In the absence of sisters, a single daughter might conceivably be treated similarly to male offspring within the family context; however, differences may become more noticeable with the inclusion of another girl in the family structure, thereby changing the criteria used to assess differential treatment [11].

Furthermore, Raj et al. argue that in contexts where preference for a particular sex is paramount, parents tend to invest differently in the gender that is deemed to be valuable (either economically or socially) to the parents [12]. Considering that most of the ethnic groups in Ghana practice the patrilineal system of inheritance, which forms a key component of traditional families, it is expected that there might be a preference for a male child compared to a female child. As a result, parents might want to invest household resources differently among children of opposite sexes based on the value (social and economic) they ascribe to their children [13].

Given the limited evidence on the influence of sibling composition on child nutritional outcomes in Ghana and the potential impact of the sibling composition of a child on health outcomes, this research aimed to provide new evidence on the role of the gender of a sibling in influencing childhood stunting in Ghana using representative data. This study is relevant to the African context due to the uniqueness of cultural systems relating to gender norms, roles and expectations that influence the differential treatment (caregiving) and socialization of children. Examining the relationship between a child's nutritional status and sibling composition is important because it can offer valuable insights into the gender dynamics within households, which impact the short- and long-term health and economic outcomes of household members.

Materials and methods

Source of data

This analysis used data from the 2022 Demographic and Health Survey (DHS) of Ghana. The demographic and health survey is a nationally representative survey that collects data on basic health and demographic indicators in developing countries. The DHS enables policymakers to measure trends and statuses of health and demographic indicators. The survey also helps governments and development actors streamline population and health interventions. The 2022 GDHS employed a stratified two-stage sampling design to select respondents. The first stage involved the selection of 618 clusters obtained using the 2021 Population and Housing Census as a sampling frame. Equal probability systematic random sampling was used to select the clusters. The second stage also involved the listing of households from which the survey respondents were selected. A total of 15,014 women aged 15–49 years and 15–59 years were interviewed. The 2022 GDHS gathered information on various population and health indicators, such as maternal and child health, nutritional status of children, and fertility levels. This analysis used data from the children's files since the unit of analysis was children younger than five years. The children's file contained 9353 responses; however, the analysis was restricted to only 5416 children. The 5416 children included in the study met specific criteria: their height-for-age Z scores were recorded during data collection, and they either had no other siblings, had only male or only female siblings, or had a combination of both male and female siblings.

Variables

Dependent variable

Childhood stunting as the outcome variable was measured by the height-for-age index, which was compared with the World Health Organization (WHO) growth standard reference population [8]. The height-for-age index is expressed in standard deviation units (z scores) from the median of the reference population. Therefore, a child is considered stunted when the height-for-age Z score (HAZ) is less than −2 standard deviations (< -2 SD) from the median of the reference population. Childhood stunting was thus categorized as stunted (HAZ < -2 SD) or not stunted (HAZ >= -2 SD). Height measurements were taken using the ShorrBoard measuring board. Recumbent length was measured for children younger than 24 months, and the heights of older children were measured while standing.

Independent variables

The main independent variable – sibling composition – was measured by the sex of the sibling(s) of the index child. This variable was generated from the 'daughters at home' and 'sons at home' variables in the children's files. In the present study, sibling composition was categorized as "no other sibling", "brothers only", "sisters only" or "both".

Control variables

The control variables were grouped under three broad categories: child, maternal, and household context factors. The child factors included the sex of the child (male or female), breastfeeding status (categories: still breastfeeding, ever breastfed, not currently breastfeeding, or never breastfed), birth weight, and birth order number. Birth weight was measured in grams and categorized as low (<2500 g), normal (2500–4000 g), or high (>4000 g), and birth order number had the following categories: 1st, 2nd, 3rd, 4th, 5th+. The maternal factors included maternal body mass index (BMI), maternal education (categories: no education, primary, secondary, higher), and parity (categorized as 2 or fewer, 3–5, and 6+). Maternal BMI was measured by the mother's weight (in kilograms) divided by her height (measured in meters squared). Thus, maternal BMI was categorized as underweight (<18.5 kg/m^2), normal weight (18.5–25 kg/m^2), or obese (>30 kg/m^2).

The household context factors included household size [categorized as small (i.e., household membership less than 3), medium (i.e., household membership between 3 and 6), and large (i.e., household membership of more than 6)], place of residence (categorized as rural and urban), water supply (categorized as improved and unimproved), toilet facility (categorized as improved and unimproved), and household wealth status. Household wealth status measures the cumulative standard of living of households. It is computed using data on household assets (bicycles and televisions), the materials used for house construction, the type of water access, and sanitation facilities, using principal component analysis (PCA). The household wealth variable was categorized as poorest, poorer, middle, richer, and richest.

Methods of analysis

Analysis was performed on 5416 mother-child dyads at two main levels: bivariate and multivariate. The bivariate analysis involved assessing the relationship between sociodemographic factors and stunting using cross-tabulations. The Pearson chi-square test of association was further performed to test the significance of the association between the independent/control variables and the dependent variable.

Binary logistic regression was employed to examine the extent to which the independent variable influenced the dependent variable after controlling for other predictor variables. Two separate adjusted models were fitted: the composite model, which included the '*sex of child*' variable, and the sex-stratified model, which excluded the '*sex of child*' variable. In each of the models, one category of each of the nominal variables was used as the reference category against which the remaining categories of the variables were compared. The results from the binary logistic regression analysis are presented as odds ratios (ORs) together with 95% confidence intervals (CIs) and p values. A test of multicollinearity was performed, and the results showed no evidence of collinearity among the variables. Analyses were performed using the R programming language.

Results

Table 1 presents the two-way bivariate results for stunted children as well as their distribution across sociodemographic characteristics. Pearson's chi-square test was performed to determine the associations between the independent variables and stunting. An 18% stunting prevalence was recorded from the analysis. The results from Table 1 show that a greater proportion of stunted children had only male siblings (21%), while 16% of children with only sisters were stunted. Stunting was more prevalent among boys (20%) than among girls (16%). A greater percentage of children who had never been

Table 1 Distribution of stunted children by sociodemographic characteristics

Characteristic	Categories	Stunted Children		
		n	%	*p* value[1]
Sibling Composition	No other sibling	185	17	**0.02**
	Brothers only	186	21	
	Sisters only	141	16	
	Both	290	19	
Sex of Child	Female	341	16	**< 0.001**
	Male	461	20	
Breastfeeding Status	Ever breastfed, not currently breastfeeding	201	22	**< 0.001**
	Never breastfed	34	27	
	Still breastfeeding	304	17	
Birth Weight (grams)	Low	73	32	**< 0.001**
	Normal	320	17	
	High	146	21	
Birth Order Number	1st	209	19	0.3
	2nd	138	16	
	3rd	141	19	
	4th	118	19	
	5th	196	19	
Mother's BMI	Normal Weight	522	21	**< 0.001**
	Obese	56	9.6	
	Overweight	158	15	
	Underweight	66	27	
Maternal Education	No Education	329	23	**< 0.001**
	Primary	135	20	
	Secondary	321	16	
	Higher	17	5.2	
Parity	2 or fewer	325	18	0.13
	3–5	354	17	
	6+	123	21	
Household Size	Small	106	15	**0.01**
	Medium	394	18	
	Large	302	21	
Place of Residence	Urban	287	16	**< 0.001**
	Rural	515	20	
Water Supply	Improved	522	18	0.60
	Unimproved	271	18	
Toilet Facility	Improved	210	16	**< 0.001**
	Unimproved	521	22	
Household Wealth Status	Poorest	322	23	**< 0.001**
	Poorer	238	22	
	Middle	115	15	
	Richer	94	15	
	Richest	33	6.5	
Stunting Prevalence			***18***	

1 Pearson's Chi-squared test; Abbreviations/Symbols: n = Number; % = percent

Source: Analysis of 2022 GDHS

breastfed (27%) than of those who were still being breastfed (17%) had stunting. In terms of birth weight and maternal BMI, children with low birth weight and those born to underweight mothers accounted for the greatest proportion of stunted children (32% and 27%, respectively) among their peers. Additionally, the prevalence of stunting decreases with improvements in mothers' education, as does household wealth. However, stunting prevalence was the same among children from richer households and among those from middle-class households (15%). Moreover, children from households with improved toilet facilities are less stunted than those with unimproved toilet facilities (16% and 22%, respectively). Further, stunting prevalence increased with an increase in household size. As a result, children from smaller households were less stunted than those from medium and large households (15%, 18%, and 21% respectively. The chi-square test revealed that all sociodemographic characteristics, except birth order number, parity, and water supply, were significantly associated with stunting.

Table 2 displays the binary logistic regression analysis results to assess the association between sibling composition and childhood stunting after controlling for other predictor variables. The results of the composite model, which included both male and female children, showed that having only male siblings and having a combination of both male and female siblings showed significant association with childhood stunting (p-values 0.02 and 0.01 respectively). Thus, children with brothers only were more likely to be stunted compared to those who had no other siblings (OR: 1.73; 95% CI: 1.11, 2.73). Similarly, children with both male and female siblings were 1.92 times as likely as those with no other siblings to be stunted. However, having only female siblings was not significantly associated with childhood stunting. Similar results were also observed in the male sex-stratified model. The results from the male sex-adjusted model suggest that compared to male children who had no other siblings, male children with only male siblings were more likely to be stunted (OR: 1.90; 95% CI: 1.08,3.39). Likewise, male children with both male and female siblings were more likely to be stunted compared to male children with no other siblings (OR: 2.46; 95% CI: 1.31,4.74). In contrast to results in the male sex-stratified model, having siblings of either gender may not pose any stunting threats for female children as observed in the female sex-stratified model. Instructively, having female siblings was not associated with childhood stunting in any of the three models.

Additionally, the sex of the child was significantly associated with childhood stunting (p-value <0.001). Compared to female children, male children were more likely to be stunted (OR: 1.54; 95% CI: 1.25, 1.90). Breastfeeding status was more a significant predictor of childhood stunting among females than among males. It is observed from the female sex-stratified model that compared to female children who were still breastfeeding, female children who were ever breastfed but currently not breastfeeding were 2.00 times more likely to be stunted. On the other hand, female children who were never breastfed were 2.85 times more likely to be stunted than their counterparts who were still breastfeeding.

Birth weight is significantly associated with childhood stunting. According to the composite model, compared to children with normal birth weights, children with low birth weights are 2.46 times more likely to be stunted. High birth weight, however, was not associated with stunting. Additionally, children of obese and overweight mothers are 38% and 34% respectively less likely to be stunted than are children of mothers with normal weight. Furthermore, compared to children of mothers with higher education, children of mothers with no education were more likely to be stunted (OR: 2.70; 95% CI: 1.22,6.88), likewise children whose mothers have obtained primary education (OR: 2.36; 95% CI: 1.06,6.03). Compared to children from the richest households, children from poorer households are more likely to be stunted (OR: 2.16; 95% CI: 1.04, 4.86). Moreover, parity, place of residence, household size, water supply, and toilet facility did not show any significant relationships with childhood stunting in the composite model.

Discussion

This study sought to examine the association between sibling gender composition and chronic malnutrition among children in Ghana. It further aimed to answer the question of whether having siblings of either the same or opposite sex matters in stunting analysis. Evidence from this study suggests that sibling composition influences stunting among children under the age of five. This finding is consistent with the findings of previous studies on the role of siblings' sex in influencing chronic malnutrition [9, 12, 14, 15]. The analysis further revealed that unlike having only female siblings, having only male siblings and having a combination of both male and female siblings significantly predict stunting among children under five years of age. Specifically, children with only male siblings and those with both male and female siblings have a heightened risk of being stunted. However, having female siblings was not a threat of being stunted. This is in stark contradiction to the findings of prior research by Raj et al., which suggested a lower risk of stunting among boys with many male siblings than among girls with many female siblings [12]. Their research suggested that having more female siblings increased girls' odds of being stunted, which is inconsistent with the findings of the present study.

Table 2 Multivariate model showing the association with childhood stunting

Characteristic			Adjusted Model: Composite			Adjusted Model: Sex-Stratified (Male)			Adjusted Model: Sex-Stratified (Female)		
		Categories	OR[1]	95% CI[1]	*p*-value	OR[1]	95% CI[1]	*p*-value	OR[1]	95% CI[1]	*p*-value
Child Factors	Sibling Composition	No other sibling **	—	—		—	—		—	—	
		Brothers only	1.73	[1.11, 2.73]	0.02	1.90	[1.08, 3.39]	0.03	1.77	[0.84, 3.84]	0.14
		Sisters only	1.37	[0.86, 2.18]	0.20	1.31	[0.73, 2.37]	0.40	1.50	[0.70, 3.27]	0.30
		Both	1.92	[1.19,3.15]	0.01	2.46	[1.31,4.74]	0.01	1.64	[0.76,3.69]	0.20
	Sex of Child	Female **	—	—							
		Male	1.54	[1.25, 1.90]	< 0.001						
	Breastfeeding Status	Still breastfeeding **	—	—		—	—		—	—	
		Ever breastfed, not currently breastfeeding	1.52	[1.21, 1.90]	< 0.001	1.31	[0.96, 1.77]	0.09	2.00	[1.42, 2.82]	< 0.001
		Never breastfed	2.07	[1.31, 3.21]	0.001	1.42	[0.76, 2.56]	0.3	2.85	[1.41, 5.56]	0.003
	Birth Weight (grams)	Normal **	—	—		—	—		—	—	
		Low	2.46	[1.75, 3.45]	< 0.001	2.67	[1.65, 4.29]	< 0.001	2.47	[1.47, 4.09]	< 0.001
		High	1.02	[0.80, 1.30]	0.80	0.82	[0.58, 1.14]	0.3	1.29	[0.90, 1.86]	0.20
	Birth Order	1st **	—	—		—	—		—	—	
		2nd	0.58	[0.37, 0.89]	0.02	0.65	[0.36, 1.12]	0.13	0.46	[0.22, 0.95]	0.04
		3rd	0.77	[0.41, 1.46]	0.40	0.63	[0.27, 1.43]	0.30	0.95	[0.33, 2.65]	> 0.90
		4th	0.69	[0.35, 1.38]	0.48	0.48	[0.19, 1.20]	0.12	0.95	[0.32, 2.83]	> 0.90
		5th	0.52	[0.25, 1.07]	0.08	0.38	[0.15,0.98]	0.05	0.72	[0.23, 2.24]	0.60
60 Maternal Factors	Maternal BMI	Normal Weight **	—	—		—	—		—	—	
		Obese	0.62	[0.39, 0.97]	0.04	0.55	[0.28, 1.03]	0.08	0.78	[0.39, 1.44]	0.4
		Overweight	0.66	[0.50, 0.88]	0.01	0.72	[0.49, 1.03]	0.08	0.55	[0.33, 0.88]	0.02
		Underweight	1.28	[0.86, 1.88]	0.20	1.18	[0.70, 1.94]	0.50	1.47	[0.77, 2.70]	0.2
	Maternal Education	Higher **	—	—		—	—		—	—	
		No Education	2.70	[1.22, 6.88]	0.02	1.64	[0.63, 4.85]	0.30	8.98	[1.72, 166]	0.04
		Primary	2.36	[1.06, 6.03]	0.05	1.14	[0.43, 3.45]	0.80	9.73	[1.87, 180]	0.03
		Secondary	2.11	[0.99, 5.25]	0.08	1.37	[0.55, 3.91]	0.50	6.41	[1.29, 117]	0.07
	Parity	2 or fewer **	—	—		—	—		—	—	
		3–5	0.77	[0.44, 1.33]	0.30	0.87	[0.43, 1.79]	0.70	0.64	[0.26, 1.53]	0.30
		6+	0.85	[0.42, 1.69]	0.60	0.71	[0.28, 1.78]	0.20	0.98	[0.33, 2.85]	> 0.90

Table 2 (continued)

Characteristic	**Categories**	**Adjusted Model: Composite**			**Adjusted Model: Sex-Stratified (Male)**			**Adjusted Model: Sex-Stratified (Female)**		
		OR[1]	**95% CI[1]**	***p*-value**	**OR[1]**	**95% CI[1]**	***p*-value**	**OR[1]**	**95% CI[1]**	***p*-value**
Household Context Factors										
Place of Residence	Urban **	—	—		—	—		—	—	
	Rural	0.86	0.66, 1.13	0.30	0.94	[0.66, 1.35]	0.80	0.81	[0.53, 1.24]	0.30
Household Size	Large **	—	—		—	—		—	—	
	Medium	1.06	[0.83, 1.35]	0.70	0.96	[0.70, 1.33]	0.80	1.19	[0.81, 1.75]	0.40
	Small	0.80	[0.55, 1.15]	0.20	0.61	[0.37, 1.00]	0.05	1.15	[0.64, 2.06]	0.60
Water Supply	Improved **	—	—		—	—		—	—	
	Unimproved	1.18	[093, 1.49]	0.20	1.09	[0.79, 1.49]	0.60	1.30	[0.90, 1.85]	0.20
Toilet Facility	Improved **	—	—		—	—		—	—	
	Unimproved	1.13	[0.88, 1.45]	0.30	1.13	[0.81, 1.57]	0.50	1.16	[0.78, 1.75]	0.50
Household Wealth Status	Richest **	—	—		—	—		—	—	
	Poorest	2.03	[0.96, 4.64]	0.08	2.90	[1.06, 9.51]	0.05	1.17	[0.38, 4.16]	0.80
	Poorer	2.16	[1.04, 4.86]	0.05	3.23	[1.20, 10.4]	0.03	1.19	[0.40, 4.08]	0.80
	Middle	1.34	[0.65, 3.00]	0.40	2.01	[0.75, 6.46]	0.20	0.80	[0.27, 2.69]	0.70
	Richer	1.73	[0.84, 3.86]	0.20	3.23	[1.22, 10.2]	0.03	0.66	[0.21, 2.31]	0.50

[1] OR = Odds Ratio, CI = Confidence Interval, ** = Reference Category

Source: Analysis of 2022 GDHS

In an attempt to understand the nuanced relationship between sibling composition and childhood stunting, a sex-stratified analysis was performed for both male and female children. In the context of childhood stunting, having only male siblings and having a combination of both male and female siblings was a problem for male children but for female children. In fact, the gender of a sibling may not pose stunting threats to female children. This finding disagrees with findings from a study by Chaudhuri that examined the effect of sibling sex on nutritional outcomes in children [16]. The study revealed that having male siblings negatively impacted both boys and girls and not only boys, even though the impact was more severe among boys than girls. However, Chaudhuri explains that in households where there are only male children, there is strong competition for household resources, including food and nutrition [16]. A plausible explanation is given by Helfrecht & Meehan, Kramer et al., and Magvanjav et al., who opine that there is fierce competition for resources, including nutrition, among male children, especially those from resource-constrained households [15, 17, 18].

Within the Ghanaian cultural context, where the majority of ethnic groups practice the patrilineal inheritance system and where priority is given to male children, parents might want to invest greater resources such as attention, food, and nutrition in males because they are thought to be successors and future breadwinners of their families. Additionally, in all-male-children families, parents may invest scarce resources equally in their children. As is well articulated by Helfrecht and Meehan, the seemingly equal treatment given to male children in a household tends to deepen their rivalry, extending to competition over scarce resources [17].

Biologically, boys and girls experience significant growth and development during childhood [20]. However, boys tend to grow faster in height, weight, and muscle development [21]. This rapid growth necessitates additional nutrients for tissue building and repair [22]. As a result, male children may require more energy and nutrients to support their growth and development. The need for the nutrients required for healthy growth and development among boys may exacerbate competition for scarce resources such as food, especially in resource-constrained households [17].

In addition, the findings from this present study which suggest that male children with a combination of both male and female siblings are at a higher risk of being stunted, is novel. The authors of this present study attempt to explain this finding by noting that in a typical traditional Ghanaian household where there is a combination of male and female children, mothers, oftentimes, tend to involve their female children in 'kitchen duties' more than male children and this increases the girls' closeness and access to food and nutrition [19]. In this context, the existential competition among boys over nutrition could interact with female children's relative closeness and easy access to nutrition (which may potentially reduce male children's access to adequate nutrition) to increase the likelihood of stunting for the male children.

Adding to the hypothesized objectives of the gendered influences of siblings on chronic childhood malnutrition, this study documents some of the child, maternal, and household context factors that put children at risk of being stunted. Consistent with prior research, the sex of the child [22, 23], breastfeeding status [24, 25], and birth weight [26–28] were the child factors that showed a significant association with childhood stunting. Specifically, while male children had greater odds of being stunted than female children, children with low birth weight had greater odds of stunting than children with normal birth weight.

Like other cross-sectional studies, the present study has several limitations. First, because this was a cross-sectional study where data collection was performed at a single point in time, the study is limited in making causal inferences or observing variable changes with time. Even though a robust sampling technique was utilized to ensure that a representative sample was obtained, the DHS survey may be fraught with biases due to errors in measurement, underrepresentation of certain population subgroups, or nonresponse. Additionally, because the DHS allows for self-reporting of some measurements, such as birth weight (a key variable in this analysis), the data may face errors of social desirability bias. Also, the authors acknowledge that there are other factors such as genetics [29, 30] and maternal factors (i.e., maternal mental health) [31, 32] that could confound the observed relationship between the variables of interest, however, these variables were excluded in this study because the dataset used for the analysis did not have these variables.

Furthermore, since the sibling composition variable was generated from both the 'sons at home' and 'daughters at home' variables, it may bias the results. This is because it is assumed in this study that mothers' resource allocation is limited to only children living in the same household as their parents. This assumption may not be accurate, especially in instances where mothers allocate resources (food and nutrition) to children who are not presently living in the same household as them. Nevertheless, children living with their mothers are usually considered a good representation for sibling composition analysis.

Conclusion and recommendations

This study examined the association between sibling composition and stunting among children under five years of age. This study reports the gender effect of siblings on stunting for male and female children. Although having sisters had no effect on stunting for children, having male siblings and having a combination of male and female siblings increased male children's risk of being stunted. The findings from this study indicate that in households where there are male children, in addition to the extra nutrients that boys need for healthy growth and development, resource (food) constraints reinforce rivalry and competition between siblings, which may result in unequal access to food and adequate nutrition. These findings have both childcare and policy implications. In terms of childcare, parents and guardians need to be consciously aware of the subtle and apparent competition between children and take measures to prevent children's disproportionate access to nutrition which could increase their likelihood of stunting.

In terms of policy, it is also important for policymakers to design nutrition interventions that consider gendered aspects of sibling composition. Policies could include programs that promote gender equality in nutrition and resource distribution within households. Engaging parents and other relevant stakeholders can help shift cultural norms that favor certain genders over others relating to nutritional investment. Community-based programs can promote awareness about the importance of equal treatment and investment in all children .

Abbreviations

BMI	Body Mass Index
DHS	Demographic and Health Survey
GDHS	Ghana Demographic and Health Survey
HAZ	Height-for-age Z-scores
LMICs	Low and Middle-Income Countries
SD	Standard Deviation
SSA	Sub-Saharan Africa
WHO	World Health Organization

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Author contributions
PAM conceptualised this study, performed the analysis, and drafted the initial manuscript. RTS reviewed the initial manuscript and contributed to the discussion. AKC supervised the analysis and directed the drafting of the manuscript. All three authors read and approved the final manuscript.

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Data availability
The Ghana Statistical Service host the data for the study and shall be given access to upon written request.

Declarations

Ethical approval
The study used data from the 2022 GDHS. The survey was carried out in conformity to the principles of the Helsinki Declaration. Ethical clearance for the conduct of the survey was given by the Ethical Review Committee of the Ghana Health Service, and ICF Institutional Review Board. Access to the data was granted by the Ghana Statistical Service.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Consent to participate
Interviewers trained by the Ghana Statistical Service sought consent from participants to participate in the survey. Respondents then agreed to participate in the survey. The data for this study anonymized the respondents so that no personally identifiable information could be traced to individual respondents.

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