


Co-Occurrence of Anemia and Overweight among Women of Reproductive Age in Burkina Faso: A Limited Double Burden?

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How to cite this paper: Lanou, H.B., Savadogo, B., Diendéré, J. and Zeba, A.N. (2026) Co-Occurrence of Anemia and Overweight among Women of Reproductive Age in Burkina Faso: A Limited Double Burden? *Food and Nutrition Sciences*, 17, 79-89.

<https://doi.org/10.4236/fns.2026.171007>

Received: December 11, 2025

Accepted: January 18, 2026

Published: January 21, 2026

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Abstract

The double burden of malnutrition (DBM), defined as the coexistence of undernutrition and overweight or obesity (OWO) in the same individual, is an emerging challenge in sub-Saharan Africa. In Burkina Faso, where anemia affects 28.0% of women and obesity 11.0%, few studies have examined the determinants of their co-occurrence. This study aims to determine whether this DBM occurs randomly or follows a specific sociodemographic trend. We analyzed data from 7987 women aged 15 - 49 years from the Burkina Faso Demographic and Health Survey (DHS-V). DBM was defined as the simultaneous presence of anemia (Hb < 12.0 g/dL) and overweight/obesity (OWO) (BMI ≥ 25.0 kg/m²). Analyses used methods adapted to the complex sampling design, including Rao-Scott chi-square tests and multivariate logistic regression. DBM was significantly less frequent than expected (observed/expected ratio = 0.89, $p < 0.001$). 10.1% of women presented with DBM. Compared to women in the lowest wealth quintile, those in the highest quintile (aOR = 0.35; 95% CI: 0.23 - 0.52) had significantly reduced odds of being protected. Similarly, older age was associated with 66% lower odds of protection versus the youngest group age showed a negative association (aOR = 0.34 for 35+ years vs. <25 years; 95% CI: 0.27 - 0.44), while rural residence was modestly protective (aOR = 1.32; 95% CI: 1.00 - 1.73). The anemia-obesity DBM presents an epidemiological profile characterized by an inverse wealth gradient and increased vulnerability with age. These results suggest that nutritional interventions should target women from wealthier households and older women, and support the protective benefits of

traditional rural lifestyles.

Keywords

Double Burden of Malnutrition, Anemia, Obesity, Women of Reproductive Age, Burkina Faso

1. Introduction

Malnutrition remains a major public health problem, affecting nearly 10% of the global population, characterized by insufficient intakes of calories, protein, and micronutrients [1]. Concurrently, in many resource-limited countries, dietary habits have shifted from traditional diets toward the consumption of energy-dense, readily accessible foods, leading to an increase in OWO [2]. In 2022, approximately 2.3 billion people were affected by OWO [3].

The coexistence of these two forms of malnutrition—undernutrition (stunting, wasting, micronutrient deficiencies) and overweight, obesity, or nutrition-related non-communicable diseases—defines the double burden of malnutrition (DBM). This burden can manifest within the same individual, household, or population [4]. This phenomenon, rapidly increasing in low- and middle-income countries, results from a caloric excess combined with insufficient micronutrient intakes, exacerbated by urbanization, sedentary lifestyles, low dietary diversity, and limited access to healthcare [2]. One form of the DBM is the co-occurrence of anemia and OWO among women of reproductive age. This form is becoming increasingly frequent, particularly in West and Central Africa, where up to 12.4% of women are affected in certain contexts [5]. Anemia, often linked to iron deficiency and infections, compromises maternal health and fetal development, while obesity increases the risk of gestational diabetes, hypertension, and obstetric complications [6].

Despite the importance of this issue, few national studies have assessed its prevalence and determinants. In Burkina Faso, the prevalence of anemia among women aged 15 - 49 years is 28.0%, while the prevalence of OWO among women aged 20 - 49 years reaches 11.0% [7]. Understanding the magnitude and overlap of these forms of malnutrition is essential for targeting at-risk populations and developing integrated interventions, such as “double-duty actions” aimed at simultaneously addressing undernutrition and overweight [8]. Therefore, the present study aims to assess the prevalence of this DBM—defined as the co-occurrence of anemia and obesity—as well as its associated factors in Burkina Faso.

2. Methods

2.1. Data Source and Survey Design

This study used secondary data from the fifth Burkina Faso Demographic and Health Survey (BFDHS-V), conducted between July and November 2021 by the

National Institute of Statistics and the DHS Program (ICF, USA). The BFDHS-V is a national cross-sectional survey with a stratified two-stage sampling design, intended to provide representative results at the national, urban, and rural levels. A total of 13,251 households and 17,659 women of reproductive age (15 - 49 years) were included. For this analysis, a weighted subsample of 7987 non-pregnant women with data on BMI and hemoglobin was retained.

2.2. Outcome Variable

For the purpose of this analysis, DBM refers specifically to the coexistence of anemia and OWO within an individual. OWO was defined as Body Mass Index (BMI) ≥ 25 kg/m² and anemia as hemoglobin level < 12 g/dL, according to the new WHO recommendations [9]. The presence of DBM was coded as “1” and its absence as “0”.

2.3. Explanatory Variables

Individual and household factors included: age, age at first birth, marital status, occupation, education level, prenatal visits for the last child, sex of household head, minimum dietary diversity, partner’s occupation and education level, media exposure, smoking, wealth index, contraceptive use, source of drinking water, type of toilet, number of children under five, and household size. The community-level variable was place of residence (urban or rural). These variables were selected based on existing literature [10].

2.4. Statistical Analysis

As the BFDHS-V used a stratified two-stage cluster sampling design, the analysis followed the recommendation for a multilevel model for DHS data [11]. Descriptive statistics were presented as weighted frequencies for categorical variables and means (\pm SD) for continuous variables.

Before analyzing the association between DBM and household, parental, and child characteristics, we determined whether the co-occurrence of maternal OWO and anemia occurred more frequently than would be expected by chance. Using the Rao-Scott chi-square test, appropriate for complex survey data, we compared the observed prevalence of DBM to the expected prevalence under the assumption of independence between anemia and obesity. The expected prevalence was calculated as the product of the prevalence of maternal OWO and the prevalence of the specific child undernutrition indicator, multiplied by 100. Associations between DBM and explanatory variables were assessed using generalized linear models for complex surveys (“*svyglm*”) in R (version 4.4.2) with the “survey” package [12]. The significance threshold was set at $p < 0.05$. All significant variables and those non-significant ($p < 0.20$) in bivariate analysis were included in the multivariate model. Multicollinearity was checked using the variance inflation factor (VIF), with a threshold of 3. Results are presented as adjusted odds ratios (aOR) with 95% confidence intervals.

3. Results

3.1. Sample Characteristics

The mean (SD) age of the mothers was 28.8 (9.8) years; those with no formal education accounted for 58.8% of cases, and only 4.9% had a higher education level. The mothers' mean BMI was 22.6 (4.9) kg/m². The prevalence of maternal OWO was 15.5% and 5.9%, respectively. **Table 1** describes the household and sociodemographic characteristics of the participants.

Table 1. Sociodemographic characteristics of participants.

Characteristics	N	%
Household Size		
≤4 Persons	1385	17.4
5 - 6 Persons	1846	23.6
≥7 Persons	4756	59.0
Number of Children < 5 Years		
1	4474	56.8
2 - 3	2887	35.5
4 - 5	626	7.8
Residence		
Urban	2829	33.2
Rural	5158	66.8
Wealth Quintile		
Lowest	1278	17.2
Lower	1414	17.8
Middle	1673	19.5
Fourth	173	20.1
Highest	1892	25.4
Age (Years)		
<25	3213	40.1
25 - 29	1176	14.7
30 - 34	1112	13.9
≥35	2519	31.4
Education Level		
None	4702	58.8
Primary	111	13.9
Secondary	1802	22.4
Higher	373	4.9
Working Status		
Don't Work	2688	35.1
Currently Working	5299	64.9

Continued

Partner Working Status		
None	4057	74.0
Primary	667	11.8
Secondary	607	11.1
Higher	165	3.1

3.2. Preliminary Analysis: Observed vs. Expected Prevalence of DBM

Figure 1 shows the prevalence of the different nutritional statuses of women of reproductive age (WRA) in relation to anemia and OWO. Contrary to the hypothesis of a synergistic co-occurrence, anemia and obesity occurred simultaneously significantly less frequently than would be expected by chance, with an expected prevalence of 11.8% and an observed prevalence of 10.1% (observed/expected ratio = 0.89; $p < 0.001$). This suggests the presence of protective factors preventing the simultaneous manifestation of both conditions in WRA.

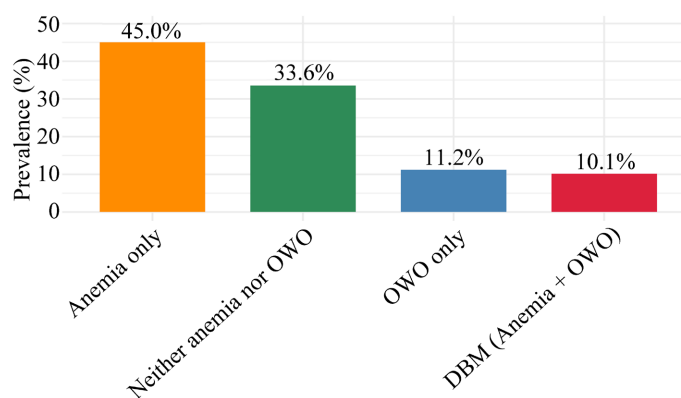


Figure 1. Distribution of nutritional status among women of reproductive age, Burkina Faso.

3.3. Associated Factors

The results of the logistic regression for the main covariates show a strong inverse wealth gradient in terms of protection against DBM (**Table 2**). Compared to women in the lowest wealth quintile (94.7% protected, 95% CI: 93.3% - 96.0%), those in the highest quintile were significantly less protected (82.7%, 95% CI: 80.3% - 85.2%; aOR = 0.35, 95% CI: 0.23 - 0.52, $p < 0.001$). This reflects a dose-response relationship, with each higher wealth quintile associated with progressively lower odds of protection.

Protection also decreased significantly with age. Women aged 40 and above had only one-third the odds of protection compared to those under 25 years (aOR = 0.34, 95% CI: 0.27 - 0.44, $p < 0.001$), indicating that older women have a significantly higher risk of co-occurring anemia and obesity.

Table 2. Factors associated with protection against the double burden of malnutrition among women of reproductive age: prevalence and multivariate analysis.

Variable	Category	Protected (%)	95% CI	aOR*	95% CI	p value
Wealth Quintile	Lowest	94.7	93.3 - 96.0	Ref.		
	Lower	94.6	93.3 - 95.9	1.03	0.72 - 1.47	0.876
	Middle	92.1	90.6 - 93.5	0.72	0.52 - 0.99	0.043
	Fourth	88.5	86.8 - 90.2	0.50	0.36 - 0.71	< 0.001
	Highest	82.7	80.3 - 85.2	0.35	0.23 - 0.52	< 0.001
Education Level	None	90.7	89.7 - 91.7	Ref.		
	Primary	87.5	85.0 - 89.9	0.78	0.61 - 1.01	0.060
	Secondary	90.6	89.0 - 92.3	1.05	0.81 - 1.35	0.717
	Higher	83.1	78.1 - 88.2	0.92	0.63 - 1.34	0.658
Age	<25 Years	93.8	92.6 - 95.1	Ref.		
	25 - 29 Years	90.0	88.0 - 92.0	0.55	0.40 - 0.74	< 0.001
	30 - 34 Years	87.3	85.1 - 89.5	0.41	0.30 - 0.56	< 0.001
	≥35 Years	85.9	84.4 - 87.4	0.34	0.27 - 0.44	< 0.001
Minimum Dietary Diversity	No	90.4	89.5 - 91.4	Ref.		
	Yes	88.2	86.4 - 90.0	0.93	0.76 - 1.14	0.481
Residence	Urban	84.1	82.1 - 86.1	Ref.		
	Rural	92.7	91.8 - 93.6	1.32	1.00 - 1.73	0.049
Working Status	Do Not Work	91.2	89.9 - 92.5	Ref.		
	Currently Working	89.0	87.9 - 90.2	0.96	0.79 - 1.17	0.721
Media Exposure	No	93.7	92.6 - 94.8	Ref.		
	<1 per Week	88.2	86.7 - 89.7	0.77	0.61 - 0.97	0.025
	≥1 per Week	88.5	87.0 - 90.0	0.81	0.65 - 1.02	0.076

*Survey-weighted logistic regression examining factors associated with being protected from the double burden of malnutrition among women of reproductive age. aOR: adjusted odds ratio; CI: confidence interval.

Rural residence was protective against DBM; rural women had 32% higher odds of protection compared to urban women (aOR = 1.32, 95% CI: 1.00 - 1.73, $p = 0.049$), despite an overall higher prevalence of anemia in rural areas. Media exposure showed a nuanced relationship; women exposed to media less than once a week had 23% lower odds of protection compared to those with no exposure (<1x/week: aOR = 0.77, 95% CI: 0.61 - 0.97, $p = 0.025$), while those exposed at least once a week had 23% lower odds of protection, though not statistically significant (aOR = 0.81, 95% CI: 0.65 - 1.02, $p = 0.076$). Maternal education level, occupational status, and dietary diversity were not significantly associated with protection against DBM after adjusting for wealth and other covariates (all $p > 0.05$), suggesting that these factors do not independently influence the co-occurrence of anemia and obesity.

4. Discussion

In this study, we examined the prevalence and associated factors of the co-occurrence of OWO and anemia among women aged 15 - 49 years in Burkina Faso. Our findings indicate that one in ten women (10.1%) presented with this DBM. This figure represents a notable increase compared to earlier national estimates of 4.5% in 2000 and 5.3% in 2010 [13], and it aligns with previous research estimating that 8.5% of adults in Burkina Faso simultaneously faced OWO and at least one micronutrient deficiency in 2014 [14]. Together, these findings underscore that the dual burden is an emerging and growing public health concern among women of reproductive age in Burkina Faso. Consequently, identifying and addressing its underlying preventable factors is essential to mitigate its health and societal consequences.

The prevalence of DBM observed in our study was higher than that reported in some Sub-Saharan African countries like Malawi (3.4%) [15] and Ghana (7%) [16], although it remains similar to prevalences reported in low- and middle-income countries (12.4%) [13] as well as some Latin American countries such as Guatemala (12%) and Brazil (14%) [17]. However, it remained lower than that observed in contexts where DBM is particularly pronounced, such as India (23.1%) [18] and the Philippines (23.7%) [19]. This global heterogeneity could reflect geographical, demographic, and socioeconomic differences, as well as variations in social, cultural, and health contexts.

The analysis of factors associated with this form of DBM among women of reproductive age (WRA) in Burkina Faso reveals counterintuitive associations with socioeconomic status. While poverty is typically linked to poorer health indicators, our results show that the poorest women are better protected against the co-occurrence of anemia and obesity (94.7%) than their wealthier counterparts (82.7%). This protection also decreases with age and is slightly higher in rural areas, posing unique challenges for developing integrated nutritional interventions.

Contrary to conventional expectations in public health, our study reveals an inverse socioeconomic gradient in protection against the DBM. This pattern contrasts with most health indicators, where socioeconomic disadvantages are generally associated with poorer outcomes. Similar associations have been observed in Ghana [16] and in the majority of low- and middle-income countries [10].

A plausible reason for this finding is that a transition from traditional diets to more varied eating patterns that include energy-dense, nutrient-poor foods, which are the key contributors to both OWO and micronutrient deficiencies, particularly among individuals with higher socioeconomic status in LMICs [20]. The lack of physical activity, a key determinant of obesity, is common in wealthier households. Furthermore, in many African contexts, cultural norms that associate a larger female body size with wealth and higher social or marital status may contribute to an environment where excess weight is socially desirable, thereby perpetuating the obesity component of the DBM [21].

Age, as a major determinant of DBM, with a progressive and significant de-

crease in protection as women age, has also been reported elsewhere in several other studies [10] [16] [19]. Prolonged exposure of women to obesogenic environments and suboptimal micronutrient intake over several years, combined with a decrease in basal metabolism and changes in body composition with age, are commonly cited causes [22]. Multiparity, making women more vulnerable to iron deficiencies while accumulating gestational weight, could be a contributing factor [23].

Rural residence appears as a protective factor against DBM. This observation aligns with the literature on the nutrition transition, where urbanization is associated with rapid changes in dietary habits and lifestyles [2]. Urban environments offer easier access to processed foods that are energy-rich but poor in micronutrients, while promoting sedentary behaviors [2]. Conversely, rural settings might retain more diversified diets and higher levels of physical activity. Media exposure was associated with a modest but significant reduction in protection against DBM. This association persisted after controlling for wealth status and could reflect several phenomena: first, an increased dietary intake and consumption of unhealthy foods through exposure to media and advertising for processed foods and sugary drinks as shown in previous studies [24] [25]; second, media exposure may correlate with other aspects of an urban lifestyle that facilitate access to and consumption of such foods.

The absence of a significant association between Minimum Dietary Diversity (MDD) and protection against DBM is notable. While MDD is a validated indicator of micronutrient adequacy, it does not distinguish between diverse diets rich in nutrient-dense whole foods and those that are diverse but high in energy-dense, nutrient-poor processed items. Consequently, a high MDD score may not protect against OWO if dietary diversity includes significant amounts of unhealthy fats, sugars, and refined carbohydrates.

Our findings—that affluent and urban-dwelling women are at higher risk for the anemia-OWO type of DBM—call for targeted double-duty interventions for these groups. Effective strategies could include: 1) nutrition education and social marketing to promote nutrient-dense foods and discourage consumption of ultra-processed items, even in higher-income settings; and 2) regulatory and advocacy measures to reduce the pervasive marketing of unhealthy foods and beverages to which these groups are often exposed. Such integrated approaches are necessary to simultaneously combat obesity and micronutrient deficiency within the same individual.

This study has some limitations. First, because DHS surveys measure only hemoglobin concentration, the present analysis couldn't distinguish the underlying causes or types of anemia, although previous studies in Burkina Faso and sub-Saharan Africa contexts have shown that iron deficiency, infection, and inflammation are the major contributors to anemia among women of reproductive age [26] [27]. In addition, important determinants such as other micronutrient deficiencies, dietary intake, physical activity, and socio-cultural influences were not

considered. Second, the cross-sectional nature of the study does not allow for establishing a causal relationship. Despite these limitations, the main strength of this study lies in using a nationally representative population sample. It contributes to knowledge of factors associated with the co-occurrence of OWO and anemia among women in Burkina Faso.

5. Conclusion

This study reveals a unique epidemiology of the double burden of malnutrition in Burkina Faso, characterized by two major nutritional paradoxes. Vulnerability to anemia-obesity DBM increases with wealth level, suggesting that economic development may expose women to food environments that simultaneously promote caloric excess and micronutrient deficiencies. This DBM is not a random occurrence but a phenomenon structured by specific sociodemographic determinants. Nutritional interventions should consider women from affluent households and older women as priority populations for DBM prevention.

Acknowledgements

The authors are grateful to the Demographic and Health Survey (DHS) program for providing free access to the datasets for this study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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