International Journal of Nutrition and Food Sciences
2026, Vol. 15, No. 5, pp. 248–258
https://doi.org/10.11648/j.ijnfs.20261505.18

Research Article

The Triple Burden of Malnutrition in Urban Informal Settlements: Undernutrition, Overweight and Anemia Among Women of Reproductive Age in Ouagadougou

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Abstract

Women of reproductive age (WRA) living in informal settlements are exposed to socioeconomic, food, and health constraints that can contribute to various forms of malnutrition. Undernutrition, overweight, and anemia can thus coexist within the same population. However, data describing this nutritional vulnerability remain limited. This study aimed to describe the nutritional status of WRA living in informal settlements in Ouagadougou, highlighting undernutrition, overweight, and anemia. This was a descriptive cross-sectional study conducted in informal settlements of Ouagadougou between November and December 2023. It included 417 WRA aged 15 to 49 years, selected using a two-stage stratified sampling method. The characteristics of the WRA were collected using a standardized questionnaire. Mid-upper arm circumference (MUAC) was assessed in WRA and body mass index (BMI) in non-pregnant women. Anemia was assessed using hemoglobin levels measured with a HemoCue® device. Statistical analyses considered stratification, weighting, and clustering. The prevalence of undernutrition, as measured by MUAC, was 21.3%. Among non-pregnant women, 8.7% were underweight, with 2.1% experiencing severe underweight, while 27.9% were overweight. Anemia affected 68.3% of pregnant women and 50% of non-pregnant women. MUAC value varied significantly according to age ($p = 0.013$), household head status ($p = 0.011$), education level ($p = 0.029$), and meal frequency ($p = 0.018$). Nutritional vulnerability was particularly pronounced among younger women, female heads of household, women with little or no formal education, and those consuming no more than two meals a day. No significant associations were observed with physiological status, income-generating activities, or anorexia. These findings underscore the need for multisectoral interventions that combine improved access to adequate nutrition, nutrition education, enhanced food security, and improved access to healthcare.

Keywords

Malnutrition, Overweight, Anemia, Women, Informal Settlements, Ouagadougou, Burkina Faso

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Received: 7 September 2026; **Accepted:** 16 September 2026; **Published:** 29 September 2026

1. Introduction

Malnutrition in women of reproductive age (WRA) is no longer limited to a single form of nutritional deficiency. In many contexts, undernutrition, overweight, and micronutrient deficiencies can coexist within the same population. This diversity of malnutrition forms is now a major public health challenge. It is particularly concerning in WRA due to their specific nutritional needs and the potential repercussions on pregnancy and child health [1, 2]. The period before and around pregnancy represents a critical window for maternal and infant health. Inadequate nutritional status can compromise fetal growth and increase the risk of low birth weight and obstetric complications [3, 4]. Conversely, overweight also exposes women to adverse consequences for their health and pregnancy. Furthermore, micronutrient deficiencies can disrupt fetal and neonatal development and affect cognitive function and overall health [4, 5]. Anemia is a particularly important manifestation in this regard. During pregnancy, it is associated with an increased risk of hemorrhage, miscarriage, maternal and perinatal mortality, and low birth weight [4]. The coexistence of these different forms of malnutrition This therefore reflects a multidimensional nutritional vulnerability. This vulnerability occurs within an environment where economic resources, access to food, dietary habits, sanitary conditions, and the use of health services combine to shape the nutritional status of vulnerable populations [2, 6, 7]. Disadvantaged urban areas concentrate several of these constraints. Low income, economic instability, and deficits in social and health infrastructure can, in particular, limit opportunities for regular access to sufficient food, both in terms of quantity and quality, and to healthcare [8-10]. In Ouagadougou, rapid urban expansion has been accompanied by a significant increase in informal settlements, where precarious living conditions persist [11, 12]. In these areas, economic constraints can restrict household food choices [13, 14]. Consumption habits there are often characterized by a significant emphasis on cereals and condiments, while foods particularly rich in micronutrients are less frequently consumed [7, 14]. Furthermore, since the informal settlements of Ouagadougou are located in an urban area, there is increasing ease of access to and consumption of energy-rich foods, although these foods remain less rich in micronutrients [15-17]. Added to these constraints are sanitary conditions and the occurrence of diseases that can alter nutritional needs or compromise nutrient utilization [7, 18]. In such an environment, assessing the nutritional status of vulnerable populations cannot be limited to studying a single manifestation of malnutrition. Simultaneously identifying undernutrition, overweight, and anemia allows for a broader understanding of the various dimensions of their nutritional vulnerability. However, data describing this coexistence in the informal settlements of Ouagadougou remain limited. The present study therefore aimed to describe the nutritional situation of WRA living in the unplanned districts of Ouagadougou, highlighting the presence of malnutrition, overweight and anemia.

2. Materials and Methods

2.1. Study Framework

This study focused on informal settlements in Ouagadougou, in the Kadiogo region of Burkina Faso. It is important to note that the expansion of these informal settlements accompanies the rapid growth of the city of Ouagadougou and is part of an urbanization process characterized by precarious living conditions [12, 19, 20]. These settlements face multiple challenges: vulnerable housing, insufficient access to basic social services, weak health and sanitation infrastructure, and economic insecurity [11, 12, 19, 21]. Households in these areas often have low and irregular incomes, primarily derived from the informal sector [11, 21]. These conditions can restrict access to sufficient food of good quality and quantity, as household nutrition relies heavily on food purchases [14, 22]. This context is also associated with nutritional vulnerabilities, particularly anemia among women [14, 18, 23]. Unplanned neighborhoods thus constitute a particularly relevant context for describing the coexistence of different forms of nutritional vulnerability among WRA.

2.2. Type and Period of the Study

This descriptive cross-sectional study was conducted in the unplanned neighborhoods of Ouagadougou. Its implementation spanned from June to December 2023. The preparatory phase, which began in June 2023, focused on training and standardizing the survey team, as well as identifying households. Data were then collected from participants between November and December 2023.

2.3. Sampling

In this study, analyses were performed using secondary data with a minimum size estimated at 416 FAPs, based on the prevalence (28.8%) of consumption of at least five food groups observed in the Kadiogo region in 2023 [24]. The calculation was performed using the Cochran formula [25] adapted for a 95% confidence level, a 5% margin of error, a cluster effect of 1.2, and a non-response rate of 10%.

The formula is:

$$N = [(z * z * p * q)/e * e] * [r * (1 + s)]$$

In total, 417 WRAs were actually investigated.

A stratified sampling proportional to the population of WRA was first conducted in the four health districts of Ouagadougou that include informal settlements: Boulmiougou,

Bogodogo, Sig-Noghin, and Nongr-Massom. A two-stage cluster sampling method was then applied. In the first stage, two informal settlements were randomly selected in each of the four health districts, resulting in a total of eight clusters: Zongo and Boassa in Boulmiougou; Gampela and Yamtenga in Bogodogo; Pazani and Yagma in Sig-Noghin; and Polesgo and Sakoula in Nongr-Massom. In the second stage, households were selected by random walk from a defined starting point within each cluster. Eligible pregnant women were included in each selected household. When a household contained several eligible non-pregnant women, only one participant was selected using the Kish method [26, 27].

2.4. Inclusion Criteria

Eligible participants were women aged 15 to 49, residing in the selected areas and who had consented to participate in the study.

2.5. Collection of Anthropometric and Biological Data and Measurements

Data were collected using a standardized questionnaire administered during individual interviews via the KoboCollecte platform. Interviewers were trained in data collection procedures, anthropometric measurements, and blood sampling. The questionnaire was pre-tested, and quality controls were performed during data collection. *Sociodemographic and socioeconomic characteristics* included age, education level, marital status and regime, income-generating activity (IGA), household size, number of children, head of household status, and physiological status. *Socio-health and hygiene characteristics* included Prenatal consultations visits (CPN), handwashing practices, and morbidity during the 14 days preceding the survey. Weight was measured using an electronic scale and height using a wooden measuring rod. *upper arm circumference (MUAC)* was measured at the midpoint between the acromion and the olecranon, according to the method of Shakir and Morley (1974) [28]. Nutritional status is thus classified into three categories: Severe acute malnutrition when MUAC < 180 millimeters (mm). Moderate acute malnutrition when 180 ≤ MUAC < 230 mm. Satisfactory or normal nutritional status when MUAC ≥ 230 mm [28]. *Body Mass Index (BMI)* was calculated using the ratio weight (in kilograms) / height × height (in meters) ^{2} and interpreted according to the criteria of the World Health Organization (WHO). Nutritional status is thus classified into five categories: normal nutritional status when the BMI is between 18.5 and 25 kilograms/square meter (kg/m^2); severe acute undernutrition when the BMI is < 16 kg/m^2; moderate acute undernutrition when 16 ≤ BMI < 18.5 kg/m^2; overweight when the BMI is ≥ 25 kg/m^2; and obesity when the BMI is ≥ 30 kg/m^2 [16, 28]. *Iron status or anemia of FAP was assessed based on* blood hemoglobin levels measured using a "HemoCue Hb 201" device produced by HemoCue® (Ängelholm, Sweden) [29]. WHO thresholds were applied according to pregnancy status. For the interpretation of test results, the thresholds below (Table 1), described by the WHO in 2007, were considered for pregnant women (PW) and non-pregnant women (NPW) [30].

Table 1. *Classification of anemia in women according to hemoglobin thresholds in grams per liter (g/L).*

Targets	No anemia	mild anemia	Moderate anemia	Severe anemia
PW	≥ 110	100-109	70-99	< 70
NPW	≥ 120	110-119	80-109	< 80

PW = pregnant women; NPW = non-pregnant women
Source: Adapted from WHO in 2007 [1].

2.6. Data Analysis

The data were cleaned and analyzed using Statistical package for the social sciences version 25.0. Variables are presented as counts, proportions or frequencies, and means for quantitative variables. The prevalence of undernutrition, overweight, and anemia was estimated separately to describe the multiple nutritional vulnerabilities of the study population. Associations were assessed using the Wald F-test adjusted in generalized linear models for complex samples, considering stratification and cluster sampling. The threshold for statistical significance was set at $p < 0.05$.

2.7. Ethical Considerations

The study was approved by the Health Research Ethics Committee under number 2022-12-261 on December 23, 2022. Informed consent was obtained from the participants before data collection. Data confidentiality and anonymity were guaranteed.

3. Results

3.1. Sociodemographic, Economic and Dietary Characteristics of the Women Surveyed

Table 2 presents the socio-demographic, economic, and dietary characteristics of the women surveyed. It highlights the observed numbers and valid percentages for each variable category.

Table 2. *Sociodemographic, economic and dietary characteristics of the women surveyed.*

Variables	N	%
Physiological status (n = 417)		
NPW	376	90.2
PW	41	9.8
Household size (n= 413)		
< 5	167	40.4
≥ 5	246	59.6
Age groups in years (n= 414)		
< 20	53	12.8
20-30	254	61.4
> 30	107	25.8
Education level (n= 280)		
Educated	117	41.8
Uneducated	163	58.2
income-generating activity (IGA) (n= 416)		
Housewives without income support	272	65.4
Woman with IGA	144	34.6
Meal frequencies per day (n= 410)		
≤ 2 meals per day	66	15.8
≥ 3 meals per day	351	84.2

N = Observed number, % = Valid percentage
PW = pregnant women; NPW = non-pregnant women

3.2. Health Characteristics of Women Surveyed

3.2.1. Use of Maternal Healthcare and Recent Morbidity Among the Women Surveyed

Table 3 presents the rate of Prenatal consultations (*CPN*) visits and clinical signs observed in the two weeks preceding the survey among the women interviewed. It highlights the observed frequencies and valid percentages for each variable category. The CPN data pertains to only 361 women with at least one child.

Table 3. *Use of Prenatal consultations visits (CPN) and clinical signs during the two weeks in the women surveyed.*

Variables	N	%
Use of Prenatal consultations (CPN) (n=361)		
< 4 CPN visits	263	72.9
≥ 4 CPN visits	98	27.1
Fever (n=417)		
No	345	82.7
Yes	72	17.3
Diarrhea (n=417)		
No	391	93.8
Yes	26	6.2
Cough (n=417)		
No	384	92.1
Yes	33	7.9
Anorexia (n=417)		
No	357	85.6
Yes	60	14.4
Vomiting (n=417)		
No	375	89.9
Yes	42	10.1

N = Observed sample size, % = Valid percentage,
CPN: Prenatal consultations.

3.2.2. Anemic Status of the Women Surveyed

Hemoglobin levels were measured using the HemoCue method in all 41 pregnant women surveyed. Of the 376 non-pregnant women surveyed, 118 underwent blood sampling for HemoCue analysis. In total, the analyses included 118 non-pregnant women and 41 pregnant women with a valid hemoglobin measurement. The results are presented in Table 4 shows the mean ± standard deviation of hemoglobin levels according to physiological status. It also presents the observed frequencies and valid percentages for each category of the "anemia" variable.

Table 4. Anemic status of the women surveyed.

Variables	PW (n = 41)	NPW (n = 118)
Hemoglobin level (g/L)		
Mean ± Standard deviation	103.58±14.59	118.30±14.54
Classification of anemia	N (%)	N (%)
Severe anemia	1 (2,4)	1 (0.8)
Moderate anemia	17 (41.5)	32 (27.1)
mild anemia	10 (24,4)	26 (22.0)
Absence of anemia	13 (31,7)	59 (50.0)

N = Observed number, % = Valid percentage
PW = pregnant women; NPW = non-pregnant women

3.3. Nutritional Profile of the Women Surveyed

3.3.1. Nutritional Status of the Women Surveyed According to the MUAC

Table 5 presents the distribution of women's nutritional status according to MUAC and physiological status. It highlights the means ± standard deviations of MUAC according to physiological status. It also presents the observed frequencies and valid percentages for each category of the nutritional status variable. MUAC assessment was performed on 325 of the 376 non-pregnant women in the sample.

Table 5. Nutritional status of women surveyed according to mid-upper arm circumference (MUAC).

State Nutritional	PW (n = 41)	NPW (n = 325)	WRA (n = 366)
Average MAUC ± SD	253.95±40	262.65±37.27	258.21±38.88
Classification	N (%)	N (%)	N (%)
Muac < 180 mm	2 (4.9)	1 (0.3)	3 (0,8)
180 ≤ Muac < 230 mm	10 (24,4)	65 (20.0)	75 (20.5)
Muac ≥ 230 mm	29 (70.7)	259 (79.7)	288 (78.7)

N = Observed number, % = Valid percentage; SD = standard deviation; PW = pregnant women; NPW = non-pregnant women

3.3.2. Nutritional Status of Non-pregnant Women (NPW) According to BMI

Table 6 presents the distribution of nutritional status among non-pregnant women according to BMI. It highlights the mean ± standard deviation of the BMI. It also presents the observed frequencies and valid percentages for each category of the nutritional status variable according to BMI. BMI assessment was performed on 194 of the 376 non-pregnant women in the sample.

Table 6. Nutritional status according to BMI of non-pregnant women (n = 194).

Nutritional status by BMI class	N	%
Severe thinness (BMI < 16)	4	2.1
Moderate thinness (16 ≤ BMI < 18.5)	13	6.6

Nutritional status by BMI class	N	%
Normal build (18.5 ≤ BMI < 25)	123	63.4
Overweight (25 ≤ BMI < 30)	43	22.2
Obesity (BMI ≥ 30)	11	5.7
BMI (continuous variable) Variable	Average	Standard deviation
BMI in kg/ m^2	23.25	4.12

N = Observed number, % = Valid percentage
PW = pregnant women; NPW= non-pregnant women

3.4. Sociodemographic, Economic, Health and Dietary Variables Associated with MUAC in Bivariate Analysis

Table 7 This table presents the associations between MUAC and sociodemographic, economic, health, and dietary characteristics in bivariate analysis. It highlights the estimated marginal means per variable category, 95% confidence intervals (95% CI), and p-values.

Table 7. *Association between MUAC and sociodemographic, economic, health and dietary characteristics in bivariate analysis.*

Variables	Average of the MUAC ± SD (mm)	IC95%	p-value
Age groups			
< 20	241.65 ± 3.4	[232.04-251.25]	0.013
20-30	255.04 ±2.6	[247,92-262,17]	
> 30	276.11 ±3.7	[265,82-286,41]	
Status Physiological			
Pregnant	253.96 ±3.5	[244,34-263,58]	0.165
Not pregnant	262.66 ±2.9	[254.71-270.62]	
Status of Head of Household			
Yes	225.39 ±5.92	[208.97-241.82]	0.011
No	259.70 ±2.17	[253.68-265.72]	
Level Instruction			
Educated	261.27 ± 3.5	[251,47-271,07]	0.029
Uneducated	247.53 ± 3.4	[238,21-256,86]	
AGR			
Yes	253.98 ± 3.8	[243.35-264.62]	0.172
No	259.77 ± 1.3	[256,24-263,29]	
Anorexia			
Yes	234.32 ± 10	[205.73-262.90]	0.056
No	262.72 ± 1.7	[257.98-267.45]	
Frequencies Meal			
≤ 2 meals per day	235.62 ± 5.3	[220.99-250.24]	0.018

Variables	Average of the MUAC ± SD (mm)	IC95%	p-value
≥ 3 meals per day	262.21 ± 2.3	[255.64-268.78]	

95% CI = 95% confidence intervals
SD = Standard deviation

4. Discussion

4.1. General Characteristics of the Women Surveyed

The participants had a mean age of 26.7 ± 6.5 years, with a predominance of those aged 20-30 (61.4%). Nearly 59.6% of households had a size of 5 or more people; and the mean household size in the WRA was 5.19 ± 2.532 people. More than half of the women were not 58.2% of educated women and 65.4% of women did not engage in any income-generating activities. These characteristics describe a socioeconomic context marked by low levels of education and limited participation of women in income-generating activities. This profile is comparable to that reported among women living in unplanned areas of Ouagadougou in 2021 by Zoubga et al. [14]. It is more broadly consistent with the social characteristics documented in precarious urban areas of Ouagadougou [11, 12]. The high proportion of households with at least five members completes this profile. In unplanned neighborhoods, household structure and economic resources constitute important dimensions of the food environment. Our results show a significant proportion of women with limited access to food (15.8%) who report consuming two or fewer meals per day. In Ouagadougou, the work of Custodio et al. (2020), Savy et al. (2008), de Becquey et al. (2010) and de Kabre et al. (2025) had already documented the links between socioeconomic conditions, food security and the characteristics of the diets of households and women in informal settlements [7, 18, 22]. Overall, these results highlight an unfavorable socioeconomic environment, within which the nutritional situation of the women studied is situated.

4.2. Use of Maternal Healthcare and Recent Morbidity Among the Women Surveyed

The low frequency of reported symptoms suggests relatively limited recent acute morbidity in the studied population. However, their presence warrants attention given their potential implications for nutritional status. In a context of nutritional vulnerability, infectious episodes can be accompanied by decreased food intake and increased metabolic needs, while anorexia can directly limit food intake. These results must be interpreted within the specific context of the informal settlements of Ouagadougou. The work of Rossier et al. (2019) showed that the populations of these areas experience multiple forms of social and health vulnerability [13]. Access to water, sanitation, and health services is a significant factor contributing to health problems. The work of Kombassere et al. (2007) also documented the constraints on access to drinking water and the health risks in the informal settlements of Ouagadougou [21]. In the urban population of Ouagadougou, Djourdebbe et al. (2018) also demonstrated the importance of considering the environmental and socioeconomic context when analyzing morbidity in this population [9]. Low Prenatal consultations coverage is another health factor to consider: only 27.1% of women who had at least one live birth had attended at least four CPN visits. While not establishing a causal link with the observed nutritional problems, this low uptake of prenatal care reflects a persistent health vulnerability in this population. It thus complements the previously described unfavorable socioeconomic profile and helps to characterize the environment in which the nutritional vulnerability of the women studied is situated.

4.3. Coexistence of Malnutrition, Overweight and Anemia Among WRAs Residing in Precarious Urban Areas

Based on the results, it appears that, according to the MUAC, 21.3% of participants presented with malnutrition (MUAC < 230 mm). This finding highlights significant nutritional vulnerability among women living in informal settlements in Ouagadougou. A comparable prevalence had already been reported in similar contexts. Zoubga et al. (2021) observed a proportion of 30.9% among pregnant and breastfeeding women living in informal settlements in Ouagadougou [14]. In India, Gaur et al. (2013) also showed that underweight was more frequent among women living in slums than among those residing outside these areas [31]. In our context, this malnutrition occurs within an environment marked not only by economic constraints that could cause difficulties in accessing adequate food but also by greater health vulnerability in informal settlements [14, 31]. It must also be placed within the broader context of the social and health inequalities observed in the informal settlements of Ouagadougou. The work of Rossier et al. (2019), carried out within the framework of the Ouagadougou Population Observatory, indeed shows health disparities according to the socioeconomic and environmental characteristics of the population [8]. Residence in an informal settlement thus appears as a component of the context of social disadvantage in an urban setting [11-13, 32]. Analysis based on BMI confirms the presence of underweight

in this population. Among non-pregnant women, 8.7% were underweight, including 2.1% who were severely underweight. This proportion is close to that reported by Zoubga et al. (2021) among breastfeeding women in the informal settlements of Ouagadougou, where 13.5% were underweight [14]. A higher prevalence was reported by Haidar et al. (2004), with 27.1% of breastfeeding women living in six informal settlements in Addis Ababa being underweight [33]. These discrepancies may reflect differences between the populations studied, particularly in terms of socioeconomic conditions, dietary practices, health context, physiological status, and survey period. This underweight, however, coexists with a significant amount of overweight. In our study, 27.9% of non- pregnant women were overweight. A proportion of 18.4% had been reported among breastfeeding women living in unplanned areas of Ouagadougou [14]. Higher levels have been observed in other precarious urban contexts, notably 67% in an informal settlement in Tshwane, South Africa, according to Thsiambara et al. in 2026 [34] and 40.5% in a Mumbai slum, India, according to Mulik and Surayawanshi in 2021 [35]. This contrast can be compared with the transformations of urban food systems, marked in particular by a greater availability of foods with high energy density and low nutritional density, as well as by changing lifestyles [15, 17]. These results illustrate the paradox of nutritional profiles found in precarious urban areas. Housing insecurity is therefore not systematically accompanied by underweight. It can also manifest itself in situations characterized by the coexistence of thinness and excess weight. Added to this anthropometric vulnerability is a significant burden of anemia. Anemia affects 68.3% of pregnant women and 50% of non-pregnant women. These proportions are comparable to those reported in several disadvantaged urban contexts. In Ouagadougou, Zoubga et al. (2025) reported a prevalence of 46.27% among pregnant women living in informal settlements in Ouagadougou [23]. In an informal settlement in Accra, Appiah-Dwomoh et al. (2024) observed 56% anemia among the women in their study sample [36]. In India, Panigrahi and Sahoo (2011) reported a prevalence of 60.8% among pregnant women living in a slum in Bhubaneswar [37]. These differences may reflect the specific physiological needs of pregnancy, but also the fact that these studies were not conducted in the same dietary, health, and socioeconomic contexts. In slum areas, anemia may thus be part of a broader nutritional and health vulnerability, to which insufficient micronutrient intake, infections, and increased nutritional needs during pregnancy may contribute. Overall, these results highlight the coexistence of several nutritional problems within the same population: undernutrition as measured by body mass index (BMI) and body mass index (BMI), overweight, and anemia. This profile illustrates the complexity of the nutritional situation of women living in precarious urban neighborhoods, where different forms of malnutrition can be observed simultaneously within the same social space. It thus demonstrates a multidimensional nutritional vulnerability, characterized by underweight, overweight, and anemia.

4.4. Distribution of MUAC According to WRA Characteristics

The MUAC showed a differentiated distribution according to several characteristics of the women. It increased significantly with age ($p = 0.013$), rising from 241.65 mm in women under 20 years of age to 276.11 mm in women over 30 years of age. This progression may reflect, at least in part, changes in body composition during adulthood [38]. However, this interpretation should remain cautious because basal body mass by MUAC is also influenced by nutritional status.

The mean basal body mass by MUAC was also lower among female heads of household (225.39 mm) compared to 259.70 mm among women who were not heads of household ($p = 0.011$). This difference, close to the threshold of 230 mm used in our study, may be a signal of social vulnerability. It could reflect the burden of economic and food-related responsibilities assumed by these women. In Ouagadougou, the work of Custodio et al. (2020) also highlights the importance of socioeconomic conditions in women's nutritional vulnerability [7]. The level of education was also associated with basal body mass by MUAC ($p = 0.029$), with a higher mean value among educated women (261.27 mm) compared to 247.53 mm among uneducated women. Education can facilitate access to information, employment, resources, and certain decision-making capacities. This relationship is consistent with the observations of Savy et al. (2028) in Ouagadougou, which showed links between socioeconomic characteristics and dietary and anthropometric profiles [18]. However, MUAC does not depend directly on the level of education. This association should therefore be understood as a possible reflection of a broader set of social and economic resources. Finally, meal frequency was associated with MUAC ($p = 0.018$). Women consuming a maximum of two meals per day had a mean MUAC of 235.62 mm, compared to 262.21 mm for those consuming at least three meals. This difference suggests that low meal frequency may constitute a marker of nutritional vulnerability among WRA in this context of unplanned settlements. Indeed, low meal frequency may reflect insufficient food availability or a limited capacity to regularly meet energy needs. The work of Becquey and Martin-Prevel in Ouagadougou also shows that women's diets remain highly constrained in terms of nutritional adequacy, despite the urban context [32, 39]. However, no significant difference in basal body mass by MUAC was observed according to physiological status ($p = 0.165$), income-generating activities ($p = 0.172$), or anorexia ($p = 0.056$). Overall, these results suggest that nutritional vulnerability, as measured by MUAC, is not evenly distributed across the population. It appears to be more pronounced among younger women, female heads of household, uneducated women, and those with infrequent meals. This finding reinforces the importance of a multidimensional approach to nutritional vulnerability in precarious urban settings.

5. Conclusions

Women living in the informal settlements of Ouagadougou exhibit multidimensional nutritional vulnerability characterized by the coexistence of undernutrition, overweight, and a high prevalence of anemia. These findings underscore the need for multisectoral interventions combining improved access to adequate nutrition, nutritional education, strengthened food security, and improved access to healthcare.

Abbreviations

BMI	Body Mass Index
95% CI	95% Confidence Interval
WRA	Women of Reproductive Age
IGA	Income-generating Activity
PW	Pregnant Women
NPW	Non-pregnant Women
PN	Prenatal Consultations
MUAC	Mid-upper Arm Circumference
WHO	World Health Organization
SPSS	Statistical Package for the Social Sciences

Acknowledgments

The authors have the honor to thank all the participants in the study as well as the investigators and supervisors of the data collection in the field.

Author Contributions

Adama Wendpagnagde Zoubga: Conceptualization, Formal Analysis, Writing – original draft
Sibiri Bougma: Writing – review & editing
Denis Erbi: Resources
Urbain Zongo: Conceptualization
Aly Savadogo: Writing – review & editing

Data Availability Statement

As part of this research, additional material will be available upon request from the corresponding author.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] United Nations Children's Fund (UNICEF), Conceptual Framework on Maternal and Child Nutrition; 2021, p. 4.

[2] Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), World Health Organization (WHO), World Food Programme (WFP), United Nations Children's Fund (UNICEF). The State of Food Security and Nutrition in the World 2025. Rome: FAO; 2025, p. 224. https://doi.org/10.4060/cd6008en-supplementary

[3] International Federation of Red Cross and Red Crescent Societies (IFRC), Nutrition Guidelines; 2015, p. 72.

[4] Food and Agriculture Organization of the United Nations (FAO). Nutrition in Developing Countries. Available from: https://www.fao.org/4/W0073F/w0073f00.htm#toc (accessed 15 September 2026).

[5] WHO, UNICEF, UNU, Iron Deficiency Anaemia Assessment, Prevention, and Control A guide for programme managers; 2001, p. 132.

[6] Famine Early Warning Systems Network (FEWS NET), Burkina Faso, Food Security Outlook October 2024 - May 2025: Crisis (IPC Phase 3) or worse outcomes persist in areas with high security challenges; 2024, p. 20.

[7] E. Custodio, F. Kayikatire, S. Fortin, A. Thomas, Y. Kameli, T. Nkunzimana et al., Minimum dietary diversity amongwomen of reproductive age in urban Burkina Faso, Maternal & Child Nutrition 16 (2020), pp. e12897. https://doi.org/10.1111/mcn.12897

[8] C. Rossier and M.-C. Peytrignet, Poverty and health in OPO neighborhoods: a qualitative approach, in Health Inequalities in Ouagadougou: Results from an Urban Population Observatory in Burkina Faso, A. Bassiahi Soura and G. Duthe, eds., Ined Editions, Paris, 2019, pp. 71-100. https://doi.org/10.4000/books.ined.12314

[9] Djourdebbe FB, Dos Santos S, Legrand TK, Soura AB. Child morbidity in African urban areas: the case of the Ouagadougou Health and Demographic Surveillance System (Burkina Faso). European Scientific Journal. 2018, 14, 163. https://doi.org/10.19044/esj.2018.v14n11p163

[10] Kombassere A. Access to drinking water and the risk of diarrhea in the informal settlements of Ouagadougou: the case of Yamtenga. Online thesis. Available at: https://www.memoireonline.com/07/09/2242/m_Lacces--leau-potable-et-les-risques-diarrheiques-dans-les-zones-irregulieres-de-Ouagadougou2.html (accessed 15 September 2026).

[11] L. Guigma, The "Hammer": A Heavy Blow to the Homogenization of Ouagadougou's Neighborhoods; 2019, p. 36.

[12] F. Boyer, coord., D. Delaunay and coord., Peuplement de Ouagadougou et developpement urbain: rapport provisoire; 2008, p. 249.

[13] Rossier C. (ed.), Soura A. B. (ed.), Duth é G. (ed.), Baya B. (foreword), Ridde Val éry (afterword). Health inequalities in Ouagadougou: results from an urban population observatory in Burkina Faso. (Major Surveys). Paris: INED; 2019, p. 276. https://doi.org/10.4000/books.ined.12284

[14] Zoubga W. A., Zongo U., Some W. J., Nikiema P. A., Savadogo A. Food Quality and Nutritional Status of Pregnant and Lactating Women in Neighbourhoods on the Outskirts of Ouagadougou, Burkina Faso. Journal of Nutrition and Food Security (JNFS), 2021; 6(4): 296-305. https://doi.org/10.18502/jnfs.v6i4.7613

[15] National Institute of Statistics and Demography, Ouagadougou, Burkina Faso and Inner City Fund, 2021 Demographic and Health Survey; 2023, p. 768.

[16] World Health Organization (WHO). Obesity and overweight. Available from : https://www.who.int/fr/news-room/fact-sheets/detail/obesity-and-overweight (accessed 15 September 2026).

[17] C. Dabone, The Double Burden of Malnutrition Among School-Age Children in an Urban Setting: A Study in Burkina Faso, Universite de Montreal, Department of Nutrition, Faculty of Medicine; 2011, p. 284.

[18] M. Savy, Y. Martin-Prevel, P. Danel, P. Traissac, H. Dabire and F. Delpeuch, are dietary diversity scores related to the socio-economic and anthropometric status of women living in an urban area in Burkina Faso? Public Health Nutr. 2008, 11, 132-141. https://doi.org/10.1017%2FS1368980007000043

[19] S. Bronfort and A. F. University of Liege > Master sc. & gest. approx., Adaptation strategies facing the risk of flooding in spontaneous habitat areas of Ouagadougou, Burkina Faso; 2017, p. 88.

[20] National Institute of Statistics and Demography (INSD), Results of the Fifth General Population and Housing Census (5eRGPH): Monograph of the Municipality of Ouagadougou; 2022, p. 136.

[21] T. Kabre, S. Rouamba and A. Ouedraogo, Determinants of household food consumption in the city of Ouagadougou, Journal of Geography of the University of Ouagadougou. 2022, 11(3), 24.

[22] A. W. Zoubga, J. W. Some, S. Bougma, M. Toni, U. Zongo and A. Savadogo, Analysis of sociodemographic factors, health practices, and their impact on anemia rates among women of childbearing age in disadvantaged peri-urban areas of Ouagadougou, PAMJ-OH. 2025, 46633. https://doi.org/10.11604/pamj-oh.2025.18.15.46633

[23] Ministry of Health and Public Hygiene (MSHP), 2023 National Nutrition Survey. Final Report; 2023, p. 116.

[24] W. G. Cochran, Sampling Techniques, 3. Ed, New York, NY; 1977, p. 428.

[25] H. Wiegand, Kish, L.: Survey Sampling. John Wiley & Sons, Inc., New York, London 1965, IX + 643 S., 31 Abb., 56 Tab., Preis 83 s., Biometrische Zeitschrift. 1968,10, 88-89. https://doi.org/10.1002/BIMJ.19680100122

[26] Ministry of Health (MoH), 2019 National Nutrition Survey. 2019 SMART Final Report. 2020, p. 87.

[27] Ministry of Health, National Protocol for the Integrated Management of Acute Malnutrition (IMAM), Burkina Faso. 2014, p. 154.

[28] T. Tassin, L. Glady, V. Moal, N. Oueidat, I. Martinel, M. Dubos et al., Use of HemoCue® or portable hemoglobinometers: results of national surveys conducted by the SFBC's EBMD working group, Annales de Biologie Clinique. 2024, 82, 536-554. https://doi.org/10.1684/abc.2024.1925

[29] World Health Organization (WHO), Centers for Disease Control and Prevention (CDC). Assessing the Iron Status of Populations: Including Literature Reviews: Report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva, Switzerland, 6-8 April 2004. 2nd ed. Geneva: World Health Organization; 2007, p. 108.

[30] E. Becquey, M. Savy, P. Danel, H. B. Dabire, S. Tapsoba and Y. Martin-Prevel, Dietary patterns of adults living in Ouagadougou and their association with overweight, Nutr J. 2010, 9, 13. https://doi.org/10.1186/1475-2891-9-13

[31] K. Gaur, K. Keshri and W. Joe, Does living in slums or non-slums influence women's nutritional status? Evidence from Indian mega-cities, Social Science & Medicine. 2013, 77, 137-146. https://doi.org/10.1016/j.socscimed.2012.11.017

[32] S. A. Bukachi, M. Ngutu, A. W. Muthiru, A. Lepine, S. Kadiyala and P. Domínguez-Salas, Gender and sociocultural factors in animal source foods (ASFs) access and consumption in lower-income households in urban informal settings of Nairobi, Kenya, J Health Popul Nutr. 2022, 41, 30. https://doi.org/10.1186/s41043-022-00307-9

[33] J. Haidar, N. Muroki, A. Omwega and G. Ayana, Malnutrition and iron deficiency anaemia in lactating women in urban slum communities from Addis Ababa, Ethiopia, E Af Med Jrnl. 2004, 80, 191-194. https://doi.org/10.4314/eamj.v80i4.8640

[34] P. Tshiambara, C. Ellis, M. Beeforth and C. Martin, Food insecurity and dietary diversity among women of reproductive age in an informal settlement in Tshwane, South Africa, South African Journal of Clinical Nutrition. 2026, 1-6. https://doi.org/10.1080/16070658.2026.2654314

[35] P. U. Mulik and S. R. Suryawanshi, An epidemiological study of the prevalence and determinants of overweight and obesity in women of reproductive age (15 to 49 years) group in an urban slum, Int J Community Med Public Health. 2021, 8, 2460. https://doi.org/10.18203/2394-6040.ijcmph20211774

[36] C. Appiah-Dwomoh, P. Tettey, E. Akyeampong, P. Amegbor, G. Okello, P. K. Botwe et al., Smoke exposure, hemoglobin levels and the prevalence of anemia: a cross-sectional study in urban informal settlement in Southern Ghana, BMC Public Health. 2024, 24, 854. https://doi.org/10.1186/s12889-024-18304-4

[37] A. Panigrahi and P. Sahoo, Nutritional anemia and its epidemiological correlates among women of reproductive age in an urban slum of Bhubaneswar, Orissa, Indian J Public Health. 2011, 55, 317. https://doi.org/10.4103/0019-557X.92415

[38] W. P. James, G. C. Mascie-Taylor, N. G. Norgan, B. R. Bistrian, P. S. Shetty and A. Ferro-Luzzi, The value of arm circumference measurements in assessing chronic energy deficiency in Third World adults, Eur J Clin Nutr. 1994, 48, 883-894.

[39] Y. Martin-Prevel, E. Becquey, S. Tapsoba, F. Castan, D. Coulibaly, S. Fortin et al., The 2008 Food Price Crisis Negatively Affected Household Food Security and Dietary Diversity in Urban Burkina Faso, The Journal of Nutrition. 2012, 142, 1748-1755. https://doi.org/10.3945/jn.112.159996