Original Article

Prevalence and Associated Factors of Underweight among Women of Reproductive Age in Rwanda: Analysis of the Rwanda Demographic and Health Survey 2019/2020

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Abstract

Background
Underweight among women of reproductive age poses significant health risks. Despite global and national reductions, it remains a public health concern in Rwanda.
Objectives
This study assessed the prevalence and associated factors of underweight among Rwandan women of reproductive age.
Methods
A cross-sectional analysis was used on data from the 2019-2020 Rwanda Demographic and Health Survey (RDHS), involving a nationally representative sample of 6,831 women aged 15-49 years. Data was collected through questionnaires and anthropometric measurements. A weighted analysis and multivariable analysis were performed.
Results
The prevalence of underweight was 5.8% (95% CI: 5.26-6.46). Women aged 15-24 years had higher odds of being underweight (AOR: 1.54, 95% CI: 1.21-1.95), while those aged 25-34 years had lower odds of being underweight (AOR: 0.67, 95% CI: 0.47-0.94). Moreover, women from rural (AOR: 1.76, 95% CI: 1.25-2.49), from poor household (AOR: 1.74, 95% CI: 1.35-2.25), middle-class households (AOR: 1.42, 95% CI: 1.05-1.93) and being anemic (AOR: 1.40, 95% CI: 1.04-1.87) were more likely to be underweight.
Conclusions
Although underweight prevalence was low, younger women, rural residents, and those from lower socioeconomic status or with anaemia were at greater risk. These findings underscore the need for targeted interventions addressing both nutritional and broader social determinants of health.
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Keywords: Prevalence, Reproductive women, Rwanda Demographic Health Survey (RDHS), Underweight

Introduction

Underweight, defined by the World Health Organization (WHO) as a body mass index (BMI) below 18.5 kg/m², indicates a state of undernutrition when not associated with other medical conditions.[1,2] This condition leads to health risks, particularly for women of reproductive age, as it can result in infertility, pregnancy complications, weakened immune function, and a higher likelihood of low birth weight in infants, perpetuating a cycle of malnutrition.[3–7]

Globally, approximately 10% of women aged 20 to 49 years are underweight,[8] with the pooled prevalence of underweight in LMICs among women of reproductive age being 15.2%.[9,10] Despite significant global reductions in underweight prevalence, dropping 14.6% over the past four decades, it remains a persistent challenge.[11–13] In Rwanda, the prevalence of underweight among women of reproductive age only slightly decreased from 7% in 2015 to 6% in 2020, as reported by the 2020 RDHS.[14] While this reduction reflects progress, underweight among Rwandan women remains a significant public health concern with long-term impacts on maternal and child health.[15] Despite considerable government investments averaging $184 million annually to combat undernutrition, further efforts are needed to sustain and accelerate progress in addressing this issue.[16]

Various studies have identified several factors contributing to the prevalence of underweight in women of reproductive age, including demographic characteristics such as age, marital status, number of children under five, birth intervals, parity, and region of residence.[12,13,17] Socioeconomic and lifestyle factors, such as maternal education, husband's education, wealth status, employment, and media exposure, are also strongly associated with undernutrition.[13,18,19] Additionally, health and hygiene conditions, including anaemia, access to antenatal care, availability of clean water, and types of toilet facilities, further influence thelikelihood of underweight in women.[20–23]

Although these studies have explored the determinants of underweight among women of reproductive age in low- and middle-income countries, evidence from Rwanda remains limited and fragmented. Most existing studies either rely on small sample sizes or focus on narrow geographic regions, which restricts the generalizability of their findings. To date, few have utilized nationally representative data to comprehensively assess the interplay of demographic, socioeconomic, and health-related factors in undernutrition among Rwandan women. This study directly addresses this gap by leveraging data from the most recent Demographic and Health Survey (DHS), offering robust, evidence-based insights that can inform national policy and targeted interventions.

Methods

Study Design and population

This cross-sectional study utilized data from the 2019-20 RDHS and involved a nationally representative sample of women aged 15–49. The survey, conducted between November 2019 and July 2020, gathered detailed health and demographic data through questionnaires and anthropometric measurements; no specific interventions were implemented as part of the survey.

Study sampling and sample size

The 2019-20 RDHS used a two-stage stratified sampling method to ensure national representativeness for key indicators. In the first stage, clusters composed of enumeration areas (EAs) were selected, with 500 clusters chosen from 112 in urban areas and 388 in rural areas. In the second stage, households were systematically sampled from these clusters. A household listing operation conducted in July 2019 in the selected EAs led to the selection of 13,000 households nationwide, averaging 26 households per district.

For this study, data from the RDHS 2019/2020 focused specifically on women of reproductive age, between 15 and 49 years.

Initially, 7,299 women were considered, but after excluding 413 pregnant women, 6,886 women met the inclusion criteria for analysis. After applying weighting factors to adjust for the sampling design and ensure national representativeness, the sample size was further adjusted by removing 55 women, resulting in a final sample of 6,831 women (Figure 1).

The study used the Individual (women's) Recode (IR) dataset from the RDHS, which provides detailed information on reproductive women. The outcome variable, underweight, was determined by assessing the BMI of the women, with underweight defined as a BMI below 18.5, according to the WHO classification.

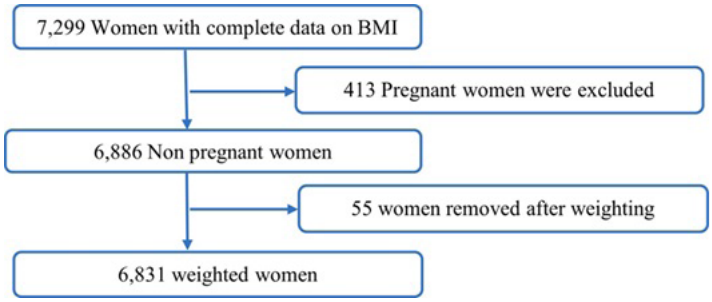

Figure 1. Flowchart of study sampling and final sample size selection from RDHS 2019–20

Study variables

Dependent/Outcome Variable

The outcome variable was underweight status among women aged 15-49, assessed using BMI according to WHO classification. Women with a BMI below 18.5 were categorized as underweight. The outcome variable was recorded as binary: underweight (BMI <18.5) and not underweight (BMI ≥18.5).[24]

Independent Variables (Explanatory Variables)

The study examined a variety of factors grouped into three main categories: demographic characteristics, socioeconomic and health and hygiene conditions. Demographic variables included age, marital status, number of children under five, birth interval, parity, place of residence, and region. Socioeconomic factors covered education, husband's education, wealth status, employment status, and media use. Health and hygiene conditions involved anaemia status, antenatal care visits, water source, and type of toilet.

Analysis and data processing

Access to the DHS datasets was granted through an online application, and data analysis was performed using STATA Version 17. Sampling weight was used to ensure accurate representation. Descriptive statistics summarized the socio-demographic and relevant characteristics of the participants. To examine the association between underweight and each predictor variable, binary logistic regression was initially conducted, yielding crude odds ratios. Predictors with a p-value less than 0.05 were then included in a multivariable logistic regression to calculate adjusted odds ratios for their association with underweight. Multi-collinearity was checked using the Variance Inflation Factor (VIF), leading to the exclusion of marital status and parity from the multivariable analysis due to their collinearity with maternal education. Risk factors were deemed significant if they had a P value of less than 0.05, and an odds ratio differing from one, and confidence intervals excluding one.

Results

Socio-demographic, economic, health/ hygienic factors and prevalence of underweight

Most women were aged 15-24 years (38.1%), with the majority residing in rural areas (80.3%). Over half were married (51%), and 86.2% had a birth interval of more than 24 months. Most had completed primary education (57.9%), while 35.7% had never given birth. About 43.4% belonged to the rich class, and 66.3% were employed. Additionally, 85.7% used media, and 86.9% were not anaemic. The majority had access to improved drinking water (78.8%) and toilet facilities (74.6%). Husbands' education largely reflected primary education (68.2%) (Table 1). The table further shows that 5.8% of the population was underweight (95% CI: 5.26-6.46).

Table 1. Socio-demographic, economic, health/hygienic factors and prevalence of underweight

Variables	n(6831)	%
Women's Age		
15-24	2,768	38.1
25-34	2,120	29.2
>=35	2,378	32.7
Marital status		
Widowed/divorced/ separated/ never in union	3,560	49
Married/living with partner	3,705	51
Birth Interval		
<24 months	516	13.8
>=24 Months	3,219	86.2
Parity		
Never give Birth	2,597	35.7
1 to 4	3,450	47.5
>=5	1,218	16.8
Residence		
Urban	1,430	19.7
Rural	5,835	80.3
Region		
Kigali	1,052	14.5
South	1,522	20.9
West	1,605	22.1
North	1,089	15
East	1,998	27.5
Women's Education		
No education	721	9.9
Primary Education	4,205	57.9
Secondary education	2,024	27.9
Higher	315	4.3
Husband Education		
No education	500	13.6
Primary education	2,514	68.2
Secondary education and higher	671	18.2
Wealth status		
Poor Class	2,738	37.7
Middle Class	1,374	18.9
Rich Class	3,154	43.4
Working Status		
No	2,446	33.7
Yes	4,820	66.3
Media use		
Never used Internet/Radio/Telephone/TV	1,041	14.3
Used Internet/Radio/Telephone/TV	6,224	85.7
Anaemia status		
Severe/ Moderate/Mild	953	13.1
Not Anemic	6,307	86.9
Drinking water source		
Non-Improved	1,510	21.2
Improved	5,630	78.8
Type of toilet Facility		
Unimproved	1,668	23.4
Improved	5,326	74.6
Open Defecation	149	2.1
Underweight		
Yes	399	5.8
No	6432	94.2

Notes: n, weighted frequency; %, proportion

Univariable analysis of factors associated with underweight

Table 2. Univariate logistic regression analysis of factors associated with underweight

Variables(s)	Underweight				Univariable logistic regression			
	Yes		No					
	n	%	n	%	COR	95% CI		*P* Value
Women's Age (Years)								
15-24	206	7.8	2,443	92.2	1.46	1.15	1.84	**0.002**
25-34	70	3.6	1,857	96.4	0.66	0.47	0.92	**0.015**
>=35 (Ref)	123	5.5	2,133	94.5	1.00			
Marital status								
Widowed/divorced/ separated/ never in union (Ref)	279	8.0	3,216	92.0	1.00			
Married/living with partner	119	3.6	3,216	96.4	0.43	0.34	0.54	**<0.001**
Birth Interval								
<24 months (Ref)	12	2.5	460	97.5	1.00			
>=24 Months	137	4.5	2,903	95.5	1.86	1.02	3.37	**0.042**
Parity								
Never give Birth (Ref)	211	8.5	2,270	91.5	1.00			
1 to 4	138	4.3	3,044	95.7	0.49	0.39	0.61	**<0.001**
>=5	51	4.3	1,119	95.7	0.49	0.35	0.68	**<0.001**
Residence								
Urban (Ref)	49	3.6	1,308	96.4	1.00			
Rural	350	6.4	5,125	93.6	1.82	1.29	2.58	**0.001**
Region								
Kigali (Ref)	38	3.8	958	96.2	1.00			
South	129	9.1	1,284	90.9	2.55	1.66	3.93	**<0.001**
West	92	6.1	1,410	93.9	1.65	1.07	2.56	**0.025**
North	47	4.5	979	95.5	1.20	0.73	1.98	0.461
East	94	4.9	1,801	95.1	1.32	0.84	2.07	0.23
Women's Education								
No education (Ref)	42	6.0	648	94.0	1.00			
Primary Education	224	5.7	3,710	94.3	0.94	0.66	1.34	0.727
Secondary education	121	6.3	1,791	93.7	1.05	0.71	1.55	0.8
Higher	13	4.2	284	95.8	0.69	0.35	1.37	0.287
Husband Education								
No education (Ref)	27	5.9	427	94.1	1.00			
Primary education	79	3.5	2,199	96.5	0.57	0.37	0.9	**0.015**
Secondary education or higher	11	1.9	573	98.1	0.31	0.15	0.64	**0.002**
Wealth status								
Poor Class	185	7.2	2,373	92.8	1.68	1.30	2.16	**<0.001**
Middle Class	80	6.3	1,199	93.7	1.43	1.06	1.93	**0.019**
Rich Class (Ref)	133	4.5	2,860	95.5	1.00			
Working Status								
No (Ref)	201	8.7	2,096	91.3	1.00			
Yes	198	4.4	4,337	95.6	0.48	0.39	0.59	**<0.001**
Media use								
Never used Internet/Radio/ Telephone/TV (Ref)	90	9.2	886	90.8	1.00			
Used Internet/Radio/Telephone/ TV	309	5.3	5,546	94.7	0.55	0.42	0.72	**<0.001**
Anaemia status								
Severe/ Moderate/Mild	67	8.0	779	92.0	1.48	1.11	1.97	**0.008**
Not Anemic (Ref)	330	5.5	5,649	94.5	1.00			
Drinking water source								
Non-Improved (Ref)	95	6.6	1,341	93.4	1.00			
Improved	295	5.6	4,985	94.4	0.84	0.66	1.07	0.155
Type of toilet Facility								
Unimproved	111	7.1	1,451	92.9	1.34	1.06	1.69	**0.016**
Improved (Ref)	271	5.4	4,746	94.6	1.00			
Open Defecation	9	6.7	130	93.3	1.26	0.67	2.36	0.479

Notes: COR, Crude Odd ratio; Bolded P value indicate significance at <5%; 95% CI, 95% Confidence Interval; Ref, Reference group; n, Weighted Frequency; %, Percentage

The significant variables associated with underweight were identified through univariable logistic regression analysis whereby a single predictor variable at a time was included in the model (Table 2). Women aged 15-24 years had higher odds of being underweight (COR=1.46) compared to those aged ≥35 years. Married women had lower odds (COR=0.43) compared to widowed/ divorced/never in union. Those with ≥24-month birth intervals had higher odds (COR=1.86) than those with <24-month intervals. Rural residents were more likely to be underweight (COR=1.82) compared to urban residents. Women with poor social category had higher odds of underweight (COR=1.68) compared to those in rich category. Working women (COR=0.48) and those using media (COR=0.55) had lower odds of underweight. In addition, anemic women were more likely to be underweight (COR=1.48).

Multivariable analysis of factors associated with underweight

The multivariable logistic regression model shows that women aged 15-24 years had 1.5 times higher odds of being underweight (AOR: 1.54, 95% CI: 1.21-1.95), while women aged 25-34 had 0.6 times lower odds (AOR: 0.67, 95% CI: 0.47-0.94) compared to those aged ≥35 years. Rural women were more likely to be underweight compared to urban women (AOR: 1.76, 95% CI: 1.25-2.49). Additionally, women from the poor social class (AOR: 1.74, 95% CI: 1.35-2.25) and middle classes (AOR: 1.42, 95% CI: 1.05-1.93) had higher odds compared to those from the rich social class. Anemic women also had a higher likelihood of being underweight compared to non-anemic women (AOR: 1.40, 95% CI: 1.04-1.87) (Table 3).

Table 3. Multivariable analysis of factors associated with underweight

Variable(s)	Multivariable logistic regression model	
	AOR(95%CI)	***P* Value**
Women's Age		
15-24	1.54(1.21,1.95)	**<0.001**
25-34	0.67(0.47,0.94)	**0.022**
>=35 (Ref)	1.00	
Residence		
Urban (Ref)	1.00	
Rural	1.76(1.25,2.49)	**0.001**
Wealth status		
Poor	1.74(1.35,2.25)	**<0.001**
Middle	1.42(1.05,1.93)	**0.021**
Rich (Ref)	1.00	
Anaemia		
Severe/ Moderate/Mild	1.40(1.04,1.87)	**0.023**
Not Anemic (Ref)	1.00	

Notes: AOR, Adjusted Odd ratio; 95% CI, 95% Confidence interval; Ref, Reference group; Bolded P value indicate significance at <5%

Discussion

This study aimed to determine the prevalence and identify factors associated with underweight among Rwandan women of reproductive age (15 to 49 years) using data from the 2019-20 RDHS. The results showed that 5.8% of women were underweight, with a 95% confidence interval of 5.26% to 6.46%. Despite progress through initiatives such as food supplementation and public health campaigns promoting balanced diets, this finding underscores the need for continued and targeted nutrition interventions, particularly for women of reproductive age.[15,25]

Compared to other countries in Sub-Saharan Africa, such as Ethiopia with a prevalence of 17.6%,[12] Uganda with 6.9%,[8] and Tanzania with 9.4%,[26] Rwanda's prevalence is relatively low. This may reflect the success of national strategies, including multi-sectoral nutrition policies, community-based interventions, and the proactive role of community health workers in reaching vulnerable groups. These integrated efforts have likely contributed to improved access to nutrition education and services and should be sustained and adapted to further reduce undernutrition among women.

Regarding the determinants of underweight, age was found to be significantly associated with underweight, with women aged 15 to 24 years being 1.54 times more likely to be underweight compared to those aged 35 and above. The current findings in Rwanda are likely driven by the 15–24 age group, which largely comprises adolescents and young adults undergoing rapid physical, cognitive, and psychosocial development. This period of accelerated growth and change significantly increases nutritional demands, rendering this population particularly susceptible to nutritional deficiencies and related health risks.[17] Similar associations have been observed in Ethiopia and Sierra Leone, and Nigeria, where younger maternal age was linked to undernutrition, often driven by limited autonomy and lower income.[12,17,27] These findings highlight the need for age-targeted nutrition interventions. School-based nutrition programs, reproductive health education, and supplementation during adolescence may be effective strategies for reducing underweight in this vulnerable group.

Compared to those living in urban areas, rural women were nearly twice as likely to be underweight, indicating a clear disparity in nutritional outcomes based on place of residence. In rural Rwanda, agricultural livelihoods, which dominate these areas, are particularly vulnerable to seasonal variations and climate change. These challenges exacerbate food insecurity and reduce dietary diversity. Dependence on subsistence farming often fails to ensure access to a diverse and nutritious food supply, especially during lean agricultural seasons. Additionally, socio-economic factors such as poverty and limited educational attainment in rural settings restrict knowledge and access to proper nutrition, further contributing to the increased risk of underweight status among women.[28] These results are consistent with the study conducted in SSA countries, where rural residency was associated with underweight due to limited access to nutritious food and lower socioeconomic status.[29] Addressing this issue requires targeted rural development strategies, including strengthening livelihoods, promoting sustainable agriculture, and expanding community-based nutrition education to reduce the rural-urban gap in undernutrition.

Socioeconomic status was also significantly associated with underweight, with women from poor households being nearly twice as likely, and those from middle-income households moderately more likely, to be underweight compared to women from wealthy households. Poor households often face food insecurity, leading to insufficient dietary intake in both quantity and quality. Financial constraints restrict access to diverse, nutrient-rich foods, resulting in diets primarily composed of staple foods like maize, beans, and cereals, which can cause micronutrient deficiencies. Additionally, lower levels of education and health awareness in poorer households contribute to unhealthy dietary practices and limited knowledge of proper nutrition. [30–32] Similar findings have been reported in studies from low- and middle-income countries, where limited purchasing power and widespread food insecurity often hinder access to nutritious foods.[9] To reduce undernutrition among low-income women, comprehensive poverty alleviation efforts are needed, including social protection programs, economic empowerment initiatives,

and improved access to affordable, nutritious foods and essential health services.

Lastly, the study found a significant association between anaemia and underweight, with anaemic women being about 40% more likely to be underweight compared to non-anaemic women. Anaemia can weaken the immune system, making individuals more susceptible to infections and illnesses, which in turn can lead to weight loss. Furthermore, anaemia may result in appetite loss, reduced dietary intake and undernutrition and underweight status.[33,34] Similar associations have been reported in lower and middle-income countries, particularly sub-Saharan Africa.[20–22,35,36] Integrating anaemia prevention and treatment into maternal health programs through routine screening, iron and folic acid supplementation, and nutrition counseling can play a vital role in improving the nutritional status of women of reproductive age.

Strength and Limitation

This study benefits from the use of the comprehensive and nationally representative 2019-20 RDHS dataset, enhancing the generalizability of our findings. However, its cross-sectional design limits the ability to establish causal relationships. Additionally, reliance on self-reported data may introduce recall bias. Furthermore, due to data limitations, we were unable to account for women's dietary habits and total energy intake in relation to BMI. Future research should prioritize longitudinal studies to better clarify causal pathways and incorporate factors such as nutritional habits and total energy intake to provide a more complete understanding.

Conclusion

The study found that six out of every hundred women of reproductive age in Rwanda are underweight, highlighting significant disparities among younger women, those in rural areas, women from lower socioeconomic backgrounds, and individuals with anaemia. While anaemia may reflect nutritional challenges, underweight is multifactorial and may involve other unmeasured factors. To address these challenges effectively, tailored interventions are crucial. This includes prioritizing comprehensive nutrition education for younger women, enhancing healthcare access and diversifying food sources in rural areas, expanding social safety nets and nutrition assistance programs for those from lower socioeconomic backgrounds, and integrating iron supplementation and promoting iron-rich diets for women suffering from anaemia. By implementing these targeted strategies, we can reduce the prevalence of underweight and improve the overall health and well-being of vulnerable populations in Rwanda. These findings highlight the need for context-specific strategies that address not only nutritional gaps but also broader social and health inequalities. Further research is recommended to explore additional determinants not captured in this study, including behavioural and environmental factors.

Authors' contribution

All authors were significantly contributed to this study.

Conflict of interest

The authors declared no conflict of interest to this article.

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