

Nutritional Status of Pregnant Women Attending the Prenatal Consultation Service at Musaga Health Center

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Abstract

This study was conducted at Musaga Health Center with the aim of assessing nutritional status and identifying factors associated with malnutrition among pregnant women attending prenatal consultation service. This is a cross-sectional study with analytical aims that covered a three-month period from August 20 to November 20, 2024. It was conducted among 417 pregnant women who met the inclusion criteria and gave their consent. The study revealed a prevalence of malnutrition of 34.3% among pregnant women in our sample. Factors associated with the nutritional status of pregnant women in Musaga Health Center ($p < 0.05$) are: low dietary diversity score (OR = 16.38; 95% CI: [7.356 - 38.199]; $p = 0.001$), poor food consumption score (OR = 5.037; 95% CI: [3.141 - 8.077]; $p = 0.003$), non-consumption of fruits (OR = 3.095; 95% CI: [1.710 - 5.601]; $p = 0.001$), consumption of two meals (OR = 2.222; 95% CI: [1.101 - 4.479]; $p = 0.026$), 2nd trimester of pregnancy (OR = 0.060; 95% CI: [0.019 - 0.187]; $p = 0.01$). Targeted interventions are needed to improve the nutritional health of pregnant women. These interventions should aim to improve nutritional status and diversify food consumption. At the end of our study, according to the response from the responders and according to the findings of the study we suggest the following recommendations: Implement projects to support households with limited resources. Increase awareness sessions on nutrition for pregnant women. Educate women on the importance of prenatal visits. Perform systematic screening for malnutrition in all pregnant women who consult for pregnancy monitoring. Use locally available and less expensive foods to diversify your diet. Increase fruit consumption.

Keywords

Nutritional Status, Pregnant Women, Prenatal Consultation, Health Center

1. Introduction

Nutrition during pregnancy plays a fundamental role in maternal health, fetal development and the prevention of complications (Dumas, 2011). The energy and nutritional needs of pregnant women increase, requiring a sufficient, varied and balanced diet (Badiou, 2012). Adequate nutrition is essential to promote fetal growth and maintain maternal well-being (Alamu et al., 2019). Nutrient deficiency can lead to adverse effects for both the mother and the unborn child (Black et al., 2013).

African women are exposed to nutritional deficiency problems (Russel, 2023). Limited access to sufficient and nutritious food is a reality in developing countries (FAO, 2021). This shows that maternal and child health is a major issue. During pregnancy, a diet lacking sufficient key nutrients such as iodine, iron, folate, calcium and zinc can cause anemia, preeclampsia or hemorrhage and lead to the death of the mother (OMS, 2019). In addition, these deficiencies sometimes cause stillbirths, low birth weight, wasting and developmental delays in children (Dangura & Gebremedhin, 2017).

Iodine deficiency with hypothyroidism during the first half of pregnancy is thought to be responsible for a decrease in intellectual abilities in children aged 4 to 7 linked to neurocognitive alterations (David, 2012). Marked iodine deficiency is associated with an increase in spontaneous abortions, perinatal mortality, hypotrophy at birth and neonatal hypothyroidism (Larry, 2023). Globally, malnutrition in all its forms affects millions of women: Approximately 800 million women of childbearing age suffer from iron deficiency, and nearly 10% of pregnant women suffer from anemia (OMS, 2023). Malnutrition affects more than 30% of pregnant women worldwide, of which approximately 20% are in sub-Saharan Africa (OMS, 2023).

Far too many adolescent girls and women are not receiving the nutrition services they need to stay healthy and give their infants the best chance of survival, growth and development (Chiabi et al., 2019). In many African countries, women's diets are poor in terms of fruits, vegetables, dairy products, fish, and meat (Christian, 2004). UNICEF estimates that each year, more than 20 million newborns are underweight due to maternal nutritional status (UNICEF, 2020).

Various factors influence women's diets, including access to food products and their costs (which limit women's ability to ensure optimal nutrition) as well as access to health care (FAO & PAM, 2021).

In Africa, a study conducted in Benin reported that 40% of pregnant women experienced the consequences of malnutrition on maternal health (Sossa et al., 2023b). Similarly, a study conducted in Tanzania in 2021, found a prevalence of anemia of 80.8% among pregnant women (Gibore et al., 2021).

In Burundi, according to the report on the state of food security, low incomes

and increasing market prices do not allow many households to obtain a diversified diet on a regular basis (FAO & PAM, 2021). Integrated food security Phase Classification (IPC) analyses show that in 2021, 26,142 pregnant or breastfeeding women were acutely malnourished (PAM & MINEAGRI, 2023). For the period from June to September 2024, the province of Bujumbura Mairie and 26 health districts are in the Alert phase (IPC Phase 2). A 2019 study revealed that nearly 30% of pregnant women in Burundi were chronically malnourished (Niyonzima, 2021). Data from the 2016 Demographic and Health Survey show that approximately 46% of Burundian women of reproductive age suffer from anemia, a particularly acute problem among pregnant women (ISTEEBU & MSPLS, 2017).

The Musaga neighborhood is one of the deprived areas of the capital, with a population that has limited means of living. Many families live in precarious conditions, with limited access to drinking water (Manirakiza et al., 2024). This suggests that the nutritional health of women of reproductive age is not optimal. Few studies have focused on the nutritional and dietary status of pregnant women. The available data are results presented in reports of national surveys giving overall figures from the Bujumbura city hall, which motivated this study.

A study of the determinants linked to nutritional and dietary status would be relevant in order to discover the state of the nutritional and dietary status of pregnant women and to develop strategies aimed at positively impacting the nutritional status of women as well as preventing the occurrence of consequences on pregnant women as well as on children.

2. Materials and Methods

2.1. Description of the Study Location

Musaga Health Center is located in the Musaga area, in the Muha urban commune. Its area of responsibility covers 7 hills and 28 sub-hills that make up the Musaga area. To the southeast is the Kanyosha area, to the west is the Kinindo area, and to the north is the Rohero area of the Mukaza commune.

Source: Musaga Health Center Annual Action Plan 2023-2024

2.2. Period and Type of Study

This is a cross-sectional analytical study conducted among 417 pregnant women who consulted for pregnancy monitoring at the Musaga Health Center, during the three-month period from August 20 to November 20, 2024.

2.3. Inclusion and Exclusion Criteria

Pregnant women who attended prenatal care and agreed to participate in the survey were included in our study. However, pregnant women who attended prenatal care but did not want to participate were excluded.

2.4. Study Sample

We used an empirical method with a purposive sampling technique, surveying all

pregnant women who came for a prenatal consultation and met the inclusion criteria and provided consent. A total of 417 pregnant women were registered during the study period.

2.5. Data Collection Tools and Techniques

2.5.1. Data Collection Procedures

A letter requesting authorization to conduct the study at the health center was sent to the chief district medical officer of the Bujumbura South District. The study was conducted after obtaining authorization from him and the agreement of the Musaga Health Center Manager.

Data collection was conducted by previously trained interviewers from August 20 to November 20, 2024. We used a questionnaire coded in the Kobocollect data collection tool. Information related to sociodemographic determinants, diet-related determinants, and socio-health determinants was obtained by completing the questionnaire face-to-face based on the responses provided by the respondents. Dietary diversification and food consumption were assessed based on the food groups consumed by the individuals. Nutritional status was determined by measuring mid-upper arm circumference using a MUAC tape.

2.5.2. Data Analysis

A database was created by exporting the data collected from Kobotoolbox to Microsoft Excel 2016 for grooming, then exported to SPSS 25.0 for statistical analysis. A sample description was performed by calculating means, standard deviations, and frequencies. A bivariate descriptive analysis was then performed using Pearson's chi-square test. Finally, a multiple logistic regression was performed by calculating the odds ratio and its 95% confidence interval between the response variable and the independent variables whose p -value was <0.20 in bivariate analysis. Only variables with a p -value < 0.05 at this level were considered predictors of malnutrition among pregnant women in the Musaga Health Center. The discriminatory power of the final model was tested to assess its reliability using the ROC curve.

2.5.3. Ethical Considerations

Before data collection, the purpose of the study was presented to participants. Only respondents who gave their consent were included in our study. The survey was conducted with strict respect for confidentiality and respondent anonymity.

2.6. Operational Definition of Variables

Table 1 shows an operational definition of the response variable.

Table 1. Description of the nutritional status of pregnant women.

Dependent variable	Description	Operational definition
Nutritional status	Binary categorical variable expressed in brachial circumference	<ul style="list-style-type: none"> • Normal status (MUAC \geq 23 cm) • Malnutrition (MUAC $<$ 23 cm)

Tables 2-4 show an operational definition of the explanatory variables.

Table 2. Sociodemographic determinants.

Independent variable	Description	Operational definition
1. Age of woman	Discrete quantitative variable in completed years categorized into three modalities	<ul style="list-style-type: none"> • Under 18 • 18 to 35 • Over 35
2. Marital status	Categorical variable	<ul style="list-style-type: none"> • Single • Married • Widowed • Common-law
3. Household manager occupation	Categorical variable	<ul style="list-style-type: none"> • Farmer • Shopkeeper • Civil Servant • Housewife • Other
4. Income	Quantitative variable	<ul style="list-style-type: none"> • Less than 100,000 BIF (34 USD) • 100,000 to 200,000 BIF (34 to 68 USD) • 200,001 to 300,000 BIF (34.01 to 100 USD) • More than 300,000 BIF (100 USD)
5. Level of study	Categorical variable	<ul style="list-style-type: none"> • Without any level • Primary • Technical training • Secondary • University

Table 3. Diet-related determinants.

Independent variable	Description	Operational definition
1. Individual dietary diversity score (IDDS)	Categorical variable	<ul style="list-style-type: none"> • Low Diversity ≤ 3 groups • Average diversity > 3 groups and ≤ 5 groups • High Diversity > 5 groups
2. Food Consumption Score (FCS)	Categorical variable	<ul style="list-style-type: none"> • Poor ≤ 28 • Borderline > 28 and ≤ 42 • Acceptable > 42
3. Number of meals	Categorical variable	<ul style="list-style-type: none"> • One meal • Two meal • Three meals
4. Fruit Consumption	Binary categorical variable	<ul style="list-style-type: none"> • Yes • No
5. Vegetable consumption	Binary categorical variable	<ul style="list-style-type: none"> • Yes • No
6. Snacking	Binary categorical variable	<ul style="list-style-type: none"> • Yes • No

Table 4. Socio-health determinants.

Independent variable	Description	Operational definition
1. Physical activity	Categorical variable	<ul style="list-style-type: none"> • Yes • No
2. Consultation with a specialist	Categorical variable	<ul style="list-style-type: none"> • Yes • No
3. Gestational age	Categorical variable	<ul style="list-style-type: none"> • 1st trimester < 12 weeks • Second trimester ≥ 12 weeks to 24 weeks • Third trimester > 24 weeks

Figure 1 below provide the conceptual framework of factors assumed to be associated with the malnutrition of pregnant women at the Musaga Health Center.

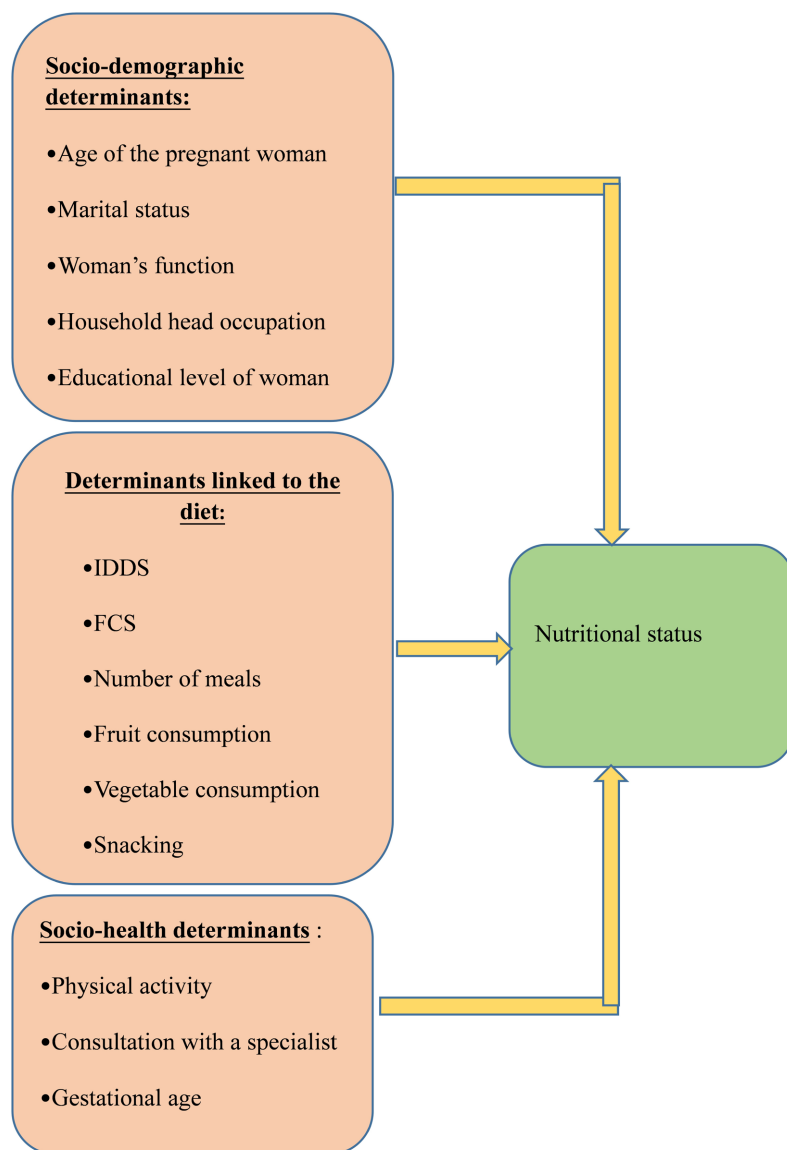


Figure 1. Conceptual framework of factors associated with malnutrition in pregnant women at the Musaga Health Center.

3. Results

3.1. Description of the Sample

The graph and tables below provide a detailed description of the various characteristics of our study sample. The graph shows the nutritional status of pregnant women, while **Tables 5-7** illustrate the sociodemographic, diet-related, and socio-health determinants of pregnant women, respectively. The results show that the majority of pregnant women, 65.7%, are classified as having normal nutritional status. In contrast, 34.3% of pregnant women are malnourished (**Figure 2**).

Table 5. Sociodemographic determinants of pregnant women seen for prenatal consultation at the Musaga Health Center.

Variables	Mean \pm Standard deviation	
Age of the pregnant woman (in years)	29 \pm 12	
	Effective	Frequency
Marital status		
Single	31	7.5%
Married	324	77.7%
Widowed	2	0.5%
Common-law	60	14.4%
Educational level of women		
None	21	5%
Primary education	170	40.8%
Technical training	5	1.2%
Secondary education.	140	33.6%
Bachelor's or equivalent level	81	19.4%
Household head occupation		
Farmer	58	13.9%
Trader, Shopkeeper	62	14.9%
Housewife	223	53.5%
Civil servant	28	6.7%
Others	46	11%
Household income		
Less than 100,000 BIF (34 USD)	107	25.7%
100,000 to 200,000 BIF (34 to 68 USD)	112	26.9%
200,000 to 300,000 BIF (68 to 100 USD)	74	17.7%
More than 300,000 BIF (100 USD)	124	29.7%

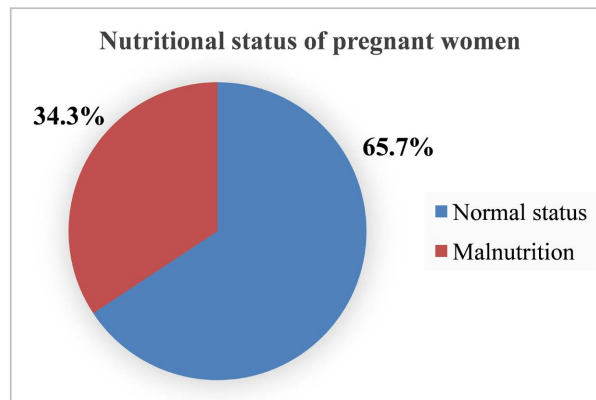


Figure 2. Nutritional status of pregnant women.

Table 6. Description of determinants linked to the diet of pregnant women seen in prenatal consultation at the Musaga Health Center.

Variables	Mean \pm Standard deviation	
Individual dietary diversity score (IDDS)	4 \pm 2	
Food Consumption Score (FCS)	55.25 \pm 26.9	
Number of meals	2 \pm 1	
	Effectives	Frequency
Individual dietary diversity score (IDDS)		
Low diversity	49	11.8%
Average diversity	163	39.1%
High diversity	205	49.2%
Food Consumption Score (FCS)		
Poor	116	27.8%
Limit	44	10.6%
Acceptable	257	61.6%
Number of meals		
One meal	84	20.1%
Two meals	122	29.3%
Three meals	211	50.6%
Fruit Consumption		
No	275	66.1%
Yes	142	33.9%
Vegetable consumption		
No	203	48.6%
Yes	214	51.4%
Snacking		
No	299	71.7%
Yes	118	28.3%

Table 7. Description of the socio-health determinants of pregnant women seen for prenatal consultation at the Musaga Health Center.

	Effectives	Proportion (%)
Physical activity		
No	191	45.8%
Yes	226	54.2%
Consultation with a specialist		
No	417	100%
Yes	0	0%
Gestational age		
1st trimester	78	18.7%
2nd trimester	173	41.5%
3rd trimester	166	39.8%

The results also show that the mean age of pregnant women is 29 ± 12 standard deviation. The youngest woman is 17 years old while the oldest is 43 years old. Most women, or 77.7%, are married. Those in a common-law relationship represent 14.4% and single women 7.5%. A minority, or 0.5%, are widowed. Regarding the educational level of pregnant women, primary level is the most represented, followed by secondary level with respective frequencies of 40.8% and 33.6%. Among pregnant women, 25.7% have an income of less than 100,000 BIF, while 26.9% earn between 100,000 and 200,000 BIF. In addition, 17.7% have an income between 200,000 and 300,000 BIF, and 29.7% have an income above 300,000 BIF (**Table 5**).

The results also show that women with low dietary diversity are represented at 11.8% while 39.1% have medium diversity and 49.2% high diversity. Regarding the food consumption score, 27.8% of women are in the poor category, 10.6% have a borderline consumption and 61.6% an acceptable food consumption. Regarding meal frequency, the results of our study show that pregnant women consume on average 2 meals per day, with 20.1% of women having only one meal per day. Regarding fruit and vegetable consumption, 66.1% do not consume fruit and 48.6% do not consume vegetables (**Table 6**).

Finally, 54.2% of pregnant women who engage in physical activity are represented, compared to 45.8% who do not. Regarding the age of pregnancy, 18.7% of women are in the first trimester, compared to 41.5% in the second trimester and 39.8% in the third trimester. No pregnant woman consulted a nutrition or dietetics specialist (**Table 7**).

3.2. Bivariate Analysis

Tables 8-10 show the association between the nutritional status of pregnant women and sociodemographic, diet-related, and socio-health determinants using Pearson's chi-square test.

Table 8. Analysis of the association between nutritional status and sociodemographic determinants of pregnant women in the Musaga Health Center.

Pregnant women with malnutrition				
Explanatory variables	Effectives	n (%)	Chi 2	p-value
Age of pregnant woman				
Less than 18 years	9	5 (55.55)	0.349	0.840
18 to 35 years old	370	130 (35.13)		
Over 35 years old	38	8 (21.05)		
Marital status				
Single	31	6 (19.4)	4.614	0.202
Married	324	117 (36.1)		
Widowed	2	0		
Common-law	60	20 (33.3)		
Educational level of pregnant women				
None	21	3 (14.3)	16.826	0.014*
Primary education	170	62 (36.5)		
Technical training	5	1 (20.0)		
Secondary education.	140	50 (35.7)		
Bachelor's or equivalent level	81	28 (34.6)		
Household head occupation				
Farmer	58	13 (22.4)	8.475	0.076
Trader, Shopkeeper	62	29 (46.8)		
Housewife	223	76 (34.1)		
Civil servant	28	8 (28.6)		
Others	46	17 (37.0)		
Household income				
Less than 100.000 BIF	107	44 (41.1)	6.979	0.081
100.000 to 200.000 BIF	112	30 (26.8)		
200.000 to 300.000 BIF	74	30 (40.5)		
More than 300.000 BIF	124	39 (31.5)		

Table 9. Analysis of the association between nutritional status and determinants related to the diet of pregnant women in the Musaga Health Center.

Pregnant women with malnutrition				
Explanatory variables	Effectives	n (%)	Chi 2	p-value
Individual dietary diversity score (IDDS)				
Low diversity	49	41 (83.67)	63.891	0.001
Average diversity	163	54 (33.12)		
High diversity	205	48 (23.41)		

Continued

Food Consumption Score (FCS)				
Poor	116	69 (59.5)	48.429	0.002
Limit	44	16 (36.4)		
Acceptable	257	58 (22.6%)		
Fruit Consumption				
Yes	283	63 (22.3)	56.573	0.001
No	134	80 (5.7)		
Number of meals				
One meal	84	24 (28.57)	39.676	0.0013
Two meals	122	37 (30.3)		
Three meals	211	53 (25.1)		
Vegetable consumption				
No	203	33 (16.25)	2,15	0,81
Yes	214	41 (19.16)		

Table 10. Analysis of the association between nutritional status and socio-health determinants of pregnant women in the Musaga Health Center.

Pregnant women with malnutrition				
Explanatory variables	Effectives	n (%)	Chi 2	p-value
Physical activity				
Yes	209	82 (39.23)	4.818	0.090
No	208	61 (29.32)		
Gestational age				
1st trimester	78	5 (6.4)	33.412	0.001
2nd trimester	173	68 (39.3)		
3rd trimester	166	70 (42.2)		

Thus, the variables significantly associated with the nutritional status of pregnant women are: educational level ($p = 0.014$) (Table 9); IDDS ($p = 0.001$), FCS ($p = 0.002$), fruit consumption ($p = 0.001$), and number of meals per day ($p = 0.0013$) (Table 10); and gestational age ($p = 0.001$) (Table 11).

3.3. Multivariate Analysis

Table 11 shows the multiple logistic regression analysis after introducing variables with a $p < 0.20$ in the bivariate analysis and after adjusting for other variables. Indeed, the variables significantly associated with malnutrition in pregnant women seen for prenatal care at the Musaga Health Center (p -value < 0.05) are: Dietary Diversity Score, Food Consumption Score, Fruit Consumption, Level of Education, and Age at Pregnancy (Table 11).

Table 11. Predictors of malnutrition in pregnant women.

Variables	Coefficients	OR	95% confidence interval for OR		p-Value
			Inferior	Upper	
Individual dietary diversity score (IDDS)					0.003**
High Diversity		1			
Average Diversity	0.483	1.620	1.024	2.565	0.039**
Low Diversity	0.000	16.763	7.356	38.199	0.001***
Food consumption score (FCS)					0.014**
Acceptable					
Limit	0.673	2.023	1.961	0.993	0.052*
Poor	1.617	5.037	3.141	8.077	0.003***
Fruit Consumption					0.002***
Yes		1			
No	1.130	3.095	1.710	5.601	0.001***
Educational level of pregnant women					0.003***
None		1			
Primary education	-2.524	0.080	0.014	0.458	0.004**
Technical training	-0.492	0.611	0.304	1.231	0.168
Secondary education	-20.248	0.000	0.000		0.999
Bachelor's or equivalent level	-0.099	0.906	0.440	1.863	0.788
Gestational age					0.000
1st Trimester		1			
2nd Trimester	-2.814	0.060	0.019	0.187	0.000***
3rd Trimester	-0.002	0.998	0.591	1.685	0.993
Number of meals					0.048**
Three meals		1			
Two meals	0.798	2.222	1.102	4.479	0.026**
One meal	0.187	1.205	0.655	2.219	0.549
Constant	-1.078	0.340			0.002

Indeed, women with average dietary diversity are 1.620 times more likely to be malnourished, and those with low diversity are 16.763 times more likely to be malnourished than women with high diversity. Women with a limit dietary intake score are 2.023 times more likely to be malnourished, and those with a poor dietary intake score are 5.037 times more likely to be malnourished than women with an acceptable dietary intake score. Women who do not consume fruit are 3.095 times more likely to be malnourished than women who do. Women with only a primary education are 2.524 times less likely to be malnourished than women who have not studied at all. Women in the second trimester of pregnancy are 2.814

times less likely to be malnourished than those in the first trimester.

Discriminatory power of the model

Figure 3 shows the ROC curve obtained from the results of the final estimated model. The area under the ROC curve is 0.80, which means that in 80% of cases, the model will correctly classify the observations. It can be concluded that this model has predictive power, with excellent discrimination, and is effective in predicting the nutritional status of pregnant women.

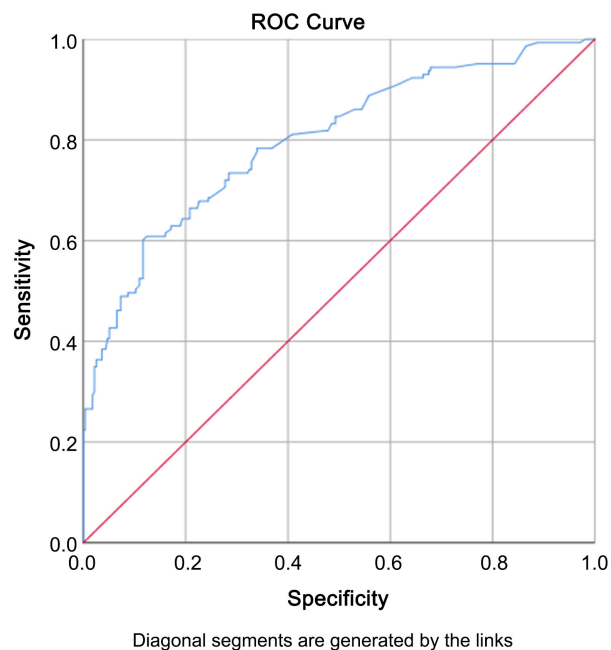


Figure 3. ROC curve, AUC = 0.80.

4. Discussion

This study aimed to assess nutritional status and identify factors associated with malnutrition among pregnant women seen for antenatal care at the Musaga Health Center. This study found that 34.3% of pregnant women were malnourished. This demonstrates that malnutrition is a public health problem in the locality and that pregnant women are vulnerable to it. This prevalence is lower but comparable to that found in the study conducted in Ethiopia in 2021 by Zewdie et al., which found that 41.2% of pregnant women were malnourished (Zewdie et al., 2021). However, these results are significantly lower than those found in the study conducted in Congo by Gloire Kasongo et al. in 2022, where they reported a frequency of 80.27% of pregnant women with an MUAC less than 23 cm (Gloire Kasongo et al., 2022).

This study revealed a significant relationship between the individual dietary diversity score (IDDS) and the risk of malnutrition in pregnant women, according to logistic regression analysis (p -value of 0.003; CI = 95%). This confirms the conclusion of the study conducted by Savy and colleagues in 2005, which demonstrated that increased dietary diversity is correlated with better nutritional status

in women (p -value = 0.004) (Savy et al., 2005).

The results of this study also revealed a significant association between poor food consumption score and malnutrition in pregnant women (p -value = 0.003; OR = 5.037, 95% CI: (95% CI: 3.141 - 8.077), these results suggest that a decrease in food consumption score is associated with an increased risk of malnutrition. These results correspond to those of the study carried out in Burkina Faso by Ousmane Ouédraogo in 2020, which demonstrated that the food consumption score was correlated with underweight women (p -value = 0.01; CI = 95%) (Ouédraogo, 2020).

The results of this study show that 66.1% of pregnant women do not consume fruit. In multivariate analysis, there was a significant association between fruit consumption and malnutrition in pregnant women, with a P -value of 0.000. The results of the study carried out in Kenya by Shrestha in 2019, show that pregnant women who regularly consume fruit have higher levels of vitamin C and folic acid, which is associated with better nutritional status (p -value = 0.027) (Shrestha, 2019). The results of this study finally show that the number of meals is associated with malnutrition in pregnant women (p -value of 0.048; CI = 95%). These results confirm those found in the study carried out in Benin by Sossa et al., in 2023 where the number of daily meals was significantly associated with the risk of malnutrition (p = 0.01) (Sossa et al., 2023a).

5. Limits of the Study

- Our study focused on a single health center, which limits the extrapolation of results to the whole of the Bujumbura Sud health district, of which the Musaga health centre is part of.
- Information on dietary habits was collected by means of a face-to-face interview based on respondents' statements. This may introduce a memory bias or respond in a socially expected manner.

6. Conclusion

This study on the nutritional status of pregnant women was conducted at the Musaga Health Center with the aim of assessing nutritional and dietary status and identifying factors associated with malnutrition among pregnant women seen for prenatal care. This study revealed a prevalence of malnutrition of 34.3% among pregnant women, representing a maternal health concern. The results of this study showed that unacceptable dietary diversity, poor food consumption scores, insufficient fruit consumption, and fewer than three meals a day are predictors of malnutrition among pregnant women at Musaga Health Center. Targeted interventions are needed to improve the nutritional health of pregnant women. These interventions should aim to correct malnutrition and diversify food consumption.

Conflicts of Interest

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

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