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Prevalence of Undernutrition and Associated Factors among Adult Patients with a Clinical Diagnosis of Heart Failure at the Cardiology Clinic of Mbarara Regional Referral Hospital

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Abstract: ***Background: Undernutrition is a common but often under-recognised complication among adult patients with heart failure (HF) and is associated with increased morbidity and mortality. Objective: This study aimed to determine the prevalence of undernutrition and its associated factors among adults with a clinical diagnosis of HF attending the cardiology clinic of Mbarara Regional Referral Hospital (MRRH). Methods: We conducted a cross-sectional study among 115 adult patients with clinical HF. Demographic, clinical, and laboratory data were collected. Nutritional status was assessed using anthropometric measurements and laboratory indices, including the Controlling Nutritional Status (CONUT) score. Factors associated with undernutrition were identified using modified Poisson regression analysis, and adjusted prevalence ratios (aPR) with 95% confidence intervals (CI) were reported. Results: Out of 115, most participants were female (58.3%) and from rural areas (75.6%), with a median age of 70 years (IQR 42–79). The prevalence of undernutrition was 66.1% (95% CI: 56.8–74.3), with 38.3% mild, 25.2% moderate, and 2.6% severe undernutrition. In multivariable analysis, age ≥70 years (aPR 1.38 (95% CI 1.01–1.99; p=0.041) and haemoglobin level≤12g/dl (aPR 1.84(95% CI 1.20–2.81; p=0.005) were independently associated with undernutrition. Use of guideline-directed medical therapy (GDMT) was associated with a lower prevalence of undernutrition (aPR 0.45(95% CI 0.33–0.83; p < 0.001). Conclusions: Undernutrition is highly prevalent among patients with HF in this setting, particularly among older adults and those with anaemia. GDMT use was associated with a lower prevalence of undernutrition. Routine nutritional assessment and early intervention should be integrated into HF care.***

Keywords: HF; Undernutrition; CONUT score; GDMT; Uganda

1. Introduction

1.1 Background

Heart failure (HF) is a clinical syndrome characterized by typical symptoms and signs resulting from structural or functional cardiac abnormalities that impair ventricular filling or ejection of blood (1). It remains a major public health problem worldwide and is associated with recurrent hospitalization, poor quality of life, and high mortality(2,3).

Globally, HF affects an estimated 64.3 million people(4) , with the incidence rising from 647.9 per 100,000 in 1990 to 682.7 per 100,000 in 2021 (5).The global prevalence is 1–3% of adults (6).In sub-Saharan Africa, HF accounts for a substantial proportion of cardiovascular admissions and is associated with considerable morbidity and mortality (7).

In Africa, HF is a leading cause of cardiovascular admissions and mortality, frequently presenting as a medical emergency requiring prolonged hospitalization(8). In Uganda, cardiovascular diseases account for approximately 10% of all deaths (9)

Undernutrition is an imbalance in nutrient intake, deficiencies or impaired utilization of essential nutrients(8). Undernutrition, sarcopenia, and cachexia are common nutritional complications of HF, and these conditions often lead to prolonged disability, poor quality of life, exercise intolerance, and higher rehospitalization and mortality rates (10,11). Malnutrition arises from reduced dietary intake, malabsorption, systemic inflammation, neurohormonal activation, oxidative stress, and hypermetabolism, leading to loss of fat-free mass and functional decline (12,13) .This worsens prognosis by driving cycles of cytokine activation, catabolism, and cachexia (14). Although malnutrition includes both undernutrition and overnutrition, this study specifically evaluated undernutrition. The term malnutrition is retained only when referring to previous studies that used this terminology.

Globally, the prevalence of malnutrition among hospitalized patients ranges from 11–74% (15,16). With 10–29% reported in Europe, increasing with age(17) .Among patients with HF, malnutrition is estimated at 37–56%, with higher rates reported in right-sided HF due to gut edema and impaired absorption(18). Another study done in Japan evaluated the

prevalence of malnutrition among HFrEF patients, their long-term outcomes, and whether their nutritional status was associated with the use of combination medical therapy, and found that the prevalence was 42.6% (20). While individual studies have reported prevalence ranging from 37% to 78% (19,21).

In sub-Saharan Africa (SSA), evidence on undernutrition in HF remains limited. A study in Ethiopia reported a prevalence as high as 78%(21). Another study found 28.6% in a similar population seven years later (22). Despite the dual burden of HF and undernutrition, and their profound impact on clinical outcomes. Another study in Ethiopia investigated the prevalence of undernutrition among adult patients with cardiac diseases and found that about 42.6%; it was a hospital cross-sectional study and was associated with NYHA class III-IV (23). Despite the substantial burden of undernutrition in HF, data from Uganda are scarce. Understanding the magnitude of undernutrition and its associated factors is essential for improving nutritional assessment and clinical management of patients with HF. Therefore, this study aimed to determine the prevalence of undernutrition and identify factors associated with undernutrition among adults with a clinical diagnosis of HF attending the cardiology clinic at Mbarara Regional Referral Hospital in southwestern Uganda

2. Methods

Study design

This was a hospital-based cross-sectional study among adult patients with a clinical diagnosis of heart failure attending the cardiology clinic at MRRH.

Study site

The study was conducted at the cardiology clinic at MRRH. MRRH is located in Mbarara City in the southwestern region. The cardiology clinic has heart failure and RHD clinics; these two clinics are separate. The heart failure clinic runs at MRRH on Tuesdays, with an attendance of approximately 20 adult patients with heart failure, and we recruited our participants from the heart failure clinic. The clinic is run by specialist physicians, resident doctors, and two nurses. The RHD clinic operates on Fridays and is managed by a cardiologist. However, RHD patients often mistakenly attend on Tuesdays. During these visits, we refill their medications and advise them to return to the RHD clinic on Friday for review, without needing to register with the heart failure clinic.

Laboratory investigations were performed at the SANAS-accredited MRRH laboratory. Operates from Monday to Sunday. The laboratory has seven chemistry machines, each with a different function. We performed all chemistry tests, including serum albumin, total cholesterol, and renal function tests. The haematology section processed all complete blood count (CBC) samples.

Sample size

The sample size was calculated using a finite population correction formula**.** Assuming a prevalence of undernutrition of 78% from a previous Ethiopian study, a 95% confidence level, a 5% margin of error, and an estimated HF clinic population of 203 patients, the minimum required sample size was calculated as 115 participants

Eligibility criteria

We included adult-aged patients with a clinical diagnosis of heart failure aged 18 years and above, who received care at the cardiology clinic at MRRH, and who provided informed consent to participate in the study. Pregnant women were excluded because pregnancy alters serum albumin and lymphocyte levels independently of nutritional status. Patients with rheumatic heart disease (RHD) were excluded because they were managed in a separate RHD clinic and were not part of the heart failure clinic population targeted by this study.

3. Study Variables

Dependent variable

A diagnosis of undernutrition according to the CONUT score among adult patients with a clinical diagnosis of heart failure

Independent variable

- Socio-demographic data: age, sex, marital status, residence, use of alcohol and smoking.
- Anthropometric features: Mid-Upper Arm Circumference (MUAC), skin fold thickness, BMI, height and weight. Comorbidities: COPD, hypertension, chronic kidney disease, asthma, HIV, and chronic liver disease. Medical history: Duration of heart failure in years, New York Heart Association Functional Class, medication history including: Angiotensin converting enzymes, loop diuretics, mineralocorticoid antagonists, beta blockers, calcium channel blockers and aspirin.
- Laboratory: serum albumin, total cholesterol, CBC (lymphocytes, white blood cell count, haemoglobin, and platelets).

Definitions of study variables and terms are provided in Supplementary Table S3.

Study procedure

This study was conducted at MRRH by a research team comprising the principal investigator and a trained study nurse, and the study purpose, procedures, risks, and benefits were explained in simple, understandable language, and each participant voluntarily agreed before any data were collected. Adult patients with heart failure who attended the cardiology clinic were recruited, and to minimize selection bias, by using a simple consecutive sampling method and applied uniform eligibility criteria to every patient who presented. We maintained a screening log that included all assessed patients, along with any refusals and their reasons. Recruitment was carried out on clinic days. Eligible participants had to have a diagnosis of heart failure according to the Framingham criteria. We reviewed their ECHO results to assess the underlying causes and ejection fraction of heart failure, and written informed consent was obtained before enrolment.

Demographic and clinical data- including age, sex, marital status, residence, smoking and alcohol use, medications, and comorbidities such as diabetes mellitus, HIV, and chronic kidney disease- were collected using a structured, standardized questionnaire.

All enrolled participants had their blood samples drawn into vacutainers for laboratory tests of serum albumin, total lymphocyte count, and total cholesterol, and all needles were safely disposed of in sharps containers in accordance with hospital infection control standards.

We assessed the nutritional status using the CONUT score, which includes laboratory parameters such as albumin, total lymphocyte count, and total cholesterol. The total CONUT score was 12, with albumin scoring 6, total cholesterol scoring 3, and lymphocyte count scoring 3. Adult patients with heart failure and a CONUT score of ≥2 were classified as undernourished. Because mild abnormalities were included to identify early nutritional impairment, while those with a score of <2 were considered well-nourished. The CONUT score was originally developed to identify malnutrition risk.

The CONUT score calculation and interpretation are presented in Supplementary Table S1.

In this study, we use the term undernutrition to specifically describe nutritional deficiency rather than overnutrition. Collected data were initially entered into Microsoft Excel and subsequently exported to STATA version 17 for statistical analysis and stored on devices that were encrypted and password-protected (29).

This is a study procedure flow chart, illustrated in Figure 1 below.

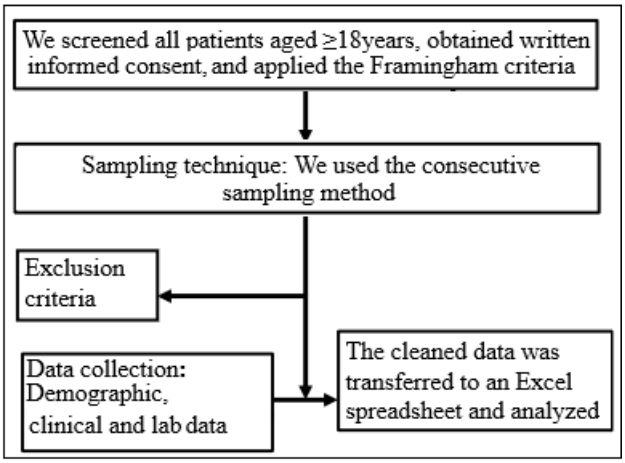

Figure 1: Study procedure flow chart.

Quality control

Was maintained throughout the study to ensure the accuracy and reliability of the results. Standard operating procedures were followed during patient selection, sample collection, handling, and laboratory analysis. Blood samples were collected using appropriate techniques and processed promptly to minimize errors. Internal quality control (IQC) procedures were conducted at the MRRH Laboratory. External quality assessment (EQA) for complete blood count, renal function tests, total cholesterol, and serum albumin was performed through the accredited Lancet laboratory at Mbarara City in southwestern Uganda. Laboratory equipment was regularly calibrated, quality control checks were performed daily before sample analysis, and reagents were stored and used according to the manufacturer's instructions. Data entry was verified for completeness and accuracy, and random samples were reanalyzed to ensure consistency.

Data analysis

Data were analyzed using STATA version 17. Continuous variables were expressed as means and standard deviations. For skewed data, medians and interquartile ranges were used. We used percentages and frequencies to represent categorical variables.

Objective one: The prevalence of undernutrition was presented as a simple proportion, with a 95% confidence interval, as the number of those with undernutrition over the total number of patients in the study.

Objective two: Factors associated with undernutrition were assessed using modified Poisson regression analysis with robust variance estimation to obtain prevalence ratios. Variables with p-values <0.20 in bivariable analysis and those considered clinically relevant were included in the multivariable model. A variable was considered significant if it had a p-value <0.05. We presented a 95% confidence interval.

Ethical consideration

Ethical approval was obtained from the Department of Internal Medicine and Health Sciences, Mbarara University of Science and Technology (MUST); the Faculty of Medicine Research Committee (MUST FRC); the MRRH administrative clearance; and the MUST Research Ethics Committee (MUST-2025-639). The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. Written informed consent was obtained from all participants before enrolment. Participant confidentiality was maintained throughout the study. Personal identifiers, including names, phone numbers, and hospital registration numbers, were not recorded on the data collection tools; instead, each participant was assigned a unique study code. Information obtained from participants and medical records was used solely for research purposes. Data were stored on a password-protected computer kept under lock and key, with access restricted to the principal investigator and authorised study personnel.

Interviews and physical examinations were conducted respectfully in a private room to ensure participants' comfort, dignity, and privacy, with minimal exposure and a chaperone present when necessary. The study did not interfere with routine patient care at the cardiology clinic.

4. Results

Participant recruitment flow

A total of 137 adult participants with a clinical diagnosis of heart failure were screened between March and May 2026. Of these, 22 patients were excluded: five due to histologically confirmed malignancy (one hepatocellular carcinoma, one lung cancer, and three gastric cancers) and 17 who declined

to provide informed consent, as illustrated in the participant recruitment flow diagram, Figure 2 below.

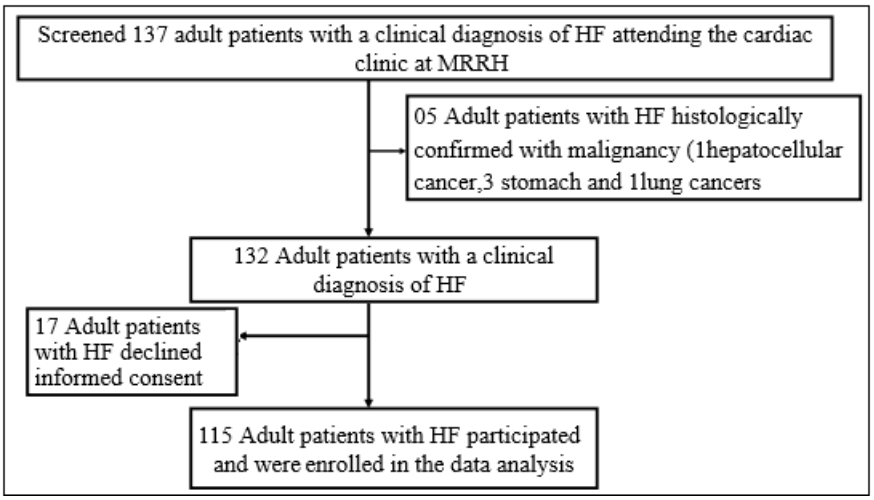

Figure 2: Participant recruitment flow diagram

A total of 115 patients were enrolled, and their baseline demographic, clinical, anthropometric, and laboratory characteristics were analyzed and are presented in Table 1. The median age was 70 years (IQR: 57–79), and 58.3% were female. Most were married (58.3%) and lived in rural areas (75.6%). Alcohol use (22.6%) and smoking (16.5%) were less common. Hypertension was the main comorbidity (53.0%), followed by Chronic Obstructive Pulmonary Disease/asthma (14.8%). Most patients had HF for less than 5 years (73.1%), and 58.3% were in NYHA class I–II. The median LVEF was 36%. The most common type was HFrEF (60.0%). DCM was the main cause (42.6%), followed by HHD (22.6%) and IHD (18.3%). Most participants had fewer than three hospital admissions in the past year (81.7%). The majority of participants were on GDMT (90.4%). The mean BMI was 24 ± 4 kg/m², with 53.9% in the normal range. 60% had low MUAC (<23 cm) and low triceps skinfold thickness (<5 mm). Renal function was generally normal, with a mean eGFR of 110.5 ml/min/1.73m². The median serum albumin was 3.76 g/dl. The mean CONUT score was 2.74. The median total cholesterol was 138 mg/dl, and the median NLR was 1.125. Most patients had normal haemoglobin levels (>12 g/dl in 87.8%), with a median of 14.2 g/dl. The median blood pressure was 123/74 mmHg.

Table 1: Baseline demographic, clinical, anthropometric and laboratory characteristics of participants with heart failure (N = 115).

Variable	Result, N=115
Age median (IQR), years	70 (42-79)
Female, n (%)	67 (58.3)
Marital status, n (%): Married	67 (58.3)
Residence, n (%): Rural	87 (75.6)
History of alcohol use, n (%)	26 (22.6)
History of smoking, n (%)	19 (16.5)
Comorbidities, n (%)	
Hypertension	61 (53.0)
COPD/Asthma	17 (14.8)
Type 2 Diabetes Mellitus	16 (13.9)
Others	11 (9.6)
Duration of HF diagnosis, median (IQR) years	3 (0.5-5)
Duration of HF in years, n (%)	
<5	84 (73.1)
NYHA Functional class, n (%)	
I&II	67 (58.3)
III&IV	48 (41.7)
LVEF, %, median (IQR)	36 (26-54)
LVEF phenotype of HF, (n)%	
HFrEF	69 (60.0)
HFmrEF	13 (11.3)
HfpEF	33 (28.7)
Etiology of heart failure (n)%	
DCM	49 (42.6)
HHD	26 (22.6)
IHD	21 (18.3)
Others	18 (16.5)
No. of hospital admissions in the past 12 months (n)%	
<3 times	94 (81.7)

3-5times >5times	10 (8.7) 11 (9.6)
Medications (n)% GDMT Non-GDMT	 104 (90.4) 11 (9.6)
BMI Kg/m², mean (±SD) <18.4 18.5-24.9 25-29.9 ≥30	24±4 07 (6.1) 62 (53.9) 34 (29.6) 12 (10.4)
MUAC (cm), median (IQR) <23	24.5 (22.4-26.8) 69 (60)
Triceps skin fold thickness (TSF) mm, median (IQR) <5	5 (4-6) 69 (60)
eGFR ml/min/1.73m², mean (±SD)	110.5 (36.0)
Serum Albumin, g/dl, median (IQR)	3.76 (3.52 – 4.0)
CONUTscore mean (±SD)	2.74 (2.30)
Total cholesterol, mg/dl, median (IQR)	138 (107-138)
Lymphocyte count, median (IQR)	2.03 (1.54 - 2.35)
Neutrophil to Lymphocyte ratio (NLR), median (IQR)	1.125 (0.87-1.70)
Haemoglobin (HB)g/dl, median (IQR) >12 n (%)	14.2 (12.9-15.2) 101 (87.8)
SBP median (IQR) mmHg	123 (105-138)
DBP median (IQR) mmhg	74 (69-83)

***MUAC**— Middle Upper Arm Circumference, **BMI** — Body Mass Index, **eGFR**— Estimated glomerular filtration rate, **COPD** — Chronic Obstructive Pulmonary Disease, **NYHA**— New York Heart Association (Functional Classification), **LVEF**—Left Ventricular Ejection Fraction, **HFrEF**—Heart Failure reduction Ejection Fraction, **HFmrEF**—Heart Failure middle-range Ejection Fraction, **HFpEF**—Heart Failure Preserved Ejection Fraction, **DCM**—Dilated Cardiomyopathy, **IHD**—Ischemic Heart Disease, **HHD**—Hypertensive Heart Disease, **GDMT**—Guideline Directed Medical Therapy, **SBP**—Systolic Blood Pressure, **DBP**—Diastolic Blood Pressure.*

Our study found that the prevalence of undernutrition among adult participants with a clinical diagnosis of heart failure was 66.1% (95% CI: 56.8–74.3%), as assessed using the CONUT score. Among the 115 participants included in the analysis, 76 were classified as undernourished, and the severity of undernutrition according to CONUT score categories is presented in Figure 3.

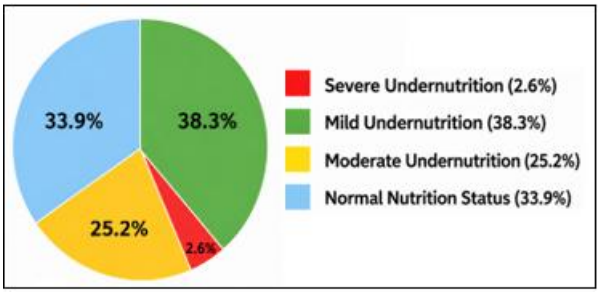

Figure 3: Severity of undernutrition among adult patients with heart failure according to CONUT score categories (N = 115).

The results of the bivariable (unadjusted) modified Poisson regression analysis are presented in Supplementary Table S2. Variables with a p-value <0.20 in the bivariable analysis and those considered clinically relevant were included in the multivariable model.

Table 2 presents the results of the multivariable modified Poisson regression analysis.

After adjustment, HF duration, NYHA functional class, LVEF phenotype, hypertension, residence, triceps skinfold thickness, and previous hospital admissions were not independently associated with undernutrition among adult patients with a clinical diagnosis of heart failure attending the cardiology clinic.

Table 2: Modified Poisson regression analysis of factors associated with undernutrition among adult patients with heart failure.

Variables	Unadjusted			Adjusted		
Age, years	**cPR**	**95%CI**	**Pvalue**	**aPR**	**95%CI**	**Pvalue**
<70 **≥70**	Ref **1.34**	**0.96-1.85**	**0.079**	**1.38**	**1.01-1.99**	**0.041**
HF diagnosis duration, years <5 ≥5	Ref 1.20	0.69-2.10	0.154	1.45	0.83-2.52	0.188
NYHA Functional class I&II III&IV	Ref 1.09	0.77-1.55	0.597	1.10	0.78-1.56	0.579

Medication: GDMT						
No	Ref	**0.15-0.65**	**0.000**	**0.45**	**0.33-0.83**	**0.000**
Yes	**0.42**					
LVEF%-Phenotypic						
HFpEF	Ref					
HFmrEF	0.90	0.78-1.70	0.748	1.26	0.73-2.25	0.441
HFrEF	1.06	0.74-1.53	0.738	1.25	0.91-1.73	0.165
Haemoglobin level						
>12	Ref					
≤ 12	**1.77**	**1.24-2.53**	**0.002**	**1.84**	**1.20–2.81**	**0.005**
HTN						
No	Ref					
Yes	0.78	0.57-1.07	0.124	0.87	0.64-1.19	0.387
Residence						
Urban	Ref					
Rural	1.03	0.40-2.57	0.942	1.27	0.83-1.93	0.265
Triceps skinfold thickness(mm)						
≥5	Ref					
<5	0.78	0.58-1.68	0.124	1.24	0.63-2.51	0.259
No. of admissions in the past 12 months						
<3 times	Ref					
3-5 times	0.91	0.28-2.49	0.757	0.86	0.54-1.36	0.277
>5 times	0.83	0.44-1.54	0.553	0.517	0.43-1.12	0.137
Alcohol						
No	Ref					
Yes	1.03	0.41-2.58	0.942			
Smoking						
No	Ref	0.27-1.96	0.528			
Yes	0.73					
Diabetes Mellitus						
No	Ref	0.30-20.0	0.231			
Yes	2.45					
Sex						
Female	Ref	0.26-2.71	0.780			
Male	0.85					
Marital status						
Married	Ref	0.17-1.63	0.269			
Un married	0 .53					

5. Discussion

This study found an overall prevalence of undernutrition among adult participants with a clinical diagnosis of heart failure attending a tertiary cardiology clinic in southwestern Uganda was 66.1% (95% CI: 56.8%–74.2%). Of these, 38.3% had mild undernutrition, 25.2%% had moderate undernutrition, and 2.6% had severe undernutrition. Factors independently associated with undernutrition were age ≥70 years and haemoglobin ≤12 g/dL, while GDMT was associated with a lower likelihood of undernutrition.

The prevalence of undernutrition in this study was higher than that reported in several studies from high-income countries, where the prevalence of malnutrition among patients with HF ranges from 20% to 50%, depending on the nutritional assessment tool used. This difference may be attributed to the routine implementation of nutritional assessment in clinical practice in these settings (24,25).

Our prevalence of 66.1% may be explained by the pathophysiological mechanisms of HF, including chronic inflammation, reduced appetite, intestinal congestion, and increased metabolic demand, all of which contribute to progressive nutritional depletion (26). In sub-Saharan Africa, the prevalence of undernutrition found in our study was lower than that reported by Amare et al. at Jimma University Specialized Hospital in south-eastern Ethiopia, where 77.8% of adults with HF had undernutrition. In that study, nutritional status was assessed using serum albumin and triceps skinfold thickness (21).

In contrast, our study used the CONUT score to assess for undernutrition. The CONUT score demonstrates a sensitivity of 80% and a specificity of 94% for detecting malnutrition in adult patients with Heart Failure (18), with positive and negative predictive values of 88.9% and 19.2%, respectively (Horiuchi et al., 2018).Indicating its sensitivity in detecting subclinical malnutrition. This suggests that patients may be nutritionally compromised even in the absence of overt clinical signs such as oedema.

Factors associated with undernutrition in patients with HF

In our study, we found that age above 70 years, use of guideline-directed medical therapy (GDMT), and haemoglobin level ≤12g/dl were independently associated with undernutrition among adult patients with heart failure. These findings are consistent with those of similar studies, although variations may be explained by differences in study setting, population characteristics, methods of nutritional assessment, and severity of HF among participants.

In the unadjusted analysis, age>70 years was not associated with undernutrition (cPR = 1.34, 95% CI: 0.96–1.85, p = 0.079). After controlling for potential confounders using modified Poisson regression, age 70 years and above was a significant factor for undernutrition, with a 38% higher prevalence of undernutrition compared to those aged below 70 years (aPR = 1.38, 95% CI: 1.01–1.99, p = 0.041). This finding is similar to studies from China and Europe, which reported that adult age is a predictor of malnutrition among patients with heart failure. In China, Liang et al. found that malnutrition was more common in elderly patients with heart failure and was linked to worse outcomes. In Europe, Sze et al. reported that adult age was one of the main factors associated with malnutrition among ambulatory patients with heart failure. The similarity may be due to age-related decline, sarcopenia, frailty, impaired mobility, and multiple comorbidities (27).

Our study found that those who received GDMT had a 55% lower prevalence of undernutrition compared with those who did not receive GDMT (aPR= 0.45, 95% CI: 0.33–0.83, p < 0.001). This finding suggests that optimized treatment of heart failure may help preserve nutritional status by improving cardiac output, reducing fluid congestion, enhancing gut perfusion, and decreasing inflammatory activity (13). Our results are consistent with the study by Fernández et al. (2022), which also found that GDMT lower the prevalence of malnutrition in patients with heart failure. In particular, beta-blockers were shown to reduce neurohormonal activation. Similarly, inhibition of the renin–angiotensin–aldosterone system (RAAS) through angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) was associated with improved metabolic stability and reduced risk of nutritional decline (13). Another similar study done by Ahmed et al. (2022) in northwestern Ethiopia at Gondar specialized hospital found that a similar GDMT was independently associated with a lower prevalence of undernutrition in elderly patients with HF for a similar reason (28).

We found that participants with haemoglobin levels (≤12 g/dL) had a significantly higher prevalence of undernutrition compared with those with normal haemoglobin levels (aPR = 1.84, 95% CI: 1.20–2.81, p = 0.005). Participants with anaemia showed an 84% higher prevalence of undernutrition after adjusting for confounding factors. This aligns with previous studies that have found anaemia correlates with malnutrition in heart failure patients. Sze et al. noted an association between anaemia and undernutrition, while Liang et al. found similar results in elderly patients (30,31). A similar study was done in Ethiopia by Amare et al. (2015). It was found that serum haemoglobin levels are significantly associated with the nutritional status of heart failure patients. As serum haemoglobin increases by 1 gm/dl, the risk of malnutrition decreases by 15% (21) .In heart failure patients, chronic inflammation affects both anaemia and undernutrition(9).

NYHA functional class III–IV, LVEF phenotype, residence, hypertension, previous hospital admissions, and duration of heart failure diagnosis were not independently associated with undernutrition after adjustment (31,32). This differs from some studies that have reported an association between advanced NYHA class and malnutrition, possibly due to increased symptoms, fatigue, and catabolic activity among patients with more severe heart failure. Similarly, although repeated admissions and longer disease duration are often markers of advanced disease and have been associated with nutritional impairment in some settings, these associations were not observed in our study (22).

6. Study Limitations

This cross-sectional study design limits our ability to establish causal relationships between the severity of heart failure and undernutrition. Secondly, the study was conducted at a single tertiary hospital, which may restrict the generalizability of the findings to other healthcare settings. The relatively small sample size may have also reduced the statistical power to detect significant associations with certain comorbidities, and we excluded the RHD population CONUT relies on laboratory parameters influenced by inflammation and disease severity, which may not completely distinguish nutritional deficiency from systemic illness associated with heart failure.

7. Conclusion

This study found a high prevalence of undernutrition among adult patients with a clinical diagnosis of heart failure attending the cardiology clinic at MRRH. Undernutrition was independently associated with low haemoglobin and advanced age, while GDMT was associated with a lower prevalence of undernutrition.

8. Recommendations

1) All health care providers at the cardiology clinic should perform routine nutritional assessment, and care should be integrated into the management of adult patients with heart failure.
2) We recommend that the hospital or cardiology clinic be integrated into the nutritionists' or cardiac rehabilitation programs for older patients and or those with low haemoglobin levels to receive regular nutritional monitoring and early nutritional support, as they are at increased risk of undernutrition.
3) Physicians and clinicians should optimize guideline-directed medical therapy (GDMT) for all patients with heart failure, which may help reduce the risk of undernutrition.
4) We recommended that other physicians should do large multicentre longitudinal studies to determine causal relationships and evaluate clinical outcomes among patients with heart failure.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Author Contributions
Dr Sadi Amri Sadi conceptualized the study, collected and analyzed the data, and drafted the manuscript. Dr Abeya Charles Fardous, Dr Kananura Keneth and Dr Rose Muhindo provided supervision, critical revisions, and mentorship throughout the research process. All authors read and approved the final manuscript.

Consent for Publication: Not applicable.

Competing Interests: The authors declare no competing interests.

List of Abbreviations and Acronyms
CBC: Complete Blood Count
CHF: Chronic Heart Failure
CKD: Chronic Kidney Disease
CONUT: Controlling Nutritional Status
COPD: Chronic Obstructive Pulmonary Disease
CVD: Cardiovascular Disease
DM: Diabetes Mellitus
FRC: Faculty Research Committee
GDMT: Guideline-Directed Medical Therapy
GNRI: Geriatric Nutritional Risk Index
HF: Heart Failure
HFpEF: Heart Failure with Preserved Ejection Fraction
HFrEF: Heart Failure with Reduced Ejection Fraction
HIV: Human Immunodeficiency Virus
HTN: Hypertension
IHD: Ischemic Heart Disease
MNA: Mini-Nutritional Assessment
MRRH: Mbarara Regional Referral Hospital
MUST: Mbarara University of Science and Technology
NYHA: New York Heart Association
PNI: Prognostic Nutritional Index
REC: Research Ethics Committee
RHD: Rheumatic Heart Disease
SANAS: South Africa Accreditation System

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