



College of Health Science

School of Medicine

Department of Internal Medicine

Prevalence of undernutrition and its associated factors among heart failure patients at the cardiology follow-up clinic of Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia.

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Abstract

Background: Many studies have consistently highlighted a significant high incidence and prevalence of undernutrition among individuals diagnosed with heart failure. No study looked into undernutrition among heart failure patients in Ethiopia or Tikur Anbessa Specialized hospital

Objective: To assess prevalence of undernutrition and associated factors among heart failure patients at the cardiology clinic of Tikur Anbessa Specialized Hospital from May 1/2023 to October 30/2023 G.C.

Method: An institution-based Cross-sectional observational study done in Tikur Anbesa Hospital. Simple random sampling was used to select 269 patients. Subjective Global Assessment (SGA) and Mini Nutritional Assessment (MNA) was employed to evaluate the undernutrition status of heart failure patient. The categorical variables in the study were presented with using frequency, percentage, and compared between groups using the chi-square test. The normal distribution of continuous variables was assessed using Shapiro-ilk test. The mean and standard deviation calculated for normality distributed data while median and interquartile range calculated for skewed data. A univariate and multivariate ordinal logistic regression analysis was performed to examine the factors associated with undernutrition in heart failure. The results of logistic regression reported as adjusted odds ratios (OR) with 95% confidence intervals and p-value < 0.05 are considered statistically significant.

Results: An analysis of 269 patients diagnosed with heart failure median age of 44(\pm (IQR=29.5) years was made. The predominant etiologies of heart failure in our study were found to be chronic rheumatic valvular heart disease (CRVHD) at 58%, ischemic heart disease (IHD) at 21.2%, and dilated cardiomyopathy (DCMP) at 10%. In this study, it was observed that the prevalence of undernutrition was 64.5% (95%CI: 53.7-75.3%) among patients below 60 years of age, while 42.6% (95%CI:25.5-59.7) of individuals aged above 60 displayed indicators of abnormal nutritional status. Following the adjustment of all variables using multivariate ordinal regression, a noteworthy observation emerged: for each additional year, there was a significant 3% decrease in the rate of undernutrition (AOR= 0.97, 95% CI (0.94, 0.99), p = 0.031).In our finding noted that chronic rheumatic valvular heart disease (AOR=1.7 (95% CI (0.23, 2.1), p = 0.52), congenital heart disease (AOR=1.7 (95% CI (0.18, 15.5), p = 0.66), and dilated cardiomyopathy (DCM) (AOR=1.3 (95% CI (0.4, 4.3), p = 0.644) had a positive association with

undernutrition but all exhibited no statistically significant associations with undernutrition. Interestingly, the study identified a contrasting trend in undernutrition prevalence based on the underlying cause of heart failure. Hypertensive heart failure demonstrated a lower likelihood of undernutrition (AOR=0.1 (95% CI (0.01, 0.6), p = 0.012)

Conclusion: Undernutrition has been notably prevalent among heart failure patients, with a higher statistical occurrence seen among younger individuals and a lower likelihood in those with hypertensive heart failure. While not statistically significant, undernutrition is also linked to factors such as a higher NYHA class, congenital heart disease (CHD), and chronic rheumatic valvular heart disease (CRVHD). These associations highlight the importance of addressing undernutrition in the management of heart failure patients, considering specific patient characteristics and medical conditions.

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Acronyms and Abbreviations

AAU	Addis Ababa University
AHA	American Heart Association
CHF/HF	Congestive heart failure/heart failure
CMI	Charlson comorbidity index
COPD	Chronic obstructive pulmonary disease
ESC	European Society of Cardiology
FMOH	Federal Ministry of Health
MNA/ MNA-SF	Mini nutritional assessment/ - Short form
NYHA	New York Heart Association
SGA	Subjective global assessment
SPSS	Statistical Package for Social Sciences
TASH	Tikur Anbessa Specialized Hospital

CHAPTER ONE: INTRODUCTION

1.1. Background

Heart failure is a complex clinical syndrome characterized by a constellation of signs and/or symptoms resulting from structural or functional abnormalities in the heart. It has contributed a significant burden in terms of disability, morbidity, economic cost, and mortality rates worldwide(1). Cachexia, defined as an involuntary weight loss of > 5 - 6 % over a period of at least six months in the absence of edema, has a prevalence between 5 and 15 %, and its prognosis is grim, with mortality rates 2 to 3 times greater than those of individuals with non-cachectic heart failure(2, 3). There are numerous pathophysiological pathways that CHF & poor nutrition have in common. The amount of energy needed to handle the symptoms of heart failure, anorexia and swallowing difficulties, the patients' restricted diets and many medications, neurohormonal and inflammatory reaction characterized by a decrease in anabolic factors and an increase in inflammatory mediators, all contribute to the malnutrition state. Additionally, comorbidities like hypertension, anemia, COPD, diabetes mellitus, and chronic renal disease, have a significant impact on both the clinical course of the illness and susceptibility to nutritional deficiencies(4, 5). To assess malnutrition among patients with congestive heart failure a various anthropometric, nutritional biomarker, bioelectrical imaging techniques, and screening tools has been employed. Evaluating malnutrition in CHF patients is challenging because the underlying loss of weight and muscle mass may be obscured by edema(6, 7). Several screening tools have been applied to CHF patients. None of them, though, has been proposed as the gold standard. As a result, any of them Nutritional Risk Screening 2002, Subjective Global Assessment, Mini Nutritional Assessment (MNA), Malnutrition Universal Screening Tool (MUST) Short Nutritional Assessment Questionnaire (SNAQ) that are currently in use are valid, always taking the context of their use into consideration (hospitalized, outpatient or elderly patient). Regarding MNA, its short version (MNA-SF) was demonstrated to be an independent predictor of muscle wasting and death in a trial of the SICA-HF programme(8, 9).

1.2.Statement of the problem

Global epidemiological data suggests that heart failure is the leading cause of global mortality, and disability(10-12). Evidences obtained from the Global Burden of Disease study indicate a substantial global burden of heart failure, with an estimated 56 million prevalent cases reported in 2019 (11). It is one the most clinical and public health challenges in prevention, control, treatment and rehabilitation , affecting around 1% to 2% of adults worldwide(12). The weight and consequences of heart failure have significantly impacted low and middle-income countries more than others. This is mainly due to their limited resources and human capacity, exacerbating the challenges associated with managing this condition effectively. Numerous international studies have delved into this disparity, conducting thorough investigations to understand and address the issue comprehensively. A notable collaborative research, the INTER-CHF prospective study, conducted between 2012 and 2014, enlisted patients with heart failure from 108 centers spanning 16 countries involving 5,823 patients found that an overall mortality rate of 16.5% was reported, with the highest rates observed in Africa (34%) and India (23%), intermediate rates in South-East Asia (15%), and the lowest rates in China (7%), South America (9%), and the Middle East (9%)(13). Many studies have consistently highlighted a significant high incidence and prevalence of malnutrition among individuals diagnosed with heart failure. Comprehensive analysis of 17 observational studies found that the prevalence of malnutrition ranging from 16% to as high as 90%(14). The prevalence rates of undernutrition, as determined through various assessment tools such as the Mini Nutritional Assessment (MNA), Geriatric Nutritional Risk Index (GNRI), and Nutritional Risk Index (NRI), exhibited ranges of 16-90%, 22-48%, and 23-90% respectively(14). In a post hoc analysis from an observational prospective study cohort study involving 151 participants diagnosed with heart failure the utilization of the Global Leadership initiative on Malnutrition (GLIM) criteria revealed abnormal nutritional status in approximately 19.8% of the patients. Additionally, when the Mini Nutritional Assessment (MNA) tool was applied, a higher proportion of patients, approximately 25.1%, were identified as having abnormal nutritional status(15).In a comparative analysis of individuals diagnosed with chronic heart failure assessed using the Subjective Global Assessment (SGA) tool, a malnutrition rate of 15.9% was identified within this cohort(9).

1.3. Significance of study

Heart failure has been contributed a paramount share to global morbidity, mortality, disability, and economic cost on a worldwide scale(10-12). Many studies have consistently highlighted a significant high incidence and prevalence of malnutrition among individuals diagnosed with heart failure. The study exploring the relationship between heart failure and malnutrition holds crucial importance in the field of healthcare and medical research. Malnutrition can significantly affect the prognosis and outcomes of individuals with heart failure. Malnourished patients tend to have poorer clinical outcomes, including higher mortality rates, longer hospital stays, and increased risk of complications. Understanding how malnutrition influences the course of heart failure can help healthcare providers tailor interventions to improve patient outcomes.

Effective management of heart failure requires a multifaceted approach that addresses not only cardiac function but also nutritional status. Nutritional interventions, such as dietary modifications, nutritional supplementation, and monitoring for malnutrition, can play a crucial role in improving quality of life and outcomes for heart failure patients. Understanding the association between these two conditions is essential for developing comprehensive treatment strategies.

Malnutrition in heart failure is a global health concern, particularly in low-resource settings where access to adequate nutrition may be limited. By studying the link between malnutrition and heart failure, researchers can advocate for policies and programs that address nutritional needs in vulnerable populations with heart failure, ultimately improving health outcomes at a population level.

CHAPTER TWO: LITERATURE REVIEW

2.1. Burden of Heart failure

Heart failure has been contributed a paramount share to global morbidity, mortality, disability, and economic cost on a worldwide scale(10-12). The impact of heart failure varies significantly across different geographical regions, socioeconomic development levels (SDI), and healthcare systems(10-12). The nuances in the distribution of its effects highlight the complex interplay between geographic location, socioeconomic status, and healthcare infrastructure in shaping the outcomes and management of heart failure on a global scale. Evidences obtained from the Global Burden of Disease study indicate a substantial global burden of heart failure, with an estimated 56 million prevalent cases reported in 2019. The age-standardized prevalence rate was recorded at 712 per 100,000 individuals, underscoring the pervasive impact of this cardiovascular condition on populations worldwide(11). Age-standardised mortality rate of heart failure varied by regions I 2022, with high-income Asia pacific having 73.6 per 100,000 and Eastern Europe having 432.3 per 100,000(10). Heart failure is a significant global challenge in the realms of both clinical practice and public health, affecting around 1% to 2% of adults worldwide(12). As our population ages, the incidence of heart failure is on the rise, which not only impacts the quality of life for those affected but also places a growing economic strain on individuals and public health systems. The regional variation of burden of heart failure across regions has been a subject of interest in many international collaborative studies. A notable collaborative research, the INTER-CHF prospective study, conducted between 2012 and 2014, enlisted patients with heart failure from 108 centers spanning 16 countries involving 5,823 patients found that an overall mortality rate of 16.5% was reported, with the highest rates observed in Africa (34%) and India (23%), intermediate rates in South-East Asia (15%), and the lowest rates in China (7%), South America (9%), and the Middle East (9%)(13). Different trends in 1-year mortality rates were found in the REPORT-HF global registry, which collected data on patients hospitalized for acute heart failure from 44 countries on six continents. Patients from the

Eastern Mediterranean and Africa region, as well as Latin America, had the highest 1-year mortality rates (22%), while patients from Eastern Europe had the lowest rate (16%)(16, 17).

In the European Society of Cardiology Heart Failure Long-Term Registry (ESC-HF-LT-R), a prospective observational study involving 211 cardiology centers across 21 European and/or Mediterranean countries from May 2011 to April 2013, data was gathered from a substantial cohort of 12,440 patients found that the all-cause 1-year mortality rates of acute heart failure (AHF) and chronic heart failure were 23.6% and 6.4% respectively(18). The regional disparities in heart failure prevalence primarily stem from variations in data registry quality, the economic status of a country, the robustness of its healthcare system, and the distribution of risk factors among populations.

2.2. Prevalence of malnutrition among patients with heart failure

Many studies have consistently highlighted a significant high incidence and prevalence of malnutrition among individuals diagnosed with heart failure. Comprehensive analysis of 17 observational studies found that the prevalence of malnutrition ranging from 16% to as high as 90%(14). The prevalence rates of undernutrition, as determined through various assessment tools such as the Mini Nutritional Assessment (MNA), Geriatric Nutritional Risk Index (GNRI), and Nutritional Risk Index (NRI), exhibited ranges of 16-90%, 22-48%, and 23-90% respectively(14). This diversity in prevalence rates highlights the importance of utilizing multiple assessment methods to gain a comprehensive understanding of undernutrition in different populations and underscores the need for tailored interventions to address this critical aspect of patient care effectively(14). A study conducted on 467 consecutive patients with heart failure found that the prevalence of malnutrition among individuals with heart failure can reach as high as 62%, varying in severity, and is linked to heightened rates of morbidity and mortality(8). Despite this significant impact, there remains a lack of a universally recognized standard tool for accurately evaluating malnutrition in this patient population(8). In a comprehensive meta-analysis pooling data from 31 observational studies and encompassing a substantial cohort of 12537 patients with heart failure found that the total prevalence of malnutrition was approximately 46%(19). Assessing the prevalence of malnutrition in individuals with heart

failure poses a significant challenge, primarily due to the variability in measurement tools and methods utilized across studies(20). The complexity of accurately quantifying malnutrition in this population highlights the need for standardized and consistent approaches to effectively capture and address this critical aspect of heart failure management(20). In a post hoc analysis from an observational prospective study cohort study involving 151 participants diagnosed with heart failure the utilization of the Global Leadership initiative on Malnutrition (GLIM) criteria revealed abnormal nutritional status in approximately 19.8% of the patients. Additionally, when the Mini Nutritional Assessment (MNA) tool was applied, a higher proportion of patients, approximately 25.1%, were identified as having abnormal nutritional status(15). In a comparative analysis of individuals diagnosed with chronic heart failure assessed using the Subjective Global Assessment (SGA) tool, a malnutrition rate of 15.9% was identified within this cohort(9). Data on the prevalence and impact of cardiovascular disorder in Ethiopia remains scarce. However, an analysis of global burden of disease has found that cardiovascular disorders was the leading cause of mortality and disability in Ethiopia and across regions(21).

2.3. Clinical impacts of malnutrition among heart failure patients

Numerous investigations conducted globally have established a compelling association between malnutrition and a range of adverse clinical outcomes in various populations. From increased rates of hospitalizations, prolonged stays in healthcare facilities, and elevated transfers to intensive care units, to heightened overall morbidity and mortality rates, the impact of malnutrition reverberates across multiple dimensions of health and well-being(9, 15, 19)

CHAPTER THREE: OBJECTIVES

3.1 General objective

- To assess prevalence of under-nutrition and associated factors among heart failure patients at the cardiology clinic of Tikur Anbessa Specialized Hospital from May 1/2023 to October 30/2023 G.C.

3.2 Specific objectives

- To assess the prevalence of under-nutrition among heart failure patients at the cardiology clinic of Tikur Anbessa Specialized Hospital (TASH)
- To assess determinant factors for undernutrition among heart failure patients at the cardiology clinic of Tikur Anbessa Specialized Hospital (TASH)

CHAPTER: METHODS AND MATERIALS

4.1 Study area:

The study conducted at the cardiology clinic at Tikur Anbessa Specialized Hospital (TASH), which is the largest referral hospital in Ethiopia and is situated in Addis Abeba, the capital city. Since its founding in 1972, the hospital has served as the primary site for the delivery of specialty clinical services to a wide range of cases referred from around the nation. It is also the primary location for preclinical and clinical teaching in the majority of disciplines within its many departments. One of the specialty clinics is the cardiology clinic, which offers treatment and follow-up for patients with various cardiovascular problems, primarily heart failure patients. Based on audit reports, the cardiology clinic sees 1000–1500 patients every month.

4.2 Study period:

The study conducted over six months from May 1/2023 to October 30/ 2023 G.C

4.3 Study Design:

The institutional based cross-sectional observational study conducted at Tikur Anbessa Specialized Hospital from May 1/2023 to October 30/ 2023 G.C, aimed to assess the prevalence of undernutrition among heart failure patients.

4.4 Population

4.4.1 Sources population

- All patients with heart failure who visited the cardiology clinic of TASH.

4.4.2 Study population

- All patients who meet the eligibility

4.5 Eligibility Criteria

4.5.1 Inclusion criteria

- All patients who fulfill 2021 joint society of heart failure (i.e – current or prior heart failure symptoms/signs plus structural abnormalities on echocardiography) on follow-up at TASH cardiology clinic seen during the study period willing to participate in the study & ≥ 18 years old

4.5.2 Exclusion criteria

- All patients who don't fulfill 2021 joint society definition of heart failure
- Pregnant or within 6 weeks postpartum period

4.6 Sample size;

The sample size is determined by using the formula for single population proportion considering a prevalence of undernutrition of 77.8 % from a study done in Jimma university specialized hospital from a study done in Addis Ababa public hospitals. The sample was calculated by assuming a Confidence interval of 95%, 5% margin of error, & 10% non-response rate.

$$n = (Z_{\alpha/2})^2 \times P(1-p) / d^2$$

Where: n = Sample size

$$P = 77.8\%;$$

d= margin of error

Z ($\alpha/2$)²= confidence interval and significance level

$$n = (1.96)^2 \times 0.778 (1-0.778) / d^2 = 265 + 10\% \text{ non-response rate} = 292 \text{ patients}$$

4.7 Sampling procedures

Simple random sampling was used by identifying heart failure patients on each clinic visit day until the sample size is completed.

4.8 Study Variables

4.8.1 Dependent variable

- Undernutrition

4.8.2 Independent variables

- Age
- Sex
- Marital status,
- occupation,
- Education
- Signs of heart failure
- Echocardiography
- NYHA class
- Cause of heart failure
- Comorbidities
- CMI

4.9 Operational Definitions

- **Heart failure:** - is described as a clinical syndrome with current or prior signs and/or symptoms brought on by a structural (echocardiographic assessment) or functional (BNP/NT-Pro BNP measurement) cardiac defect and supported by increased natriuretic peptide levels as well as/or by concrete proof of pulmonary or systemic congestion.
- **Subjective global assessment (SGA)** is a commonly used, reliable, and valid nutritional assessment technique for diagnosing malnutrition. It is a subjective assessment based on a medical history and physical examination. The grading system consists of three levels: level A represents well-nutrition, level B represents moderate malnutrition, and level C represents severe malnutrition(22).
- **MNA is one of** reliable, and valid nutritional assessment technique for diagnosing malnutrition in elderly population. MNA score 24 to 30 points -normal nutritional status, 17 to 23.5 points at risk of malnutrition and, less than 17 points Malnourished(23).

- **Cachexia;** defined as an involuntary weight loss of > 5 - 6 % over a period of at least six months in the absence of edema.
- **Sarcopenia;** is characterized by a decrease in fat mass, defined as the loss of skeletal muscle mass and strength.

4.10 Data collection and procedures

The structured questionnaire used in the study was developed based on previous published literature and included sections on sociodemographic data, dietary history, clinical profiles, and biochemical tests. Before the main data collection, the questionnaire was pretested with 5% of the sample size to ensure clarity and relevance of the questions. In addition to the questionnaire, electronic medical records were utilized to extract clinical and biochemical test results of the heart failure patients. This comprehensive approach allowed for a thorough assessment of the patients' nutritional status. To assess the nutrition status of heart failure patients, the subjective global assessment tool was used for patients below 60 years of age(22), while the Mini Nutrition Assessment (MNA) was employed for elderly patients(23). These tools are widely recognized and validated methods for evaluating nutritional status and provided valuable insights into the prevalence of undernutrition among the study participants.

4.11 Data processing and analysis

The categorical variables in the study were presented with using frequency, percentage, and compared between groups using the chi-square test. The normal distribution of continuous variables was assessed using Shapiro-ilk test. The mean and standard deviation calculated for normality distributed data while median and interquartile range calculated for skewed data. Multicollinearity test performed for categorical, continuous and binary variables. Multicollinearity measured by variance inflation factor (VIF) and tolerance. When a VIF was

below five and tolerance was above 0.1, variables were forwarded to multivariable ordinal logistic regression analysis. Variables with a VIF score of ≥ 5 to 10 and tolerance below 0.1 were excluded from the final model. A univariate ordinal logistic regression analysis was performed to examine the factors associated with malnutrition in heart failure. Variables with p-value 0.25 or less in the bivariate analysis were entered into the multivariable ordinal logistic model. A multiple ordinal logistic regression model was performed to assess independent association between factors and malnutrition in heart failure. The results of logistic regression reported as adjusted odds ratios (OR) with 95% confidence intervals and p-value < 0.05 are considered statistically significant.

4.12. Ethical consideration

The ethical approval was obtained from the Institutional Review Board, ethical review committees of the Department of Internal medicine, college of medicine and health sciences, Addis Ababa University. Written informed consent was taken from all the participants after making sure that adequate explanations are given to participants about the study project and their right not to be involved in the study if they do not wish and their ability to withdraw from the study.

CHAPTER: FIVE

5.1. Results

In a detailed examination involving a cohort of 269 patients diagnosed with heart failure, the analysis revealed a median age of 44 years with an interquartile range (IQR) of 29.5 years, indicating variability in the age distribution within the patient population. Females constituted a majority of the patients at 61%, underscoring the gender distribution in the study cohort. Moreover, a significant proportion of patients hailed from Addis Ababa, with 63.2% of individuals originating from this region. These demographic insights provide valuable context regarding the age, gender composition, and geographical distribution of patients with heart failure in the study population, offering a foundation for further research and tailored healthcare interventions aimed at addressing the multifaceted aspects of heart failure in diverse patient groups.

Table 1: Sociodemography characteristics of patients on heart failure at Tikur Anbesa, Ethiopia 2024

Variable	Response	Frequency	Percentage
Age	Median \pm IQR	44 \pm 29.5	
Sex	Female	164	61.0
	Male	105	39.0
Marital status	Currently married	157	58.4
	Divorced	31	11.5
	Never married	47	17.5
	Widowed	34	12.6
Education	College/ University completed	37	13.8
	High school completed	42	15.6
	Less than primary school	42	15.6
	No formal education	42	15.6
	Post graduate degree	3	1.1
	Primary school completed	48	17.8
	Secondary school completed	55	20.4
Regions	Addis Ababa	170	63.2
	Amhara	9	3.3
	B/Gumuz	1	.4
	Dire-Dawa	1	.4
	Harari	1	.4
	Oromia	68	25.3
	SNNPR	14	5.2
	Tigray	5	1.9
Occupation	Government employ	27	10.0
	Self-employ	82	30.5
	Unemployed	160	59.5

Clinical presentation

An analysis of 269 patients, each with a median duration of heart failure lasting around 5 years (IQR= \pm 8 years), our study provided valuable insights into the clinical characteristics of this

patient cohort. The majority of individuals with heart failure were classified as NYHA Class II (50.6%), indicating mild to moderate symptoms, while a substantial proportion fell into NYHA Class III (42.8%), reflecting more advanced stages of the condition. Upon further investigation, the predominant etiologies of heart failure in our study cohort were found to be chronic rheumatic valvular heart disease (CRVHD) at 58%, ischemic heart disease (IHD) at 21.2%, and dilated cardiomyopathy (DCMP) at 10%. Notably, a large percentage of patients with heart failure exhibited preserved ejection fraction (EF) at 82.5%, indicating a subtype of heart failure with EF values within the normal range despite the presence of clinical symptoms. These findings offer valuable insights into the diverse presentations and underlying causes of heart failure in our patient population and emphasize the importance of tailored management strategies based on the specific characteristics of the condition. The nutritional status of individuals with heart failure was evaluated using different assessment tools based on age groups, with the Subjective Global Assessment (SGA) utilized for those below 60 years and the Mini Nutritional Assessment (MNA) for those aged 60 years and above. Among the 214 patients assessed using the SGA tool, the findings revealed the prevalence of undernutrition in any degree was 64.5% (95%CI: 53.7-75.3%) among patients below 60 years of age- 6.1% (95%:2.8-9.4%) were classified as Class C and 58.4% (95%CI: 47.8-68.6) as Class B, indicating varying degrees of nutritional status within the cohort.

Moreover, among the 55 heart failure patients evaluated using the MNA tool, 43.6% exhibited abnormal nutritional status. Within this group, 14.5% were classified as malnourished, and 29.1% were identified as at risk of malnutrition. This data underscores the critical understanding of nutritional status and the associated challenges encountered by individuals with heart failure across various age brackets.

Table 2: The clinical profile of patients on heart failure at Tikur Anbesa, Ethiopia 2024

Variable	Response	Frequency	Percentage
Albumen(N=73)	Low	13	4.8
	Normal	60	22.3
Total cholesterol level (N=118)	Normal	103	38.3
	Borderline	9	3.3
	High	6	2.2
Duration of HF	Median ±IQR	5±8	
Class	NYHA Class I	14	5.2
	NYHA Class II	136	50.6

	NYHA Class III	115	42.8
	NYHA Class IV	4	1.5
Sign of current congestion	Yes	82	30.5
	No	187	69.5
Cause of HF	CRVHD	156	58.0
	HHD	21	7.8
	DCMP	27	10.0
	HOCMP	2	.7
	CHD	6	2.2
	IHD	57	21.2
EF	Preserved EF >50	222	82.5
	Mild reduced 41-49	16	5.9
	Reduced <40	31	11.5
Comorbidity	No	145	53.9
	Yes	124	46.1
BMI	Underweight	45	16.7
	Normal	150	55.8
	Overweight	60	22.3
	Class I obesity	12	4.5
	Class II obesity	1	.4
	Class III Obesity	1	.4
MUAC	Severe malnutrition	12	5.6
	Moderate malnutrition	39	18.2
	Normal	163	76.2
SGA(N=214)	A	75	35.5
	B	125	58.4%(95%CI:47.8,68.6)
	C	13	6.1% (95%:2.8-9.4%)
MNA(N=55)	Malnourished	8	14.5
	Normal	31	56.4
	At risk of malnutrition	16	29.1

In the study, univariate and multivariate ordinal regression were conducted to identify factors associated undernutrition in patients with heart failure. The univariate ordinal regression analysis highlighted important variables such as age, NYHA class, comorbidity, causes of heart failure and echocardiography ejection. These variables were subsequently selected as key factors to be incorporated into the multivariate ordinal regression analysis, aimed at delving deeper into the complex interplay of factors influencing malnutrition in heart patients. Following the adjustment of all variables using multivariate ordinal regression, a noteworthy observation

emerged: for each additional year, there was a significant 3% decrease in the rate of undernutrition (AOR= 0.97, 95% CI (0.94, 0.99), p = 0.031). Further analysis revealed compelling associations between specific heart failure characteristics and undernutrition. Interestingly, the study identified a contrasting trend in undernutrition prevalence based on the underlying cause of heart failure. Hypertensive heart failure demonstrated a lower likelihood of undernutrition (AOR=0.1 (95% CI (0.01, 0.6), p = 0.012) as compared with other causes of heart failure. In contrast, heart failure etiologies such as chronic rheumatic valvular heart disease (AOR=1.7 (95% CI (0.23, 2.1), p = 0.52), congenital heart disease (AOR=1.7 (95% CI (0.18, 15.5), p = 0.66), and dilated cardiomyopathy (DCM) (AOR=1.3 (95% CI (0.4, 4.3), p = 0.644) had a positive association with undernutrition, but all exhibited no statistically significant associations with malnutrition.

Table 3: Univariate and multivariate ordinal regression analysis to identified factors associated of undernutrition in patients on heart failure at Tikur Anbesa, Ethiopia 2024

Variable	Response	A	B	C	COR (95%CI)	P	AOR (95%CI)	P
Age					0.96(.94,0.98)	0.000	0.97(0.94,.0.99)	0.031*
Sex	Female	49	83	8	1.1(0.6,1.8)	0.86		
	Male	26	42	5	1			
Education	College/ University completed	15	16	2	0.7(.29, 1.7)	.434		
	High school completed	14	21	2	.0.92(.39,2.2)	.843		
	Less than primary school	11	18	3	1.0(0.40, 2.5)	.966		
	No formal education	8	17	0	0.99(.39, 2.6)	.987		
	Primary school completed	9	27	2	1.5(0.65, 3.64)	.324		
	Secondary school completed	18	26	4	1			
Marital	Currently	52	72	3	0.9(0.31,	.823		

status	married				2.6)			
	Divorced	7	16	2	1.7(0.46, 6.1)	.437		
	Never married	12	27	8	2.5(0.76, 8.30)	.129		
	Widowed	4	10	0	1			
Occupation	Government employ	8	18	1	1.1(0.5, 2.6)	.750		
	Self-employ	28	42	4	0.9(.49, 1.6)	.686		
	Unemployed	39	65	8	1			
NYHA Class	1	8	4	0	0.1(.007,1.14)	.063	0.1(.005 1.1)	.055
	2	47	58	6	0.25(0.03,2.5)	.234	0.34(0.03, 3.97)	.393
	3	20	60	7	0.54(0.05,5.3)	.595	0.75(0.1, 8.7)	.819
	4	0	3	0	1		1	
Comorbidity	No	39	84	12	2.4(1.8 4.2)	0.002*	1.4(0.67, 2.9)	0.35
	Yes	36	41	1	1			
CMI					0.96(0.8, 1.1)	0.45		
Causes of HF	CRVHD	43	90	10	2.2(0.98, 4.78)	.056	1.7(0.23, 2.1)	.520
	HHD	9	2	0	0.13(0.022,0.78)	.025	0.1(0.01, 0.6)	.012*
	DCMP	8	14	1	1.7(0.57, 4.97)	.346	1.3(0.4, 4.3)	.654
	HOCMP	0	2	0	5.2(0.30, 90.3)	.255	2.2(0.10, 51.1)	.615
	CHD	2	2	2	5.2(0.6,42.1)	.119	1.7(018, 15.5)	.644
	IHD	13	15	0	1		1	
	Duration of HF				1.0(0.95, 1.2)	0.9		
EF Class	Preserved EF >50	58	110	13	4.2(1.6,10.5)	.003	4.5(1.5, 13.3)	.007*
	Mild reduced 41-49	3	8	0	4.2(1.0,17.8)	.05	5.7(1.24, 26.4)	.026*
	Reduced <40	14	7	0	1		1	
Sign of current congestion	Yes	21	36	5	1.1(0.6, 1.95)	0.8		
	No	54	89	8	1			
Hemoglobin					0.93(0.8, 1.1)	0.33		

CHAPTER SIX: DISCUSSION AND RECOMMENDATION

6.1. Discussion

This comprehensive research delved into the prevalence of undernutrition among patients with heart failure patients with different nutritional assessment tools. The Subjective Global Assessment (SGA) tool was harnessed as a pivotal instrument to assess the nutritional status of individuals under the age of 60 facing heart failure. In a detailed examination facilitated by the Subjective Global Assessment (SGA) tool, a thorough evaluation was undertaken within a cohort consisting of 214 heart failure patients. This comprehensive analysis unearthed a significant prevalence of malnutrition within the studied population, with a striking 64.5 % of individuals showcasing varying degrees of undernutrition.

The findings from this study revealed a nuanced picture of undernutrition within the heart failure patient group, with 58.4% of the participants demonstrating moderate malnutrition and an additional 6.1% struggling with severe malnutrition. These statistics underline the complex interplay between nutritional status and heart failure, highlighting the critical importance of

addressing malnutrition as an integral part of comprehensive patient care strategies. In addition to the utilization of the Subjective Global Assessment (SGA) tool for younger age, the Mini Nutritional Assessment (MNA) tool emerged as a crucial instrument in the comprehensive evaluation of nutritional status among a cohort of 56 heart failure patients aged above 60 years, the findings illuminated that 42.6% of individuals exhibiting signs of abnormal nutritional status. Within this subgroup, 14.2% were identified as malnourished, while a substantial 28.6% were deemed to be at risk of malnutrition.

Previous published observational and meta-analysis studies have reported varying rate of prevalence rates of undernutrition among heart failure patients when assessed using with different nutritional assessment tools. In an observational prospective cohort study with 151 participants diagnosed with heart failure, the Mini Nutritional Assessment (MNA) tool identified approximately 25.1% of patients with abnormal nutritional status (15). Conversely, when the Subjective Global Assessment (SGA) tool was employed in a similar participant group, a malnutrition rate of 15.9% was observed within this cohort(9). In a comprehensive meta-analysis pooling data from 31 observational studies and encompassing a substantial cohort of 12537 patients with heart failure found that the total prevalence of any degree malnutrition was approximately 46%(19). In another extensive meta-analysis comprising 17 observational studies, the prevalence of malnutrition was identified to vary significantly, ranging from 16% to as high as 90% when utilizing different nutritional assessment tools. The prevalence rates of undernutrition, as evaluated through diverse assessment tools including the Mini Nutritional Assessment (MNA), Geriatric Nutritional Risk Index (GNRI), and Nutritional Risk Index (NRI), exhibited ranges of 16-90%, 22-48%, and 23-90% respectively(14). These findings underscore the importance of elevating nutritional considerations within the realm of heart failure care, advocating for a comprehensive evaluation of nutritional status as a fundamental component of multidisciplinary care plans.

Various factors have been attributed to the occurrence of undernutrition in patients with heart failure. These contributory factors encompass a multitude of influences, ranging from physiological and metabolic aspects to dietary practices, comorbid conditions, socioeconomic factors, and the complex interplay of medical treatments and lifestyle choices. Within the context of this study, a multifactorial analysis revealed significant associations between malnutrition and

various factors in heart failure patients. The New York Heart Association (NYHA) classification, patient age, echocardiography-derived ejection fraction, comorbidities, and underlying causes of heart failure were all identified as key variables demonstrating relationships with malnutrition.

Our findings suggested a trend where lower New York Heart Association (NYHA) classifications were associated to a lower prevalence of undernutrition compared to the higher classes, although this association did not reach statistical significance. A parallel observation was made in a study involving 467 consecutive heart failure patients in the UK, reinforcing the notion that NYHA classification may play a role in influencing malnutrition rates(8). The reasons behind this pattern warrant further investigation and consideration. Possible explanations may encompass the varying levels of physical activity, symptom severity, dietary habits, and overall health status associated with different NYHA classes. Understanding the nuances of how NYHA classification intertwines with nutritional status in heart failure patients can provide valuable insights for tailored interventions and care approaches to address undernutrition risks effectively within this patient population.

Our analysis also revealed notable associations between the underlying causes of heart failure and the presence of undernutrition. Hypertensive heart disease demonstrated a significantly lower rate of undernutrition, a finding supported by a high level of statistical significance ($p = 0.031$). The rationale behind this intriguing association can be attributed to the prevalence of hypertension in patients with metabolic syndrome. As hypertension often coexists with metabolic abnormalities, individuals with hypertensive heart disease may exhibit a lower likelihood of undernutrition due to these underlying metabolic factors.

Conversely, chronic rheumatic valvular heart disease (CRVHD), congenital heart disease (CHD), and dilated cardiomyopathy (DCMP) displayed higher rates of undernutrition, despite the lack of statistical significance in the associations. The reasoning behind the elevated prevalence of undernutrition in CRVH and CHD patients can be linked to the onset of these conditions at a younger age, their long-term persistence, and the potential impact on dietary patterns. The chronic nature of CRVHD and CHD, coupled with their influence on dietary habits over an extended period, may contribute to the higher rates of undernutrition observed in these patient groups.

In intriguing findings from our study unveiled a higher prevalence of undernutrition among younger individuals. For every one-year increment in age, there was a 3% decrease in the likelihood of undernutrition ($p = 0.002$). This trend can potentially be attributed to the fact that conditions like congenital heart disease (CHD) and chronic rheumatic valvular heart disease (CRVH) are more commonly observed in younger age groups. These heart conditions, prevalent in younger individuals, can exert a significant impact on their nutritional status, potentially influencing the higher occurrence of malnutrition in this demographic. Conversely, as individuals age, the risk factors for heart diseases like ischemic heart disease (IHD) and hypertensive heart disease (HHD) become more prevalent, often associated with conditions such as metabolic syndrome. Metabolic syndrome, characterized by a cluster of metabolic abnormalities, poses a higher risk for heart diseases typically seen in older age groups. The association of these conditions with advanced age may contribute to the differing nutritional status observed across age groups, with older individuals facing a distinct set of risk factors affecting their nutritional health. The observed association between age, specific heart diseases, and malnutrition underscores the complex interplay of age-related cardiovascular conditions and their implications for nutritional well-being.

6.2. Recommendation

Upon analyzing our research data, it has become evident that undernutrition is significantly prevalent among individuals with heart failure, particularly in cases associated with high NYHA class, younger age, congenital heart disease (CHD), and chronic rheumatic valvular heart disease (CRVHD). The study recommended to healthcare providers to advocate for routine screening of malnutrition in heart failure patients as part of standard care protocols. Early identification and intervention can significantly improve treatment outcomes and quality of life for these individuals. The study also recommended to Ethiopia Internal Medicine Society and Health Professionals to encourage the adoption and validation nutrition assessment tools specifically tailored for heart failure patients within the Ethiopian healthcare system. These tools can provide

more accurate and culturally relevant insights into the nutritional status of patients, facilitating better-informed care decisions. This study also recommended to policy makers to develop and implement a comprehensive nutritional assessment and intervention policy targeting undernutrition in individuals with heart failure. By integrating evidence-based guidelines and interventions into healthcare policies, policymakers can enhance nutritional support services for this vulnerable population. Finally, the study strongly recommended the collaboration of nutrition experts and researchers to further investigate the impact of undernutrition on heart failure outcomes and explore innovative strategies for nutritional support.

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