# Exploring the Impact of Malnutrition on Cardiovascular Health: A Combined Nursing, Nutrition, and Ultrasound Approach

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**Abstract**

**Malnutrition is a critical factor that exacerbates cardiovascular disease (CVD) outcomes, particularly among hospitalized patients. This prospective cohort study was conducted at a tertiary hospital to investigate the impact of nutritional interventions on cardiovascular health in malnourished patients with CVD. A multidisciplinary team involving nurses, clinical nutritionists, and sonographers provided individualized nutritional support, monitored nutritional status, and assessed cardiovascular function using ultrasound imaging. Significant improvements were observed in left ventricular ejection fraction (LVEF) and left ventricular wall thickness, along with improved nutritional status. These findings emphasize the importance of early detection and management of malnutrition and highlight the value of an integrated approach in optimizing cardiovascular outcomes for malnourished patients.**

**Keywords**: **Malnutrition, Cardiovascular Disease, Nutritional Intervention, Left Ventricular Function, Multidisciplinary Care, Ultrasound Assessment, Hospitalized Patients**

**Introduction**

Malnutrition, characterized by deficiencies or imbalances in nutrient intake, is a prevalent issue globally and has significant effects on health, particularly among hospitalized patients (Correia & Waitzberg, 2003). Malnutrition is known to exacerbate the risk of morbidity and mortality, especially among individuals with chronic diseases, such as cardiovascular disease (CVD) (Norman et al., 2008). Cardiovascular disease remains the leading cause of death worldwide, accounting for 17.9 million deaths each year (Mendis et al., 2007). There is growing evidence that malnutrition, whether due to undernutrition or poor quality diets, can have a profound impact on cardiovascular health (Carbone et al., 2017).

The relationship between malnutrition and cardiovascular health is complex. Malnutrition can lead to an imbalance in metabolic function, which may contribute to the progression of atherosclerosis and other cardiovascular conditions (Ekpenyong,2017). For example, deficiencies in essential nutrients such as omega-3 fatty acids, vitamins, and minerals have been linked to increased inflammation, oxidative stress, and endothelial dysfunction, all of which play a role in the pathophysiology of cardiovascular diseases (Cano-Torres et al., 2017; Lavie et al., 2009). Moreover, malnourished patients tend to have reduced muscle mass and impaired immune function, which may negatively affect their ability to recover from cardiovascular events (Anker et al., 1997).

Early identification and targeted nutritional intervention are critical in managing malnutrition in patients with cardiovascular conditions. Ultrasound imaging, which allows for non-invasive assessment of cardiovascular structure and function, can serve as a valuable tool in evaluating the effects of nutritional interventions on cardiovascular health (Yancy et al., 2013). Utilizing a multidisciplinary approach that involves nurses, clinical nutritionists, and sonographers can ensure that patients with cardiovascular disease receive comprehensive care. Nurses are pivotal in screening and monitoring patients for signs of malnutrition, while nutritionists can provide individualized dietary plans, and sonographers can assess the impact of these interventions on cardiovascular health.

By combining nutritional support, ultrasound assessment, and patient care, this study aims to investigate the impact of malnutrition on cardiovascular health. It will also assess how nutritional interventions can potentially improve cardiovascular outcomes, ultimately contributing to a more effective and integrative model of care for patients with cardiovascular disease.

## Literature Review

The relationship between malnutrition and cardiovascular health has been the subject of increasing research over the past decades. Studies have demonstrated that malnutrition significantly contributes to poor outcomes in patients with cardiovascular diseases (CVD). According to Norman et al. (2008), disease-related malnutrition is associated with increased mortality and morbidity, emphasizing the importance of early detection and management. Malnutrition can lead to adverse effects on cardiovascular function, including compromised heart muscle mass and impaired cardiac output (Anker et al., 1997).

A systematic review by Lavie et al. (2009) highlighted the paradoxical relationship between body weight and cardiovascular risk, suggesting that while obesity is often linked to CVD, malnutrition and underweight status also pose significant risks. Malnutrition, specifically protein-energy malnutrition, is associated with diminished muscle mass, including cardiac muscle, which can lead to worsened heart function and increased vulnerability to cardiovascular events. The review emphasized that patients who are undernourished may have impaired metabolic responses, leading to increased susceptibility to arrhythmias, heart failure, and other complications (Lavie et al., 2009).

The role of specific nutrient deficiencies in cardiovascular health has also been well-documented. For instance, deficiencies in omega-3 fatty acids, which are known for their anti-inflammatory properties, have been linked to increased cardiovascular risk due to heightened inflammation and oxidative stress (Ekpenyong,2017). Similarly, Cano-Torres et al. (2017) found that deficiencies in essential vitamins and minerals, such as vitamin D and magnesium, are associated with endothelial dysfunction, a key contributor to atherosclerosis. Addressing these deficiencies through nutritional interventions may help mitigate the progression of cardiovascular disease.

The importance of a multidisciplinary approach in managing malnutrition among patients with cardiovascular diseases has been increasingly recognized. Yancy et al. (2013) underscored the value of utilizing ultrasound imaging in assessing cardiovascular function in malnourished patients. Ultrasound serves as a non-invasive tool that can provide valuable insights into the structural and functional changes occurring in the heart, particularly in patients with poor nutritional status. Such assessments can be instrumental in tailoring nutritional interventions to improve patient outcomes.

Carbone et al. (2017) discussed the obesity paradox in heart failure, suggesting that while obesity is often a risk factor for CVD, a higher body mass index (BMI) may sometimes be protective in patients with chronic heart failure. This paradox highlights the complex interplay between nutritional status and cardiovascular health, suggesting that not only undernutrition but also the type and distribution of body fat can impact patient prognosis. This further supports the need for individualized nutritional assessment and intervention to optimize cardiovascular health outcomes.

In clinical settings, nurses, clinical nutritionists, and sonographers each play a crucial role in addressing malnutrition and cardiovascular health. Nurses are often the first to screen for malnutrition using tools such as the Malnutrition Universal Screening Tool (MUST) and provide ongoing monitoring and support (Correia & Waitzberg, 2003). Nutritionists are essential in developing individualized dietary plans that address specific nutrient deficiencies and overall caloric needs, while sonographers contribute by using ultrasound to assess cardiac structure and function, thus helping to evaluate the effectiveness of nutritional interventions.

The integration of these disciplines ensures a comprehensive approach to managing malnutrition in patients with cardiovascular disease. By employing targeted nutritional interventions and monitoring their effects through advanced imaging techniques, healthcare providers can work towards improving cardiovascular health outcomes in malnourished patients. This literature review underscores the need for continued research into effective, multidisciplinary interventions aimed at optimizing nutritional status and cardiovascular health.

**Methodology**

This study was conducted at a tertiary hospital to investigate the impact of malnutrition on cardiovascular health and to assess how nutritional interventions can improve cardiovascular outcomes. The research employed a prospective cohort design, focusing on patients admitted to the cardiology unit who were identified as being at risk of malnutrition.

Study Population

The study included 150 adult patients diagnosed with cardiovascular disease who were admitted to the cardiology unit over a six-month period. Inclusion criteria were adults aged 18 years and older, diagnosed with cardiovascular disease, and at risk of malnutrition as determined by the Malnutrition Universal Screening Tool (MUST). Patients with severe comorbidities unrelated to cardiovascular health or those receiving palliative care were excluded from the study.

Data Collection

Data were collected at baseline and during follow-up visits over a three-month period. Nutritional status was assessed using the Malnutrition Universal Screening Tool (MUST), which was administered by trained nursing staff. Clinical nutritionists conducted dietary assessments and provided individualized nutritional interventions, including dietary counseling and supplementation where necessary.

Cardiovascular health was assessed using ultrasound imaging conducted by sonographers. Parameters such as left ventricular ejection fraction (LVEF), wall thickness, and other indicators of cardiovascular function

were measured at baseline and at three-month follow-up. The sonographers were blinded to the patients' nutritional status to reduce bias.

Intervention

Patients identified as malnourished received targeted nutritional interventions from clinical nutritionists. These interventions included individualized dietary plans designed to meet the specific nutritional needs of each patient, with a focus on increasing protein and calorie intake. Oral nutritional supplements were provided as needed. The nursing staff provided continuous monitoring, patient education, and support throughout the intervention period.

Data Analysis

Quantitative data were analyzed using statistical software (SPSS, version 26.0). Descriptive statistics were used to summarize patient demographics, baseline nutritional status, and cardiovascular parameters. Paired t-tests were conducted to assess changes in cardiovascular parameters before and after the nutritional intervention. A multivariate regression analysis was performed to determine the relationship between improvements in nutritional status and changes in cardiovascular function, controlling for confounding factors such as age, gender, and baseline cardiovascular health.

Ethical Considerations

Ethical approval was obtained from the hospital's ethics committee prior to commencing the study. All participants provided written informed consent. Patient confidentiality was maintained throughout the study, and all data were anonymized for analysis.

**Findings**

The study found significant improvements in cardiovascular parameters following nutritional intervention in malnourished patients. The mean left ventricular ejection fraction (LVEF) improved from 45.2% at baseline to 50.8% at the three-month follow-up ($p < 0.01$). There was also a significant decrease in left ventricular wall thickness, from a mean of 13.4 mm at baseline to 11.9 mm at follow-up ($p < 0.05$). Table 1 provides a summary of changes in cardiovascular parameters before and after the intervention.

**Table 1. Changes in Cardiovascular Parameters Before and After Nutritional Intervention**

| Parameter | Baseline (Mean ± SD) | Follow-Up (Mean ± SD) | p-value |
|---|---|---|---|
| Left Ventricular Ejection Fraction (LVEF) (%) | 45.2 ± 7.1 | 50.8 ± 6.5 | <0.01 |
| Left Ventricular Wall Thickness (mm) | 13.4 ± 1.8 | 11.9 ± 1.6 | <0.05 |

Nutritional status also showed notable improvements. The mean MUST score decreased from 3.1 at baseline to 1.5 at follow-up, indicating a reduced risk of malnutrition ($p < 0.01$). Additionally, patients demonstrated significant weight gain, with a mean increase of 2.3 kg over the three-month period ($p < 0.05$). Table 2 provides a summary of changes in nutritional parameters before and after the intervention.

**Table 2. Changes in Nutritional Parameters Before and After Nutritional Intervention**

| Parameter | Baseline (Mean ± SD) | Follow-Up (Mean ± SD) | p-value |
|---|---|---|---|
| MUST Score | 3.1 ± 0.8 | 1.5 ± 0.6 | <0.01 |
| Weight (kg) | 67.4 ± 10.2 | 69.7 ± 9.8 | <0.05 |

Multivariate regression analysis showed that improvements in nutritional status were significantly associated with better cardiovascular outcomes, particularly improved LVEF ($\beta = 0.32$, $p < 0.01$). Age, gender, and baseline cardiovascular health were also significant predictors of changes in cardiovascular function.

**Discussion**

The findings of this study highlight the significant impact of targeted nutritional interventions on cardiovascular health outcomes in malnourished patients with cardiovascular disease. The improvements observed in left ventricular ejection fraction (LVEF) and left ventricular wall thickness indicate that addressing malnutrition through individualized dietary plans can have a direct positive effect on cardiac function. The increase in LVEF, from 45.2% at baseline to 50.8% at follow-up, suggests enhanced cardiac performance, which is particularly important for patients with compromised heart function.

The reduction in left ventricular wall thickness further supports the beneficial effects of nutritional interventions on cardiovascular health. Excessive wall thickness is often indicative of cardiac remodeling and increased workload on the heart, which can lead to adverse outcomes in patients with cardiovascular disease. By improving nutritional status, it is likely that the heart's workload was reduced, leading to favorable structural changes. These results are consistent with previous research, which has shown that malnutrition exacerbates cardiovascular complications and that nutritional support can improve outcomes (Anker et al., 1997; Lavie et al., 2009).

The significant decrease in the MUST score and corresponding weight gain indicate that the nutritional interventions were effective in improving overall nutritional status. Weight gain in malnourished patients, particularly in those with cardiovascular disease, is often a sign of improved muscle mass and energy reserves, which can contribute to better physical function and resilience against disease-related complications (Norman et al., 2008). The reduction in malnutrition risk, as evidenced by the decrease in MUST scores, underscores the importance of early identification and management of malnutrition in this patient population.

The multidisciplinary approach employed in this study, involving nurses, clinical nutritionists, and sonographers, was instrumental in achieving the observed improvements. The role of nurses in screening and monitoring, the expertise of nutritionists in tailoring dietary interventions, and the use of ultrasound by sonographers to assess cardiac function all contributed to a comprehensive care model that addressed both the nutritional and cardiovascular needs of the patients. This integrated approach highlights the need for collaboration across healthcare disciplines to optimize patient outcomes, particularly in complex cases involving malnutrition and cardiovascular disease (Yancy et al., 2013).

The multivariate regression analysis showed that improvements in nutritional status were significantly associated with better cardiovascular outcomes, particularly LVEF. This finding suggests that improving nutritional intake can directly influence heart function, even after controlling for other factors such as age, gender, and baseline cardiovascular health. The significant association between improved nutritional status and enhanced cardiac function emphasizes the potential of nutritional interventions as a key component of cardiovascular care, especially in hospitalized patients who are at risk of malnutrition.

The results also shed light on the complex relationship between nutritional status and cardiovascular health. Malnutrition, whether due to inadequate protein, calorie intake, or specific nutrient deficiencies, has been linked to increased inflammation, impaired immune function, and altered cardiac metabolism—all of which can negatively impact cardiovascular outcomes (Ekpenyong,2017). Addressing these deficiencies not only improved cardiovascular structure and function in this study but also highlighted the need for continued focus on nutritional health as an integral part of managing cardiovascular disease.

However, there are some limitations to this study that should be considered. The relatively short follow-up period of three months may not fully capture the long-term effects of nutritional interventions on cardiovascular health. Future studies should consider longer follow-up periods to assess the sustainability of these improvements. Additionally, while the study employed a prospective cohort design, the absence of a control group limits the ability to attribute improvements solely to the nutritional intervention. Randomized controlled trials are needed to further establish causality and to evaluate the effectiveness of specific types of nutritional support in this population.

In conclusion, this study demonstrates that targeted nutritional interventions can significantly improve cardiovascular outcomes in malnourished patients with cardiovascular disease. The improvements in LVEF, reduction in wall thickness, and enhanced nutritional status underscore the importance of early detection and comprehensive management of malnutrition. The findings also highlight the value of a multidisciplinary approach, involving nurses, clinical nutritionists, and sonographers, in delivering effective care. These results provide a foundation for further research into the role of nutrition in cardiovascular health and underscore the need for integrated, patient-centered approaches in managing complex health conditions.

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