

## A PROSPECTIVE STUDY ON EXPLORING MICRONUTRIENT DEFICIENCY IN NON-ISCHEMIC CARDIOMYOPATHY AMONG THE YOUNG: POTENTIAL FOR CORRECTION.

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Page | 1

### ABSTRACT

#### Background

Micronutrient deficiencies are increasingly recognized as significant yet often overlooked factors in the pathogenesis and progression of non-ischemic cardiomyopathy (NICM), especially among young populations. This study aims to explore the prevalence and effects of micronutrient deficiencies in young patients with NICM, assessing the relationship between micronutrient levels and disease severity, and evaluating the efficacy of nutritional interventions.

#### Methods

A prospective cohort study was conducted, enrolling 64 participants aged 18-35 diagnosed with NICM. Exclusion criteria included ischemic heart disease, primary valvular heart disease, and chronic diseases affecting micronutrient levels. Baseline assessments included medical history, physical examination, dietary assessment, blood tests for key micronutrients, and cardiac imaging. Participants with identified deficiencies received tailored supplementation plans. Follow-ups were conducted monthly, with repeat assessments at 6 and 12 months.

#### Results

At baseline, 56% of participants had at least one micronutrient deficiency, with vitamin D being the most common. After 6 months of supplementation, significant improvements in micronutrient levels and mean left ventricular ejection fraction (LVEF) were observed (from 45% to 52%,  $p < 0.001$ ). Quality of life improved significantly, and a reduction in cardiovascular event rates was noted, although not statistically significant.

#### Conclusion

This study highlights the high prevalence of micronutrient deficiencies among young individuals with NICM and demonstrates that tailored nutritional interventions can significantly improve cardiac function and quality of life. These findings underscore the importance of screening for and addressing micronutrient deficiencies in this population, suggesting a potential avenue for improving cardiovascular outcomes in NICM.

#### Recommendations

Healthcare providers should screen young NICM patients for micronutrient deficiencies and incorporate tailored nutritional interventions into their management. This can potentially improve cardiac function and quality of life, though further research is needed to establish comprehensive guidelines.

**Keywords:** Non-Ischemic Cardiomyopathy, Micronutrient Deficiency, Young Adults, Nutritional Intervention, Cardiac Function, Vitamin D, Iron, Magnesium.

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### INTRODUCTION

Micronutrient deficiencies are increasingly recognized as a significant yet often overlooked factor in the pathogenesis and progression of non-ischemic cardiomyopathy, particularly among young populations. Non-ischemic cardiomyopathy, a diverse group of heart muscle diseases not caused by coronary artery disease, poses a significant health burden worldwide [1]. While the etiology of non-ischemic cardiomyopathy is

multifactorial, involving genetic, environmental, and lifestyle factors, recent studies have begun to shed light on the role of micronutrient deficiencies in its development and outcomes.

Micronutrients, including vitamins and minerals, are essential for a wide range of physiological processes, including those critical for maintaining heart health and preventing cardiac remodeling and dysfunction. Deficiencies in micronutrients such as selenium, zinc,

magnesium, and the antioxidant vitamins C and E have been linked to oxidative stress, inflammation, and myocardial energy dysregulation, all of which are key pathways in the pathophysiology of cardiomyopathy [1, 2]. Furthermore, vitamin D deficiency has been specifically associated with an increased risk of heart failure, highlighting the importance of adequate micronutrient intake for cardiovascular health [3].

The young demographic is particularly vulnerable to micronutrient deficiencies due to various factors, including inadequate dietary intake, increased nutritional requirements during growth, and lifestyle choices that may predispose to poor nutrition. This vulnerability underscores the need for targeted nutritional interventions and awareness to prevent or mitigate the development of non-ischemic cardiomyopathy in this population.

Emerging evidence suggests that addressing micronutrient deficiencies through dietary modification or supplementation could play a role in the management and prevention of non-ischemic cardiomyopathy among the young. However, further research is needed to fully understand the complex interactions between micronutrient status and heart muscle health and to develop evidence-based guidelines for the prevention and treatment of cardiomyopathy related to nutritional deficiencies [4, 5].

Exploring the impact of micronutrient deficiencies on non-ischemic cardiomyopathy among young individuals is a critical area of research that holds the potential to significantly improve cardiovascular outcomes. By advancing the understanding of the nutritional underpinnings of cardiomyopathy, better target interventions to prevent and manage this condition in at-risk populations can be achieved.

The study aims to explore the prevalence and effects of micronutrient deficiencies in young patients with non-ischemic cardiomyopathy, assessing the relationship between micronutrient levels and disease severity. It seeks to evaluate the efficacy of nutritional interventions in enhancing cardiac function and patient health outcomes, laying the groundwork for integrating nutritional strategies into the management of non-ischemic cardiomyopathy.

## METHODOLOGY

### Study Design

A prospective cohort study.

### Study Setting

The study was carried out at ANMMCH, Gaya, from July 2022 to August 2023.

### Participants

A total of 64 participants were enrolled in the study.

### Inclusion Criteria

- Individuals aged between 18 and 35 years.

- Diagnosed with NICM through echocardiography or magnetic resonance imaging (MRI).

### Exclusion Criteria

- A history of ischemic heart disease.  
- Presence of primary valvular heart disease.  
- Chronic diseases affecting micronutrient levels, such as chronic kidney disease.

### Bias

To minimize selection bias, participants were consecutively recruited from those presenting to the cardiology department. Measurement bias was reduced through standardized training of the personnel conducting the assessments and interventions.

### Variables

Primary variables included micronutrient levels (vitamins D, B12, iron, magnesium, and zinc) and cardiac function parameters (left ventricular ejection fraction [LVEF], left ventricular volumes). Secondary variables encompassed dietary intake, quality of life, and cardiovascular event rates.

### Data Collection

#### Baseline Assessment

Participants underwent a comprehensive medical history review, physical examination, dietary assessment using food frequency questionnaires, blood tests for key micronutrients, and cardiac imaging (echocardiography and MRI) to establish baseline values.

#### Intervention

Participants identified with micronutrient deficiencies were provided with tailored supplementation plans, designed in consultation with a clinical nutritionist and based on current correction guidelines.

#### Follow-up

Participants were followed up monthly for clinical assessment and dietary counseling, with repeat blood tests and cardiac imaging conducted at 6 and 12 months to monitor changes.

#### Statistical Analysis

Data were analyzed using descriptive statistics to summarize baseline characteristics. The data obtained from the study was arranged in a tabulated manner in an Excel sheet, and the data was then subjected to statistical analysis. Statistical analysis was accomplished using an appropriate software program (e.g., SPSS). A  $p < 0.05$  change was considered to be statistically significant.

## Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants

## RESULT

**Table 1: Demographic characteristics of the study population**

Variable	Value
Total Participants	64
Average Age (years)	27.5 ( $\pm$ 4.2)
Female Participants (%)	40% (26)
Baseline LVEF (%)	45% ( $\pm$ 5.6)
Micronutrient Deficiency	
Vitamin D Deficiency (%)	34% (22)
Iron Deficiency (%)	22% (14)
Magnesium Deficiency (%)	15.6% (10)

Page | 3

The study enrolled 64 participants with an average age of 27.5 years ( $\pm$  4.2), of which 40% (n=26) were female. At baseline, the mean LVEF was 45% ( $\pm$  5.6), indicating reduced cardiac function consistent with NICM diagnosis.

Blood tests revealed that 56% (n=36) of participants had at least one micronutrient deficiency, with vitamin D deficiency being the most common (n=22, 34%), followed by iron (n=14, 22%) and magnesium (n=10, 15.6%).

After 6 months of tailored micronutrient supplementation, Vitamin D levels increased significantly from an average of 20 ng/mL ( $\pm$  5) to 35 ng/mL ( $\pm$  4.8) ( $p < 0.001$ ). Iron levels improved from an average ferritin level of 15 ng/mL ( $\pm$  6.2) to 50 ng/mL ( $\pm$  5.4) ( $p < 0.001$ ). Magnesium and other micronutrient levels also showed significant improvements ( $p < 0.05$ ).

The mean LVEF improved from 45% ( $\pm$  5.6) at baseline to 52% ( $\pm$  4.9) at the 12-month follow-up ( $p < 0.001$ ). Significant reductions in left ventricular volumes were observed, indicating positive structural changes in the heart ( $p < 0.01$ ).

Quality of life, assessed by validated questionnaires, showed significant improvement post-intervention ( $p < 0.01$ ). There was a reduction in the incidence of cardiovascular events during the follow-up period, though this did not reach statistical significance ( $p = 0.09$ ).

Multivariate regression analysis adjusting for age, gender, baseline LVEF, and micronutrient levels confirmed that the improvement in cardiac function was independently associated with the correction of micronutrient deficiencies (adjusted  $R^2 = 0.36$ ,  $p < 0.001$  for LVEF improvement).

## DISCUSSION

The study's results demonstrate a significant association between micronutrient supplementation and improved cardiac function in young individuals with NICM. Specifically, participants who received tailored micronutrient supplementation experienced notable improvements in key micronutrient levels, such as vitamin D, iron, and magnesium, which were accompanied by a significant increase in LVEF and a reduction in left ventricular

volumes. These findings suggest that addressing micronutrient deficiencies in this population can lead to meaningful improvements in cardiac structure and function.

Additionally, the observed enhancements in quality of life, alongside a non-significant trend towards reduced cardiovascular events, further support the potential benefits of integrating nutritional interventions into the management strategies for young patients with NICM. This underscores the importance of considering micronutrient status in holistic care and treatment planning for individuals with NICM, highlighting a promising avenue for adjunct therapy that warrants further investigation.

The results indicate that among young individuals with NICM, micronutrient deficiencies are prevalent, and that tailored micronutrient supplementation can significantly improve both micronutrient levels and cardiac function. The improvement in LVEF and reduction in left ventricular volumes suggest that addressing micronutrient deficiencies could be a viable adjunct therapy for NICM management. The study also highlights the potential role of nutritional interventions in improving the quality of life for individuals with NICM, although further research is needed to understand the long-term impact on cardiovascular events.

Various studies identified span a range of subjects related to cardiomyopathy, offering insights into diagnostic advancements, myocardial tissue characterization, risk stratification, survival prediction, and genetic considerations, albeit not directly addressing micronutrient deficiencies in NICM among young populations. For instance, a study focuses on a diagnostic classifier for distinguishing between ischemic and non-ischemic cardiomyopathy, which is crucial for accurate diagnosis but does not delve into micronutrient impacts [6]. Another study enhances myocardial tissue characterization through imaging techniques, supporting structural change identification in NICM potentially influenced by micronutrient status, without directly exploring nutritional deficiencies [7]. Studies on ICD

implantation effectiveness and survival prediction in heart failure patients, indirectly relate to NICM management and prognosis but do not specifically address the role of micronutrients [8, 9]. Lastly, the correspondence in a study raises important points on genetic screening in cardiomyopathies, including NICM, without directly linking to micronutrient deficiencies [10]. These studies collectively contribute to the broader understanding of cardiomyopathy but highlight the need for more focused research on the impact of micronutrient deficiencies in NICM, especially among younger demographics.

## CONCLUSION

In conclusion, the study underscores the significant impact of micronutrient deficiencies in young individuals with non-ischemic cardiomyopathy (NICM) and provides compelling evidence that tailored nutritional interventions can lead to substantial improvements in cardiac function and quality of life. The findings emphasize the importance of routine screening for and addressing micronutrient deficiencies in this population, offering a promising avenue for enhancing cardiovascular outcomes in NICM patients.

## Limitations

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

## Recommendation

Healthcare providers should screen young NICM patients for micronutrient deficiencies and incorporate tailored nutritional interventions into their management. This can potentially improve cardiac function and quality of life, though further research is needed to establish comprehensive guidelines.

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## List of abbreviations

NICM- non-ischemic cardiomyopathy  
LVEF- left ventricular ejection fraction  
MRI- magnetic resonance imaging

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## Conflict of interest

The authors have no competing interests to declare.

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Page | 5

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