



Thiamine Supplementation and its Impact on Ejection Fraction: A Systematic Review and Meta-analysis of Clinical Trials

Mohammad Hossein Sharifi¹ , Maryam Jalali² , Sorour Sarihi³ , Parisa Keshani^{4*} , Firoozeh Abtahi⁵ , Samane Nematollahi⁶

¹Non-Communicable Diseases Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

²Colorectal Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

³Department of Human Nutrition and Hospitality Management, College of Human Environmental Sciences, The University of Alabama, Tuscaloosa, AL, USA

⁴Health Policy Research Center, Institute of Health, Shiraz University of Medical Sciences, Shiraz, Iran

⁵Department of Echocardiography, Faculty of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

⁶Non-Communicable Diseases Research Center, Bam University of Medical Sciences, Bam, Iran

Abstract

Background and aims: Heart failure (HF) is a serious cardiovascular condition with a high mortality rate. In the last decade, there have been concerns about the use of thiamine as a potential factor for enhancing ejection fraction in people with HF. Accordingly, this study aimed at investigating whether thiamine supplementation affects ejection fraction.

Methods: The PubMed, Scopus, and Web of Science databases were systematically searched, and a systematic review and meta-analysis was conducted on the clinical trials performed on thiamine supplementation in patients with HF. Six of the eleven studies included in this systematic review were considered suitable for the meta-analysis (randomized controlled trial and cross-over designs) and 4 within-group designs. The total sample sizes for the systematic review and meta-analysis were 545 and 319. Heterogeneity among the primary studies was assessed using Cochran's Q test and the I² index. The analyses were conducted with Comprehensive Meta-Analysis software. Eventually, the trim-and-fill method was utilized to verify the validity of the findings.

Results: The analysis of the seven eligible studies for meta-analysis (six studies and seven reports) revealed that thiamin had no significant effect on left ventricular ejection fraction (LVEF; $P=0.05$, 95% CI: -0.003 to 0.46). The results of the subgroup meta-analysis were not significant. Notably, the results of the five within-group comparisons for meta-analysis (four studies and five reports) revealed the considerable effect of thiamin on LVEF ($P<0.001$, 95% CI: 0.57 to 1.88).

Conclusion: Thiamine supplementation might improve ejection fraction in patients with HF. More information on the role of thiamine in HF would help establish a greater degree of accuracy on this matter.

Keywords: Heart failure, Ejection fraction, Thiamine, Meta-analysis

*Corresponding Author:

Parisa Keshani,

Email: parisa.keshani@gmail.com

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Introduction

Heart failure (HF) is considered a severe cardiovascular disease that has a high rate of mortality.^{1,2} The progress of the disease can lead to complications, such as hospitalization, fatal arrhythmia, and death.³ Various pharmaceutical and non-pharmacological interventions, including thiamin, Coenzyme Q10, and omega-3 supplementation, aim to mitigate underlying cardiac diseases and improve the quality of life.^{4,5}

Thiamine, a generally safe dietary supplement, has raised concerns regarding its potential to improve ejection fraction in HF patients.^{6,7} Definitions of HF vary, with HF with reduced left ventricular ejection fraction (HFrEF)

defined as LVEF < 40% and HF with preserved EF (HFpEF) as LVEF ≥ 50%. The prevalence of HF in developed countries ranges from 1% to 2%.^{8,9} Research suggests that interventions raising ejection fraction enhance the quality of life while alleviating HF symptoms.^{10,11} Despite guidelines for HF management, dietary supplements, such as thiamine, have received less attention.

Thiamine, a water-soluble vitamin B1, is essential for cellular energy synthesis.¹² Thiamine deficiency (TD) is notably higher in both developed and developing nations due to factors such as poor diet, long-term alcohol use, and aging.¹² Marginal TD can cause symptoms such as anorexia, weight loss, and exhaustion.⁷ Studies indicate that TD is 2.5

fraction of patients with HF, except for heart rate.¹⁶ It is noteworthy that the outcomes and study limitations of these meta-analyses were different. Therefore, future meta-analyses will be beneficial in this regard. Based on six high-quality clinical trials, the findings of the current meta-analysis confirmed that thiamine supplementation had no significant effect on LVEF in patients with HF. Notably, the five within-group comparison reports demonstrated the substantial impact of thiamin on LVEF. Even though the results of the current meta-analysis and those of two previous meta-analyses suggested that thiamin supplementation had no significant effect on LVEF, a within-group comparison revealed that thiamin supplementation had a substantial impact on LVEF. A possible explanation/mechanism is the effect of thiamine, an essential water-soluble vitamin required for cellular energy generation, on the energy breakdown of cardiomyocytes.¹⁷ In this regard, TD may contribute to the progression of HF. Hence, in clinical practice, it is critical to understand TD's pathophysiology and consider it one of the differentials in patients with new-onset HF with an unknown etiology and appropriate risk factors.¹⁷ Notably, in the present study, there was no significant difference in the period (one week or more than one week), form of intervention (oral and intravenous), or dosage (200 mg and 300 mg) of thiamine supplementation. According to the asymmetry test, there was no indication of publishing bias.

Although thiamine supplementation is not recommended in the current congestive HF guidelines, clinical experience and some data have shown promising outcomes when it comes to the use of thiamine therapy in patients with renal disease and HF.^{35,36} Moreover, at high daily doses (300–900 mg), thiamine is a relatively safe prescription with no notable adverse effects.³⁷ In this regard, thiamine may be added to chronic HF guidelines as an adjuvant therapy to help with HF symptoms and signs. Nonetheless, a large, multi-center study should be conducted to confirm the advantages of thiamine in systolic HF and ameliorate the symptoms.

The strength of the present study was the utilization of many databases for searching and high-quality RCTs for analysis. On the other hand, the limitations of the current investigation were the lack of information on comorbidities, a comprehensive prescription list, and the usage of supplements, such as Coenzyme Q10 and Omega-3. Furthermore, hospitalization, death, dyspnea, heart rate, and diastolic hypertension could not be analyzed due to the heterogeneity of the studies. It is noteworthy that a future meta-analysis seems necessary because only six papers were reviewed in the current investigation.

Conclusion

The results of the current investigation on how thiamine affects the ejection fraction in HF patients revealed that thiamine supplementation might benefit patients with systolic HF. It was found that thiamine is a reasonably safe

prescription with no significant side effects at high doses (300–900 mg/d). Considering the prevalence of TD in patients with HF and those using loop diuretics, thiamine supplementation may be a sensible suggestion to enhance the clinical condition, promote quality of life, and reduce symptoms and signs in patients with HF. However, further data on the function of thiamine in HF would contribute to the development of a higher level of accuracy in this area.

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Authors' Contribution

Conceptualization: Mohammad Hossein Sharifi, Firoozeh Abtahi.

Data curation: Maryam Jalali, Sorour Sarihi, Parisa Keshani.

Formal analysis: Maryam Jalali, Parisa Keshani, Samane Nematollahi.

Investigation: Mohammad Hossein Sharif, Parisa Keshani.

Methodology: Mohammad Hossein Sharif, Parisa Keshani.

Project administration: Mohammad Hossein Sharif, Parisa Keshani.

Supervision: Mohammad Hossein Sharif, Parisa Keshani.

Validation: Mohammad Hossein Sharifi, Maryam Jalali, Firoozeh Abtahi.

Visualization: Mohammad Hossein Sharifi, Maryam Jalali, Parisa Keshani.

Writing-original draft: Mohammad Hossein Sharifi, Maryam Jalali, Parisa Keshani.

Writing-review and editing: Mohammad Hossein Sharifi, Maryam Jalali, Sorour Sarihi, Parisa Keshani, Firoozeh Abtahi.

Competing Interests

There are no competing interests to disclose.

Ethical Approval

Not applicable.

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Supplementary Files

Supplementary file 1 contains Tables S1-S3 and Figures S1-S3.

References

1. Groenewegen A, Rutten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. *Eur J Heart Fail.* 2020;22(8):1342-56. doi: [10.1002/ehf.1858](https://doi.org/10.1002/ehf.1858).
2. Lippi G, Sanchis-Gomar F. Global epidemiology and future trends of heart failure. *AME Med J.* 2020;5:15. doi: [10.21037/amj.2020.03.03](https://doi.org/10.21037/amj.2020.03.03).
3. Savarese G, Becher PM, Lund LH, Seferovic P, Rosano GM, Coats AJ. Global burden of heart failure: a comprehensive and updated review of epidemiology. *Cardiovasc Res.* 2023;118(17):3272-87. doi: [10.1093/cvr/cvac013](https://doi.org/10.1093/cvr/cvac013).
4. Truby LK, Rogers JG. Advanced heart failure: epidemiology, diagnosis, and therapeutic approaches. *JACC Heart Fail.* 2020;8(7):523-36. doi: [10.1016/j.jchf.2020.01.014](https://doi.org/10.1016/j.jchf.2020.01.014).
5. DiNicolantonio JJ, Lavie CJ, Niazi AK, O'Keefe JH, Hu T. Effects of thiamine on cardiac function in patients with systolic heart failure: systematic review and metaanalysis of randomized, double-blind, placebo-controlled trials. *Ochsner J.* 2013;13(4):495-9.
6. Helali J, Park S, Ziaeiian B, Han JK, Lankarani-Fard A. Thiamine and heart failure: challenging cases of modern-day cardiac beriberi. *Mayo Clin Proc Innov Qual Outcomes.*