

Living FRIendly Summaries of the Body of Evidence using Epistemonikos (FRISBEE)

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Should sodium intake be restricted in chronic heart failure?

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Abstract

Sodium restriction has been recommended in chronic heart failure for decades. However, the evidence about the benefit of this measure is not clear, and it might even increase risks. Searching in Epistemonikos database, which is maintained by screening multiple databases, we identified three systematic reviews incorporating 13 studies addressing the question of this article, 10 were randomized trials. We extracted data, combined the evidence using meta-analysis and generated a summary of findings table following the GRADE approach. We concluded sodium restriction might increase mortality and the risk of hospital admission in chronic heart failure, but the certainty of the evidence is low.

Problem

High sodium intake increases morbidity and mortality, mainly in hypertensive people. Sodium restriction has also been recommended in chronic heart failure for decades, to diminish edema and to improve symptoms. However, it has been also postulated sodium restriction might increase the activity of renin-angiotensin and sympathetic systems through intravascular depletion, specially when combined with fluid restriction and diuretic therapy. Even though guidelines widely support this measure, existing evidence is controversial.

Methods

We used Epistemonikos database, which is maintained by screening multiple databases, to identify systematic reviews and their included primary studies. We extracted the information from the reviews, and with this information we generated a structured summary using a pre-established format, which includes key messages, a summary of the body of evidence (presented as an evidence matrix in Epistemonikos), meta-analysis of the total of studies, a summary of findings table following the GRADE approach and a table of other considerations for decision-making.

Key messages

- Sodium restriction might increase mortality and the risk of hospital admission in chronic heart failure, but the certainty of the evidence is low.
- The main guidelines widely recommend sodium restriction, and do not address the evidence suggesting it might be harmful.

About the body of evidence for this question

<p>What is the evidence. See evidence matrix in Epistemonikos later</p>	<p>We found three systematic reviews [1],[2],[3] incorporating 13 primary studies overall [4],[5],[6],[7],[8],[9],[10],[11],[12],[13],[14],[15],[16], including 10 randomized controlled trials [4],[5],[6],[7],[8],[9],[10],[11], [12],[13]. This table and the summary in general are based on the latter.</p>
<p>What types of patients were included</p>	<p>Ejection fraction was 22.5% in one trial [8], <35% in three trials [4],[5],[6], < 40% in one trial [13] and in five it was not reported [10],[12],[13],[14],[15].</p> <p>NYHA functional class of included patients was the following:</p> <p>In three trials it was II at 30 days post-discharge [4],[5],[6]; in one trial 72.6% were class II and 11.7% class III [7]; in one trial 17% class II and 83% class III [9]; in one 48.1 % II, 51.9% III or IV [10]; in one 90% II and 10% III [11]; in one I-III [12]; in one 24% II, 74% III [13]; and in one it was not reported [8].</p>
<p>What types of interventions were included</p>	<p>Three trials compared furosemide po + 120 mmol sodium per day versus furosemide po + 80 mmol sodium per day [4],[5],[6].</p> <p>One trial compared providing general information versus providing information for a 2500 mg per day restriction [7].</p> <p>Another trial compared a prescription of sodium 2000 mg per day versus 2000 mg per day + education by nutritionist [8].</p> <p>One trial compared providing general information versus sodium restriction (2000-3000 mg/day and liquid 1.5 L + education) [9].</p> <p>One trial compared provision of information + general care versus diet, education and sodium restriction 2000-3000mg per day [10].</p> <p>One trial compared a restriction of 2300 versus 1500 mg per day [11].</p> <p>One trial compared usual care versus diet, education and sodium restriction 2000-3000 mg per day [12].</p> <p>Another trial compared provision of information about salt and fluid intake restriction versus fluid restriction 1500 cc per day and 5000 mg sodium per day restriction + nutritional support [13].</p>
<p>What types of outcomes were measured</p>	<p>The primary studies measured several outcomes, but the systematic reviews identified grouped them as follows:</p> <ul style="list-style-type: none"> • Mortality • Hospital admission

Summary of findings

The information about the effects of sodium restriction in chronic heart failure is based on only three trials including 775 patients for the outcome mortality and 578 for hospital admission [7],[8],[9]. The remaining trials were not incorporated in the meta-analysis of any of the reviews identified.

The summary of findings is the following:

- Sodium restriction might increase mortality in chronic heart failure, but the certainty of the evidence is low.
- Sodium restriction might increase the risk of hospital admission in chronic heart failure, but the certainty of the evidence is low.

Sodium restriction in chronic heart failure				
Patients	Chronic heart failure			
Intervention	Sodium restriction			
Comparison	No restriction			
Outcomes	Absolute effect*		Relative effect (95% CI)	Certainty of the evidence (GRADE)
	WITHOUT sodium restriction	WITH sodium restriction		
	Difference: patients per 1000			
Mortality	61 per 1000	158 per 1000	RR 2.61 (1.57 to 4.33)	⊕⊕○○ ^{1,2} Low
	Difference: 97 patients more per 1000 (Margin of error: 35 to 202 more)			
Hospital admission	113 per 1000	411 per 1000	RR 3.64 (2.58 to 5.15)	⊕⊕○○ ^{1,2} Low
	Difference: 298 patients more per 1000 (Margin of error: 179 to 469 more)			

RR= Risk ratio.
Margin of error = 95% confidence interval (CI).
GRADE: evidence grades of the GRADE Working Group (see later in this article).

* The risk **WITHOUT sodium restriction** is based on the risk in the control group of the trials. The risk **WITH sodium restriction** (and its margin of error) is calculated from relative effect (and its margin of error)

1 We downgraded the certainty of the evidence because the trials have important risk of bias.
2 We downgraded the certainty of the evidence in one level because one of the systematic reviews state two trials had duplicate data (which could not be verified because the authors responded the data were lost due to a computer failure), which constitute more than 50% to two outcomes [3].

About the certainty of the evidence (GRADE)*

⊕⊕⊕⊕
High: This research provides a very good indication of the likely effect. The likelihood that the effect will be substantially different† is low.

⊕⊕⊕○
Moderate: This research provides a good indication of the likely effect. The likelihood that the effect will be substantially different† is moderate

⊕⊕○○
Low: This research provides some indication of the likely effect. However, the likelihood that it will be substantially different† is high.

⊕○○○
Very low: This research does not provide a reliable indication of the likely effect. The likelihood that the effect will be substantially different† is very high.

*This concept is also called 'quality of the evidence' or 'confidence in effect estimates'.
† Substantially different = a large enough difference that it might affect a decision.

Other considerations for decision-making

To whom this evidence does and does not apply

- This evidence applies to patients with chronic heart failure with important decrease in ejection fraction (typically < 35%). The evidence presented in this summary does not allow recognizing a subgroup that might experience harm from sodium restriction, but clinically it is reasonable to anticipate it would occur in those with advanced heart failure.
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About the outcomes included in this summary

- We considered the two key outcomes for decision-making. These coincide with those presented in the systematic reviews identified.
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Balance between benefits and risks, and certainty of the evidence

- Even though the certainty of the evidence is low, there would be an increase in mortality and hospital admissions, so the risk/benefit ratio is not favorable.
-

What would patients and their doctors think about this intervention

- Confronted with an intervention difficult to adhere and potentially harmful, most patients and clinicians should be inclined against its use.
 - However, considering it is a measure widely recommended by experts and guidelines, and the certainty of the evidence is low, it is likely to find important variability in decision-making.
-

Resource considerations

- The intervention does not carry important costs, although to achieve optimal adherence extra cost need to be considered.
 - However, given it might cause harm, the cost/benefit balance is not favorable.
-

Differences between this summary and other sources

- One of the reviews, published in 2012, showed better outcomes without sodium restriction. The same authors retracted this afterwards since two included trials presented duplicate data, which could not be verified because these were lost due to a computer failure [2]. The reviews did arrive to conclusions similar to this summary. The other reviews identified, also agree in concluding the evidence is controversial and high-quality trials are needed.
 - Our summary does not agree with the main guidelines, which recommend sodium restriction to control symptoms and relieve congestion in heart failure with functional class III-IV [17]. The AHA guideline 2013 also recommends sodium restriction in patients with symptomatic heart failure to relieve congestive symptoms [18]. The guideline of the Heart Failure Society of America recommends sodium restriction (2000-3000 mg per day) in symptomatic heart failure, and considering a more intensive restriction in moderate to severe heart failure [19].
-

Could this evidence change in the future?

- The probability that future evidence change the conclusions of this summary is high due to the level of uncertainty.
 - There are at least three ongoing trials according to the International Controlled Trials Registry Platform from the World Health Organization [20],[21],[22].
 - A new systematic review might contribute relevant information since all of the identified reviews have limitations. A deeper analysis of the completed trials and the incorporation of information of the ongoing trials might clarify the existing uncertainty.
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How we conducted this summary

Using automated and collaborative means, we compiled all the relevant evidence for the question of interest and we present it as a matrix of evidence.

	Paterna S 2008	Parrinello G 2009	Paterna S 2009	Dunbar SB 2013	Lennie TA 2011	Son YJ 2011	Arcand J 2011	Arcand JA 2005	Philipson H 2010	Welsh D 2013	Colin-Ramirez E 2015	Donner Alves F 2012
Abshire M 2015	X	X	X	X	X	X	X	X	X	X	X	X
Ontario, Health.. 2015	X	X	X	X	X	X	X	X	X	X	X	X
Dinicolantonio .. 2012	X	X	X	X	X	X	X	X	X	X	X	X

Starting from any systematic review, Epistemonikos builds a matrix based on existing connections in the database.

The author of the matrix can select relevant information for a specific health question (typically in PICO format) in order to display the information set for the question.

The rows represent systematic reviews that share at least one primary study, and columns display the studies.

The boxes in green correspond to studies included in the respective reviews.

Follow the link to access the **interactive version**: [Sodium restriction in chronic heart failure](#)

Notes

The upper portion of the matrix of evidence will display a warning of “new evidence” if new systematic reviews are published after the publication of this summary. Even though the project considers the periodical update of these summaries, users are invited to comment in *Medwave* or to contact the authors through email if they find new evidence and the summary should be updated earlier. After creating an account in Epistemonikos, users will be able to save the matrixes and to receive automated notifications any time new evidence potentially relevant for the question appears.

The details about the methods used to produce these summaries are described here <http://dx.doi.org/10.5867/medwave.2014.06.5997>.

Epistemonikos foundation is a non-for-profit organization aiming to bring information closer to health decision-

makers with technology. Its main development is Epistemonikos database (www.epistemonikos.org). These summaries follow a rigorous process of internal peer review.

Conflicts of interest

The authors do not have relevant interests to declare.

Referencias

1. Health Quality Ontario. Sodium restriction in heart failure: a rapid review. Toronto: Health Quality Ontario; 2015 February. 20 p | [Link](#) |
2. DiNicolantonio JJ, Di Pasquale P, Taylor RS, Hackam DG. Low sodium versus normal sodium diets in systolic heart failure: systematic review and meta-analysis. *Heart*. 2013 Mar 12. | [CrossRef](#) | [PubMed](#) |
3. Abshire M, Xu J, Baptiste D, Almansa JR, Xu J, Cummings A, Andrews MJ, Dennison Himmelfarb C. Nutritional Interventions in Heart Failure: A Systematic

- Review of the Literature. *J Card Fail.* 2015 Dec;21(12):989-99 | [CrossRef](#) | [PubMed](#) |
4. Paterna S, Parrinello G, Cannizzaro S, Fasullo S, Torres D, Sarullo FM, et al. Medium term effects of different dosage of diuretic, sodium, and fluid administration on neurohormonal and clinical outcome in patients with recently compensated heart failure. *Am J Cardiol.* 2009 Jan 1;103(1):93-102 | [CrossRef](#) | [PubMed](#) |
 5. Paterna S, Gaspare P, Fasullo S, Sarullo FM, Di Pasquale P. Normal-sodium diet compared with low-sodium diet in compensated congestive heart failure: is sodium an old enemy or a new friend? *Clin Sci (Lond).* 2008 Feb;114(3):221-30 | [PubMed](#) |
 6. Parrinello G, Di Pasquale P, Licata G, Torres D, Giammanco M, Fasullo S, et al. Long-term effects of dietary sodium intake on cytokines and neurohormonal activation in patients with recently compensated congestive heart failure. *J Card Fail.* 2009 Dec;15(10):864-73 | [CrossRef](#) | [PubMed](#) |
 7. Dunbar SB, Clark PC, Reilly CM, Gary RA, Smith A, McCarty F, et al. A trial of family partnership and education interventions in heart failure. *J Card Fail.* 2013 Dec;19(12):829-41 | [CrossRef](#) | [PubMed](#) |
 8. Arcand JA, Brazel S, Joliffe C, Choleva M, Berkoff F, Allard JP, et al. Education by a dietitian in patients with heart failure results in improved adherence with a sodium-restricted diet: a randomized trial. *Am Heart J.* 2005 Oct;150(4):716 | [PubMed](#) |
 9. Philipson H, Ekman I, Swedberg K, Schaufelberger M. A pilot study of salt and water restriction in patients with chronic heart failure. *Scand Cardiovasc J.* 2010 Aug;44(4):209-14 | [CrossRef](#) | [PubMed](#) |
 10. Welsh D, Lennie TA, Marcinek R, Biddle MJ, Abshire D, Bentley B, et al. Low-sodium diet self-management intervention in heart failure: pilot study results. *Eur J Cardiovasc Nurs.* 2013 Feb;12(1):87-95 | [CrossRef](#) | [PubMed](#) |
 11. Colin-Ramirez E, McAlister FA, Zheng Y, Sharma S, Armstrong PW, Ezekowitz JA. The long-term effects of dietary sodium restriction on clinical outcomes in patients with heart failure. The SODIUM-HF (Study of Dietary Intervention Under 100 mmol in Heart Failure): a pilot study. *Am Heart J.* 2015 Feb;169(2):274-281.e1 | [CrossRef](#) | [PubMed](#) |
 12. Donner Alves F, Correa Souza G, Brunetto S, Schweigert Perry ID, Biolo A. Nutritional orientation, knowledge and quality of diet in heart failure: randomized clinical trial. *Nutr Hosp.* 2012 Mar-Apr;27(2):441-8 | [CrossRef](#) | [PubMed](#) |
 13. Philipson H, Ekman I, Forslund HB, Swedberg K, Schaufelberger M. Salt and fluid restriction is effective in patients with chronic heart failure. *Eur J Heart Fail.* 2013 Nov;15(11):1304-10 | [CrossRef](#) | [PubMed](#) |
 14. Arcand J, Ivanov J, Sasson A, Floras V, Al-Hesayen A, Azevedo ER, et al. A high-sodium diet is associated with acute decompensated heart failure in ambulatory heart failure patients: a prospective follow-up study. *Am J Clin Nutr.* 2011 Feb;93(2):332-7 | [CrossRef](#) | [PubMed](#) |
 15. Lennie TA, Song EK, Wu JR, Chung ML, Dunbar SB, Pressler SJ, et al. Three gram sodium intake is associated with longer event-free survival only in patients with advanced heart failure. *J Card Fail.* 2011 Apr;17(4):325-30 | [CrossRef](#) | [PubMed](#) |
 16. Son YJ, Lee Y, Song EK. Adherence to a sodium-restricted diet is associated with lower symptom burden and longer cardiac event-free survival in patients with heart failure. *J Clin Nurs.* 2011 Nov;20(21-22):3029-38 | [CrossRef](#) | [PubMed](#) |
 17. McMurray JJ, Adamopoulos S, Anker SD, Auricchio A, Böhm M, Dickstein K, et al; ESC Committee for Practice Guidelines. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. *Eur Heart J.* 2012 Jul;33(14):1787-847 | [CrossRef](#) |
 18. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, et al; American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *Circulation.* 2013 Oct 15;128(16):e240-327 | [CrossRef](#) | [PubMed](#) |
 19. Heart Failure Society of America, Lindenfeld J, Albert NM, Boehmer JP, Collins SP, Ezekowitz JA, Givertz MM, et al. HFSA 2010 Comprehensive Heart Failure Practice Guideline. *J Card Fail.* 2010 Jun;16(6):e1-194 | [CrossRef](#) | [PubMed](#) |
 20. Maya Guglin, Low Sodium vs. Regular Diet in Patients Admitted for Heart Failure SALT, 2016 | [Link](#) |
 21. Stony Brook University. Dietary Sodium Intake and Outcomes in Heart Failure. [clinicaltrials.gov](#). 2015 | [Link](#) |
 22. University of Michigan. Geriatric Out of Hospital Randomized Meal Trial in Heart Failure. [clinicaltrials.gov](#). 2014

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