

Search Plan and Results

Question

[What is the relationship between sodium intake and blood pressure in adults aged 19 and older? \(DGAC 2010\)](#)

Date Searched

4/06/09; 7/10/09

Inclusion Criteria

Subjects/Population

- *Age*: Adults, 19 years and older
- *Setting*: US and International
- *Health status*: Healthy, those with elevated chronic disease risk and those diagnosed with the highly prevalent chronic diseases (coronary heart disease, cardiovascular disease, type 2 diabetes, metabolic syndrome, obesity).

Search Criteria

- *Study design preferences*: Randomized controlled trials (RCT), observational follow-up of relevant RCT and systematic reviews
- *Duration*: Intervention arms seven days or more
- *Size of study groups*: The sample size must equal 10 adults for each study group. (For example, this would include 10 patients in the intervention group and 10 patients in the control or comparison group)
- *Study drop out rate*: Less than 20%; preference for smaller dropout rates
- *Year range*: June 2004 to July 2009
- *Languages*: Limited to articles in English
- *Other*: Article must be published in peer-reviewed journal.

Exclusion Criteria

Subjects/Population

- *Age*: Less than 19 years
- *Setting*: Inpatients
- *Health status*: None
- *Nutrition related problem/condition*: (i.e., end stage renal disease, congestive heart failure).

Search Criteria

- *Study design preferences*: Cross-sectional, case-control, narrative review

- *Study group size*: Sample sizes <10
- *Study duration*: Intervention arms less than seven days
- *Study drop-out rate*: If the dropout rate in a study is 20% or greater, the study will be rejected
- *Year range*: Prior to June 2004
- *Authorship*: Studies by same author similar in content.
- *Languages*: Articles not in English
- *Other*: Animal studies; abstracts or presentations.

Search Terms: Search Vocabulary

Search terms: ("Hypertension"[mesh] OR "blood pressure"[MeSH Terms]) AND ("Sodium, Dietary"[Mesh] or sodium [mesh] or "sodium chloride"[mesh])

Electronic Databases

Total hits from all electronic database searches: 199

Total articles identified to review from electronic databases: 41

Articles Identified Via Handsearch or Other Means

Summary of Articles Identified to Review

Number of Primary Articles Identified: 12

Number of Review Articles Identified: 1

Total Number of Articles Identified: 13

Number of Articles Reviewed but Excluded: 28

List of Articles Included for Evidence Analysis

Primary Studies (12)

Cappuccio FP, Kerry SM, Micah FB, Plange-Rhule J, Eastwood JB. A community programme to reduce salt intake and blood pressure in Ghana [ISRCTN88789643]. [A community programme to reduce salt intake and blood pressure in Ghana \[ISRCTN88789643\]](#). *BMC Public Health*. 2006 Jan 24; 6:13. PMID: 16433927.

Chen J, Gu D, Huang J, Rao DC, Jaquish CE, Hixson JE, Chen CS, Chen J, Lu F, Hu D, Rice T, Kelly TN, Hamm LL, Whelton PK, He J; GenSalt Collaborative Research Group. [Metabolic syndrome and salt sensitivity of blood pressure in non-diabetic people in China: A dietary intervention study](#). *Lancet*. 2009 Mar 7; 373 (9666): 829-835. Epub 2009 Feb 14. PMID: 19223069.

China Salt Substitute Study Collaborative Group: A randomized, controlled trial. *J Hypertens*. 2007 Oct; 25 (10): 2, 011-2, 018. PMID: 17885542.

Cook NR, Kumanyika SK, Cutler JA, Whelton PK; Trials of Hypertension Prevention Collaborative Research Group. Dose-response of sodium excretion and blood pressure change among overweight, non-hypertensive adults in a three-year dietary intervention study. *J Hum Hypertens*. 2005 Jan; 19 (1): 47-54. PMID: 15343354.

Dickinson KM, Keogh JB, Clifton PM. [Effects of a low-salt diet on flow-mediated dilatation in humans](#). *Am J Clin Nutr*. 2009 Feb; 89 (2): 485-490. Epub 2008 Dec 23. PMID: 19106240.

Forrester T, Adeyemo A, Soarres-Wynter S, Sargent L, Bennett F, Wilks R, Luke A, Prewitt E, Kramer H, Cooper RS. [A randomized trial on sodium reduction in two developing countries](#). *J Hum Hypertens*. 2005 Jan; 19 (1): 55-60. PMID: 15470483.

Gates PE, Tanaka H, Hiatt WR, Seals DR. [Dietary sodium restriction rapidly improves large elastic artery compliance in older adults with systolic hypertension](#). *Hypertension*. 2004 Jul;44(1):35-41. Epub 2004 Jun 1. PMID: 15173128.

He J, Gu D, Chen J, Jaquish CE, Rao DC, Hixson JE, Chen JC, Duan X, Huang JF, Chen CS, Kelly TN, Bazzano LA, Whelton PK; GenSalt Collaborative Research Group. [Gender difference in blood pressure responses to dietary sodium intervention in the GenSalt study](#). *J Hypertens*. 2009 Jan; 27 (1): 48-54. PMID: 19145767.

He Feng J., Marciniak M, Visagie E, Markandu ND, Anand V, Dalton RN, MacGregor GA. Effect of Modest Salt Reduction on Blood Pressure, Urinary Albumin, and Pulse Wave Velocity in White, Black, and Asian Mild Hypertensives. *Hypertension*, Sep 2009. (Hand search - 21 July 2009)

Mäkelä P, Vahlberg T, Kantola I, Vesalainen R, Jula A. [The effects of a six-month sodium restriction on cardiac autonomic function in patients with mild to moderate essential hypertension](#). *Am J Hypertens*. 2008 Nov; 21 (11): 1, 183-1, 187. Epub 2008 Sep 11. PMID: 18787516.

Pimenta E, Gaddam KK, Oparil S, Aban I, Husain, Dell'Italia LJ, Calhoun DA. Effects of Dietary Sodium Reduction on Blood Pressure in Subjects With Resistant Hypertension Results From a Randomized Trial. *Hypertension*, Sep 2009. (Hand search - 21 July 2009).

Schmidlin O, Forman A, Sebastian A, Morris RC Jr. [Sodium-selective salt sensitivity: Its occurrence in blacks](#). *Hypertension*. 2007 Dec; 50 (6): 1, 085-1, 092. Epub 2007 Oct 15. PMID: 17938378

Swift PA, Markandu ND, Sagnella GA, He FJ, MacGregor GA. [Modest salt reduction reduces blood pressure and urine protein excretion in black hypertensives: A randomized control trial](#). *Hypertension*. 2005 Aug; 46 (2): 308-312. Epub 2005 Jun 27. PMID: 15983240

Review Articles (1)

He FJ, Macgregor GA. [A comprehensive review on salt and health and current experience of worldwide salt reduction programmes.](#) *J Hum Hypertens*. 2008 Dec 25. [Epub ahead of print] PMID: 19110538 (Hand search)

List of Excluded Articles with Reason

Primary Articles	Reason for Exclusion
Ajani UA, Dunbar SB, Ford ES, Mokdad AH, Mensah GA. Sodium intake among people with normal and high blood pressure. <i>Am J Prev Med</i> . 2005 Dec; 29 (5 Suppl 1): 63-67.	Cross-sectional study design.
Chen J, Gu D, Huang J, Rao DC, Jaquish CE, Hixson JE, Chen CS, Chen J, Lu F, Hu D, Rice T, Kelly TN, Hamm LL, Whelton PK, He J; GenSalt Collaborative Research Group. Metabolic syndrome and salt sensitivity of blood pressure in non-diabetic people in China: A dietary intervention study. <i>Lancet</i> . 2009 Mar 7; 373 (9666): 829-835.	Reported on same dataset as He et al, 2009.
Cook NR, Obarzanek E, Cutler JA, Buring JE, Rexrode KM, Kumanyika SK, Appel LJ, Whelton PK; Trials of Hypertension Prevention Collaborative Research Group. Joint effects of sodium and potassium intake on subsequent cardiovascular disease: The Trials of Hypertension Prevention follow-up study. <i>Arch Intern Med</i> . 2009 Jan 12;169 (1): 32-40.	Did not examine relationship between sodium intake and blood pressure.
Kojuri J, Rahimi R. Effect of "no added salt diet" on blood pressure control and 24-hour urinary sodium excretion in mild to moderate hypertension. <i>BMC Cardiovasc Disord</i> . 2007 Nov 6; 7: 34.	Case-control study design.
McNeely JD, WindhamBG, Anderson DE. Dietary sodium effects on heart rate variability in salt sensitivity of blood pressure. <i>Psychophysiology</i> . 2008 May; 45 (3): 405-411.	Study interventions were less than seven days.
Takahashi Y, Sasaki S, Okubo S, Hayashi M, Tsugane S. Blood pressure change in a free-living population-based dietary modification study in Japan. <i>J. Hypertens</i> . 2006 Mar; 24 (3): 451-458.	Does not include sodium in analysis.

Meta-Analysis/Review Articles	Reason for Exclusion
Adrogué HJ, Madias NE. Sodium and potassium in the pathogenesis of hypertension. <i>N. Engl J Med.</i> 2007 May 10;356 (19): 1, 966-1, 978. Review. No abstract available. PMID: 17494929	Review describing mechanisms of disease.
Blaustein MP, Zhang J, Chen L, Hamilton BP. How does salt retention raise blood pressure? <i>Am J Physiol Regul Integr Comp Physiol.</i> 2006 Mar; 290 (3): R514-23. Review. PMID: 16467498	Review describing mechanisms of disease.
Cohen HW, Alderman MH. Sodium, blood pressure, and cardiovascular disease. <i>Curr Opin Cardiol.</i> 2007 Jul; 22 (4): 306-310.	Narrative review.
Frohlich ED. The role of salt in hypertension: The complexity seems to become clearer. <i>Nat Clin Pract Cardiovasc Med.</i> 2008 Jan; 5 (1): 2-3. No abstract available. PMID: 18073713	Editorial publication.
Frohlich ED. The salt conundrum: A hypothesis. <i>Hypertension.</i> 2007 Jul; 50 (1): 161-166. Epub 2007 Apr 30. Review. No abstract available. PMID: 17470717	Review hypothesizing mechanisms of disease.
Funatsu K, Yamashita T, Nakamura H. Effect of coffee intake on blood pressure in male habitual alcohol drinkers. <i>Hypertens Res.</i> 2005 Jun; 28 (6): 521-527. PMID: 16231758	Does not answer question. Describes effects of coffee and alcohol intake on blood pressure(BP).
Hooper L, Bartlett C, Davey SG, Ebrahim S. Advice to reduce dietary salt for prevention of cardiovascular disease. <i>Cochrane Database Syst Rev.</i> 2004; (1): CD003656. PMID: 14974027	Does not include BP in analyses.
Iwamoto T, Kita S. Hypertension, Na ⁺ /Ca ²⁺ exchanger, and Na ⁺ , K ⁺ -ATPase. <i>Kidney Int.</i> 2006 Jun; 69 (12): 2, 148-2, 154. Epub 2006 Apr 26. Review PMID: 16641927	Does not answer question. Describes a mechanism of Na ⁺ /Ca ²⁺ and Na ⁺ K ⁺ ATPase
Jones DW. Dietary sodium and blood pressure. <i>Hypertension.</i> 2004 May; 43 (5): 932-935. Epub 2004 Mar 29. Review. No abstract available. PMID: 15128720	Narrative review.
Karppanen H, Mervaala E. Sodium intake and hypertension. <i>Prog Cardiovasc Dis.</i> 2006 Sep-Oct; 49 (2): 59-75.	Narrative review.
Kawano Y, Ando K, Matsuura H, Tsuchihashi T, Fujita T, Ueshima H; Working Group for Dietary Salt Reduction of the Japanese Society of Hypertension. Report of the Working Group for Dietary Salt Reduction of the Japanese Society of Hypertension: (1) Rationale for salt restriction and salt-restriction target level for the management of	Narrative review.

hypertension. <i>Hypertens Res.</i> 2007 Oct; 30 (10): 879-886.	
Kawano Y, Tsuchihashi T, Matsuura H, Ando K, Fujita T, Ueshima H; Working Group for Dietary Salt Reduction of the Japanese Society of Hypertension. Report of the Working Group for Dietary Salt Reduction of the Japanese Society of Hypertension: (2) Assessment of salt intake in the management of hypertension. <i>Hypertens Res.</i> 2007 Oct; 30(10): 887-893.	Narrative review.
Khalil RA. Dietary salt and hypertension: new molecular targets add more spice. <i>Am J Physiol Regul Integr Comp Physiol.</i> 2006 Mar; 290 (3): R509-513. Review. No abstract available. PMID: 16467497	Narrative review.
Lawlor DA, Smith GD. Early life determinants of adult blood pressure. <i>Curr Opin Nephrol Hypertens.</i> 2005 May; 14(3): 259-264. Review.	Narrative review.
Meneton P, Jeunemaitre X, de Wardener HE, MacGregor GA. Links between dietary salt intake, renal salt handling, blood pressure, and cardiovascular diseases. <i>Physiol Rev.</i> 2005 Apr; 85 (2): 679-715.	Narrative review.
O'Shaughnessy KM, Karet FE. Salt handling and hypertension. <i>J Clin Invest.</i> 2004 Apr; 113 (8): 1, 075-1, 081. Review. PMID: 15085183	Narrative review and editorial publication.
Orlov SN, Mongin AA. Salt-sensing mechanisms in blood pressure regulation and hypertension. <i>Am J Physiol Heart Circ Physiol.</i> 2007 Oct; 293 (4): H2039-2053. Epub 2007 Aug 10. Review. PMID: 1769354	Does not answer question. Describes molecular salt sensitivity mechanism.
Rodriguez-Iturbe B, Vaziri ND. Salt-sensitive hypertension-update on novel findings. <i>Nephrol Dial Transplant.</i> 2007 Apr; 22 (4): 992-995. Epub 2007 Jan 8. Review. No abstract available. PMID: 17210585	Does not answer question. Describes molecular salt sensitivity mechanism.
Rylander R, Arnaud MJ. Mineral water intake reduces blood pressure among subjects with low urinary magnesium and calcium levels. <i>BMC Public Health.</i> 2004 Nov 30; 4: 56. PMID: 15571635	Does not answer question. Discusses mineral water.
Weinberger MH. Is salt sensitivity of blood pressure linked to the cardiometabolic syndrome? <i>J Cardiometab Syndr.</i> 2006 Summer; 1 (3): 217-219. Review. No abstract available. PMID: 17679824	Editorial publication.

Welsh L, Ferro A. Drug treatment of essential hypertension: The case for initial combination therapy. *Int J Clin Pract*. 2004 Oct; 58 (10): 956-963. Review. PMID: 15587775

Does not answer question. Review addresses drug treatments for HTN.