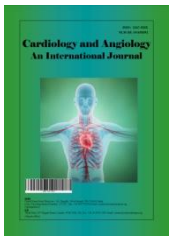

Cardiology and Angiology: An International Journal

11(4): 1-6, 2022; Article no.CA.85778
ISSN: 2347-520X, NLM ID: 101658392

Role of Black Salt to Reduce in Hypertension, Reality and Evidence Based Studies

Naresh Sen [a≡*] and Sonal Tanwar [b]

[a] Aditya Hospital, Rewari, Haryana / VG University, India.
[b] VG University, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CA/2022/v11i430200

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/85778

Review Article

Received 04 February 2022
Accepted 12 April 2022
Published 21 April 2022

ABSTRACT

Salt in diet is very important to make our life healthy and energetic. Quantity and quality of salt with appropriate ratio or balance in electrolytes which are responsible for volume of body, blood velocity, for functions of receptors and enzymes, to prevent inflammation, proliferation and to make balance in muscles contraction and nerve conduction through to avoid high stimulation of sympathetic nervous system. Hence, scanning and focus with monitoring and supply of healthy salt in limits may prevent volume overload, renal dysfunction & left ventricular hypertrophy, to prevent cardiac functions, to avoid the weaken gut immunity and also to prevent cerebral oedema, cerebral aneurysm and hypertension cause stroke. Control of salt with intake of low quantity and high quality with more frequency of intervals during 24 hours in required amount of salt in balanced electrolytes may help to avoid high salt sensitivity. Balanced salt intake is also important to avoid volume expansion and obesity with reduction of insulin resistance leads to prevent hypertension and diabetes which are leading risk factors for cardio-renal syndrome, cardiovascular morbidity and mortality. Our data suggested a 2.5-fold higher risk for high blood pressure in sea or white salt users versus black salt or Himalayan rock salt which showed more potassium and magnesium with low sodium ions as compared to sea salt.

Keywords: Black salt; white salt; hypertension.

≡Consultant Cardiologist;
**Corresponding author: E-mail: drnaresh.sen@gmail.com;*

1. INTRODUCTION

Data and previous evidence-based studies declared that more quantity of salt in diet (sodium chloride) or high rich sodium food is related to raised blood pressure cause hypertension which is responsible for cardiovascular risk as hypertensive heart disease, chronic kidney disease and stroke [1,2]. But in reality, of another part, a reduction of salt in diet leads to significant lower the blood pressure and decrease the cardiovascular risk or major adverse events in hypertensive or normotensive patients on the base of many meta-analyses of dietary interventional studies [3,2].

2. SALT AND PATHOPHYSIOLOGY

As we know salt is commonly a form of sodium chloride but it is found in various kinds of salt which are available on planet earth. Sea salt or table salt which is white in colour or creamy with fine granules as main contents of sodium chloride which contains about 38.8% to 39.8% sodium, potassium 0.12% , magnesium <0.01% and other salts such as Himalayan salt or black rock salt which is black or pinkish black in colour with thick granules as sodium sulphate (Na2SO4), magnesia having 34.5% to 36 % sodium, 0.32 to 0.28% potassium, and <0.1 to 0.2 % magnesium [4]. But in black salt or rock salt contains additional ferrous sulphate (FeSO4), ferric oxide [5]. In the markets, refined table salt is available in additional iodine with sodium chloride and black salt which is reformed with charcoal of rock salt. Another variety of salts are available with additional contains of iodine, iron and folic acids [6].

Salt related hypertension or highly sensitive to salt specially in sodium rich contents with low amount of potassium and magnesium is responsible to get expansion of volume and could cause of stress to renal infiltration resulting in impaired renal function, imbalance of sodium and potassium ratio, may slow the renin-angiotensin-aldosterone-system (RAAS) with associated renal receptors [2,7]. Rich sodium, low potassium and magnesium in salt is leading to jump of inflammatory processes towards changes of systemic or peripheral resistance which effect on cardiovascular system cause hypertension and also increase the activity of the sympathetic nervous system followed by central stimulation resulting as high heart rate and high blood pressure [7,8].

3. SALT SENSITIVITY, CURRENT INTAKE REALITY OF WORLD AND RECOMMENDATION

Sodium intake is increasing in our diet by food processing products, bakery shops products and restaurants followed by making unbalanced electrolytes leads to increase blood pressure. Salt sensitivity has very important role to play in high blood pressure, almost 50- 65 % patients of hypertension are salt-sensitive [9]. Quality of salt, colour of skin, especially in black people, obesity, aging factors, aggressive or type A personality people and in addition to genetic polymorphisms are more sensitive to the salt and its related hypertension [9]. The World Health Organization (WHO) recommended levels of salt of 5 gm per day or less than 2 gm sodium intake per day in adults and slightly lower in children [10,11]. According to the current guideline of the American Heart Association (AHA) recommended 2300 mg sodium intake in normal adult populations and advised low sodium intake around 1500 mg per day to reduce hypertension and cardiovascular risk like coronary heart disease and stroke in risk individuals [12]. Data showed throughout the world in reality about average salt intake between 9 to 12 gm per day which is not recommendable for cardiovascular health [10,11]. On the basis of researches and meta-analyses renowned society to related hypertension and cardiovascular sciences produce strict guidelines a moderate reduction of daily salt intake 30 to 50 % reduction is required and suggest to human body about 6 gm/day salt intake to reduce morbidity and mortality [10,13]. In addition of rich potassium about 4 to 4.5 gm /day with sodium restriction strategy is important to play a role to decrease CV risk by using less than 1.5 gm Na /day in heart failure, kidney failure, old age group, children group, less than 2 gm Na/day sodium intake in black people, obese or overweight people, genetically sensitive to salt for hypertension and other cardiovascular comorbid conditions, diabetes, mild kidney disease [10,11,12,13,14]. Regular physical activity (dynamic resistance, and isometric resistance training) is offered with limitation of alcohol intake for reduction of CV morbidity in salt related hypertension [10,11,12,13,15].

4. RECENT CLINICAL RESEARCH

Dose response meta-analysis with systemic review was conducted at model with random effect and estimate of high sodium intake by 36

reports of 6, 16, 905 participants. 20 reports of them were used for dose response relationship either linear or nonlinear. Risk of cardiovascular disease was found at higher level in high sodium intake versus low sodium (RR: 1.19, 95% CI=1.08-1.30) with significant linear relationship between sodium intake in diet and CV risk. Result of study revealed every 1 gm of sodium increase in diet is responsible for increase cardiovascular risk up to 6 % [16].

On the other side of experimental based studies for dose response meta-analysis of blood pressure effect of sodium reduction was performed at new 1 stage cubic spline mixed effect model. Scientific team included trials for 24 hours urine sodium excretion with manipulation of sodium through supplements or diet and measurement of systolic and diastolic blood pressure at the beginning and end of the intervention. Result showed 85 trials with sodium intake of various range between 0.4 to 7.6 gm/day and 65 trials were studied in hypertensive patients with follow up of 4 weeks to 36 months. Data revealed similar linear relationship in both group hypertensive and normotensive but in hypertensive group showed a steeper decrease in blood pressure after reduction of sodium intake [17].

The scientific paper presented on the relationship between consumption of salt and arterial hypertension in obese children and adolescents. Studies suggest as the disturbances of sodium excretion leads to raise intravascular volume followed by increased activity of adipocyte's secretion resulting in insulin resistance with functionally impaired of the renin-angiotensin-aldosterone system (RAAS axis). Investigators were found salt sensitive arterial hypertension in obese children and adolescents and recommend through review of data about Na/K ratio and water consumption is more important to development of arterial hypertension [18].

As per literature suggest us about role of potassium is for control of raise blood pressure or balanced in Na/K ratio is important to reduction of high blood pressure [19]. A systemic review published in peer reviewed journal to access the relationship of sodium & potassium intake and cardiovascular disease in older age group. Study was performed through the multiple review with help of web-sciences, Pub-med library to collect the observational and experimental data from 2015 to 2020 were reported the relationship between the sodium, potassium or Na/K ratio with CVD among old age group beyond the age of 60 years. Review showed that 12 studies were included in that with 5 of them were related to sodium -potassium ratio and CVD risk, prospective cohort and cross-sectional research. Result found inconsistent data with reduction of sodium and CV risk but investigators noted significant CV reduction like hypertension heart disease, stroke in both group of good potassium intake or low sodium-potassium ratio [19].

A double blind randomised controlled trial was performed on 187 Japanese men, aged 35-67 years, who were not taking medicines for BP reduction and divided into two groups, Interventional group A (low sodium with high potassium: Na 1175 mg and K 1476 mg) in boxed lunch and miso soup versus control group B (Na 2243 mg and K 703 mg). Results showed a significantly stronger decrease in the urinary sodium-to-potassium ratio in group A than the control group B ($p < 0.001$). The difference in systolic blood pressure change after adjustment for baseline values between the two groups was mean SBP -2.1 (95% CI: -3.6, -0.6) mmHg. Study suggests the effect of new low-sodium high-potassium seasonings and processed foods containing poly-γ-glutamic acid foods aimed at lowering blood pressure in free-living settings may be feasible and effective [20].

A randomised controlled trial was performed to access the effect of sodium and potassium supplementation on vascular and endothelial function and to determine the effect of potassium and sodium on postprandial endothelial function by using flow-mediated dilatation (FMD) and arterial compliance as assessed by using pulse wave velocity (PWV). Results found a significantly attenuated the post-meal decrease in FMD (p value < 0.05) in the addition of potassium which formed high potassium with high sodium (HKHN) compared with low potassium with high sodium (LKHN). FMD was significantly lower after the LKHN than after the HKHN at 30 min ($P < 0.01$) [21].

Apart from potassium, magnesium has beneficial role to control or reduce blood pressure leads to reduction of cardiovascular morbidity and mortality. Zhang and team published their data on cardiovascular mortality and dietary magnesium intake in 58,615 health Japanese aged 40-79 years during of median 14.7 years documented 4.58% cardiovascular death and 2.4 % from stroke. Data revealed that magnesium

intake was inversely related with mortality from haemorrhagic stroke in men (High versus low magnesium, Hazard Ratio was 0.49 (95% CL, 0.26-0.95), p value= 0.07) and mortality from cardiovascular morbidity like stroke, coronary heart disease and heart failure in women.High versus low magnesium, Hazard Ratio was 0.47 (0.29-0.77), p value < 0.001 for stroke, 0.50 (0.30-0.84), p value = 0.005 for coronary heart disease, 0.50 (0.28-0.87), p value = 0.002 for heart failure and 0.64 (0.51-0.80 in women [22].

Evidence based of cross-sectional observation cohort study and data focused on the different contains of black/pink Himalayan rock salt as compared to routine table salt utility with CV risk prevention in prehypertensive Indian patients. Low sodium with high potassium and magnesium in Himalayan salt as compare (n=600) to table salt (n=570) with same dose of 5 gm per day was the source of intervention among 1170 prehypertensive patients (mean Systolic BP 129+/-4 mmHg and Diastolic BP was 85 +/- 3 mmHg, mean age 43+/-9 years) for 12 months follow up. Himalayan black/pink salt group showed a significant reduction of SBP 6 to 8 mmHg and DBP about 3 to 5 mmHg which is 2.5fold higher than table or sea salt (p value <0.002). Himalayan salt also claimed in this study to improve diastolic function and heart rate and heart rate variability as compared to table salt. Data further revealed that low quantity with quality of salt and moderate frequency of time interval with fixed dose of salt 5 gm/day had slightly better reduction of blood pressure, improved cardiac functions, improved exercise capacity and 6 min walk test [23].

5. MANAGEMENT AND LEADERSHIP

Primordial prevention is required to modify with control of salt desire, intake and sensitivity by the using of behaviour counselling, spiritual therapy in life style interventional program. Primary prevention is required to reduce sodium intake and increase utility of additional potassium and magnesium in diet to control the blood pressure and salt sensitivity. Secondary prevention is required to give diuretic and ACE or ARB medicinal agent for reduction of volume overload, reduction of blood pressure to manage hypertensive heart disease and related complications like heart failure and stroke. Because we can restrict the limit of salt as sodium but cannot stop or lower too much in daily need which is very important to regulate our physical and mental functions.

6. CONCLUSION

Salt is required daily to maintain our functions of body and mind. We require good fruits and vegetables with balanced electrolytes and additional 5 to 7 gm salt per day for cooking food sources. In our food markets there are many types of salts available but in reality, the quality of salt which has optimum sensitivity with low sodium, high potassium and good amount of magnesium is recommended to human mankind to maintain body and mind function with perfect equilibrium of body, mind and soul satisfaction. Low quantity with moderate frequency of quality of salt could lower the risk of volume expansion and raise blood pressure. Salt management and leadership is very important to regulate our body's function and to reduce cardiovascular complications. Our data revealed more hypertension in high quantity with low frequency versus low quantity with quality of salt with high frequency users. Data suggests a significant difference of dyspnoea, cardiac functions and exercise intolerance in hypertensive rich salt users versus balanced salt intake less than 6 gm/day.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

ACKNOWLEDGEMENT

We would like to big thanks to all media and journals who have supported to write our manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mente A, O'Donnell M, Rangarajan S, Dagenais G, Lear S, McQueen M, Diaz R, Avezum A, Lopez-Jaramillo P, Lanas F, Li W, Lu Y, Yi S, Rensheng L, Iqbal R, Mony P, Yusuf R, Yusoff K, Szuba A, Oguz A, Rosengren A, Bahonar A, Yusufali A, Schutte AE, Chifamba J, Mann JF, Anand SS, Teo K, Yusuf S; PURE, EPIDREAM and Ontarget/Transcend Investigators. Associations of urinary sodium excretion with cardiovascular events in individuals with and without hypertension: a pooled

analysis of data from four studies. Lancet. 2016;388:465-75.
Available:https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)30467-6/fulltext

2. Malta D, Petersen KS, Johnson C, Trieu K, Rae S, Jefferson K, Santos JA, Wong MMY, Raj TS, Webster J, Campbell NRC, Arcand J. High sodium intake increases blood pressure and risk of kidney disease. From the Science of Salt: A regularly updated systematic review of salt and health outcomes (August 2016 to March 2017). J Clin Hypertens (Greenwich). 2018;20:1654-65.
DOI: 10.1111/jch.13408. Epub 2018 Nov 7. PMID: 30402970; PMCID: PMC8030856.
Available:https://onlinelibrary.wiley.com/doi/epdf/10.1111/jch.13408
3. Intersalt: An international study of electrolyte excretion and blood pressure. Results for 24hour urinary sodium and potassium excretion. Intersalt Cooperative Research Group. BMJ. 1988;297:319-28.
Available:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1834069/
4. Drake SL, Drake MA. Comparison of Salty Taste and Time Intensity of Sea and Land Salts from Around the World. Journal of Sensory Science. 2011;26:25-34.
Available:https://onlinelibrary.wiley.com/doi/full/10.1111/j.1745-459X.2010.00317.x
5. Esche J, Thamm M, Remer T. Contribution of iodized salt to total iodine and total salt intake in Germany. Eur J Nutr. 2020;59: 3163-9.
Available:https://link.springer.com/article/10.1007%2Fs00394-019-02154-7
6. Ramírez-Luzuriaga MJ, Larson LM, Mannar V, Martorell R. Impact of Double-Fortified Salt with Iron and Iodine on Hemoglobin, Anemia, and Iron Deficiency Anemia: A Systematic Review and Meta-Analysis. Adv Nutr. 2018;9:207-18.
Available:https://academic.oup.com/advances/article/9/3/207/4996110
7. He FJ, Tan M, Ma Y, MacGregor GA. Salt Reduction to Prevent Hypertension and Cardiovascular Disease: JACC State-of-the-Art Review. J Am Coll Cardiol. 2020;75:632-47.
Available:https://www.sciencedirect.com/science/article/pii/S0735109719386929?via%3Dihub
8. Patel Y, Joseph J. Sodium Intake and Heart Failure. Int J Mol Sci. 2020;21: 9474.
Available:https://www.mdpi.com/1422-0067/21/24/9474
9. Balafa O, Kalaitzidis RG. Salt sensitivity and hypertension. J Hum Hypertens. 2021;35:184-92.
Available:https://www.nature.com/articles/s41371-020-00407-1
10. He FJ, Burnier M, Macgregor GA. Nutrition in cardiovascular disease: salt in hypertension and heart failure. Eur Heart J. 2011;32:3073-80.
Available:https://academic.oup.com/eurheartj/article/32/24/3073/462087
11. WHO. Salt Reduction. Key facts. 29 April 2020.
Available:https://www.who.int/news-room/fact-sheets/detail/salt-reduction
12. Whelton PK, Appel LJ, Sacco RL, Anderson CA, Antman EM, Campbell N, Dunbar SB, Frohlich ED, Hall JE, Jessup M, Labarthe DR, MacGregor GA, Sacks FM, Stamler J, Vafiadis DK, Van Horn LV. Sodium, blood pressure, and cardiovascular disease: further evidence supporting the American Heart Association sodium reduction recommendations. Circulation. 2012;126:2880-9.
Available:https://www.ahajournals.org/doi/10.1161/CIR.0b013e318279acbf?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed
13. He FJ, Macgregor GA. Salt intake, plasma sodium, and worldwide salt reduction. Ann Med. 2012;44:S127-37.
Available:https://www.tandfonline.com/doi/full/10.3109/07853890.2012.660495
14. Wang YJ, Yeh TL, Shih MC, Tu YK, Chien KL. Dietary Sodium Intake and Risk of Cardiovascular Disease: A Systematic Review and Dose-Response Meta-Analysis. Nutrients. 2020; 12:2934.
Available:https://www.mdpi.com/2072-6643/12/10/2934
15. Aburto NJ, Hanson S, Gutierrez H, Hooper L, Elliott P, Cappuccio FP. Effect of increased potassium intake on cardiovascular risk factors and disease: systematic review and meta-analyses. BMJ. 2013;346:f1378.
Available:https://www.bmj.com/content/346/bmj.f1378.long
16. Filippini T, Malavolti M, Whelton PK, Naska A, Orsini N, Vinceti M. Blood Pressure Effects of Sodium Reduction: Dose-Response Meta-Analysis of

Experimental Studies. Circulation. 2021; 143:1542-67.
Available:https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.120.050371?rfr_dat=cr_pub++0pubmed&url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org

17. Wójcik M, Kozioł-Kozakowska A. Obesity, Sodium Homeostasis, and Arterial Hypertension in Children and Adolescents. Nutrients. 2021;13:4032.
Available:https://www.mdpi.com/2072-6643/13/11/4032
18. Kogure M, Nakaya N, Hirata T, Tsuchiya N, Nakamura T, Narita A, Suto Y, Honma Y, Sasaki H, Miyagawa K, Ushida Y, Ueda H, Hozawa A. Sodium/potassium ratio change was associated with blood pressure change: possibility of population approach for sodium/potassium ratio reduction in health checkup [published correction appears in Hypertens Res. [2020 Sep 8]. Hypertens Res. 2021;44: 225-31.
Available:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7815510/
19. Gonçalves C, Abreu S. Sodium and Potassium Intake and Cardiovascular Disease in Older People: A Systematic Review. Nutrients. 2020;12:3447.
Available:https://www.mdpi.com/2072-6643/12/11/3447
20. Umeki Y, Hayabuchi H, Adachi H, Ohta M. Feasibility of Low-Sodium, High-Potassium Processed Foods and Their Effect on Blood Pressure in Free-Living Japanese Men: A Randomized, Double-Blind Controlled Trial. Nutrients. 2021;13: 3497.
Available:https://www.mdpi.com/2072-6643/13/10/3497
21. Blanch N, Clifton PM, Petersen KS, Keogh JB. Effect of sodium and potassium supplementation on vascular and endothelial function: a randomized controlled trial. Am J Clin Nutr. 2015;101: 939-46.
22. Zhang W, Iso H, Ohira T, Date C, Tamakoshi A; JACC Study Group. Associations of dietary magnesium intake with mortality from cardiovascular disease: the JACC study. Atherosclerosis. 2012 Apr;221(2):587-95.
DOI:10.1016/j.atherosclerosis.2012.01.034 Epub 2012 Jan 28. PMID: 22341866.
Available:https://academic.oup.com/ajcn/article/101/5/939/4577580
23. Tanwar S, Sen N. Effects on Blood Pressure of Black Salt (Himalayan Salt) Versus Table Salt in Prehypertensive Indians. Indian Heart Journal. 2019; 71;S77.
Available:https://www.sciencedirect.com/science/article/pii/S0019483219306182

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/85778