International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Effect of Alternate Nostril Breathing Exercise on Cardiorespiratory Functions in Hypertensive Adults: A Systematic Review

Dr. Roshni Vohra (PT)

Assistant Professor, Faculty of Physiotherapy, Sigma University - Vadodara

ABSTRACT

Background: Cardiovascular diseases (CVDs), primarily driven by hypertension (HTN), are a leading global health concern. While medication is commonly used to manage HTN, non-pharmacological approaches like ANB are gaining interest. ANB is a yogic breathing technique believed to modulate the autonomic nervous system, influencing heart rate and blood pressure.

Methods: A systematic review adhering to PRISMA guidelines assessed studies published between 2015 and 2022 that investigated the effects of ANB on blood pressure in human subjects.

Results: Six studies were included, with findings suggesting a potential benefit of ANB for reducing blood pressure. All studies, except one, reported significant reductions in systolic and/or diastolic blood pressure after ANB practice. Intervention duration varied across studies, ranging from single sessions to six weeks of daily practice. Some studies also observed a decrease in heart rate and improved vascular function following ANB. However, limitations exist: unclear control groups in some studies and varying intervention protocols.

Discussion: Despite promising preliminary evidence, further well-designed, randomized controlled trials with larger sample sizes and standardized protocols are needed. Future research should compare ANB with sham interventions or standard medical management, and explore the underlying mechanisms of how ANB might influence blood pressure.

Conclusion: While the current evidence requires further confirmation, ANB appears to be a safe and potentially beneficial non-pharmacological intervention for managing blood pressure, potentially as an adjunct to medication. Healthcare professionals may consider suggesting ANB to hypertensive patients, alongside lifestyle modifications and medication, but emphasize the importance of consulting a healthcare provider before starting any new practice.

Keywords: ANB - Alternate Nostril Breathing, Hypertension, Blood Pressure, Cardiorespiratory Health

INTRODUCTION

Cardiovascular diseases (CVDs), including ischemic heart disease (IHD), atrial fibrillation (AF), stroke, and heart failure (HF) and a number of other heart and blood vessel disorders, comprise the leading cause of global mortality and disability, accounting for >18 million deaths worldwide in 2019.[1] Hypertension (HTN) is the most important driving factor for CVD.[2] Prehypertension or stage I hypertension is categorized as consistently elevated systolic blood pressure (SBP) and diastolic blood pressure (DBP) ranging from 120 to 139 mmHg and from 80 to 89 mmHg respectively, while hypertension is defined

when SBP and DBP consistently range from 130 to ≥139 and/or from 80 to ≥89 mmHg respectively.[3] More than a billion people currently suffer which includes more than a quarter of men and a fifth of women, and it is expected to be 1.56 billion by 2025, according to the World Health Organization.[4]

Cardiovascular diseases (CVDs) remain a leading global health concern, with hypertension (HTN) identified as a primary risk factor. Hypertension, characterized by elevated blood pressure, significantly increase the risk of heart disease, stroke, and other cardiovascular complications. While pharmacological interventions are commonly employed to manage hypertension, lifestyle modifications, including non-pharmacological approaches, have gained significant attention.[5]

One promising non-pharmacological intervention is Alternate Nostril Breathing (ANB), a yogic breathing technique involving alternate inhalation and exhalation through each nostril. ANB is believed to modulate the autonomic nervous system, particularly the sympathetic and parasympathetic branches, thereby influencing heart rate and blood pressure. By reducing sympathetic activity and promoting parasympathetic dominance, ANB may offer potential benefits in managing hypertension.[6]

Despite the growing interest in ANB, rigorous scientific research is needed to evaluate its efficacy in reducing blood pressure and improving cardiovascular health. This literature review aims to systematically examine existing studies investigating the effects of ANB on individuals.[7] By synthesizing the available evidence, this review will contribute to a better understanding of the potential benefits of ANB as a complementary approach to managing hypertension and promoting cardiovascular well-being.

METHODOLOGY

Systematic Review

A systematic review was conducted adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to assess the efficacy of Alternate Nostril Breathing (ANB) in managing hypertension.

Data Sources and Search Strategy

The following database was selected and used to search for original research articles without any date restriction- PubMed (Medline), Embase/Scopus, Google Scholar and Cochrane. The following keywords and their combinations were employed: "Alternate Nostril Breathing," "ANB," "Yogic Breathing," "Pranayama," "Hypertension," " "Blood Pressure," "Cardiovascular," and "Clinical Trial."

Inclusion and Exclusion Criteria

Inclusion Criteria

- Published Material
- Participants diagnosed with hypertension
- Intervention: ANB as the primary intervention
- Studies conducted from year 2015 to 2022

Exclusion Criteria

- Review articles, case reports, and case series
- The lack of sufficient information on cardiorespiratory function and other breathing exercise.

Data Extraction and Quality Assessment

Relevant data were extracted from the included studies using a standardized data extraction form. The following information was collected:

- Study characteristics (author, year of publication, country, sample size, duration of intervention, etc.)
- Participant characteristics (age, sex, baseline blood pressure, etc.)

- Intervention details (frequency, duration, intensity of ANB practice)

The methodological quality of the included RCTs was assessed using the Cochrane Collaboration's Risk of Bias Tool. This tool evaluates bias in randomization, allocation concealment, blinding, incomplete outcome data, selective reporting, and other potential biases.

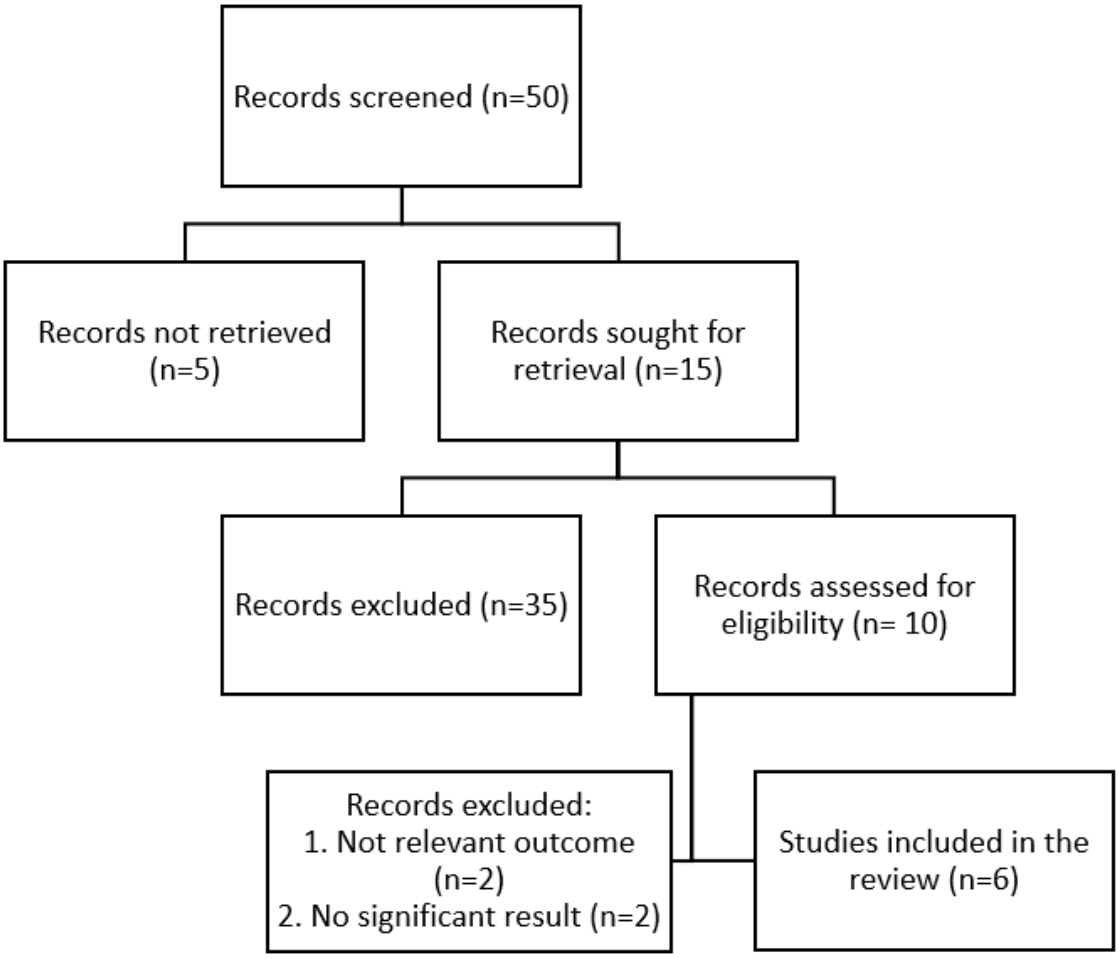
Data Synthesis and Statistical Analysis

If eligible studies were sufficiently homogeneous, a meta-analysis was conducted using a fixed-effect or random-effects model, depending on the heterogeneity between studies. The standardized mean difference (SMD) was calculated to assess the effect of ANB on SBP, DBP, and HR. Sensitivity analysis was performed to assess the robustness of the findings by excluding studies with high risk of bias or those with significant methodological limitations.

Ethical Considerations

This review involved secondary data analysis, and no primary data collection was performed. Therefore, ethical approval was not required.

By following these rigorous methodological steps, this systematic review aimed to provide a reliable and comprehensive assessment of the efficacy of ANB in managing hypertension.



A flow diagram illustrating the number of studies identified, screened, included, and excluded, along with the reasons for exclusion.

RESULT

Study Characteristics:

A summary table describing the characteristics of the included studies:

Sr. no.	Author, Year	Sample size	Intervention	Outcome measure	Major finding	Outcome conclusion
1	Gamze Uğur et al. (2020)	76	Alternate nostril breathing exercises for 15 min/day for two weeks.	SBP, DBP, Heart Rate	Compared to the mean values of the first measurement of clinical SBP and diastolic blood pressure (DBP), the mean values of the second measurement of clinical SBP and DBP showed a decrease of approximately 3 and 5 mmHg, respectively	ANB exercises can be a useful measure for improving respiratory endurance and functions.
2	K Karpagam et al. (2020)	50	Alternate nostril breathing exercise for 7 days. Everyday 20 minutes twice day.	SBP, DBP	ANB exercise significantly reduces the Blood pressure. pre diastolic pressure in the experimental group was 92.76±9.38 and post diastolic pressure was 77.20±7.92 was decreased after giving the alternate nostril breathing exercise foe hypertensive patients. The calculated paired 't' value is 10.9654, it was statistically significant at p.	ANB exercise is effective and a simple strategy to reduce the blood pressure.
3	Kalaivani et al. (2019)	170	Alternate nostril breathing exercises for 15 min/day for five days.	SBP, DBP, Heart Rate	ANB exercise for five days showed improvement in the mean value pre- and post-assessment in systolic BP (126.64 and 80.42), diastolic BP (80.42 and 80.3), heart rate (85.58 and 84.21), and rate pressure product (10839.72 and 10665.84).	Regular ANB practice reduces hypertension, reduces stress, and improves the patients' cardiovascular function, respiratory function, and well-being.
4	Saravanan P S L et al.(2019)	40	Alternate nostril breathing exercises for 30 min.	peak systolic velocity (PSV), vessel diameter	ANB exercises significantly reduced PSV ($P < 0.040$), increased VD ($P < 0.001$), and decreased RI ($P < 0.001$) in the study group. This confirms the effect of ANB	ANB exercises reduced blood pressure. This confirms the effect of ANB exercises in reducing the

				(VD) (DI), and resistive index (RI)	exercises in reducing blood pressure in hypertensive patients.	sympathetic over-activity by the parasympathomimetic effect.
5	Saraswati Devi et. al.(2018)	64	6 days in a week, for 1h in the morning for 6 weeks.	SBP, DBP	The obtained t-value is 7.68, which is significant at 0.01 levels. It is shows that ANB Yogic Intervention significant decrease in the SBP values of the Hypertension patients. The obtained t-value is 10.94, which is significant at 0.01 levels. This shows that the ANB Yogic Intervention lead to significant decrease in the DBP values of the Hypertension patients.	The only way to demonstrate that a continuous practice of ANB yogic exercise actually lowers Hypertension would be to conduct a controlled study that directly tests yoga and its effect on Hypertension.
6	Kumari, Sandeep et. al. (2015)	100	Alternate nostril breathing exercises for 30 min.	SBP, DBP, PR	It indicated that there was significant difference in the pre and post interventional cardiovascular functions that is systolic blood pressure, diastolic blood pressure and pulse rate among hypertensive patients at 0.05% level of significance. So alternate nostril breathing exercise can be used as alternative measure along with the anti hypertensive medication.	alternate nostril breathing exercise had significant effect on cardiovascular functions among hypertensive patients.

DISCUSSION

This systemic review aims at summarizing the currently available research evidence from existing RCTs on the effects of alternate nostril breathing on cardiorespiratory functions. Naturopathy asserts that the lung performs its functions efficiently in a healthy body. The nose should be appropriately used to breathe in air, the lung should expand ultimately, and the abdomen should extend outward as their natural protector. An abnormal pattern of breathing indicates illness. Among all diseases, lung ailments are among the worst. When the patient thinks their lungs are impacted, the body has already been seriously damaged. [10,11] Clean air is vital to life and enhances vigour as healthy food.[12] From the collected data, it can be concluded that cardio-myopathic and cardiorespiratory diseases stem from the heart, brain perfusion and lungs. The primary cause remains excess fatty deposits on the inner walls of significant arteries supplying these organs. It may even lead to fatal complications like sudden cardiac death and stroke. ANB can help

reduce the risk of cardiorespiratory complications by acting upon the effector organs, i. e. lungs and heart.[13,14,15] This table summarizes six studies investigating the effects of ANB on blood pressure in hypertensive individuals. Overall, the findings suggest a potential benefit of ANB for reducing blood pressure, although some limitations need to be addressed. The potential effect of ANB practice on cardiorespiratory function is that it is effective in decreasing systolic blood pressure (SBP), (DBP), low frequency(LF) heart rate (HR) (a biomarker of sympathetic activity increased), reduction in mean arterial pressure (MAP), HF (high-frequency biomarker of parasympathetic activity) levels and shows the predominant influence on cardiac activity. These combined effects of regular ANB practice in the cardiorespiratory parameters suggest that this might be a helpful intervention to reduce he risk of complications in the population burdened with cardiorespiratory diseases. The alternate nostril breathing (ANB) practice is simple and effective. ANB is traditionally said to enhance bodily and mental balance and reduce mental disturbance.[16,17,18]

The ANS and cardiorespiratory function are known to be influenced by various psychological states.[20] The start of the stress reaction raises blood pressure, skin conductivity, heart and respiratory rates, and muscle tension. Negative emotional states are thought to boost the SNS. It is hypothesized that PNS (peripheral nervous system) stimulation causes global inhibition and hyperpolarization.[21] It is hypothesized that deep, slow breathing techniques like ANB stimulate the PNS, increasing the synchronization of cardiorespiratory function and inhibiting and hyperpolarizing cells in the amygdala and thalamus, which transfers control to the PNS.[24] Deep breathing exercises like ANB have been shown to improve heart rate variability, a sign of better PNS functioning and a more effective reaction to stress.[22,23] Additionally, it is thought that the increase in PNS activity brought on by breathing exercises like ANB targets the stress response by enhancing the action of the brain's inhibitory GABA (gamma-aminobutyric acid) system, which includes stimulating the vagal nerves and ultimately reducing allostatic load. PNS stimulation also affects the HPA axis via its connections to the hypothalamus, amygdala, and hippocampus. It results in a rise in GABA levels in the hippocampus and a reduction in cortisol levels, among other consequences. Deep, diaphragmatic breathing can stimulate the production of oxytocin, vasopressin, and prolactin hormones, which are thought to be linked to enhancing sentiments of love, kinship, empathy and general well-being.[25] Because breathing is the sole autonomic process that can be easily controlled voluntarily, it can be utilized to steer the PNS toward stress-adaptive responses.[26]

This table summarizes six studies investigating the effects of ANB on blood pressure in pre-hypertensive and hypertensive individuals. Overall, the findings suggest a potential benefit of ANB for reducing blood pressure, although some limitations need to be addressed.

Positive Findings:

- All studies, except Saraswati Devi et al. (2018), reported significant reductions in systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) following ANB practice.
- The intervention duration ranged from a single 30-minute session (Saravanan et al., 2019) to six weeks of daily practice (Saraswati Devi et al., 2018). This suggests that ANB may be effective even with short-term practice.
- Studies by Kalaivani et al. (2019) and Kumari et al. (2015) also observed a decrease in heart rate after ANB practice, potentially contributing to improved cardiovascular health.
- Saravanan et al. (2019) showed positive changes in blood vessel diameter and resistance index, suggesting improved vascular function after ANB.

Limitations and Considerations:

- The control groups in some studies were not clearly defined, making it difficult to isolate the specific effects of ANB.
- Intervention protocols differed in terms of practice duration, frequency, and overall program length. Further research is needed to determine the optimal ANB practice regime for blood pressure management.

Clinical Implications:

Based on the current evidence, ANB appears to be a safe and potentially beneficial non-pharmacological intervention for managing blood pressure, particularly as an adjunct to medication. However, more robust research is needed before recommending ANB as a primary treatment strategy. Healthcare professionals may consider suggesting ANB to patients with hypertension, along with lifestyle modifications and medication when necessary. However, it is crucial to emphasize the importance of consulting a healthcare provider before starting any new practice.

CONCLUSION

While these studies offer promising preliminary evidence for the use of ANB in blood pressure management, further research with rigorous methodologies is necessary to confirm its efficacy and establish optimal practice protocols. ANB offer a valuable, cost-effective, and accessible complementary approach for individuals seeking to manage their blood pressure and improve cardiovascular health.

REFERENCE

1. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. 2020. Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019: update from the GBD 2019 study. J Am Coll Cardiol 76(25):2982–3021.
2. Zhang S, Qian ZM, Chen L, Zhao X, Cai M, Wang C, Zou H, Wu Y, Zhang Z, Li H, Lin H. Exposure to air pollution during pre-hypertension and subsequent hypertension, cardiovascular disease, and death: a trajectory analysis of the UK biobank cohort. Environmental health perspectives. 2023 Jan 25;131(1):017008.
3. Yau KK, Loke AY. Effects of diaphragmatic deep breathing exercises on prehypertensive or hypertensive adults: A literature review. Complementary therapies in clinical practice. 2021 May 1;43:101315.
4. Ma J, Ma L, Lu S, Sun Y, Bao H. The Effect of Traditional Chinese Exercises on Blood Pressure in Patients with Hypertension: A Systematic Review and Meta-Analysis. Evidence-Based Complementary and Alternative Medicine. 2023 Feb 9;2023.
5. Cardiovascular diseases. WHO. Assessed from https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1, Accessed on November 14, 2022.
6. Schwartz JR, Khan A, McCall WV, Weintraub J, Tiller J. Tolerability and efficacy of armodafinil in naive patients with excessive sleepiness associated with obstructive sleep apnea, shift work disorder, or narcolepsy: a 12-month, open-label, flexible-dose study with an extension period. Journal of Clinical Sleep Medicine, 2010; 6(5): 450-457.
7. Srivastava RD, Jain N, Singhal A. Influence on alternate nostril breathing on cardiorespiratory and autonomic functions in healthy young adults. Indian Journal of Physiology and Pharmacology. 2005 Oct 1; 49(4): 475.

8. Dinesh T, Gaur GS, Sharma VK, Madanmohan T, Kumar KH, Bhavanani AB. Comparative effect of 12 weeks of slow and fast pranayama training on pulmonary function in young, healthy volunteers: A randomized controlled trial. International journal of yoga. 2015 Jan;8(1):22.
9. Bhavanani AB. Effect of yoga training on the handgrip, respiratory pressures and pulmonary function. Indian J Physiol Pharmacol. 2003;47(4):387-92.
10. Singh SJ. History and philosophy of naturopathy. Nature Cure Council of Medical Research; 1980.
11. Dols JM, Russell JA, editors. The science of facial expression. Oxford University Press; 2017. (Page 9,48-49)
12. Kuhne L, Lust B. Neo Naturopathy: The New Science of Healing or the Doctrine of Unity of Diseases, 1917. Kessinger Publishing; 2003 August 1. (Pages 85-90)
13. Rung O, Stauber L, Loescher LJ, Pace TW. Alternate nostril breathing to reduce stress: an option for pregnant women survivors of intimate partner violence? Journal of Holistic Nursing. 2021 Dec;39(4):393-415.
14. Dhungel KU, Malhotra V, Sarkar D, Prajapati R. Effect of alternate nostril breathing exercise on cardiorespiratory functions. Nepal Med Coll J. 2008 Mar; 10(1): 25-7.
15. Subramanian RK, Devaki PR, Saikumar P. Alternate nostril breathing at different rates and its influence on heart rate variability in non-practitioners of yoga. Journal of clinical and diagnostic research: JCDR. 2016 Jan;10(1):CM01.
16. Subramanian RK, Devaki PR, Saikumar P. Alternate nostril breathing at different rates and its influence on heart rate variability in non-practitioners of yoga. Journal of clinical and diagnostic research: JCDR. 2016 Jan;10(1):CM01.N. K.
17. Dhungel KU, Malhotra V, Sarkar D, Prajapati R. Effect of alternate nostril breathing exercise on cardiorespiratory functions. Nepal Med Coll J. 2008 Mar; 10(1): 25-7.
18. Iyengar B. K. S. Light on Yoga. New York, NY, USA: Schocken Books; 1966.
19. Jahan I, Begum M, Akhter S, Islam MZ, Jahan N, Haque M. Effects of alternate nostril breathing exercise on respiratory functions in healthy young adults leading stressful lifestyle. Journal of Population Therapeutics and Clinical Pharmacology. 2020 Mar 19; 27(1): e104-14.
20. Saraswati S. Yoga and cardiovascular management. Bihar School of Yoga; 1982.
21. Kreibig SD. Autonomic nervous system activity in emotion: A review. Biological psychology. 2010 Jul 1; 84(3): 394-421.
22. Jerath R, Crawford MW, Barnes VA, Harden K. Self-regulation of breathing as a primary treatment for anxiety. Applied psychophysiology and biofeedback. 2015 Jun;40(2):107-15.
23. Chandla SS, Sood S, Dogra R, Das S, Shukla SK, Gupta S. Effect of short-term practice of pranayamic breathing exercises on cognition, anxiety, general well-being and heart rate variability. Journal of the Indian Medical Association. 2013 Oct 1;111(10):662-5.
24. Van Diest I, Verstappen K, Aubert AE, Widjaja D, Vansteenwegen D, Vlemincx E. Inhalation/exhalation ratio modulates the effect of slow breathing on heart rate variability and relaxation. Applied psychophysiology and biofeedback. 2014 Dec;39(3):171-80.
25. Jerath R, Barnes VA, Dillard-Wright D, Jerath S, Hamilton B. Dynamic change of awareness during meditation techniques: neural and physiological correlates. Frontiers in human neuroscience. 2012 September 17;6:131.
26. Brown RP, Gerbarg PL, Muench F. Breathing practices for treatment of psychiatric and stress-related medical conditions. Psychiatric Clinics. 2013 Mar 1; 36(1): 121-40.

27. Kalaivani S, Kumari MJ, Pal GK. Effect of alternate nostril breathing exercise on blood pressure, heart rate, and rate pressure product among patients with hypertension in JIPMER, Puducherry. J Educ Health Promot. 2019 Jul 29;8:145. doi: 10.4103/jehp.jehp_32_19. PMID: 31463330; PMCID: PMC6691618.
28. Saravanan PSL, Anu S, Vairapraveena R, Rajalakshmi Preethi G. Impact of alternate nostril breathing exercises on vascular parameters in hypertensive patients - An interventional study. National Journal of Physiology, Pharmacy and Pharmacology. 2019; 9(3):210-214.
29. Telles S, Sharma SK, Balkrishna A. Blood pressure and heart rate variability during yoga-based alternate nostril breathing practice and breath awareness. Med Sci Monit Basic Res 2014;20:184–93.
30. https://medcraveonline.com/MOJYPT/impact-of-yogic-intervention-on-mild-hypertensive-patients.html
31. Sandeep K, Maninder K, Lakhwinder K. Effect of alternate nostril breathing exercise on cardiovascular functions among hypertensive patients. Int J Nurs Educ. 2015; 7:131-4.
32. https://openurl.ebsco.com/EPDB%3Agcd%3A12%3A23122364/detailv2?sid=ebsco%3Aplink%3Acrawler&id=ebsco%3Adoi%3A10.5958%2F0974-9357.2015.00150.6