International Journal of Research in Medical Sciences
Khobragade Y et al. Int J Res Med Sci. 2016 Jan;4(1):12-21
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20160003

Review Article

Meditation as primary intervention strategy in prevention of cardiovascular diseases

Yadneshwar Khobragade[1]*, Adinegara Bin Lutfi Abas[1], Barua Ankur[2], Sujata khobragade[1]

[1]Department of Community Medicine, Melaka-Manipal Medical College (MMMC), Melaka, Malaysia
[2]Department of Public Health Medicine, International Medical University, Kuala Lumpur, Malaysia

Received: 10 November 2015
Accepted: 17 December 2015

***Correspondence:**
Dr. Yadneshwar Khobragade,
E-mail: drkhobragade@yahoo.com

ABSTRACT

Heart diseases especially Hypertension, Coronary Artery Diseases (CAD) and stroke are the leading causes of death all over the world. Hostility, anxiety, depression and increased reactivity to mental stress have been strongly associated with hypertension and CAD. Mental stress or anxiety causes increased sympathetic activation and poor vagus nerve control over heart. Imbalance between sympathetic and parasympathetic nervous system leads to vasospasm and has been associated with Hypertension, Coronary Artery Disease and Myocardial Infarction. Psychosocial stress has also been found to be responsible for imbalance in autonomic nervous system, causing sympathetic dominance over parasympathetic leading to acute coronary events. Meditation is a process of self-contemplation and purification of mind. Practitioner of meditation brings about desirable changes in their behaviour and lifestyle. During Meditation sympathetic activity is reduced and there is parasympathetic dominance over sympathetic. During meditation and after meditation person feels calm, quiet and relaxed. Meditation causes decrease in metabolic rate. The blood pressure may come to normal or falls, pulse rate comes to normal or low, vascular spasm if any, is reduced and myocardial perfusion increase. Thus meditation helps in preventing hypertension, coronary artery disease and other cardiac events. This may be beneficial before a person gets coronary event and post-myocardial infarction. In view of the beneficial effects of meditation, it may be introduced as primary intervention strategy in preventing Cardio-vascular Diseases. We did this review study to find out: (1) Can meditation bring about desirable changes in human mind and body in post-intervention group compared to control group? (2) Its effectiveness in prevention of heart diseases like hypertension, coronary events and post-MI complications. This review included all randomised controlled trials on patients above 18 years, both sexes, any setting with medication & meditation or meditation, Controlled group was on medication alone. Clustered and crossover studies were excluded.

Keywords: Meditation, Healthy lifestyle, Hypertension, Coronary artery disease, Myocardial infarction, Equanimeous, Non-judgemental, Mindfulness, Hostility, Stress, Anxiety

INTRODUCTION

Meditation is a process of self –reflection or self-contemplation, purification mind and thoughts. Regular practice of meditation helps development of control over the mind so that one can have right views, right actions and right behaviour can be at peace. It originated in India and was practiced through centuries and handed over to pupils by their respective teachers. It is a form of mental exercise in which meditator develops self-control. We all are aware that our physical activities, emotions, interaction with others are influenced by our thought processes.[1] When person is stressed both emotionally and mentally, it influences cardiovascular and other organ

system leading to neuro-visceral changes.[2] When mental stress is constant and prolonged over a period of time, person develops hypertension, ischemic heart disease and stroke.[3] Similarly negative thought processes like anger, ill will, jealousy, animosity, hatred etc. cause neuro-psychiatric disorders such as anxiety neurosis, panic syndrome and depression. These can also be triggering factors in hypertension, stroke and coronary artery disease.[4,13] Certain habits such as alcoholism, cigarettes smoking, use of cocaine and marijuana, overeating when formed due to depression, stress, escapism and negative thought processes lead to increase in the risk of Ischemic Heart Disease and Myocardial Infarction.[12] At hormonal level mental stress is strongly associated with increase in cortisol, nor-epinephrine, epinephrine, adreno-cortical hormones, TSH and Thyroxin and these hormones have deleterious effect on cardiovascular system.[6,7,12] Similarly patient with heightened emotional state due to increased cellular activity on one side of brain has been shown to have hypertension, cardiac rhythmic defect, left ventricular contractile dysfunction, myocardial ischemia and arrhythmia. Although these changes may be transient but can have grave consequences like acute myocardial infarction, stroke and death.[8] Cardiovascular diseases carry highest mortality among all cause deaths. Worldwide thirty percent of the deaths (2001) have been due to CVS. Deaths due to CVD are 50% in developed 28% in developing and underdeveloped countries (Mather's and others 2001; WHO 2002a). Ischemic heart disease has been found to be a major cause of cardiovascular morbidity and mortality all over the world and carries highest death toll in developed countries. Statistics shows that out of total deaths of 50.4 million people in developed countries 28% were due to coronary artery disease.[17] According to World Health Organisation report, 7.3 million (approximately 29% of all deaths) people died due to coronary artery disease and 58 million (14% of 1.5 billion) lost disability adjusted life years (DALYs) worldwide in 2001.[10] In middle income and low income countries scenario is not different, 75 % of all deaths are due IHD and loss of DALYS is 82%.[11] At least in 50% of myocardial infarction patients, there are identifiable triggering factors. The imbalance in emotions due to stress of work, conflict, loss of job, fear, anxiety, mental stress may lead to increase in sympathetic tone, constriction of coronary vessels and endothelium dysfunction. This causes decrease perfusion of heart, consequently leading to death of myocardium. Patients with more than 50% blockage in coronary artery may develop myocardial ischemia during stress due to increased myocardial activity and reduced coronary artery blood flow.[17] The myocardial ischemia caused due to vasoconstriction of sclerotic coronary blood vessels can be protected by decreasing cardiac sympathetic tone.[14] This is possible in individuals doing meditation, as meditation reduces sympathetic tone and balances autonomic nervous system.[15,16]

The main objectives of the study are as follows:

1. To determine the effectiveness of Meditation in patients with cardiovascular diseases especially hypertension and Ischemic Heart Disease (IHD).
2. To determine the effectiveness of Meditation in reducing morbidity and mortality.
3. To study the effect of Meditation on general well-being and lifestyle modifications.

REVIEW METHODS

Criteria for considering studies for this review

Types of studies taken for this review

All Randomised Controlled Trials were compared by combination of meditation and medication with medication or meditation alone. Cluster-randomised trials, Controlled before and after trials and cross over trials were excluded.

Types of participants

People with hypertension and IHD (proven by relevant investigation) of ages 18 years and above, both sexes, in any setting were included.

Type of interventions

Meditation Therapy designed to reduce cardiovascular risk like hypertension and ischemia in participants with hypertension & Ischemic Heart Diseases (IHDs) were considered. All non-pharmacological Meditation Therapy interventions delivered by health care workers with specific training in these techniques were considered. Comparison group were either people having medication alone. Trials were only considered where the follow up was 12 weeks or more following the start of the intervention.

Types of outcome measures

While the interventions is a mind control technique causing parasympathetic dominance over sympathetic leading to improved perfusion of cardiac muscles thereby preventing hypertension, coronary events and death. However neuro-hormonal outcomes may also provide an indication of efficacy and potential effectiveness in causing coronary vasodilatation and or preventing vasospasm leading to improved myocardial blood supply.

Primary outcomes

Measuring reduction in mortality due to cardiovascular disease specially Hypertension, IHD / Myocardial Infarction. Time for follow up period of primary outcome measures was six months.

Secondary outcomes

To see if any adverse effect occurs due to meditation.

To see if it helps in preventing prolonged stay in hospital reduces medicine intake and cost of medical care.

Search methods for identification of studies

Electronic searches

We searched Medline, EMBASE, Central on the Cochrane Library, LILACS (Virtual health library of Latin American countries). There was no language barrier for searching articles. Well debated key terms were included in the search strategy. Other search engines that were utilized for extraction of relevant electronic data from the internet include: PUBMED, GOOGLE SCHOLAR, EMBASE, Clinicaltrials.gov, Meta Register of Controlled Trials on http://www.controlled-trials.com/mrct/ and WHO ICTRP Search Portal on http://apps.who.int/trialsearch/. Other websites that were used; www.vri.dhamma.org, http://www.rccm.org.uk, http://nccam.nih.gov

Techniques of meditation

Mindfulness Meditation or Samata Meditation

In mindfulness Meditation or Samata Meditation subjects are asked to sit comfortably in an environment of reduced illumination with closed eyes and instructed to observe their breath in inspiration and expiration. Once they are able to do this, next step is observation of touch sensation over the nostril during inspiration and expiration. This helps meditator to control his excessive distracting thoughts.

Vipassana meditation

In Vipassana meditation subjects are asked to observe respiration initially and later taught to observe bodily sensation systematically in unbiased, unattached and non-judgemental manner. Throughout the process of meditation, an individual remains awake and aware of sensations occurring at that particular moment. The ultimate aim of meditation is to develop calm, quite, stable and Equanimeous or balanced mind, remove negativities like anger, hatred and ill will and fill it with positive thoughts like love, compassion and good will for self and others.[22] The teachers in Vipassana meditation advocate practice this technique for one hour in morning and one hour in evening for beneficial effects.

Raja Yoga

Raja Yoga meditation course consist of 5 days introductory and 2 days of intermediate lessons. Subjects are asked to sit in lotus position but those who are unable can take any comfortable sitting position. One can do meditation by sitting on chair but is expected to keep spine straight. Then subjects are asked to do pranayama – which is focusing mind on breath, slowing and controlling it. Once this is done then subjects are taught on soul searching or inward journey. Think about self, one's positive qualities etc. like what I am? What I shall do in life? Then subjects are asked to frame a phrase or concept like I am a peaceful soul. Once this is done then they are asked to visualize a star or light at the centre of forehead and concentrate on it. Subjects are taught to culture the mind, pass away negative thoughts and ingrain positive thoughts and qualities, develop mind, intellect and body. Be with self and reality of life. The ultimate aim is to understand oneself, developing peace, self-respect, confidence and love for oneself and others. They recommend meditation for minimum half an hour in morning and evening every day. It is advised to close eyes during meditation.

Transcendental meditation

In Transcendental meditation (TM), subjects are asked to chant mantra in calm and quiet place with closed eyes for 20-30 minutes each in the morning and evening. It causes relaxation of mind and body.

Islamic meditation

Reference has been made about meditative practices in Islam for spiritual growth of an individual. It is stated that "One hour of meditation is more valuable than seventy years of obligatory worship." - Prophet Muhammad (S). Zikr or Islamic meditation, advocates meditation in sitting position, comfortably in calm and serene place. Stages include (a) Tasbih (chanting or recitation of Qur'an), (b) Muraqaba (observation and surrender to Allah), (c) Taffakur (think and contemplate), (d) Murabita (connection with Allah). This helps relaxing mind and body. In order to have better understanding and spiritual development it is advised to do meditation for minimum 20 minutes morning and evening atleast 5 days a week. Similarly fasting and asking for forgiveness during the month of Ramadan and sharing one's merit and wealth (Zalat) dissolves ego and have been found to have positive impact on health.[40]

Zen or Zazen Meditation

Here subjects are taught to take full lotus or semi lotus position. Spine is kept straight and position has to be comfortable. Unlike Vipassana meditation eyes are kept open. Initially mind is focused on breath and after a week of practice one is asked to quieting the mind. However distracting thoughts may come up which one may observe without reacting or getting carried away. A stage comes when mind becomes calm, quiet and peaceful. One is expected to practice meditation daily for atleast 30 minutes. There are discourses which guide a meditator to have right type of behaviour and thoughts which are beneficial to self and others.

The mastery of an individual meditation technique depends on its respective philosophical school of thought. The meditation procedure is usually communicated under the supervision of an experienced meditation teacher. Here different phenomenological systems of thought provide elaborate cognitive instructions that lead to the control of specific physiological states.[21]

The main purpose of meditation developed by various religious schools of thought is for spiritual growth of an individual, which can help in leading peaceful, happy and contented life.

RESULTS

We have searched electronic databases and found out total 62 articles, abstracts and clinical trials studies. Most of the studies were on Transcendental meditation™ on cardiovascular diseases, one study was on TM in IHD.[32] Another study report published in Circ Cardiovascular Quarterly Outcomes 2012 , was on Stress reduction in the prevention of cardiovascular disease: randomised controlled trial of TM and health education in blacks. Two studies though completed we could not get the report /could not be retrieved in any website (refer clinicaltrials.gov appendix 1). From India, we could get one article on study of regression of coronary atherosclerosis lesion in angiographic ally confirmed cases of coronary artery disease with 121 patients. They were trained for 7 days at centre and followed up after 6 months for 2 years. 86% still follow. Some studies using complimentary therapies include meditation along with diet modification and lifestyle changes. A prospective randomised Study conducted by Curiat JA et al, published in J. alt. and compli. Med. Brazil is on 19 patients show positive impact of meditation on congestive heart failure. We did not find any specific study on Islamic meditation in hypertension or Ischemic heart disease but it has been observed that those who practice salat a Islamic form of meditation reduces heart rate and blood pressure.[36] Jordanin study on 19 patients with coronary artery disease and spirituality shows that spirituality helps patients understand heart disease and its consequences, taking right decisions, leading quality life and .better coping with IHD.[35] Search under www.vri.org and other search engine stated above did not find any study of Vipassana meditation on IHD or heart diseases however we could find mindfulness based studies which are one of the components of Vipassana Meditation. We could find some relevant and related studies on meditation and cardiovascular diseases especially hypertension Table 1 and IHD which is given in Table 2. After going through abstract of 58 studies we took out full articles of 13 studies which include study of meditation on CVS specially Hypertension and ischemic heart disease or meditation is one of the components included as influencing factor in Hypertension/CAD/MI/CVD. We find that meditation helps in reducing blood pressure (Table 1). Islamic meditation and Dhammakaya meditation does not meet our criteria because the duration of follow up is short and study group include normal individuals, not hypertensive patients, however it is worth mentioning that meditation reduce heart rate and blood pressure. Study by John Zamarra et al, on Usefulness of TM program in the treatment of patients with coronary artery disease which is single blind controlled clinical trial on CAD patients, 12 experimental and 9 controls. Average age was 55 years, all men with intervention period of 6-8 months. Outcome of this study was improved exercise tolerance on stress test. Another relevant study is by Schneider RH et al , randomized controlled trial on 201 black men (117) and women (84) , mean age 59 years with CAD in which effect of transcendental meditation was compared with health education. Patients were followed in two phases 1998-2003 and 2004-2007, with average follow up period of 5.4 years. This study shows 48% risk reduction of all-cause mortality, non-fatal MI and stroke in TM patients compared with health education. Third study does not fulfill our criteria is worth mentioning. It is from India by Gupta S et al, on effect of healthy life style (which includes raja yoga meditation, vegetarian balanced diet and daily brisk walking) on regression of atherosclerotic lesions in CAD patients aged 35-72 years, with intervention period of minimum 2 years with follow up every six months limitation of this study was only 73 of 121 patients underwent repeat angiography after 2 years. King et al shows TM helps reducing hypertension, atherosclerosis, and other risk factors such as smoking and cholesterol. Other studies stated above in table do not meet our inclusion criteria, hence excluded

DISCUSSION

In meditative process, the mind calms down, meditator feels relaxed and physiological changes similar to hypo metabolic state appear. When subject practices meditation, his musculature goes into state of relaxation, he/she is able to control his/her thought processes, normalizes physiological functions, decreased peripheral resistance, increased elasticity or normalization of elasticity of arterial muscle fibers and improved blood supply to various organs and tissues. Strong motivation and determination brings about socially acceptable behavioural changes.[42,20] During meditation, the mind goes into a state similar to that of deep sleep, but the meditator remains fully conscious, awake, alert and responsive.[21] At mental level meditation causes changes in cognition, perception & emotions. At neuro hormonal level meditation causes decreased release of cortisol & catecholamine.[20,33] It also changes the tone of autonomic nervous system.[19] Thus a meditating person is fully awakened. Physiologically his metabolic rate will be reduced and there is parasympathetic overtone over sympathetic. Under this condition person feels calm and quite.[20,21]

Beneficial effects of meditation

After meditation, physiologically following changes are seen such as reduction in pulse rate, heart rate, stroke volume, vascular resistance, heart rate signals changes from high complex behaviour to low-dimensional chaotic motions.[26,41] There is decreased oxygen (O_2) consumption and carbon dioxide (CO_2,) elimination by body cells. Also there is fall in respiratory rate and minute ventilation with no change in respiratory quotient, serum lactic acid level falls, galvanic skin resistance and the perfusion of cerebral cortex increases.[20,33] Meditator feels cheerful and happy. A study on Raja yoga meditation therapy with dietary modification at Mount Abu, India showed regression of atherosclerotic lesion in angiographically confirmed cases of myocardial ischemia.

Table 1: Effect of meditation on hypertension.

Type of meditation	Type of study	No. of patients/ participants	Duration of study	Year of publishing	Results
Transcendental meditation in hypertension	Cross-sectional descriptive study	Stress reduction and preventing hypertension: preliminary support for a psycho neuroendocrine mechanism**.** Control -33 Experimental- 22	8.5 years	1995	Decreased urinary cortisol and aldosterone, Stress reduction and improved mood.[45]
Transcendental meditation in hypertension	Meditation training and essential hypertension Randomised control trial		3 months	1980	Decrease blood pressure[46]
Transcendental meditation in hypertension individual response patterns	Selective sample	HTN patients -7 Practising TM at home and BP recording at home	3 months	1976	Reduced anxiety, psychological wellbeing & Reduction in blood pressure in six patients.[37]
Islamic meditation (Salat)		30 subjects		2013	Reduction in heart rate and blood pressure.[36]
Dhammakaya (Samata/Vipassana) meditation	Selective sample of students 20-25 years	Exp. Group-52 males Control group-30 males	2 months	1991	Decrease in serum cortisol, syst. and diast. BP, vital capacity, tidal vol., reaction time and increase serum protein.[33]

How the intervention can help in preventing cardiovascular diseases (hypertension / IHD)?

Studies have shown that acute and chronic psychological stress, anxiety, depression, hostility and anger contributes to hypertension, Ischemic Heart Disease and stroke.[43,44] Patients, aged 60-74 years with IHD and stable exertional angina pectoris when subjected to graded physical exercise, there was increased level of ACTH, Cortisol and Met-encephalin compared to normal subjects.[23] Fall in level of melatonin is strongly associated with IHD, ageing process and neurological diseases. This decreased melatonin causes reduction in competence of immunological system and increases the risk of death from heart, neurological and carcinogenic disorders; however optimal level of melatonin causes good sleep and reduces stress level with positive impact on CAD outcomes.[25] Meditation prevents excessive release of hormones like Cortisol, Epinephrine, TSH, and T3 and increases production of DHEA, Melatonin, Serotonin, Human growth hormone and Endorphins. Thus it helps in stress reduction, relaxation of mind and body and prevention of development of hypertension and IHD. A

comparative study on effect of Transcendental meditation (TM) in patients with ischemic heart disease found that patients practicing TM for eight months had greater exercise tolerance, higher maximal workload and delayed onset of ST segment elevation in ECG compared to control group.[32]

Table 2 : Effect of Meditation on coronary artery disease.

Type of meditation	Type of study	No. of patients/ participants	Duration of study	Year of publishing	Results
TM	Single blind Controlled clinical trial on patients with CAD. Average age =55 years	Experimental Group =12 Control=9. Attrition due to various reasons only 10 experimental and 6 control completed study	8 months	1996	Reduced exercise induced Myocardial Ischemia[32]
TM	Randomised controlled trial on components of metabolic syndrome in Coronary Artery Disease	103	16 weeks	2006	Improves Cardio –vascular risk factors[15]
Spirituality and Religion	Controlled trial on clinical outcomes in pts. Recovering from MI and depression	503	Prospective cohort follow up for 18 months	2007	No association[47]
Stress reduction with TM	Randomized controlled trial	201 black men and women with CAD	Average follow up = 5.4 years	2012	Reduced mortality & hospitalization Prevention of MI and stroke[44]
Brief meditation and Mindfulness intervention	Case control sequential mixed method in DM and CAD	40 patients but 27 completed study. Experimental 11 and 16 control	6 weeks	2014	Positive impact on psychological health. Good sleep, reduced worry & thought suppression[48]
Kabat-Zinn's mindfulness meditation	Case control Meditation effect on Anxiety reduction and heart disease	18 women 9 experimental. Group 9 control group	8 weeks	2003	Reduced anxiety and better Coping with heart disease[49]
Raja yoga meditation + aerobic exercise & dietary control	Experimental study on Moderate to severe CAD	123 patients. Experimental. 2 dropped out and same group served as control. Patients. Not blinded. Only Angiographer blinded	2 years follow up	2011	Regression in diameter of stenotic coronary vessels[34]
Spiritual retreat	Randomised control study on depression in CAD	41	6-18 months follow up	2011	Post interventional reduction in depression score[50]

Recent studies have reported positive impact of meditation on hypertension & Ischemic Heart Disease (IHD). Anger, hatred and ill will are reduced by inner focused relaxation state induced by guided imageries and mind–body interventions. Meditation helps in inculcate positive thoughts and emotions thereby lead to physiologically quiet state which helps the individual to adapt better in different situations.[27] Thus meditation reduces stress and improves general feeling of well-being through the effects on Autonomic nervous system.[28]

Meditation normalizes blood pressure caused by anxiety, stress and other psychosocial factors thus may prevent hypertension. It prevents myocardial ischemia both physiologically and psychologically by reducing release of sympathomimetic hormones and stress respectively.[18] Regular practice of meditation relieves anxiety, fear and depression. One feels happy and satisfied. Interventional studies show that combination of meditation, dietary control and moderate aerobic exercise cause reduction in diameter of stenotic coronary arteries and improved perfusion of heart.[34] This may help patients to recover faster from coronary artery disease, reduce future angina, arrhythmias and speed up time to return home and on job.[30] When psycho social interventions were added to standard medical treatment, significant improvement was noticed in term of survival benefits and aversion of cardiac events.[31,34] In view of various beneficial effects of meditation, it can be included as primary level of intervention in maintaining general wellbeing and also integrated into cardiac rehabilitation programme.

Adverse effects

There were no known adverse effects of meditation.

CONCLUSION

Stress has been found to be associated with Ischemic heart disease because of increased release of catecholamine and corticoids. Meditation is a mind control technique by which individual is able to calm down mind. When mind is at peace sympathetic output is low. There is parasympathetic dominance over sympathetic. This helps maintenance of tone of coronary vessels, improved blood supply, reduced oxygen demand of heart and thereby it may help in prevention of CAD. If practiced regularly it may prevent hypertension, coronary artery disease, myocardial infarction and re-infarction.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Lay UK. Manual of Vipassana Meditation. 3rd Ed. Igatpuri, India: Vipassana Research Institute. 2008. ISBN 978-81-7474-220-0.
2. Emani S, Binkley PF. Mind body medicine in chronic heart failure: A transnational science challenge. Circ Heart failure. 2010;3:715-25
3. Allison TG, Williams DE, Miller TD, Patten CA, Bailey KR, Squires RW et al. Medical and economic costs of psychological distress in patients with coronary artery disease. Mayo clinic procedures. 1995;70(8):734-42.
4. Shapiro PA. Psychiatric Aspects of Cardiovascular Disease. Psychiatric Clinics of North America. 1996;19(3):613-29.
5. Sgoutas-Emch SA, Cacioppo JT, Uchino BN, Malarkey W, Pearl D, Kiecolt-Glaser JK et al. The effects of an acute psychological stress or on cardiovascular, endocrine, and cellular immune response: A prospective study of individuals high and low in heart rate reactivity. Psychophysiology. 1994;31(3):264-71.
6. Johansson G, Laakso ML, Karonen SL, Peder A. Examination Stress affects plasma levels of TSH and Thyroid Hormones Differently in Females and Males. Psychosomatic Medicine .1987;49(4):390-6.
7. Esler M. The autonomic Nervous System and Cardiac Arrhythmias. Clinical Autonomic Research. 1992;2(2):133-5.
8. Ziegelstein RC. Acute Emotional Stress & Cardiac Arrhythmia. JAMA. 2007;298(3):324-9.
9. Harrisons Principle of Internal Medicine. 17 editions. Vol. 2. US: McGraw-Hill Professional. 2008:1375-9.
10. Gaziano TA, Reddy KS, Paccaud F, Horton S, Chaturvedi V. Cardiovascular Disease. Geneva: The World Health Organization. 2002.
11. Wig NN. World Health Day, Indian Journal of Psychiatry. 2001;43(1):1-4.
12. Schwartz BG, Mayeda GS, Burstein S, Economides C, Kloner RA. When and why do heart attacks occur? Cardiovascular Triggers and their Potential Role. Hosp Pract Minneap. 2010;38(5):144-52.
13. Ornish D, Scherwitz LW, Billings JH, Brown SE, Gould KL, Merritt TA et al. Intensive lifestyle changes for reversal of coronary heart disease. JAMA. 1998;280(23):2001-7.
14. Simula S, Vanninen E, Viitanen L, Kareinen A, Lehto S, Pajunen P et al. Cardiac Adrenergic Innervation is affected in Asymptomatic Subjects with Very Early Stage of Coronary Artery Disease. Journal of Nuclear Medicine.2002;43(1):1-7.
15. Maura Paul-Labrador, MPH; Donna Polk, MD, MPH; James H. Dwyer, PhD†; Ivan Velasquez, MD; Sanford Nidich, PhD; Maxwell Rainforth, PhD; Robert Schneider, MD; C. Noel Bairey Mer. Effects of a Randomized Controlled Trial of Transcendental Meditation on Components of the Metabolic Syndrome in Subjects With Coronary Heart Disease Arch Intern Med. 2006;166(11):1218-24.
16. Curiati JA, Bocchi E, Freire JO, Arantes AC, Braga M, Garcia Y et al. Meditation reduces sympathetic activation and improves quality of life in elderly

patients with optimally treated heart failure: A prospective randomised study. J Alt and Compl Med. 2005;11(3);465-72.
17. Deedwania PC, Carbajal EV. Silent ischemia during daily life is an independent predictor of mortality in Stable Angina. Circulation. 1990;81(3):748-56.
18. Benson H, Malhotra MS, Goldman RF, Jacobs GD, Hopkins PJ. Three case reports of the metabolic and electroencephalographic changes during advanced Buddhist meditation techniques. Behavioural Medicine. 1990;16:90-5.
19. Newton AB, Iversen J. The neural basis of the complex mental task of meditation. Neurotransmitter and Neurochemical considerations. Med Hypotheses. 2003;61(2):283-91.
20. Jevning R, Wallace RK, Beidebach M. The physology of meditation: A review. A wakeful hypometabolic integrated response. Neurosci Biobehav Rev. 1992;16:415-24.
21. Wallace RK, Benson H. A wakeful hypometabolic physiologic state. American Journal of Physiology. 1971;221:795-9.
22. William H. Art of living: Vipassana Meditation: As taught by S.N. Goenka. New York: Harper Collins Publishers.1987.
23. Korkushko OV, Frolkis MV, Yaroshenko YT. Hormonal Supply during Physical Exercise in elderly patients with IHD. Gerontology. 1988; 34(1-2):88-94.
24. MacLean CR, Walton KG, Wenneberg SR, Levitsky DK, Mandarino JP, Waziri R et al. Effect of TM programme on adaptive mechanisms: Changes in hormonal levels and responses to stress after four months practice. Psycho-neuroendocrinology. 1997;22(4):277-95.
25. Brzezinski A. Mechanisms of disease: melatonin in humans. New England Journal of Medicine. 1997;336:186-95.
26. Herrmann JM. Essential hypertension and stress: When do yoga, psychotherapy and autogenic training help? MMW Fortschr Med. 2002;144(19):38-41.
27. Porges SW. Cardiac vagus tone: a physiological index of stress. Neurosciences and Behavioural Review. 1995;19(2):225-3.
28. David S, Ludwig JKZ. Clinical mindfulness and Patient safety. JAMA. 2010;304(22);2532-3.
29. Kuo L, Davis MJ, Chilian WM. Longitudinal gradients for endothelium-dependent and independent vascular responses in the coronary microcirculation. Circulation. 1995;92(3):518-25.
30. White VD. Relaxation Therapy for rehabilitation and prevention in Ischemic heart disease: a systematic review and meta-analysis. Euro J cardiovasc prev Rehabili. 2005;12(3):193-202.
31. Linden W, Stossel C, Maurice J. Psychosocial Interventions for patients with coronary artery disease: A meta-analysis. Arch Intern Med. 1996;156(7):745-52.
32. Zamerra JW, Schneider RH, Besseghini I, Robinson DK, Salerno JW. Usefulness of Transcendental Meditation Programme in the treatment of coronary artery disease. Am J Cardiology. 1996;77(10):867-70.
33. Sudsuang R. Effect of buddhist meditation on serum cortisol and total protein levels, blood pressure, pulse rate, lung volume and reaction time. Physiology and Behavior. 1991;50(3):543-8.
34. Gupta SK, Sawhney RC, Rai L, Chavan VD, Dani S, Arora RC et al. Regression of coronary atherosclerosis through healthy lifestyle in coronary artery disease patients- Mount Abu Open heart Trial. Indian Heart J. 2011;63(5):461-9.
35. Manar M, Nabolsi RN, Alexander M, Carson RN. Spirituality, illness and personal responsibility: the experience of Jordanian Muslim men with coronary artery disease. Scandinavian Journal of Caring Sciences. 2011:25(4):716-24.
36. Doufesh H, Ibrahim F, Ismail N. Assessment of heart rate and blood pressure in different SalatPositions. J Phys the Sci. 2013;25(2):211-4.
37. Blackwell B, Bloomfield S, Gartside P, Robinson A, Hanenson I, Magenheim H et al. Transcendental meditation in hypertension. 1976;307(7953):223-6.
38. Mathers CD, Lopez A, Stein C, Fat MD, Rao C, M. Inoue, and others. 2001. "Deaths and Disease Burden by Cause: Global Burden of Disease Estimates for 2001 by World Bank Country Groups." In Disease Control Priorities Project Working Paper 18. Bethesda,
39. The World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO. 2002b.
40. Ahsan A, Khan M, Siddhique R. The Healing Power of prayer in Islam. Indian J Positive Psychology. 2012;3(2):168-72.
41. Goshvarpour A, Goshvarpour A. Recurrence Plots of Heart Rate Signals during Meditation. I J Image, Graphics and Signal Processing. 2012;4(2):44-50.
42. Liu CY, Wei CC, Lo PC. Variation Analysis of Sphygmogram to Assess Cardiovascular System under Meditation. Evid Based Complement Alternat Med. 2009;6(1):107-12.
43. Sheps DS, Sheffield D. Depression, anxiety, and the cardiovascular system: the cardiologist's perspective. J Clin Psychiatry. 2001;62(Suppl 8):12-6.
44. Schneider RH, Grim CE, Rainforth MV, Kotchen T, Nidich SI, King CG et al. Stress Reduction in the Secondary Prevention of Cardiovascular Disease. Circulation: Cardiovascular Quality and Outcomes. 2012;5:750-8.
45. Walton KG, Pugh ND, Gelderloos P, Macrae P. Stress reduction and preventing hypertension: Preliminary support for a psych neuroendocrine mechanism; Journal of Alternative & Complementary Medicine. 1995;1(3):263-83.
46. Seer P, Raaeburn JM. Meditation Training and essential hypertension: A methodological study;

Journal of Behavioral Medicine. Journal of Behavioral Medicine. 1980;3:59-71.
47. Blumenthal James A, Babyak Michael A, Ironson Gail, Thorensen Carl, Powell Lynda, Czajkowski Susan, Berg matthew et al. Spirituality, Religion and Clinical outcomes in patients recovering from Acute Myocardial Infarction; Psychosomatic Medicine. 2007;69(6):501-8.
48. Keyworth C, Knopp J, Roughley K, Dickens C, Bold S, Coventry P. A Mixed-Methods Pilot Study of the Acceptability and Effectiveness of a Brief Meditation and Mindfulness Intervention for People with Diabetes and Coronary Heart Disease. Behav Med. 2014;40(2):53-64.
49. Anna MT, Jacalyn M, Yvonne C, Patrick R. Mindfulness Meditation, Anxiety Reduction, and Heart Disease: A Pilot Study; Family & Community Health. Fam Community Health. 2003;26(1):25-33
50. Warber SL, Ingerman S, Moura V, Wunder J. Healing the heart: a randomized pilot study of a spiritual retreat for depression in acute coronary syndrome patients. Explore The Journal of Science and Healing. 2011;7(4):222-33.

Cite this article as: Khobragade Y, Abas ABL, Ankur B, khobragade S. Meditation as primary intervention strategy in prevention of cardiovascular diseases. Int J Res Med Sci 2016;4:12-21.

APPENDIX 1

Meditation in Ischemic Heart Diseases

1. Effects of meditation on mechanism of coronary heart disease

This study has been completed.
Sponsor: National Center for Complementary and Integrative Health (NCCIH)
Information provided by: National Center for Complementary and Integrative Health (NCCIH)
ClinicalTrials.gov Identifier: NCT00010738
First received: February 2, 2001
Last updated: August 17, 2006
Last verified: July 2006
History of Changes
Last Updated: August 17, 2006
Health Authority: United States: Federal Government

Additional relevant MeSH terms:

Coronary Artery Disease	Arterial Occlusive Diseases
Coronary Disease	Arteriosclerosis
Heart Diseases	Cardiovascular Diseases
Myocardial Ischemia	Vascular Diseases

ClinicalTrials.gov processed this record on September 02, 2015.

2. A randomized controlled trial of stress reduction on cardiovascular morbidity and mortality in african Americans

This study has been completed.
Sponsor: Maharishi University of Management
Collaborator: Medical College of Wisconsin
Information provided by:
Maharishi University of Management
ClinicalTrials.gov Identifier:
NCT01299935
First received: February 18, 2011

3. Mindfulness-based stress reduction and myocardial ischemia

This study has been completed.
Sponsor: University of Florida
Collaborator: National Heart, Lung, and Blood Institute (NHLBI)
Information provided by (Responsible Party): University of Florida
ClinicalTrials.gov Identifier: NCT00224835
First received: September 21, 2005
Last updated: December 13, 2013
Last verified: December 2013

4. Stress reduction and atherosclerotic CVD in blacks

This study has been completed.
Sponsor: National Heart, Lung, and Blood Institute (NHLBI)
Information provided by: National Heart, Lung, and Blood Institute (NHLBI)
ClinicalTrials.gov Identifier: NCT00000546
First received: October 27, 1999
Last updated: November 10, 2005
Last verified: October 2005
History of Changes