



**Review Article**

# Prevention of Cardiovascular diseases - it must start in childhood

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## Abstract

Across the globe, cardiovascular diseases (CVDs) (17.9 million) account for most non-communicable disease (NCD) deaths annually followed by cancers (9%). In India, 27% of NCD deaths are from CVDs followed by Chronic respiratory diseases (11%) and cancers (9%). Factors that are significantly enhancing the burden of CVDs are stress at early ages, raised blood pressure, increased prevalence of childhood obesity, hyperglycemia and increased prevalence of metabolic syndrome. Implementation of primordial preventive strategies to reduce the incidence of cardiac diseases is important. According to the reports, Indian population is consisting more than 50% of children and youth (age <30 years) and the mean age of the Indians is 29 years. Hence we should focus on primordial prevention at childhood to prevent the NCDs for healthy nation. Children play a critical role in nation's building, development and strengthening, hence it is our responsibility to promote holistic health in them. We have to inculcate healthy lifestyle in children which include promotion of physical activity, healthy dietary habits, no addictions to smoking and alcohol. Yoga and meditation has positive effects on endocrine, nervous and other systems of the body. It upregulates the levels of serotonin, melatonin, oxytocin, endorphins, encephalins, gamma-Aminobutyric acid and down regulates the cortisol levels, basal metabolic rates, body mass index and oxygen consumption rate. In conclusion, primordial preventive measures for cardiovascular diseases must be taken from the childhood through the ways of reducing the stress, inculcating healthy and good dietary principles, healthy lifestyle through yoga and meditation. (Indian J Cardiol 2022;25 (1-2):25-31)

**Keywords :** Cardiovascular disease, childhood, prevention, yoga, heartfulness meditation.

## Ideal Cardiovascular Health:

The American Heart Association (AHA) committee initially defined a construct of ideal cardiovascular health, which is defined as (1) the simultaneous presence of four favourable health behaviours (abstinence from smoking within the last year, ideal body mass index [BMI], physical activity at goal, and consumption of a dietary pattern that promotes cardiovascular health); (2) the simultaneous presence

of 4 favourable health factors (abstinence from smoking within the last year, untreated total cholesterol <200 mg/dL, untreated blood pressure <120/80 mm Hg, and absence of diabetes mellitus); and (3) the absence of clinical Cardiovascular diseases (CVD) including Coronary heart disease (CHD), stroke, heart failure, etc. Given the importance of abstinence from smoking and smoking cessation to health promotion, smoking appears in both lists of health

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factors and health behaviours. Hence, the committee defined a total of 7 health behaviours and health factors critical to the definition of ideal cardiovascular health and to satisfy all of the criteria enumerated above. These health behaviours and health factors are summarized and described in detail in Table 1.

The health-promoting benefits of each of the component metrics of health behaviours and health factors singly have been well established; however, to meet the complete definition of ideal cardiovascular health, an individual would need to meet the ideal levels of all 7 components<sup>1</sup>.

**Table 1 : Definition of Ideal Cardiovascular health**

Goal / Metric	Ideal Cardiovascular health definition
<b>Current Smoking:</b> Adults >20 y of age Children 12-19 y of age	Never or quit >12 months ago Never tried; never smoked whole cigarette
<b>Body mass index:</b> Adults >20 y of age Children 2-19 y of age	<25 kg/m <sup>2</sup> <85th Percentile
<b>Physical activity:</b> Adults >20 y of age  Children 12-19 y of age	>=150 min/week moderate intensity or >=75 min/week vigorous intensity or Combination >=60 min of moderate- or vigorous-intensity activity every day
<b>Healthy diet score*</b> Adults >20 y of age Children 5-19 y of age	4-5 components* 4-5 components*
<b>Total Cholesterol</b> Adults >20 y of age Children 6-19 y of age	<200 mg/dL† <170 mg/dL†
<b>Blood Pressure</b> Adults >20 y of age Children 8-19 y of age	<120/<80 mmHg† <90th Percentile†
<b>Fasting Plasma Glucose</b> Adults >20 y of age Children 12-19 y of age	<100 mg/dL† <100 mg/dL†

\* The committee selected 5 aspects of diet to define a healthy dietary score. The score is not intended to be comprehensive. Rather, it is a practical approach that provides individuals with a set of potential concrete actions. A comprehensive rationale is set forth in the text of this document, and a comprehensive set of nutrition recommendations is provided in the 2006 Nutrition Guidelines.<sup>2-4</sup>

†Untreated values.

### Global Burden of CVD

Across the globe, 41 million (71%) people are deceased each year due to NCDs in which 15 million people aged between 30 and 69 years and 85% of these deaths occur in low- and middle-income countries. Global statistics reported that CVDs (17.9 million) account for most NCD deaths annually followed by cancers (9%), respiratory diseases (3.9

million) and diabetes (1.6 million). Tobacco consumption, physical inactivity, harmful use of alcohol and unhealthy diet increases the risk of NCD deaths<sup>5</sup>.

### National Burden of CVD

According to the World health organisation (WHO), in India non-communicable diseases (NCD) account for 63% of all the deaths. Among these NCD

deaths, 27% from cardiovascular diseases (CVD) followed by Chronic respiratory diseases (11%) and cancers (9%).<sup>6</sup> Indian studies reported CVD as the leading causes of death and projected to contribute to the rising mortality in India (2.1 million deaths in 1960 and projected to 4.6 million deaths in 2020)<sup>7,8</sup>.

### Reasons for rising burden of CVD<sup>9</sup>

Few of the reasons that are significantly enhancing the burden of CVD are -

**Stress at early ages :** In India, the early schooling, nuclear families, employment of both the parents is creating stress to the children that probably develops CVDs at their younger ages.

**Raised blood pressure :** Stress in the childhood age causes development of hypertension in them at early/younger ages.

**Increased prevalence of childhood obesity :** Because of poor, unhealthy dietary habits and sedentary lifestyle children in India are developing childhood obesity that can lead to metabolic syndrome.

**Hyperglycemia :** As the children are consuming more simple carbohydrates and canned/packaged food without proper physical activity they are developing hyperglycemia status.

**Increased prevalence of Metabolic syndrome:** Metabolic syndrome develops due to sedentary lifestyle and poor dietary habits.

In terms of attributable deaths, the leading metabolic risk factor globally is elevated blood pressure (to which 19% of global deaths are attributed), followed by overweight and obesity and raised blood glucose.

### Our responsibility

Each individual has the responsibility to prevent the disease by following certain preventive measures. These preventive stages are primordial prevention, primary prevention, secondary prevention, and tertiary prevention.

### Prevention<sup>10</sup>

**Primordial prevention:** It consists of risk factor reduction targeted towards an entire population through a focus on social and environmental conditions. Such measures typically get promoted through laws and national policy. Because primordial prevention is the earliest prevention modality, it is often aimed at children to decrease as much risk exposure as possible. Primordial prevention targets the underlying stage of natural disease by targeting

the underlying social conditions that promote disease onset.

**Primary prevention:** Primary prevention consists of measures aimed at a susceptible population or individual. The purpose of primary prevention is to prevent a disease from ever occurring. Thus, its target population is healthy individuals. It commonly institutes activities that limit risk exposure or increase the immunity of individuals at risk to prevent a disease from progressing in a susceptible individual to subclinical disease. For example, immunizations are a form of primary prevention.

**Secondary prevention:** Secondary prevention emphasizes early disease detection, and its target is healthy-appearing individuals with subclinical forms of the disease. The subclinical disease consists of pathologic changes, but no overt symptoms that are diagnosable in a doctor's visit. Secondary prevention often occurs in the form of screenings. For example, a Papanicolaou (Pap) smear is a form of secondary prevention aimed to diagnose cervical cancer in its subclinical state before progression.

**Tertiary Prevention:** Tertiary prevention targets both the clinical and outcome stages of a disease. It is implemented in symptomatic patients and aims to reduce the severity of the disease as well as of any associated sequelae. While secondary prevention seeks to prevent the onset of illness, tertiary prevention aims to reduce the effects of the disease once established in an individual. Forms of tertiary prevention are commonly rehabilitation efforts.

### Need for Primordial prevention

According to the reports, Indian population consists of more than 50% of children and youth (age <30 years) and the mean age of the Indians is 29 years (Figure-1)<sup>11</sup>. Hence we should focus on primordial prevention at childhood to prevent the NCDs for healthy nation/society. Brain development predominantly takes place in intrauterine period and up to first six years of age. During this period the right brain dominates afterwards a transition to left brain dominance occurs till 11 years of age (figure-2). Right brain is responsible for personality, creativity, intuition, music, art and spatial ability whereas left brain is for logic, mathematical ability, language, reading, writing and analysis<sup>12</sup>.

The Third International Mathematics and Science Study (TIMSS) has showed that the schooling age is directly proportional to the academic outcome. The starting age of the schooling is very early in India (3 years) when compared to other countries

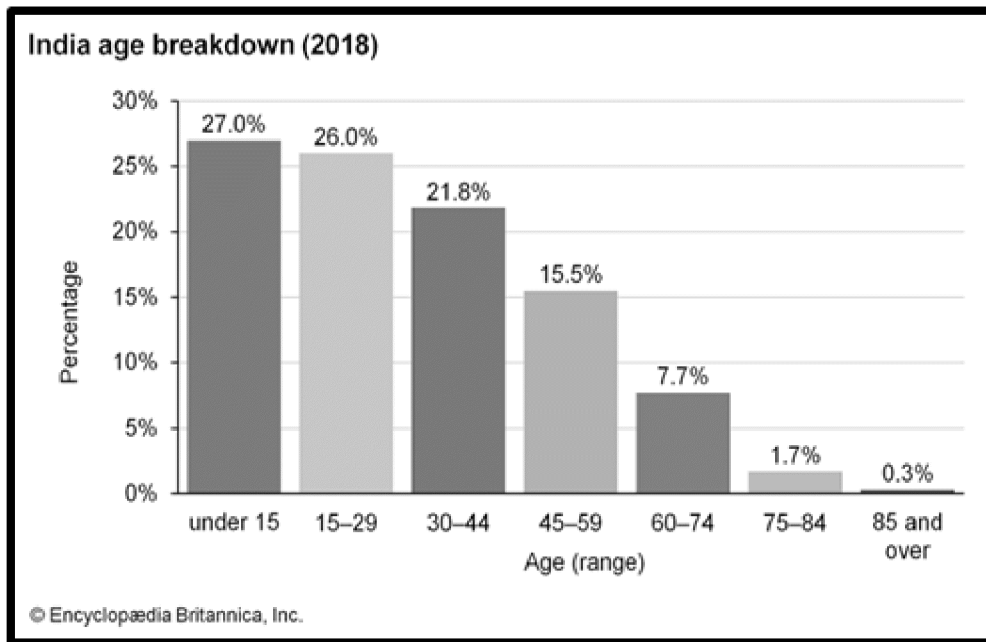


Fig. 1 : Age wise Indian population

in which it is 6 years in United States (US), United Kingdom (UK) and Japan, 6-7 years in Singapore and China.<sup>13</sup> The early schooling age in India may create stress in children at their ages that leads to NCDs in their early younger ages when compared with other countries such as Singapore, China, US, UK and Japan. There is a familiar statement that Today's children are tomorrow's citizens. Children play a critical role in nation's building, development and strengthening, hence it is our responsibility to promote

holistic health in them. We have to inculcate healthy lifestyle in children which include promotion of yoga, meditation, physical activity, healthy dietary habits, no addictions to smoking and alcoholism.

#### Role of Yoga and Meditation

Role of mind is so crucial in moulding healthy lifestyle and meditation helps in controlling the mind. There are several types of meditation techniques. Among them Transcendental, Mindfulness,

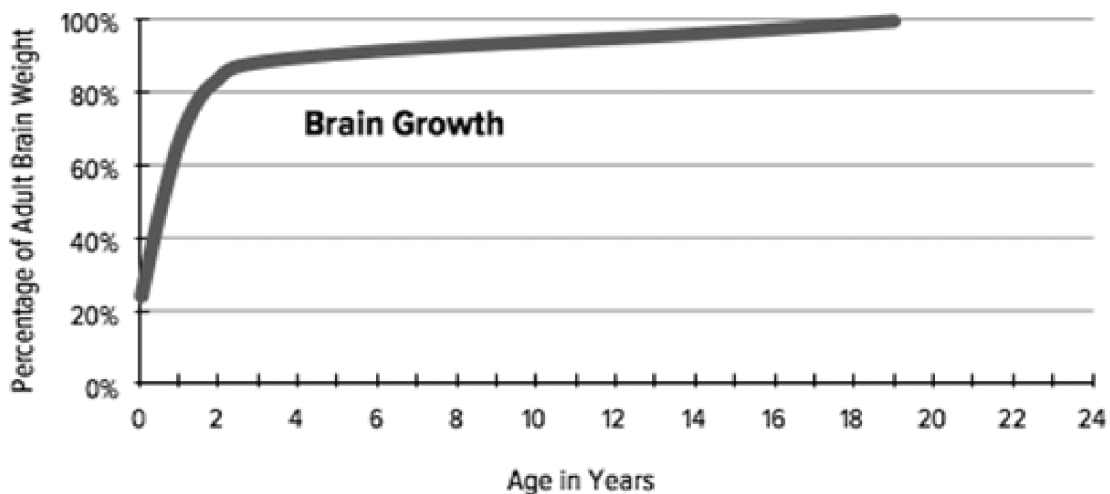
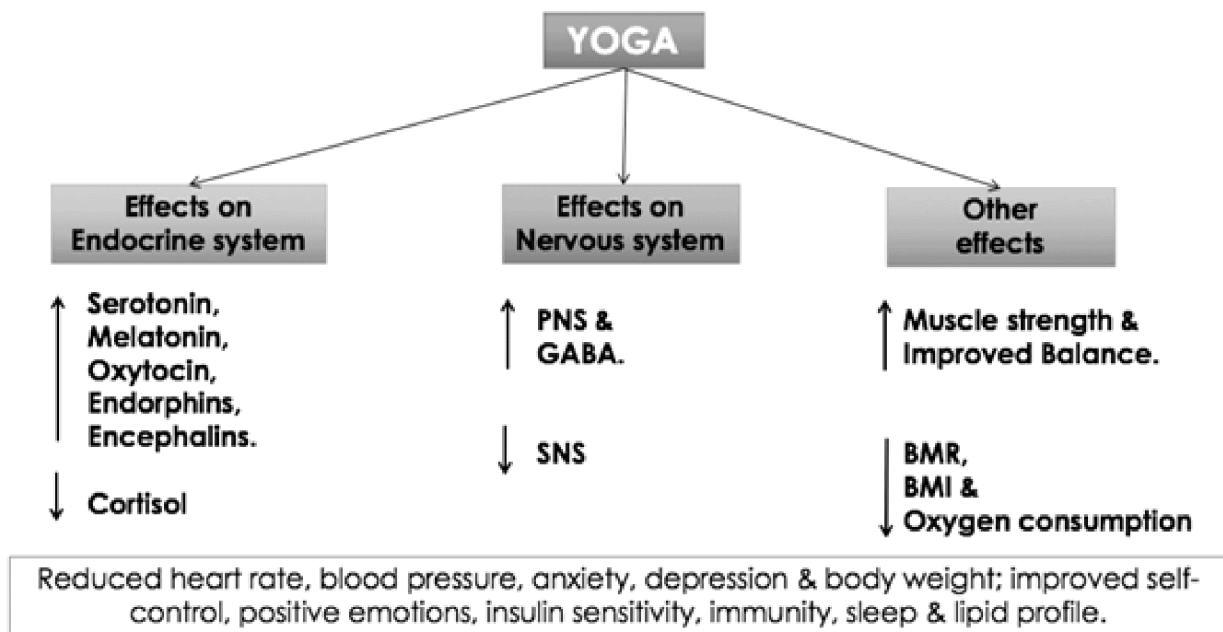


Fig. 2 : Growth chart of human brain

Heartfulness, Kundalini yoga, Sudarshan kriya etc are popular in modern days due to their simplified methodology. Positive effects of yoga and meditation on human body are summarised in figure-3. Yoga and meditation has positive effects on endocrine, nervous and other systems of the body. It upregulates

the levels of serotonin, melatonin, oxytocin, endorphins, encephalins, gamma-Aminobutyric acid (GABA) and down regulates the cortisol levels, basal metabolic rates (BMR), body mass index (BMI) and oxygen consumption rate (Figure-3)<sup>14</sup>.

## Mechanism of actions of Yogic techniques



PNS: peripheral nervous system; GABA: gamma-Aminobutyric acid; SNS: sympathetic nervous system; BMR: basal metabolic rate; BMI: body mass index.

Fig. 3 : Effects of Yoga and Meditation

**Heartfulness Meditation:** Meditation is a state to think about the presence of divine in our heart, resulting in feeling and becoming one with the ultimate. Heartfulness meditation has been gaining lots of popularity globally as a refined and modified form of Raja Yoga in which exercise of fine tuning of the heart with mind is done through meditation on the heart.

### Cardiovascular health benefits of Yoga and Meditation

Risk factors for CVDs include hypertension, diabetes mellitus, obesity, stress, dyslipidaemia and smoking. Metabolic syndrome (MetS) is another condition which increases the risk of developing CVDs and it is a constellation of - increased blood pressure,

dyslipidaemia, central obesity, insulin resistance. We can prevent CVDs by better controlling the hypertension, diabetes, dyslipidaemia, obesity, stress and smoking. There is a published evidence that yoga and meditation are useful in primordial, primary, secondary and tertiary prevention of CVDs.

Chu P et al reported that the comparative effectiveness of several forms of lifestyle modifications, such as smoking cessation, diet, and exercise strategies to a more contemporary form of exercise, yoga, on 10-year CVD risk. They found smoking cessation, Mediterranean diet, aerobic exercise and yoga are found to be beneficial in reducing the CVD risk. Studies have shown that brief training in mindfulness meditation resulted in smoking cessation<sup>16</sup>.

A meta-analysis was done by Harvard university group on the effectiveness of yoga in modifying risk factors for CVD and MetS. Total of 32 studies were included in the analysis and found that yoga has beneficial role in improving the cardio-metabolic health by reducing the BMI, SBP and LDLC. Yoga facilitates a greater long-term individual- and population-level CVD and metabolic risk reductions<sup>17</sup>. In a review on yoga for the primary prevention of CVDs showed beneficial effects of yoga on reduction of CVDs by decreasing diastolic blood pressure (DBP), triglycerides (TGL) and increasing HDL cholesterol<sup>18</sup>. Another review showed favorable effects of meditation on overall reduction of cardiovascular mortality, improvement in hypertension, diabetes mellitus, dyslipidemia and high cortisol levels<sup>14,19</sup>.

Heartfulness meditation was also associated with a significant decrease in emotional exhaustion or burnout and is an effective tool in reducing stress<sup>20-22</sup>.

An intervention of an 8-week mindfulness based stress reduction (MBSR) program improved heart rate variability (HRV) during meditation, suggesting improved sympatho-vagal balance through reduced sympathetic and increased parasympathetic influence. Another study is warranted that MBSR could be a useful adjunct in management of conditions with reduced HRV, such as acute myocardial infarction and heart failure<sup>23-25</sup>. Heartfulness meditation could induce a suppression of global vagal modulation and increase the sympathetic modulation and baroreflex suggest that the changes in breathing which occur during meditation influence HRV<sup>26</sup>.

In patients with MetS, yoga has an additive benefits along with conventional therapy that has resulted in significant reduction of early atherosclerosis as assessed by carotid intima-media thickness (cIMT), lipid profile, BMI, blood pressure<sup>27,28</sup>. Even American heart association (AHA) recommends that meditation may be useful as a non-pharmacological measure to treat blood pressure<sup>29</sup>.

Several studies have proved that yoga has a positive impact in primary prevention of ischemic heart disease (IHD), retardation of atherosclerosis, post event rehabilitation and risk factor modification in CAD<sup>30</sup>.

In conclusion, primordial preventive measures for cardiovascular diseases must be taken from the childhood through the ways of reducing the stress, inculcating healthy and good dietary principles, healthy lifestyle through yoga and meditation.

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## References

1. Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation*. 2010; 121: 586-613.
2. Appel LJ, Brands MW, Daniels SR, Karanja N, Elmer PJ, Sacks FM. Dietary approaches to prevent and treat hypertension: a scientific statement from the American Heart Association. *Hypertension*. 2006; 47:296 -308.
3. Johnson RK, Appel LJ, Brands M, Howard BV, Lefevre M, Lustig RH, Sacks F, Steffen LM, Wylie-Rosett J; on behalf of the American Heart Association Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism and the Council on Epidemiology and Prevention. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation*. 2009; 120: 1011-20.
4. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, et al. Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee [published corrections appear in *Circulation*. 2006;114:e629 and 2006;114:e27]. *Circulation*. 2006; 114:82-96.
5. World Health Organization. Noncommunicable diseases. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed on 15 Sep 2020
6. World Health Organization - Noncommunicable Diseases (NCD) country profiles , 2018. [https://www.who.int/nmh/countries/ind\\_en.pdf](https://www.who.int/nmh/countries/ind_en.pdf). Accessed on 15 Sep 2020.
7. Mukherjee AK. India's health? Today and tomorrow. *J Indian Med Assoc* 1995; 93:312?5.
8. Coelho KR. Significance of the development of a cardiovascular disease surveillance and reporting system in India. *Indian J Palliat Care*. 2013; 19:131-8.
9. World Health Organization. Noncommunicable diseases. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Accessed on 15 Sep 2020
10. Kisling LA, M Das J. Prevention Strategies. [Updated 2020 Jun 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK537222/>
11. Demographic Trend. India age breakdown 2018. <https://www.britannica.com/place/India/Demographic-trends>. Accessed on 15 Sep 2020.
12. Matthew D. Lieberman. *Social: Why our brains are wired to connect*. Oxford University Press, 2015. Oxford.
13. Robitaille DF, Donn JS. TIMSS: The Third International Mathematics and Science Study. In: Niss M. (eds) *Investigations into Assessment in Mathematics Education*. New ICMI Study Series 1993, vol 2. Springer, Dordrecht. [https://doi.org/10.1007/978-94-017-1974-2\\_15](https://doi.org/10.1007/978-94-017-1974-2_15)
14. Ray IB, Menezes AR, Malur P, Hiltbold AE, Reilly JP, Lavie CJ. Meditation and coronary heart disease: a review of the current clinical evidence. *Ochsner J*. 2014

- Winter;14(4):696-703.
15. Chu P, Pandya A, Salomon JA, Goldie SJ, Hunink MG. Comparative Effectiveness of Personalized Lifestyle Management Strategies for Cardiovascular Disease Risk Reduction. *J Am Heart Assoc.* 2016; 5(3):e002737.
  16. Tang YY, Tang R, Posner MI. Brief meditation training induces smoking reduction. *Proc Natl Acad Sci USA.* 2013; 110(34):13971-5.
  17. Chu P, Gotink RA, Yeh GY, Goldie SJ, Hunink MG. The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *Eur J Prev Cardiol.* 2016; 23(3):291-307.
  18. Hartley L, Dyakova M, Holmes J, Clarke A, Lee MS, Ernst E, Rees K. Yoga for the primary prevention of cardiovascular disease. *Cochrane Database Syst Rev.* 2014 May 13;(5):CD010072.
  19. Mishra S, Sai Sailesh K, Bashetti S, Archana R, Reddy UK, Jayasree DK et al. Effect of heartfulness meditation on perceived stress and cognition in hypertensive patients. *Int J Res Pharm Sci.* 2017; 8: 690-2.
  20. Thimmapuram JR, Grim R, Bell T, Benenson R, Lavalley M, Modi M, et al. Factors influencing work-life balance in physicians and advanced practice clinicians and the effect of heartfulness meditation conference on burnout. *Glob Adv Health Med* 2019; 8:2164956118821056.
  21. Thimmapuram J, Pargament R, Sibliss K, Grim R, Risques R, Toorens E. Effect of heartfulness meditation on burnout, emotional wellness, and telomere length in health care professionals. *J Community Hosp Intern Med Perspect.* 2017;7(1):21-27.
  22. RajaAmarnath G, Prasanthi, J, Sharma N, Jenitha S, Rajan C. Efficacy of Heartfulness Meditation in Moderating Vital Parameters - A Comparison Study of Experienced and New meditators. *International Journal of Medical Research and Health Sciences*2017; 6: 70-8.
  23. 19. Nijjar PS, Puppala VK, Dickinson O, Duval S, Duprez D, Kreitzer MJ, et al. Modulation of the autonomic nervous system assessed through heart rate variability by a mindfulness based stress reduction program. *Int J Cardiol.* 2014; 177(2):557-9.
  24. 20. Krygier JR, Heathers JA, Shahrestani S, Abbott M, Gross JJ, Kemp AH. Mindfulness meditation, well-being, and heart rate variability: a preliminary investigation into the impact of intensive Vipassana meditation. *Int J Psychophysiol.* 2013; 89(3):305-13.
  25. Arya NK, Singh K, Malik A, Mehrotra R. Effect of Heartfulness cleaning and meditation on heart rate variability. *Indian Heart J.* 2018;70 (Suppl 3):S50-S55.
  26. Léonard A, Clément S, Kuo C-D, Manto M. Changes in Heart Rate Variability During Heartfulness Meditation: A Power Spectral Analysis Including the Residual Spectrum. *Front. Cardiovasc. Med.* 2019; 6:62.
  27. Manchanda SC, Mehrotra UC, Makhija A, Mohanty A, Dhawan S, et al. (2013) Reversal of Early Atherosclerosis in Metabolic Syndrome by Yoga - A Randomized Controlled Trial. *J Yoga Phys Ther* 3: 132.
  28. Chu P, Gotink RA, Yeh GY, Goldie SJ, Hunink MG. The effectiveness of yoga in modifying risk factors for cardiovascular disease and metabolic syndrome: A systematic review and meta-analysis of randomized controlled trials. *Eur J Prev Cardiol.* 2016; 23(3):291-307.
  29. Prasad K, Sharma V, Lackore K, Jenkins SM, Prasad A, Sood A. Use of complementary therapies in cardiovascular disease. *Am J Cardiol.* 2013; 111(3):339-45.
  30. Jayasinghe SR. Yoga in cardiac health (a review). *Eur J Cardiovasc Prev Rehabil.* 2004; 11(5):369-75.