EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 7
Issue: 3
373-380
Year: 2020

COMPARATIVE STUDY OF ICE MASSAGE AND COLD COMPRESS IN PRIMARY HYPERTENSION – A RANDOMIZED TRAIL

***Prashanth Shetty (BNYS, MSc, PhD), Sadhana Kotapati (BNYS), Shashikiran H. C. (BNYS, MD) and Sujatha K. J. (BNYS, MSc)**

India.

***Corresponding Author: Dr. Prashanth Shetty**
India.

Article Received on 17/01/2020 **Article Revised on 07/02/2020** **Article Accepted on 27/02/2020**

ABSTRACT

Background: Hypertension is one of the most important risk factors for both coronary artery disease and cerebrovascular accidents which can lead to cardiac hypertrophy and potentially heart failure. Hydrotherapy, formerly called hydropathy and also called water cure is a part of alternative medicine, in particular of naturopathy, occupational therapy and physiotherapy, that involves treating of various diseases using water. In this study we see the comparative effect of ice massage and cold compress in Primary hypertensive individuals. **Methods:** A total of 60 subjects were required for the study, with a mean age group of 30 to 60 years. Subjects who fulfilled the inclusion criteria were included in research. Informed consent form was administered in English. 30 subjects were giving ice massage and the remaining 30 subjects were given cold compress. Assessments were made before and after the intervention. **Results:** Although results of individual group have shown some changes, there is no significance in the form of ($p<0.05$) when compared in between cold compress and ice massage. Group 1 (cold compress) showed significant increase in NN50 and PNN50 and decrease in HR($p<0.05$), Group 2 (ice massage) showed significant increase in NN50 and decrease in HR($p<0.05$). **Conclusion:** Both cold compress and ice massage have shown parasympathetic dominance and can be used in the treatment of hypertensive individuals.

KEYWORDS: Primary Hypertension, Ice Massage, Cold Compress.

INTRODUCTION

Hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which there is persistently elevated blood pressure in the arteries.[1] Hypertension is basically classified into primary(essential) hypertension and secondary hypertension.[2] Primary hypertension though it has no direct cause has many factors such as sedentary lifestyle, stress, obesity, hypokalemia, alcohol intake, vitamin D deficiency, smoking, excess salt in diet which may be the causative factors.[3,4] Primary hypertension can result from multiple factors including blood plasma volume and activity of the hormones that regulate blood volume and pressure. It is also influenced by environmental factors such as stress and lack of exercise. Many conditions that affects kidneys, arteries, heart or endocrine and birth control pills causes secondary hypertension also adrenal gland cancer, preeclampsia, hypothyroidism and hyperthyroidism may also add to those factors.[5,6] High blood pressure is usually asymptomatic; patients do not experience any direct symptoms of the condition. Hypertension quietly causes damage to the cardiovascular system and internal organs such as kidneys.

High blood pressure causes sweating, anxiety, sleeping problems and blushing. In most cases no symptoms at all. If it reaches hypertension crisis person may experience headaches and nosebleeds. Long term hypertension can cause complications through atherosclerosis where the formation of plaque results in the narrowing of blood vessels. This makes hypertension worse, as the heart must pump harder to deliver blood to the body. High blood pressure raises the risk of number of health problems Heart failure and heart attacks, Aneurysm, Kidney failure, Stroke, Hypertensive retinopathies which leads to blindness.[7]

Heart rate variability (HRV) reveals information on the functional state of the ANS.[8] In 1965, Hon and Lee shown the clinical relevance of HRV. They noted that fetal distress was preceded by alterations in inter beat intervals before any appreciable change occurred in heart rate.[9] In 1970, Ewing et al., invented a number of simple bedside tests of short-term RR difference to detect autonomic neuropathy in diabetic patients.[10] In 1977, Wolf et al. showed the risk of post infraction mortality with reduced HRV.[11] Power spectral analysis of heart rate fluctuations to quantitatively evaluate beat

to beat cardiovascular control was introduced by Akselrod et al. in 1981.[12]

Naturopathy is a distinct type of primary care with old healing traditions, scientific advances and current research. It has unique set of principles that recognize the body's innate healing capacity, emphasize disease prevention and encourage individual responsibility to obtain optimal health. In India present naturopathic modalities utilized by naturopaths include diet and clinical nutrition, herbology, hydrotherapy, spinal and soft tissue manipulation, massage, acupuncture, magneto therapy, colour therapy and physical therapies involving electric currents like ultrasound and light therapy, therapeutic counselling and pharmacology. According to naturopathy accumulation of the morbid matter is the cause of diseases, hence eliminating those morbid matters is the cure for disease. The use of water for various treatments is as old as mankind. Hydrotherapy is the external or internal use of water in any of its forms for health promotion or treatment of various diseases with various temperature, pressure, duration and site.[13]

The use of water for various treatments is as old as mankind. Hydrotherapy is the external or internal use of water in any of its forms for health promotion or treatment of various diseases with various temperature, pressure, duration and site. Water in its various forms and temperatures can produce different effects on different system of the body. Hippocrates had used hydrotherapy extensively around 400 B.C and had written some of the earliest dictums on hydrotherapy. Hydrothermal therapy additionally uses its temperature effects in hot and cold baths as sauna, wraps, etc and in all its forms –solid, liquid, vapour, ice and steam.

Heart rate variability (HRV) reveals information on the functional state of the ANS. In 1965, Hon and Lee shown the clinical relevance of HRV. They noted that fetal distress was preceded by alterations in inter beat intervals before any appreciable change occurred in heart rate. HRV is considered as a powerful non-invasive tool in assessing the cardiac autonomic function. It is the measure of inter-beat interval fluctuations of heart rate. The oscillation in the cardiac cycles is controlled by the sympatho-vagal balance of the ANS.[14]

METHODOLOGY

A total 60 subjects with the age of 30-75 were required for the study. Subjects who fulfilled the inclusion criteria were appraised the purpose of the study and their rights as the research subjects.

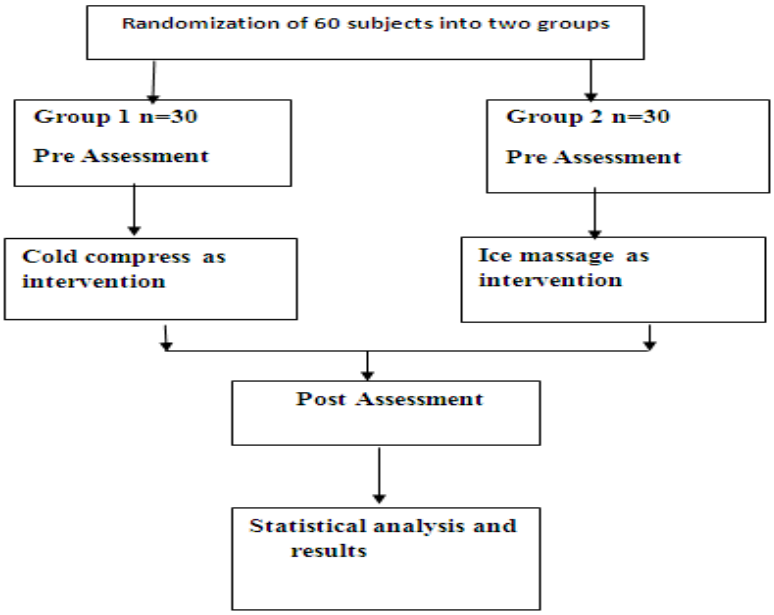
Source of subjects: The subjects will be selected from In-patients department of Sri Dharmasthala Manjunatheshwara Yoga and Nature cure Hospital, Shanthivana, after getting the ethical clearance from the institutional ethical committee and consent from the subjects.

Inclusion criteria: The patients with primary hypertension having age group between 30-65years, both the genders.

Exclusion criteria: The patients with secondary hypertension, suffering with IHD, liver and lung diseases, neurological disorders, cancer, DM, hypothyroidism, IBD and psychiatric disorders.

The study subjects were identified and screened as per the inclusion and exclusion criteria. Selected subjects were randomly divided into two groups. Pre and post assessment were analysed after the intervention.
Group 1 = ice massage on head and neck
Group 2 = cold compress on head and neck

Study plan Design: - Randomized comparative trial.



Intervention: Subject is made to sit comfortably on a chair, cold compress should cover the head and neck of the subjects which is changed for 3 times for every 5minutes the total duration of intervention consists of 15 minutes, similarly the ice massage is given continuously for 15 minutes covering whole of head and neck. The assessments were done 5 minutes before and after the intervention. The data later were arranged in Microsoft excel sheets for statistical analysis.

Assessment: HRV was derived from heart rate measures collected using electrocardiogram (ECG) data from Burdick Vision Holtermonitors. Heart rate variability is an index of beat-to-beat changes in the heart rate. The clinical relevance of heart rate variability was first appreciated in 1965 by Hon and Lee. Heart rate variability (HRV) represents one of the most promising markers of autonomic activity. The electrocardiogram [EKG] was recorded using standard bipolar limb lead II configuration and an AC amplifier with 1.5 Hz high pass filter and 75 Hz low pass filter settings (BIOPAC, Montana, USA; model No: BSL 4.0 MP 36). The R waves were detected to obtain a point event series of successive R-R intervals, from which the beat-to-beat heart rate series was computed. The data recorded was visually inspected off-line and only noise free data was included for analysis. Systolic and diastolic blood pressure was recorded at baseline and immediately after the intervention of ice massage and cold compress by using sphygmomanometer. It is a device used to measure blood pressure. The device was invented by Samuel Siegfried Karlriter von basch in 1881. It consists of an inflatable cuff, a measuring unit and a mechanism for inflation which may be manually operated electrically. Mercury sphygmomanometers are considered the gold standards they show blood pressure by affecting the height of a column of mercury, which does not require recalibration. Because of their accuracy that are often used in clinical trials of drugs and in clinical evaluation high risk patients.

RESULTS

This study was done to evaluate the effect of cold compress and ice massage on autonomic and respiratory variables in individuals with primary hypertension. The data obtained was analyzed for normality by using shapiro wilk test. The pre- post data of group 1 and group 2 were analyzed separately using paired t- test and comparative analysis between the two groups were done by using independent t- test.

The results of the pre-post comparisons for both the groups are detailed below:

Group 1:- (cold compress)

In the time domain of HRV, there was increase in NN50, PNN50 and decrease in RMSSD, HR and mean RR which is statically significant($p<0.05$). In frequency domain of HRV there is increase is LF and decrease in HF which is statically significant. ($p<0.05$) and also there is increase in VLF and LF/HF ratio which is statically insignificant. ($p<0.05$).

There was also significant increase in SBP, DBP($p<0.05$) and no significant changes in PR. ($p<0.05$).

Group 2:- (ice massage)

In the time domain of HRV, there significant increase in NN50($p<0.05$) and significant decrease in mean RR, HR and PNN50, there was also increase in RMSSD which was statically insignificant. In frequency domain of HRV there was significant decrease in LF and HF, there is also increase in VLF and LF/HF ratio which is statically insignificant. There is also significant decrease in SBP, DBP and PR.

Comparison among groups:-

There is increase in LF/HF ratio in cold compress which is stastically significant. Also the values of HR, SBP, DBP and PR is also increased in cold compress compared to ice massage but is stastically insignificant and the values of mean RR, RMSSD, NN50, PNN50, VLF, LF and HF is decreased in cold compress compared to ice massage which is also stastically insignificant.

Table 1:- Comparison of Group 1 (cold compress) with respect to pre and post test scores.

TIME POINTS	MEAN PRE ± SD	MEAN POST ± SD	P VALUE
HR	78.523±17.7845	77.067±16.828	0.001*
RR	795.660± 151.980	808.967± 151.375	0.001*
RMSSD	33.423± 46.212	33.200± 56.012	0.001*
NN50	33.423± 46.212	38.87± 122.880	0.001*
PNN50	6.193± 18.848	8.358± 19.107	0.001*
VLF	44.334± 118.797	46.167± 94.217	0.180
LF	323.327± 1145.67	397.550± 705.756	0.039*
HF	310.493± 873.665	268.740± 476.675	0.001*
LF/HF	1.816± 1.707	4.023± 4.443	0.196
SBP	133.73± 13.653	120.73± 14.626	0.001*
DBP	81.33± 11.559	78.27± 10.913	0.001*
PR	78.73± 12.654	78.73± 12.654	0.001*

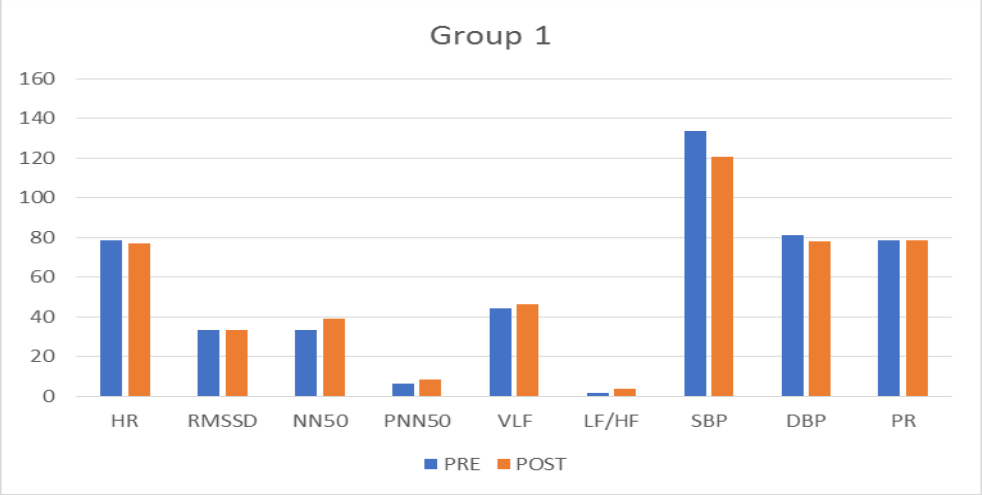


Fig:- 1: Mean HR=Heart rate, PR=Pulse rate, RMSSD=The square root of the mean squared difference between adjacent N-N intervals, NN50=Consecutive normal sinus (NN) intervals exceeds 50 ms, pNN50=The fraction of consecutive NN intervals that differ by more than 50 ms, VLF=Very low frequency power, LF/HF=Low frequency/High frequency ratio, SBP=Systolic blood pressure, DBP=Diastolic blood pressure.

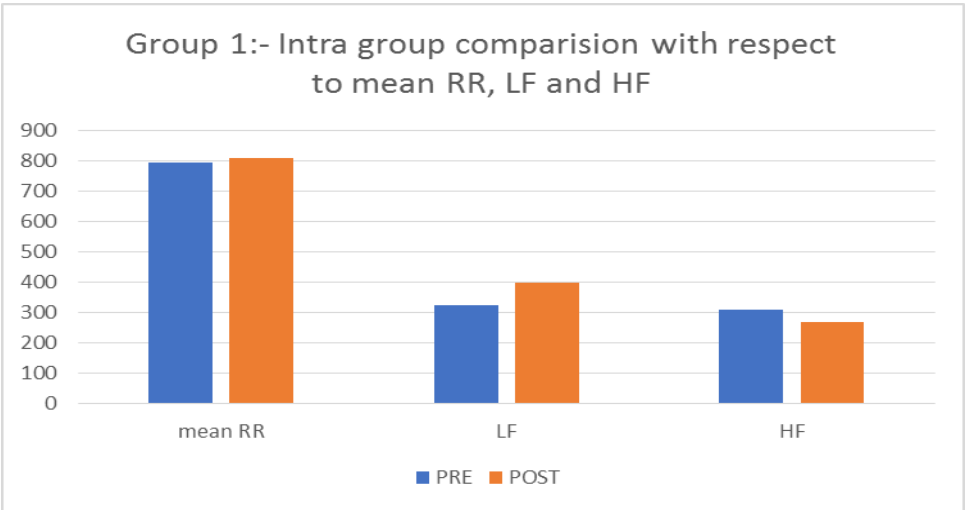


Fig 2:- mean RR= Mean of R-R interval, LF=Low frequency Power, HF=High frequency power.

Table 2:-Comparison of Group 2 (Ice Massage) with respect to pre and post test scores.

TIME POINTS	MEAN PRE ± SD	MEAN POST ± SD	P VALUE
HR	74.620±17.242	73.087±16.164	0.001*
RR	848.587±235.209	821.117±157.987	0.002*
RMSSD	235.293±767.961	37.418±67.097	0.940
NN50	34.900±56.288	48.27±138.46	0.001*
PNN50	15.860±26.650	9.924±24.116	0.001*
VLF	532.473±1932.39	2072.69±11146.19	0.789
LF	1569.60±4575.46	546.507±1651.70	0.021*
HF	1849.20±4773.85	951.413±2878.00	0.037*
LF/HF	1.784±2.630	2.062±2.241	0.707
SBP	128.93±11.249	117.40±10.676	0.001*
DBP	82.07±10.498	75.27±11.477	0.001*
PR	78.53±10.582	76±80598	0.010*

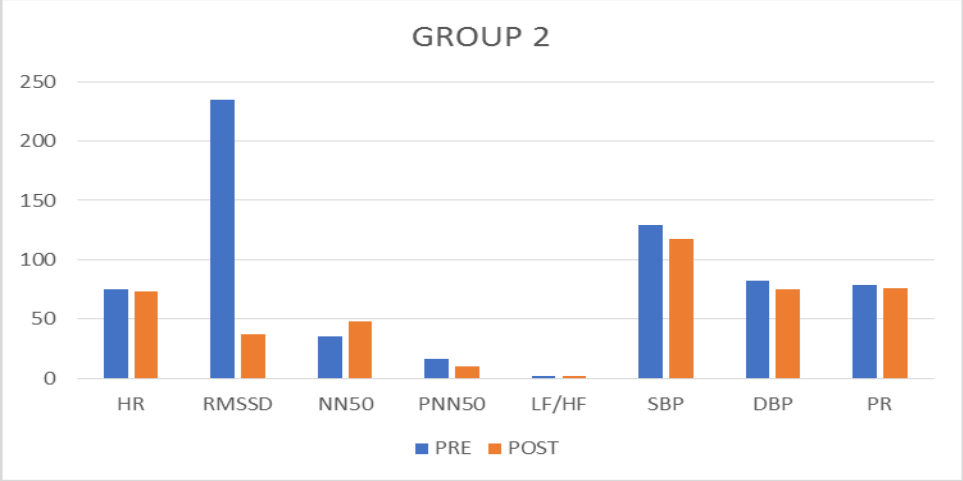


Fig:- 3: Mean HR=Heart rate, PR=Pulse rate, RMSSD=The square root of the mean squared difference between adjacent N-N intervals, NN50=Consecutive normal sinus (NN) intervals exceeds 50 ms, pNN50=The fraction of consecutive NN intervals that differ by more than 50 ms, LF/HF=Low frequency/High frequency ratio, SBP=Systolic blood pressure, DBP=Diastolic blood pressure.

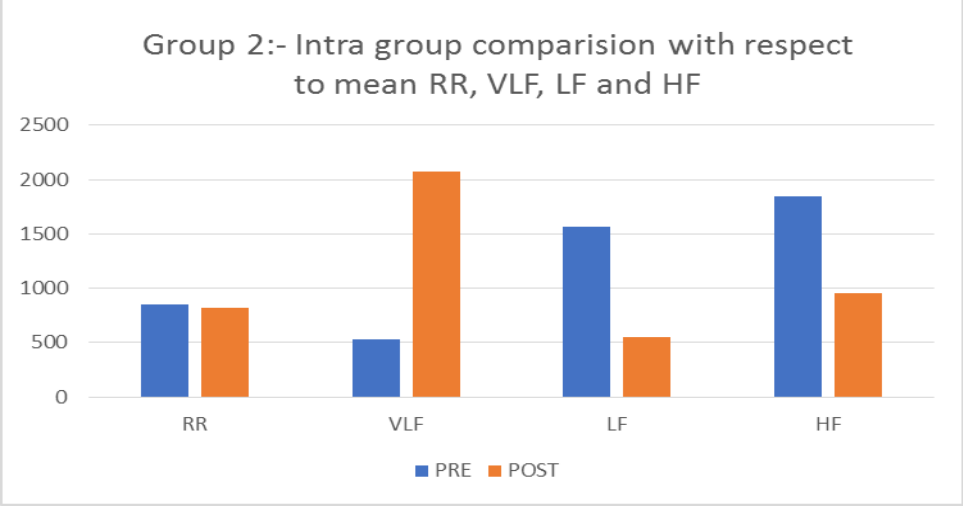


Fig 4:- mean RR= Mean of R-R interval, LF=Low frequency Power, HF=High frequency power, VLF=Very low frequency power.

Table 3:- Comparison of group 1 (ice massage) and group 2 (cold compress) with respect to post-test results by Independent T test.

VARIABLES	GROUP 1 (ice massage) MEAN (SD)	GROUP 2 (cold compress) MEAN(SD)	p-VALUE
HR	73.087±16.164	77.067±16.828	0.354
RR	821.117±157.987	808.967± 151.375	0.762
RMSSD	37.418±67.097	33.200± 56.012	0.792
NN50	48.27±138.46	38.87± 122.880	0.782
PNN50	9.924±24.116	8.358± 19.107	0.781
VLF	2072.69±11146.19	46.167± 94.217	0.323
LF	546.507±1651.70	397.550± 705.756	0.651
HF	951.413±2878.00	268.740± 476.675	0.205
LF/HF	2.062±2.241	4.023± 4.443	0.035*
SBP	117.40±10.676	120.73± 14.626	0.318
DBP	75.27±11.477	78.27± 10.913	0.304
PR	76±80598	78.73± 12.654	0.332

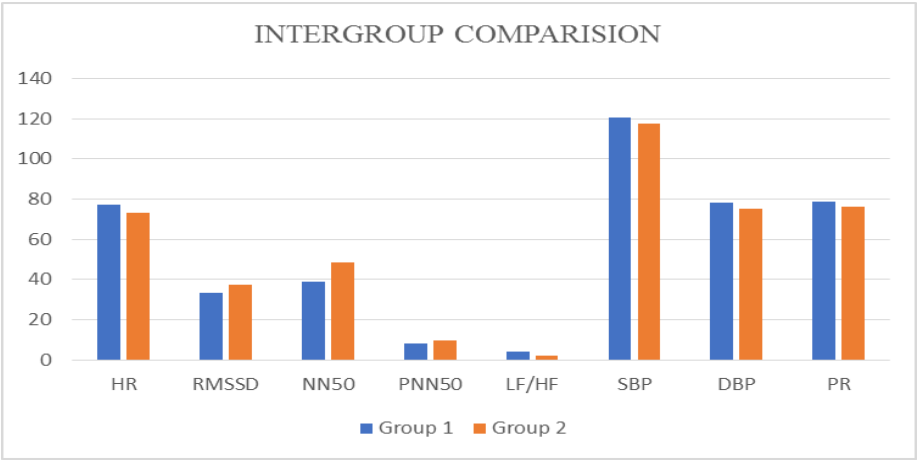


Fig:- 5: Mean HR=Heart rate, PR=Pulse rate, RMSSD=The square root of the mean squared difference between adjacent N-N intervals, NN50=Consecutive normal sinus (NN) intervals exceeds 50 ms, pNN50=The fraction of consecutive NN intervals that differ by more than 50 ms, LF/HF=Low frequency/High frequency ratio, SBP=Systolic blood pressure, DBP=Diastolic blood pressure.

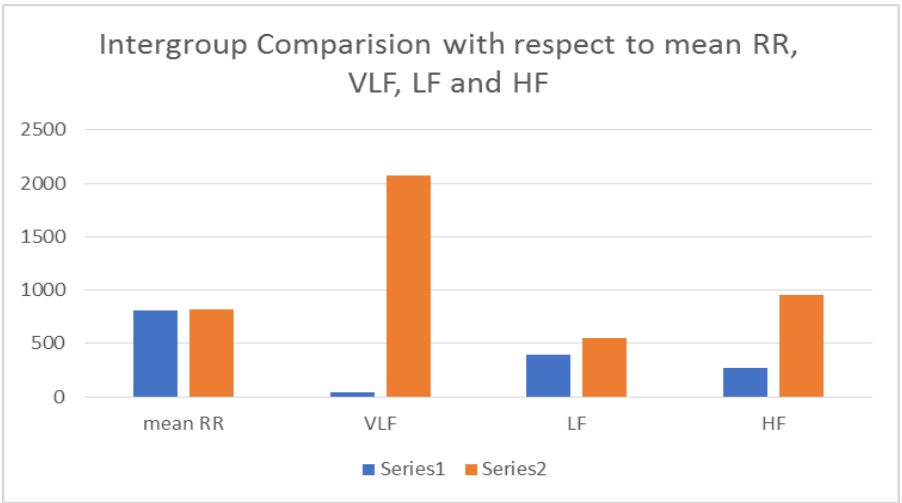


Fig 6:- mean RR= Mean of R-R interval, LF=Low frequency Power, HF=High frequency power, VLF=Very low frequency power.

DISCUSSION

The main aim of the study was to evaluate the immediate comparative effect of cold compress and ice massage on primary hypertensive individuals on the autonomic variables of the subject i.e., heart rate variability, pulse rate and blood pressure. All the 60 subjects underwent the intervention for the duration of 15 minutes. There were no drop outs as well as any side effects after the treatment. Assessments were done 5 min prior and 5 min immediately after the intervention.

The present study showed that there is no much difference between the two groups i.e., cold compress and ice massage whereas the individual effect of the intervention shows that there is significant increase in NN50 and PNN50 and decrease in HR in the cold compress group and significant increase in NN50 and decrease in HR also an insignificant increase in RMSSD. This shows that 15 minutes of cold compress and ice massage to head and neck reduced HR and improved HRV toward parasympathetic dominance or sympathetic withdrawal.

A stronger prediction of vagal modulators has been recognized in time domain measures of HRV i.e., NN50, RMSSD and mean RRI when compared to the frequency domain measures.[15] In the assessment of trigeminal brainstem vagal function of human, a cold face test can be effectively used according to Dr Ramesh K Khurana. Hence, we can say cold stimulates parasympathetic activity which is also shown in present study.[16] A study by mooventhan et all., is supportive to our results which suggested that ice massage on head and spine for 20 minis effective in reducing HR and improving the HRV towards parasymapathetic dominance in healthy individuals.[17] Cold, in contrast, stimulates and invigorates, increasing internal activity. Its mechanical action occurs during the bath when the body weight decreases by 50% to 90% when submerged in a bath, a pool, or a whirlpool, experiences a kind of weightlessness. Body is relieved from the constant pull of gravity. Water also has a hydrostatic effect. It has a massage-like feeling as the water gently kneads your body. Water, in motion, stimulates touch receptors on the skin, boosting blood circulation and releasing tight muscles.[18]

Cold application capable of inducing shivering has shown to encourage production of Irisin, an adipokine that facilitates white adipose tissue to mimic functions similar to brown adipose tissue and enhance metabolism. Though the exact effect of local mud pack and cold abdominal pack on adiposities is not so evident, it had marked effects on skin microcirculation, with a very large blood flow increase and stimulation of vasomotion. Studies shows that variations in the vascularisation of different types of adipose tissue and between white adipose tissue.[19] Cold induced thermogenesis is the ability to generate heat by increasing metabolism in response to cold, to maintain a stable core body temperature which is the basic property of endothermic thermoregulation.[20]

ACKNOWLEDGEMENT

Funded by: Ministry of Ayush, Government of India.

REFERENCES

1. Stevenson, Angus, ed. (2007). "Definition of Water Cure". Shorter Oxfrord english dictionary. 2: N-Z (6th ed.). Oxford: Oxford University Press. p. 3586. ISBN 978-0-19-920687-2
2. Carretero OA, Oparil S; Oparil (January 2000)." essential hypertension. Part I: definition and etiology"
3. Haslam DW, Jmaes WP, Obesity Lancet, 2005; 366: 1197-209.
4. Kyrou I, Chrousos GP, Tsigos C, Stress, Visceral obesity, and metabolic complications. Ann N Y Acad sci., 2006; 1083: 77-110.
5. Dickson ME, Sigmund CD, genetic basis of hypertension: Revisiting angiotensinogen, 2006; 48: 14-20.
6. Lackland, DT; Weber, MA (May 2015). "Global burden of cardiovascular disease and stroke: hypertension at the core". The Canadian journal of cardiology, 31(5): 569–71.
7. Segura J, Ruilope LM. Obesity, essential HTN and rennin angiotensin system. Public health nutrition, 2007; 40: 1151-5.
8. Kim Barrett, Heddwen Brooks, Scott Boitano et al. Hypothalamic regulation of hormonal functions, Ganong's review of medical physiology. Lange McGraw Hill., 2010; 283-285.
9. Longin E, Gerstner T, Schaible T, Lenz T, Konig S. Maturation of the autonomic nervous system: differences in heart rate variability in premature vs.term infants. Journal of Perinatal Medicine, 2006; 34(4): 303-8.
10. Park SB, Lee BC, Jeong KS. Standardized tests of heart rate variability for autonomic function tests in healthy Koreans. International Journal of Neurosciences, 2007 Dec; 117(12): 1707-17.
11. Hon E H, Lee S T. Electronic evaluations of the fetal heart rate patterns preceding fetal death: further observations. American Journal of Obstetrics and Gynecology, 1965; 87: 814-26.
12. Ewing D J, Martin C N, Young R J, Clarke B F. The value of cardiovascular autonomic function tests: 10 years' experience in diabetes. Diabetes Care., 1985; 8: 491-98.
13. Longin E, Gerstner T, Schaible T, Lenz T, Konig S. Maturation of the autonomic nervous system: differences in heart rate variability in premature vs.term infants. Journal of Perinatal Medicine, 2006; 34(4): 303-8.
14. Kang J, Kim J, Hong S, Lee C, Choi B. Heart Rate Variability for Quantification of Autonomic Dysfunction in Fibromyalgia. Annals of Rehabilitation Medicine, 2016; 40(2): 301.

15. Telles S, Sharma SK, Balakrishna A. Blood pressure and heart rate variability during yoga based alternate nostril breathing practice and breath awareness. Med Sci Monit Basic Res., 2014; 20: 184-193.
16. Dr. Ramesh Khurana, Sadakiyo Walabaki, J R Hebelet al. Cold face test in the assessment of trigeminal brainstem vagal function in humans. Annals of neurology, 1980; 7(2): 144-149.
17. Effects of ice massage of the head and spine on heart rate variability in healthy volunteers. Mooventhan A, et al. J. Integral med., 2016 Jul; 14(4): 306-10.
18. https://ndnr.com/gastrointestinal/the-abdominal compress
19. Brychta RJ, Chen KY. Cold-induced thermogenesis in humans. Eur J Clin Nutr., 2017; 71(3): 345-52.
20. https://www.4remedy.com/naturopathy_details.php?id=Benefits%20of%20%20COMPRESSES%20and%20FOMENTATION