



# A COMPARATIVE STUDY OF EFFECT OF MODERATE INTENSITY INTERVAL AEROBIC TRAINING VERSUS LOW AEROBIC CONTINUOUS TRAINING WITH COMBINATION OF YOGA ON BLOOD PRESSURE IN HYPERTENSIVE PATIENTS

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## ABSTRACT:

**BACKGROUND AND PURPOSE:** High blood pressure can be controlled by aerobic exercises and various lifestyle modification additional to drug therapy. There is lack of evidences that compare the effects of Moderate intensity interval training (MIIT) and low intensity continuous training in combination with yoga (LICT+YOGA) on BP in hypertensive patients.

**METHODOLOGY:** 40 stage 1 hypertensive patients of 45-55 years of age were recruited and divided into two group. Group-A (n=20) and Group-B (n=20) received MIIT and LICT+YOGA (4 sessions; each 50-60 minutes; for 4 weeks) Weight, HR, SBP, DBP and 6 MWD were taken before and after treatment. **RESULT:** Both groups showed statistically significant improvements( $P=0.00$ ). MIIT was superior in reducing HR, SBP, DBP and increasing 6 MWD than LICT+YOGA( $P<0.05$ ) except in weight reduction. **CONCLUSION:** Both interventions can elicit benefits on hypertension by reducing BP, HR, weight and improve functional capacity with superior effects by MIIT.

**Key Words:** Moderate Intensity Interval Training, Low Intensity Continuous Training, Surya Namaskar, BP, Stage 1 Hypertension.

## 1. INRODUCTION:

Major function of cardiovascular system is to pump the blood and circulate it through different parts of the body. It is essential for the maintenance of pressure and other physical factors within the blood vessels to meet the demand of blood volume supply to different parts of the body.<sup>1</sup>

Blood pressure is the force that is employed on walls of vessels. It is measured in mmHg. Arterial blood pressure is generally considered as blood pressure for reference in diagnosis and treatment. There are 4 terms in relation to blood pressure naming SBP, DBP, Pulse Pressure, Mean arterial pressure.<sup>1</sup>

A maximum pressure of blood flow on arterial vessels for the time of systole of heart is called Systolic Blood Pressure (SBP). Normal value for SBP is 120 mmHg (105- 135). A minimum pressure of blood flow on arterial vessels for the time of diastole of heart is called Diastolic Blood Pressure (DBP). Normal value for DBP is 80 mmHg (60-80). JNC 7 has classified stages of hypertension according to blood pressure levels as below.<sup>2</sup> JNC

8 has only described the threshold of pharmacological treatment; therefore JNC 7 classification of hypertension remains widely accepted.<sup>3</sup>

**TABLE 1.1 HYPERTENSION CLASSIFICATION**

BP Classification	Systolic BP, mmHg	Diastolic BP, mmHg
Normal	<120	<80
Prehypertension	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	≥160	≥100

Prevalence of hypertension among global population in age of 35 to 70 years is 40.8% in 2003 to 2009.<sup>4</sup> In 2000, the adult population of the world that was one billion had hypertension and by 2025, the proportion would have advanced to 29% or 1.56 billion. In this type of disease, frequency rises with age and has same prevalence for both genders; male and female.<sup>6</sup> Hypertension is 42.4% in men in the age group of 45-54 years and 34.6% in women in 45-54 years age groups respectively in India.<sup>7</sup>

There are many factors contributing to elevated blood pressure. Essential hypertension is influenced age, sex, ethnicity, weight, diet, sedentary lifestyle, stress, genetics, smoking and too much alcohol consumption.

With increase of 20 mmHg in SBP and 10 mmHg in DBP; risk of death due to stroke and Ischemic Heart Disease (IHD) gets nearly two times more.<sup>13</sup>

Aerobic exercises can be classified according to their intensity. Low, Moderate. High. It can be also classified based on their continuity. Continuous, Intermittent.

Stiffness parameter ( $\beta$ ) and Pressure-Strain elastic modulus (Ep) which are markers for arterial stiffness; were declined after 2 months of Moderate intensity intermittent training in 25 healthy young adults.<sup>22</sup>

The outcome of MIIT investigation recommended that two months of moderate intensity interval training can elicit desirable changes in HDL-C, TC, and lipoprotein ratio in male with hypertension. They suggest of this training as an adjuvant therapy in general maintenance of blood pressure in hypertension.<sup>23</sup>

Rest or recovery period between somewhat higher intensity periods is known as interval training which is emerging showing great results in athletes and in some disease population. According to ACSM guideline moderate intensity is recommended for average people and even people who cannot meet this recommendation for average people; can get benefits from lower intensity of aerobic exercises.<sup>20</sup>

HIIT can cause some undesirable knee or other injuries to body parts or have acute hypertension as side effects of vigorous intensity which can be harmful for hypertensive patients. A new report showed that moderate intensity, not HIIT have favorable effects on fibrosis of heart due to hypertension, improves heart angiogenesis and builds endothelial nitric oxide content. This study additionally reported that HIIT produce abnormal hypertrophy of heart suggesting of pathological remodeling.<sup>27</sup>

Interval exercises have shown great effects on glucose control, fat usage, postprandial lipemia and prevalent cardiovascular impacts. In the busy life of this modern aera interval exercise has shown more appropriation and can fit easily into busy life. Even with lower intensity, interval exercise has shown more effects than continuous in terms of arterial stiffness reduction.<sup>28</sup>

Aerobic exercises of low intensity lasting for 12 weeks resulted in more reduction of blood pressure than of moderate intensity continuous exercise.<sup>29</sup> In a study of 12-week low intensity continuous training has been effective to treat mild hypertension and it is a suitable training to start in sedentary hypertensive patients.<sup>30</sup>

Due to long lasting pharmacological treatment it can cause various harmful side effects like nausea, constipation, cramps, dry cough, increased urine frequency and reduced sexual drive.<sup>31</sup> With aerobic exercise, additional reduction in BP can lead to decrease in dosage of drugs hence reducing its side effects.

Yoga can be referred to as the form of practice comprising postures with synchronized breathing and relaxation practices which is socially acceptable in all around the world. Reduction in blood pressure through the holy path of yoga by relieving stress, improving parasympathetic activity and baroreceptor sensitivity is possible. In India as a regular physical activity, yoga is the form of which is acceptable.<sup>33</sup>

Surya namaskar (SN) is a part of hath yoga which helps to improve mental and physical health. It is a sequence of 12 static posture which is performed in a specific manner making surya namaskar dynamic in nature. One-time repetition of each 12 posture is referred as 1 surya namaskar. 12 repetition of this surya namaskar is counted as 1 set. Each surya namaskar should be done with 12 names of sun different at each time as a mantra. Mitra, Ravaye, Suryay, Bhanave, Khagay, Pushnai, Hirnyagarbhay, Marichaye, Adityay, Savitre, Aarkay, Bhaskaray are 12 name of sun which are chanted as “om –sun name-namh” as described in “Rigveda”.

The 12 poses are designed in such order which requires alternative forward and backward bending of spine with exhalation and inhalation respectively. But in the sixth pose where the spine is in somewhat neutral position breath is held. Surya namaskar is important to perform in a specific time hold with pace and correct posture with synchronized breathing. In a study of 20 male young adults, where physiological response to fast and slow surya namaskar is observed. Slow SN has shown 114 seconds as average and 2.0 to 4.9 MET to complete one surya namaskar.<sup>34</sup>

Surya namaskar does cost 3 met 3 MET. Surya namaskar more than 10 min period does satisfy to recommended physical activity for unfit or sedentary individual and it correlates with moderate level intensity and 54% HRmax.<sup>35</sup>

There are evidences of MIIT effectiveness of cardio respiratory parameters in healthy individuals and hypertensive patients. There are also evidences of low intensity continuous training effectiveness on hypertensive for blood pressure reduction and arterial stiffness. Several studies have also shown effect of surya namaskar on BP in hypertensive persons. But there is lack of evidences on comparison of MIIT combined effect of LICT and Surya namaskar (which will only last for 10 min to meet lower level intensity) on blood pressure, weight, HR, and functional capacity and compare these with effect of MIIT. The study is done to compare the effectiveness of 2 different program: Moderate intensity interval training of Aerobic program (MIIT) vs. Low intensity aerobic continuous training in combination with Yoga (LICT+Yoga) on BP in hypertensive patients.

## 2. METHODOLOGY:

Subjects were selected from Sainath hospital, bopal, Ahmedabad during their regular visit to hospital and were informed about study with information forms and consent was taken from each patient who showed interest. They agreed to take part in this study on their own will, not any patient was forced. They were assessed with a PAR-Q form to evaluate physical activity and any risk factors for starting an exercise program of moderate and low intensity.

### INCLUSION CRITERIA

- Age: 45-55 years
- SBP: 140-159 mm hg and/or
- DBP: 90-99 mm hg
- Patients on single same medication for blood pressure control since last 3 months.
- Subject who are willing to participate.

### EXCLUSION CRITERIA

- Person with presence of Cardio-Vascular disease
- Person with psychiatric disorder
- Active Smokers
- Pregnant women
- Person with recent fractures or injuries.
- Persons who are involved in daily physical activity or exercise from last 1 year.

## METHOD OF ASSESING OUTCOME MEASURES:

### 1. WEIGHT:

Weight was measured with digital weighing machine.

### 2. SBP/DBP and HR:

BP and HR were measured with digital monitor.

Blood pressure and HR was measured in morning between 8 to 10 a.m. following guidelines of WHO with patient sitting in chair with back supported, arm supported in outstretched manner in silent, comfortable environment at normal temperature for at least 5 minutes. Patients were asked to empty their bladder and avoid diet especially coffee, smoking and exercises for 30 min prior to measurement. 3 measurements were taken with 1-minute rest between each take. An average of these values was considered as baseline values.<sup>36</sup>

### 3. 6 MWD:

6-minute walk test was performed with standard method. Patients were informed about testing procedure in detail. Chair was provided if patient does want to take rest between 6 minutes due to any discomfort. Patients were asked to walk as maximum as possible at their comfort pace. They were asked to walk around 30-meter pathway and turn around chair as quickly as possible and continue to walk for 6 minutes.

## PROCEDURE:

Total 40 stage-1 hypertensive patients were recruited for study and they were contiently divided into 2 group. Both groups received treatment in form of aerobic exercise and Yoga comprising surya namaskar. Treatment was given according to FITT's principle on basis of ACSM recommendation in evening between 4 to 6 p.m.<sup>42</sup> Group-A received Moderate intensity aerobic interval training (MIIT) for 50-60 minutes for 4 days/week for 4 weeks. And Group-B received low intensity aerobic continuous training in combination with surya namaskar for 50 to 60 minutes for 4 days/week for 4 weeks. Treatment was given with 5-10 minutes of warm up and cool down in both groups. For understanding the intensity at which patients have to do exercise a 6 -20 scaled RPE Borg chart was explained to all patients which is as following.

**TABLE 1.2 THE BORG RATING OF PERCEVIED EXERTION SCALE**

6	No exertion at all
7-8	Extremely light
9-10	Very Light
11-12	Light
13-14	Somewhat Hard
15-16	Hard
17-18	Very Hard
19	Extremely hard
20	Exertion

## WARM UP AND COOL DOWN EXERCISES:

Warm up and Cool down period was consisting of mild to moderate intensity activities like stretching of major muscles like triceps, hamstring and calf following slow rhythmic normal range of motion exercises for upper limb, lower limb and trunk.

### GROUP A (MIIT; n=20):

In group A 20 subjects were given following program.

- (a) 5-10 minutes of warm up
- (b) 40 minutes of MIIT
- (c) 5-10 minutes of cool down

MIIT (n=20) program were given in form of 5 intervals at RPE of 12 to 14 for 6 minutes with low intensity of 5 active rest interval at RPE of 11 for 2 minutes; for total duration of 40 minutes for 4 days/week for 4 weeks. Subjects did start exercise protocol for 12 RPE and was gradually increased to 14 RPE till end of 1st week and continued exercise at 14 RPE for remaining weeks.

### MIIT Exercises:

Exercises at 12-14 RPE (6 minute for each exercises):

1. Stepping forward, backward and sideward
2. Lunges with arm flexion
3. Cycling
4. Treadmill brisk walking
5. Spot Jogging

Exercises at 11 RPE (2 minute):

1. Slow Marching

### **GROUP B (LICT+Yoga; n=20)**

In this group of 20 subjects were given following program;

- (a) 5-10 min of warm up
- (b) 40 min of LICT (30 minute) + Yoga-SN (10 minute)
- (c) 5-10 min of cool down

LICT + Yoga (n=20) will be consisting of 20 minutes of RPE of 11 followed by 20 minutes of Sun Salutation (Surya Namaskar) which is a type of yoga postures with breathing for 4 days/week for 4 weeks.

### LICT+Yoga:

LICT Exercises:

5 kind of different exercises were performed for 6 minutes contributing total 30 minutes of LICT.

1. Stepping at slower rate
2. Marching
3. Treadmill brisk walking
4. Spot Jogging
5. Cycling

### Yoga: Sun Salutation

For Sun Salutation a paper of describing sequence of postures with images was given to all subjects of group B. Surya namaskar is a sequence of 12 yoga postures which should be performed in following sequence.

**TABLE 1.3 NAME OF 12 POSES OF SURYA NAMASKAR**

Sanskrit name	English name
1. Pranamsana	Prayer pose
2. Hasta utthanasana	Raised arm pose
3. Padahastasana	Hand to foot pose
4. Ashwa sanchalasana	Equestrian pose
5. Parvatasana	Mountain pose
6. Ashtang namaskar	Eight limb pose
7. Bhujangasana	Cobra pose
8. Parvatasan	Mountain pose
9. Ashwa sanchalasana	Equestrian pose
10. Padahastasana	Hand to foot pose
11. Hasta utthanasana	Raised arm pose
12. Pranamasana	Prayer pose

### 3. STATISTICAL ANALYSIS

Achieved data were analyzed using statistically package of social sciences (SPSS) version 23 and Excel 2019. The parametric test was used in statistical analysis due to normal data distribution. Analysis was done with paired T test within group and unpaired T test between group at  $P<0.05$  significance level.

### 4. RESULT

This study was done on 40 patients with stage 1 hypertension. Following table 1.4 and graph shows male female distribution in group a and group b.

**Table 1.4 GROUP A and B GENDER and AGE**

	GROUP A (MIIT)	GROUP B (LICT+YOGA)
Age (Mean $\pm$ SD)	50.8 $\pm$ 3.5333	47.4 $\pm$ 2.683
Male	8	8
Female	12	12

Weight, HR, SBP, DBP and 6 MWD of both groups in form of Mean $\pm$ SD are described in following tables which were measured before and after treatment of one day.

Following tables shows difference between pre and post mean at 95% confidence interval with comparison to another group.

**Table 1.5 PRE AND POST WEIGHT MEAN IN GROUP A AND GROUP B**

	PRE	POST	t VALUE	P VALUE
<b>GROUP A</b>	72.15±7.75	70.64±7.32	5.904	0.00
<b>GROUP B</b>	69.82±7.52	68.50±7.48	5.045	0.00

**TABLE 1.6 PRE AND POST HR MEAN IN GROUP A AND GROUP B**

	PRE	POST	t VALUE	P VALUE
<b>GROUP A</b>	76.05±5.54	72.85±4.13	4.265	0.00
<b>GROUP B</b>	75.5±2.96	74±2.22	2.290	0.0003

**TABLE 1.7 PRE AND POST SBP MEAN IN GROUP A AND GROUP B**

	PRE	POST	t VALUE	P VALUE
<b>GROUP A</b>	147.8±6.30	137.85±7.78	8.919	0.00
<b>GROUP B</b>	147.25±3.59	141±4.15	17.273	0.00

**TABLE 1.8 PRE AND POST DBP MEAN IN GROUP A AND GROUP B**

	PRE	POST	t VALUE	P VALUE
<b>GROUP A</b>	85±4.22	79.4±3.57	7.035	0.00
<b>GROUP B</b>	82.45±5.08	80.4±4.17	5.960	0.00

**TABLE 1.9 PRE AND POST MEAN PF 6 MWD IN GROUP A AND GROUP B**

	PRE	POST	T VALUE	P VALUE
<b>GROUP A</b>	417.75±36.58	469.75±43.98	-13.034	0.00
<b>GROUP B</b>	426±26.43	449.35±26.95	-11.500	0.00

After doing paired t test within groups an unpaired t test was applied to see differences between improvements of two group. The results are mentioned in table 1.9.

There is P value of 0.58 in weight reduction difference shows no significant difference in reduction between MIIT and LICT+YOGA. P=0.02 shows significant difference between HR decrease in GROUP A (MIIT) and GROUP B (LICT+YOGA) with superior improvements by MIIT. For SBP reduction, P value is 0.03 showing significant difference in decrease in SBP between both groups with greater reduction of 9.95 mmHg average by MIIT. DBP reduction is also seen greater in MIIT; average reduction of 5.6 mmHg with P=0.00. There is P value of 0.00 for difference in 6 MWD increase between both groups again superior effect by MIIT with average increase of 52 meter.

**TABLE 1.10 COMPARISON OF MEAN DIFFERENCE OF WEIGHT, HR, SBP, DBP, AND 6 MWD BETWEEN GROUP A AND GROUP B**

	GROUP A (Mean±SD)	GROUP B (Mean±SD)	t VALUE	P VALUE
<b>Weight (kg)</b>	1.56±1.15	1.31±1.16	-0.559	0.58
<b>HR (beats/min)</b>	3.2±2.87	1.5±1.51	-2.342	0.02
<b>SBP (mmHg)</b>	9.95±4.98	6.25±1.62	-3.155	0.03
<b>DBP (mmHg)</b>	5.6±3.56	2.05±1.54	-4.09	0.00
<b>6 MWD (meters)</b>	52±17.84	23.35±9.1	6.40	0.00

## 5. DISCUSSION:

This study is done to compare the effectiveness of MIIT and LICT+YOGA program of aerobic exercises on blood pressure reduction in stage 1 hypertensive patients. In this study 40 stage 1 hypertensive subjects were taken on basis of inclusion and exclusion criteria of 45 to 55 years of age in which 20 subjects (8 male-12 female) were given GROUP A (MIIT) intervention program and other 20 subjects (8 male-12 female) were given GROUP B (LICT+YOGA) in which surya namaskar was given as yoga program. They all completed 4-week intervention od 4 days/week. Weight, HR, SBP, DBP and 6MWD were taken prior and afterwards treatment.

Intensity can be decided on basis of VO<sub>2</sub>max, VO<sub>2</sub>peak, RPE, MET. Here exercise intensity was given on RPE levels with help of 6-20 RPE Borg scale as per recommendation by Linda S Pescatello for hypertensive patients who are on medication and can have effect on their HR.<sup>20</sup> For functional capacity 6 MWD has been advised for patients with moderately severe impairment by ATS Statement.

Treatment was given in evening session between 4 to 6 p.m. to get more effects in decreasing BP according to study by Leandro C Brito et. al.<sup>42</sup> Weight, HR, SBP, DBP and 6 MWD (for functional capacity) were measured one day before starting the exercise program and one day after completing the exercises to avoid acute post exercise effects.

In group A (MIIT) pre weight mean is 72.15±7.75 kg and post mean is 70.64±7.32 kg, pre HR mean is 76.05±5.54 beats/min and post HR mean is 72.85±4.13 beats/min, pre SBP mean is 147.8±6.30 mmHg and post SBP mean is 37.85±7.78 mmHg, pre DBP mean is 85±4.22 mmHg and post DBP mean is 79.4±3.57 mmHg, and lastly pre 6 MWD mean is 417.75±36.58 meter and post 6 MWD mean is 469.75±43.98 meter

indicating significant weight reduction, decrease in HR rest, SBP and DBP reduction and increase in 6 MWD with  $p=0.00$  at 95% confidence interval as shown in table 1.3.

Study done by S Lamina et al. also found mean reduction of  $-15.70 \pm 13.16$  mmHg in SBP and  $-4.01 \pm 4.34$  mmHg in DBP with  $p$  value of 0.00 after 8 weeks (3 times per week) of MIIT program in 323 hypertensive men in which they had kept interval rest ratio to 1:1 of 6 minutes.<sup>23</sup> In contrast to above study an investigation by V S Coswig et al. revealed no significant SBP or DBP reduction after 8 weeks of MIIT in elderly women but significant improvement by HIIT, but there was no statistically significant difference between these two group also. Nonetheless they found significant weight reduction through MIIT with mean change of  $0.9 \pm 0.1$  kg;  $p=0.001$ , significant improvement in resting HR with mean decrease of  $-5.1 \pm 0.3\%$ ;  $p<0.001$ .<sup>37</sup>

In group B (LICT+YOGA) pre weight mean is  $69.82 \pm 7.52$  kg and post mean is  $68.50 \pm 7.48$  kg, pre HR mean is  $75.5 \pm 2.96$  beats/min and post HR mean is  $74 \pm 2.22$  beats/min, pre SBP mean is  $147.25 \pm 3.59$  mmHg and post SBP mean is  $141 \pm 4.15$  mmHg, pre DBP mean is  $82.45 \pm 5.08$  mmHg and post DBP mean is  $80.4 \pm 4.17$  mmHg, and lastly pre 6 MWD mean is  $426 \pm 26.43$  meter and post 6 MWD mean is  $449.35 \pm 26.95$  meter indicating significant weight reduction, decrease in HR rest, SBP and DBP reduction and increase in 6 MWD with  $p=0.00$  for all measures except  $p=0.034$  for HR at 95% confidence interval as shown in table 1.4.

Lien PT et. al. investigated effect of low intensity continuous aerobic exercise in hypertensive male (10) and female (10) and discovered average decrease of 11 mmHg in SBP and a 5 mmHg in DBP after 12 week of exercise program of 3 days/week.<sup>30</sup> and  $13.94 \pm 6.95$  mmHg mean change in SBP with  $p=0.00$  and  $-7.41 \pm 6.26$  mm Hg mean change in DBP;  $p=0.00$  after 8 weeks (3 days/week) in 112 hypertensive patients.<sup>36</sup>

N shantakumari et. al. investigated effects of a yoga program consisting of pranayama and surya namaskar in hypertensive and diabetic patients discovered significant BP reduction SBP OF  $9.49 \pm 1.90$  mmHg and DBP of  $5.085 \pm 0.978$  mmHg;  $p<0.01$ .<sup>39</sup> G Shankar et. al. studied 80 healthy persons for 2 weeks with 10 minutes of surya namaskar daily found significant SBP reduction with  $t=-5.51$ ,  $p=0.00$  and no significant reduction in heart rate.<sup>38</sup>

This is the first to compare the effectiveness of MIIT and LICT+YOGA on BP in stage 1 hypertension. Between group comparison was done by t test which has showed significant difference between improvements in both group in HR at rest;  $p=0.03$ , SBP;  $p=0.02$ , DBP;  $p=0.00$  and 6 MWD;  $p=0.00$  except no significant difference between weight reduction of both group;  $p=0.58$  suggesting more reducing effect in BP and HR by GROUP A (MIIT) compared to GROUP B (LICT+YOGA).

Aerobic exercise does work on various mechanism to control blood pressure and to decreases weight leading to improved functional capacity through decreasing arterial stiffness, increasing HDL and decreasing TC and AI, by increasing metabolic rate and many more. Tanaka et. al. founded that MIIT of 8 weeks reduces arterial stiffness which was measured by stiffness parameter and pressure-strain elastic modulus which were decreased after treatment. Main mechanism of aerobic exercises for its blood pressure lowering effects is yet to be discovered. However, many investigations showed that it occurs due to vascular structure remodeling which reduces stiffness. This remodeling may be linked to shear-stress stimulation of endothelial Nitric Oxide synthase resulting in increasing activities of Nitric Oxide.

Interval between exercising period whether it is resting type or active type, it does have a special effect to lowering blood pressure. In a study by Coswig et. al. MIIT was compared to HIIT and MICT, where MIIT showed more improvements in bp reduction, weight reduction and 6 MWD compared to MICT found that interval does have a beneficiary effect on reducing blood pressure. Hailing W et. al. compared the effect of low intensity exercises in continuous and interval type of training on arterial stiffness in normal adult men and discovered greater effects in declining stiffness of arteries. Mechanism of interval training for reducing arterial stiffness superiorly is not known.

Same mechanism works for lower intensity aerobic exercise, but lesser cardiorespiratory benefits can be achieved because these improvements are based upon intensity. Somewhat reduction in blood pressure is attributed to by effects of drugs that patients are taking but in study by Lien PT investigated effect of LICT of 12 week and compared it with control group showed significant difference between improvement in blood pressure control cannot be explained.<sup>30</sup>

Yoga is a complementary therapy for people with moderate to severe impairments who cannot perform moderate and vigorous exercises as an option to lower intensity physical activity. Marshall Hagins et. al. had discovered that hath yoga can satisfy only lower intensities of exercise as recommended by ACSM. They also

concluded that least to least 10 minutes bout of Surya Namaskara are necessary to get benefits for inactive and unfit population for beneficiary cardiorespiratory responses.

In this study, there is significant difference between improvements in outcome measures except weight(kg) reduction of both groups. MIIT showed greater results compared to LICT+YOGA group in HR at rest, SBP, DBP and 6 MWD with  $p=0.03$ ,  $p=0.02$ ,  $p=0.00$ ,  $p=0.00$  respectively as shown in table 1.6.

Greater improvements in MIIT compared to LICT+YOGA can be explained by higher intensity. Therefore, it can be said that setting recovery intervals between exercising periods of moderate intensity does not take it to level of lower intensity continuous training. In addition, our most of daily life activities are of interval type, making interval exercise more favorable in nature to fit into today's busy modern lifestyle that too moderate intensity which is not too much exhausting or riskier to unfit and sedentary people and it can be performed unsupervised so it has more adherence and not expensive.

## 6. CONCLUSION

Aerobic program of Moderate intensity intermittent training and Low intensity continuous training in combination with surya namaskar as form of hath yoga lasting for 4 weeks (4 days/week) were able to show significant difference in weight reduction, decrease in HR at rest, SBP, DBP and 6 MWD with greater improvements by MIIT with statistically significant difference shows effectiveness of moderate intensity and interval on lowering BP by various mechanism. In combination with reduction in BP, weight loss leads to improve function capacity.

## LIMITATION

No long-term follow-up were taken after completing the MIIT and LICT+YOGA.

## FUTURE SCOPE

Long term treatment can be given to gain more improvement.

Follow up after the MIIT and LICT+YOGA can be taken after 3 months or after more than that.

Additional intervention like resistance training and other form of sports and recreational activities or other type of yoga can be given to gain more cardiorespiratory fitness.

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