

# Comparison of Effect of Yoga versus Aerobic Exercise on Waist Circumference, Waist-Hip Ratio and Body Mass Index in Overweight and Obese Adult Individuals

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## ABSTRACT

### Background

Obesity is becoming serious global public health issue due to sedentary lifestyle and bad eating habits. Dietary and lifestyle practices are directly related to obesity, which can cause serious health problems like cardiac ailments, diabetes, and hypertension etc. Vast varieties of options are available for weight reduction including physical exercises, various diet plans and also the pharmacological agents. Physical activity improves the fitness of the individual and helps in reducing the ill effects of the obesity.

### Objective

To compare the effects of Yoga and Aerobic Exercise on weight circumference, waist-hip ratio (WHR) and body mass index (BMI) in overweight and obese individuals.

### Method

An experimental study was started with purposive sampling. Sixty overweight and obese individuals from the community were divided equally into two groups, one group was given supervised yoga asana and the other group was given supervised aerobic exercise for 6 weeks. Waist circumference, waist hip ratio and body mass index were taken pre and post intervention.

### Result

Statistically significant difference was seen in pre and post intervention value of waist circumference, waist hip ratio and body mass index in both the groups with the p value < 0.05. However there was no statistical significant difference noted in waist hip ratio in individuals performing aerobic exercises as p value was > 0.05.

### Conclusion

Both the interventions showed significant reduction in waist circumference, waist hip ratio and body mass index, while better results were noted in the individuals performing yoga asanas.

## KEY WORDS

Body fat percentage, Exercise, Obesity, Waist circumference, Waist hip ratio, Yoga

## INTRODUCTION

Obesity is one of the major concerns for public health according to recent increasing trends in obesity-related diseases such as Type 2 diabetes and hyperlipidemia.<sup>1</sup> The overall prevalence of obesity and overweight in India was noted to be 6.8% and 33.5% respectively in both males and females.<sup>2</sup> Elevated body mass index (BMI) and central obesity has shown an association with the number of diseases and metabolic abnormalities that have high morbidity and mortality.<sup>3</sup>

It has been shown that BMI and waist circumference independently contribute to the prediction of total body fat in overweight women.<sup>3</sup> Strong association has been found between physical activity and body mass index. Waist circumference and waist hip ratio is a measure of relative overall body fat distribution and has been widely used in adults to identify the physical status.<sup>4</sup>

Physical inactivity and obesity seems to increase the total mortality risk independently and additively.<sup>4</sup> Study shows that a large percentage of people in India are inactive with fewer than 10% engaging in recreational physical activity.<sup>5</sup> Therefore, awareness amongst the general population should be increased to promote physical activity and to reduce the complications of obesity.

There are various weight reduction programmes available like crash diet, food supplements, pharmacological agents and special work outs. These are no doubt effective, but with some financial burden on the individual.<sup>6</sup> Yoga and aerobic exercises has shown the promising results in reducing the weight, as both are cost effective, doesn't require special equipment and can be performed and adapted easily by the individuals, thus the purpose of this study is to know whether yoga or aerobic gives the better results in reducing the BMI, WHR and waist circumference, hence effective intervention can be suggested.<sup>7</sup>

## METHODS

A comparative study with Pre-post design was started after receiving clearance from the institutional ethics committee and the duration of the study was 6 months. Eighty individuals, from the community of Pune city both males and females between the age of 28 to 40, having sedentary lifestyle were screened, out of which 60 individuals who met the inclusion criteria of BMI > 23 kg/m<sup>2</sup> (According to Asian Classification of Obesity) were selected for the study. Individuals undergoing any structured exercise programme and diet modification or supplements for reduction of weight, underwent any recent surgery and uncontrolled comorbidities were excluded from the study.

Sixty individuals who met the inclusion criteria were included in the study with purposive sampling technique they were further randomly allocated to 30 participants in Group A and 30 participants to Group B using chit method without replacement. The allocation was done by the

primary investigator prior to the baseline assessment. After thorough explanation of procedure written informed consent was taken from all the participants and their doubts were cleared. Group A underwent yoga sessions, whereas Group B received aerobic exercises. Both the interventions were supervised by the primary investigator.

Demographic characteristic like age, weight and height were taken before the starting of intervention, Outcome measures were waist circumference, waist hip ratio and BMI, which was taken pre intervention and after 6 weeks of yoga and aerobic exercises by primary investigator by direct method.

The waist circumference was taken with the help of measuring tape midway between the lower rib margin and the iliac crest, while hip circumference was measured at the widest point over greater trochanter and waist hip ratio (WHR) was calculated.<sup>8</sup> The (reliability) intraobserver intraclass correlation coefficients (ICC) value for waist circumference is 0.987 and for WHR is 0.970. The interobserver ICC for waist circumference is 0.988 and for WHR is 0.969.<sup>9</sup>

Weight and height of the subjects were taken and BMI was calculated.<sup>10</sup> Correlation between BMI and body fat percentage was found to be maximum and shows the reliability of 0.95.<sup>11</sup>

### Group A: (Yoga sessions)

Subjects performed asanas supervised by primary investigator, in sitting, standing and lying position for 45 minutes daily, five days a week.

Asanas carried out in Sitting: Paschimottanasana and Gomukhasana.

Asanas carried out in Standing: Trikonasana and Virbhadrasana.

Asanas carried out in Lying: Bhujangasana, Pavanmuktasana, Dhanurasana, Setubandhasana and Shavasana.

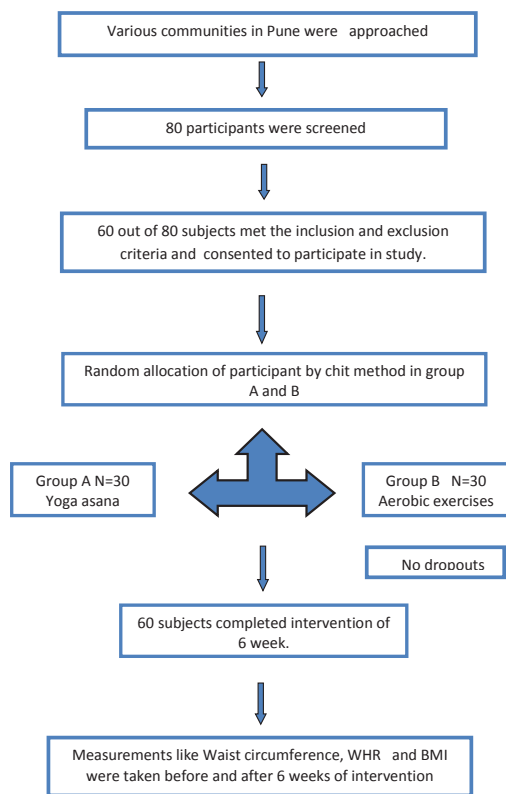
Each asana was performed for 3 repetitions and the end position of each repetition was hold for 30 seconds. Purak and Rechak (deep breathing) was coordinated with the different posture of every asana. Thirty seconds rest period was given between each asana. Cool down was done with Shavasana for 5 minutes.

### Group B: (Aerobic session)

Subjects were given supervised walking on a leveled surface as the aerobic exercise for 45 minutes, including warm up and cool down for five days/week for 6 weeks.

Warm up included the stretching of major muscle groups like trunk muscles, quadriceps, hamstring, biceps and triceps.

Walking was given for 30 minutes with an intensity of 40-60% of HRR (heart rate reserve) for first 3 weeks, slowly progressing to 60-75% of HRR for the rest of the 3 weeks. At the end of session, cool down was done with slow walking and deep breathing.



Sixty overweight and obese individuals were divided equally into two groups. Student paired t tests was used to analyze the difference within the groups and unpaired t test was used to compare the parameters between two groups. Results on continuous measurements were presented on Mean ± SD. Level of significance was fixed at p=0.05 and any value less than or equal to 0.05 was considered to be statistically significant. The Statistical software IBM SPSS 20.0 was used for the analyses of the data.

**RESULTS**

Demographic characteristics of age and BMI of the individuals of both the groups is shown in the fig. 1 and 2.

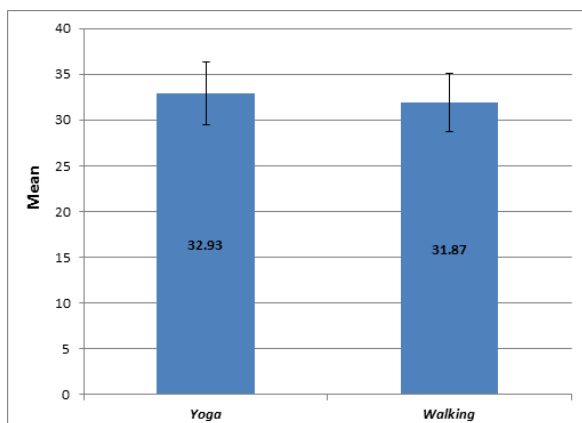


Figure 1. Age in both the groups

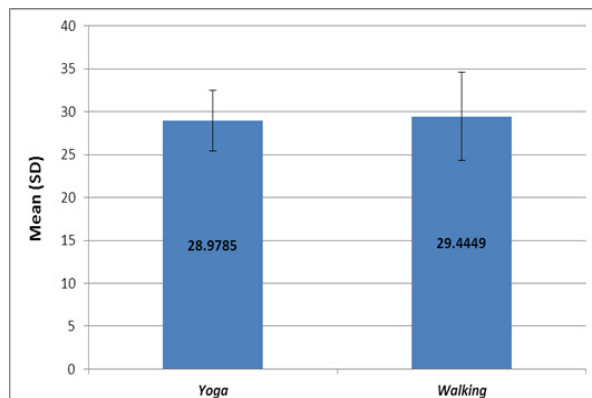


Figure 2. BMI in both the groups

Table 1 shows the pre-post intervention difference in waist circumference, WHR and BMI in individuals performing yoga asanas, statistically significant difference was noted in all the three parameters with p value being < 0.05.

Table 1. Comparison of waist circumference, waist hip ratio and BMI in yoga group (n=30)

	Time Interval	Mean	Std. Deviation	t value	p value
Waist circumference	Baseline	88.1333	9.88724	15.731	0.001
	6 <sup>th</sup> week	83.2500	9.69247		
WHR	Baseline	0.8257	0.06007	4.591	0.001
	6 <sup>th</sup> week	0.8097	0.06213		
BMI	Baseline	28.9785	3.50993	12.648	0.001
	6 <sup>th</sup> week	27.7721	3.45875		

Table 2 shows the pre-post intervention difference in waist circumference, WHR and BMI in individuals performing walking as a form of aerobic exercise. Statistically significant difference was noted in waist circumference and BMI with p value being < 0.05, while no statistical difference was noted in WHR as p value is > 0.05.

Table 2. Comparison of Waist Circumference, Waist Hip Ratio and BMI in walking group (n=30)

	Time interval	Mean	Std. Deviation	t value	p value
Waist circumference	Baseline	89.5000	14.82717	9.379	0.001
	6 <sup>th</sup> week	87.6000	15.09304		
WHR	Baseline	0.8307	0.09766	0.311	0.379
	6 <sup>th</sup> week	0.8301	0.09721		
BMI	Baseline	29.4449	5.13387	8.892	0.001
	6 <sup>th</sup> week	29.0461	5.14505		

Table 3 shows the comparison between both the groups after six weeks of intervention. Subjects performing yoga asanas showed more improvement in waist circumference and BMI, while difference in WHR was equal in both the groups.

**Table 3. Comparison of Waist Circumference, Waist Hip Ratio and BMI between both the groups (N=30)**

	Group	Mean	Std. Deviation	t value	p value
Waist Circumference	Yoga	4.8833	1.67478	8.134	0.001
	Walking	1.9000	1.10952		
WHR	Yoga	0.0160	0.01939	3.732	0.0004
	Walking	0.0006	0.01152		
BMI	Yoga	1.2064	0.52147	7.667	0.001
	Walking	0.3988	0.24675		

## DISCUSSION

The purpose of this study was to compare effects of yoga versus aerobic exercise (walking) on waist circumference, WHR and BMI in overweight and obese adult individuals. Significant difference was noted in all the parameters in both the groups while yoga group showing more difference.

As per table 1 intragroup comparison for yoga comparing results at baseline and after 6 weeks significant reduction was observed in all three parameters waist circumference, waist-hip ratio, and BMI of the participants. Similar study concludes that 12 weeks of yoga have improved the various anthropometric and self-reported measurements in women with abdominal obesity. Author also concluded that yoga is safe and can be recommended as a technique for reducing abdominal obesity in women.<sup>1</sup> Shinde et al. suggests that by doing yoga asanas it is possible to burn fat and boosts the metabolism.<sup>10</sup> Yoga asanas involving backward bending and twisting postures stimulate the thyroid and adrenal glands as well as flush out toxins.<sup>10</sup> Stimulation of thyroid gland secretes thyroid hormone which increases BMR and increases utilization of food, enhances glycolysis, decreases the quantity of cholesterol, phospholipids and triglyceride in plasma.<sup>13</sup> Adrenal gland secretes epinephrine (adrenaline) which stimulates lipolysis by activating triglyceride lipase and free fatty acids stored in adipose tissue, which are utilized for energy purpose.<sup>14</sup> Decrease in body weight causes change in body fat distribution. Mauro et al. reported that weight loss is also associated with changes in regional fat distribution.<sup>15</sup> Weight loss correlates more closely with the amount of subcutaneous than visceral fat, thus fat redistribution after weight loss might be the cause for decrease in the waist circumference and waist-hip ratio.<sup>16</sup> Another study has found a strong linear correlation between waist circumference and BMI values.<sup>17</sup> Thus BMI and waist circumference are directly proportional to each other.

There is higher energy expenditure associated with regular practice of yoga which contributes in weight reduction and weight control, it has been shown to alleviate other psychological disorders like chronic depression and stress, this could mean a reduction in overeating to compensate for negative feelings leading to emotional eating and the resultant overweight.<sup>12</sup>

As per table 2 intragroup comparison of aerobic exercises comparing results at baseline and after 6 weeks significant reduction was observed in two parameters - waist circumference and BMI of the participants as shown in table 2. previous study suggests that Aerobic exercise stimulates fat metabolism thus causes reduction in extra fat from the body.<sup>1</sup> Stored fat represents the body's most plentiful source of potential energy. The energy reserves from fat comes from triacylglycerol in adipocytes and from intramuscular triacylglycerol. Prior to energy release from fat, lipolysis in the cell's cytosol splits the triacylglycerol molecule into a glycerol molecule and three water insoluble fatty acid molecules. In this way there is breakdown of triacylglycerol to free fatty acids.<sup>18</sup>

Aerobic training increases muscle's capacity to use intramuscular triacylglycerol due to greater blood flow within trained muscles.<sup>19</sup> During exercise there is glycogen sparing which decreases the levels of glycogen. Exercise increases the capacity to mobilize and oxidize fat and increases the levels of fat mobilizing and fat metabolizing enzymes. This in turn leads to increases energy expenditure and also improves the efficiency of the aerobic systems which helps in producing more energy by utilization of fat which in turn helps in reducing the body fat.<sup>2</sup>

In the present study improvement in the measures is seen which could be because of the mechanical work associated with muscle contractions requiring energy. Exercise leads to an increased substrate oxidation by working muscle and the oxidative capacity of muscle increases.<sup>7</sup> Thus, fat from various region of the body is metabolized leading to improvement in the parameters.

However, in this study it was found that reduction in waist-hip ratio was not statistical significant. These results suggest that there was no difference between the reductions in fat stored centrally (waist circumference) and in fat stored peripherally (hip circumference) with the aerobic exercise interventions. The result of this study is supported by the another author who concluded that there was no significant difference found in waist-to-hip ratio between mean scores of pre-test and post test of overweight sedentary male.<sup>20</sup> Shirley et al. in their study found that significant reduction in adiponectin levels resulted in no difference between the reductions of fat in both waist and hip circumference, thus the waist-hip ratio remained unchanged, as the waist to hip ratio is a derived value from the two parameters.<sup>7</sup> This result is also consistent with the findings of the similar study of Donnelly et al. which indicates that Waist-to-hip ratio showed no significant differences after 18 months of intervention.<sup>21</sup>

As per table 3 comparing the results between both the groups, it is seen that changes in mean difference of waist circumference, waist-hip ratio and BMI for both Yoga and aerobic groups is significant at the end of 6 weeks. However, it also suggests that mean difference in Yoga participants is substantially higher than that of the Walking group. In

comparison to other study which suggests that maintaining a yoga posture causes conditioning of muscles along with stretching, increasing the oxidative capacity of muscles and decrease glycogen utilization, which is associated with increased in number of mitochondria and improvement intramuscular oxygen and glycogen stores.<sup>22</sup> Yoga also helps in improving strength, flexibility and relaxation leading to improvement of posture.<sup>9,10</sup> It also decreases BMI associated with increased energy expenditure.<sup>8,16</sup>

Yoga assists in achieving recommended levels of activity. It requires little space and no equipment. There are no side-effects and weight-loss is accompanied by proper conditioning of body it provides one of the best means of self-improvement and gaining full potential of one's body, mind and soul.<sup>10</sup> Tundwala et al. conducted a study of yoga on various parameters and found significant improvement in various lipid profile parameters, decrease in total cholesterol, LDL, triglycerides, VLDL and increase in HDL, thus helps in reducing the overall fat content of the body.<sup>23</sup>

Yoga considers all aspects of obesity like physical, emotional and mental. By doing yoga it is possible to burn fat, boost the metabolism and give all benefits to improve health.

Limitation of the study was that body composition and other anthropometric measurements like skin fold, waist height ratio etc. were not considered. Further study can be done to see the sustenance of the effect post intervention and also certain lab tests can be done to check the other parameters to gain the more appropriate benefits of the intervention.

## CONCLUSION

The study concludes that yoga and walking for a period of six weeks showed significant reduction in waist circumference, waist-hip ratio and BMI, however yoga showing more significant results.

## REFERENCES

1. Azeem K. Effect of twelve weeks brisk walking on blood pressure, body mass index, and anthropometric circumference of obese males. *Int J Med Health Biomed Bioengineer Pharma Engineer*. 2011 Nov 27;5(11):530-2.
2. Singh RB, Pella D, Mechirova V, Kartikey K, Demeester F, Tomar RS, et al. Prevalence of obesity, physical inactivity and undernutrition, a triple burden of diseases during transition in a developing economy. The Five City Study Group. *Acta Cardiol*. 2007 Apr;62(2):119-27. doi: 10.2143/AC.62.2.2020231. PMID: 17536599.
3. Melam GR, Alhusaini AA, Buragadda S, Kaur T, Khan IA. Impact of brisk walking and aerobics in overweight women. *Journal of physical therapy science*. 2016;28(1):293-7.
4. Mathew A, Fernandes S, Sreedharan J, Ahmed M. Relationship between physical activity, BMI and waist hip ratio among middle aged women in a multiethnic population: A descriptive study. *Country: United Arab Emirates*. 2012 May;6:169-73
5. Anjana RM, Pradeepa R, Das AK, Deepa M, Bhansali A, Joshi SR, et al. Physical activity and inactivity patterns in India - results from the ICMR-INDIAB study (Phase-1) [ICMR-INDIAB-5]. *Int J Behav Nutr Phys Act*. 2014 Feb 26;11(1):26. doi: 10.1186/1479-5868-11-26. PMID: 24571915; PMCID: PMC3974063.
6. Shenbagavalli A, Mary RD. Effect of aerobic training on body mass index on sedentary obese men. *Journal of Exercise Science and Physiotherapy*. 2008 Dec;4(2):125.
7. Telles S, Sharma SK, Yadav A, Singh N, Balkrishna A. A comparative controlled trial comparing the effects of yoga and walking for overweight and obese adults. *Medical science monitor: international medical journal of experimental and clinical research*. 2014;20:894.
8. Vivian H Heyward, Ann L Gibson. *Advanced Fitness Assessment and Exercise Prescription*: 7<sup>th</sup> ed. Edward brothers 2014; 255-6.
9. Chen MM, Lear SA, Gao M, Frohlich JJ, Birmingham CL. Intraobserver and interobserver reliability of waist circumference and the waist-to-hip ratio. *Obesity*. 2001 Oct 1;9(10):651.
10. Shinde N, Shinde KJ, Khatri SM, Hande D. A comparative study of yoga and aerobic exercises in obesity and its effect on pulmonary function. *J Diabetes Metab*. 2013;4(257):2.
11. Misra P, Singh AK, Archana S, Lohiya A, Kant S. Relationship between body mass index and percentage of body fat, estimated by bio-electrical impedance among adult females in a rural community of North India: A cross-sectional study. *Journal of postgraduate medicine*. 2019 Jul;65(3):134.
12. Cramer H, Thoms MS, Anheyer D, Lauche R, Dobos G. Yoga in women with abdominal obesity; a randomized controlled trial. *Deutsches Ärzteblatt International*. 2016 Sep;113(39):645.
13. Vijaya D Joshi, *Physiology, Prep manual for undergraduate Sadhana Mendhurwar*. Elsevier India, fourth edition, Pg 351.
14. Vijaya D Joshi, *Physiology, Prep manual for undergraduate Sadhana Mendhurwar*. Elsevier India Physiology, fourth edition, Pg 361.
15. Mauro Zamboni, Fabio Armellini, Emanuela Turcato, et al. Effect of weight loss on regional body fat distribution in premenopausal women. *Am J Clin Nutr*. 1993; 58:29-34.
16. Kekan D, Kshalikar S. Effect of Kapalbhata pranayama on waist and hip circumference. *Journal of Evolution of Medical and Dental Sciences*. 2013 Mar 18;2(11):1695-700.
17. Gierach M, Gierach J, Ewertowska M, Arndt A, Junik R. Correlation between body mass index and waist circumference in patients with metabolic syndrome. *International Scholarly Research Notices*. 2014;2014.
18. McArdle WD, Katch FI, Katch VL. *Exercise Physiology*, VL. Central Science Library. Seventh Edition, Pg 153
19. McArdle WD, Katch FI, Katch VL. *Exercise Physiology Central Science Library*. Seventh Edition, Pg 459
20. Ahsan M, Kumar B, Joshi YC. A Study of effective use of aerobic exercise for body weight reduction in overweight male. *International Journal of Health, Sports and Physical Education*. 2012;1:36-9.
21. Donnelly JE, Jacobson DJ, Heelan KS, Seip R, Smith S. The effects of 18 months of intermittent vs continuous exercise on aerobic capacity, body weight and composition, and metabolic fitness in previously sedentary, moderately obese females. Cited by <http://www.nature.com/ijo/journal/v24/n5/full/0801198a.html>
22. Ponde K, Agrawal R, Hussaini SH. Effect of yoga therapy versus aerobic exercise on climacteric symptoms, perceived stress and quality of life in perimenopausal women.
23. Tundwala V, Gupta RP, Kumar S, Singh VB, Sandeep BR, Dayal P, et al. A study on effect of yoga and various asanas on obesity, hypertension and dyslipidemia. *Int J Basic Appl Med Sci*. 2012;2(1):93-8.