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RESEARCH ARTICLE

EFFECTIVENESS OF PLANKS VS CORE STRENGTHENING EXERCISES ON WAIST-HIP RATIO OF OVERWEIGHT INDIVIDUALS

Srushti T. Gaikwad [1]; Dr. Trupti Yadav [2]
[1]Intern, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India
[2]HOD, Department of Oncologic Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, 415110, Maharashtra, India.

*Corresponding Author

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Abstract: ***Background-*** The human body type and its general shape or figure is defined by skeletal structures, as well as distribution of muscles and fats. With right set of exercises distribution of fat in some specific areas can be controlled, especially abdominal fat storage. Higher the Waist-hip ratio, higher the fat around abdominal region. In this project, comparing Isometric VS Isotonic core exercises i.e., Planks and Core strengthening exercises are used to find changes in Waist-hip ratio (WHR). The study was conducted to determine effect of planks and core strengthening exercises & to evaluate change in WH ratios and body fat percentage.Materials and methods- 32.5% of total screened population was overweight, out of which 62 consenting participants fulfilling the selection criteria were included in this study. Participants were evaluated pre and post the intervention with outcome measures- Waist circumference, Hip circumference, WHR and Body Fat percentage. Results- 83.8% of the study population had higher WHR, 88.7% showed reduction of body fat percentages post the exercise intervention period. Significant reduction of WHR was seen in all participants. Conclusions- Statistically planks are significant in reduction of WHR and waist circumference as well. Clinically there is no significant difference between effectiveness of both interventions.

Keywords: Core strengthening exercises, Overweight individuals, Planks, Waist-Hip ratio (WHR).

INTRODUCTION

'Obesity' a leading worldwide risk factor of many health diseases. In population of millions, it is easy to categorize obese people by their BMI (Body mass index), which relates weight to height, is a mostly used simple measure of body size, and to discover the prevalence of obesity within population [1]. According to WHO classification of BMI, value of more than equal to 25 kg/m^2 is considered as obesity.

Anthropometric indices for obesity have been used to assess body fat content. BMI is used as a classic index for obesity, though it is not an ideal indicator of body fat. However, alternative methods that reflect abdominal adiposity, like waist circumference (WC), waist–hip ratio (WHpR) and waist–height ratio (WHtR), have been superior to BMI in predicting health risks. Since, differential distribution of fats vary among ethnic groups and hence has varying effects on metabolic risk. Waist-to-height ratio (WHtR) is the best simple anthropometric measurement, but because of the high visceral fat of Asians, there is possibility of using only waist circumference (WC) for measuring metabolic risk. It is suggested that WC is a simpler anthropometric measurement that has strong association with an individual's metabolic risk level [2]. WC or waist-to-hip ratio (WHR) are recognized to be more reliable indices for abdominal adiposity and body fat distribution [3] but they are less available in measuring total amount of body fat. To measure body fat percentage there are some inexpensive devices like skin fold calliper and some expensive machines like body fat analyser by which we can track up the progress of weight/ fat reduction interventions. Regardless of which indicator is used remarkable increase of abdominal fat is worthy of great concern and is associated with risk for lifestyle and weight-related diseases. Even if High BMI has been associated with an increased risk of metabolic diseases, this measurement does not estimate variation in body fat distribution and abdominal fat mass, which can differ majorly among populations and can vary substantially within a restricted range of BMI [4]. Not only obese but even men and women with normal BMI have a high proportion of visceral obesity [5].

Age, physical activity, food intake, drinking, smoking, educational level, income level and community level urbanicity all are associated risks of obesity and increased abdominal obesity indicators. Therefore, effective approaches for prevention and control the epidemic of abdominal obesity are needed to diminish the adverse effects on public health [5]. Obese patients have increased CVD risk factors including increased prevalence of metabolic syndrome (even at lower BMI), insulin resistance, type 2 diabetes mellitus, increased lipoprotein, etc [6].

A Human body shape, which describes the contours of the body figure as well as the distribution of muscles and fat, contains a rich source of information, from health issues to aesthetic presentation of lifestyles. However, most of the existing methods for estimating body types are derived from subjective measures [7]. Which does not include BMI values, but encompasses WHR, WC, etc. WHR measures value of waist

circumference divided by value of hip circumference, when waist is equal in proportion to hip the value becomes 1. Indicating more abdominal fat storage. Which has been proven to be a risk factor in health-related issues.

Studies shows BMI, WC and WHR all are found to be higher in diabetic, hypertensive participants, concluding that Higher WC in population has increased risks of developing hypertension, type 2 diabetes mellitus, hypercholesterolemia, joint pain, low back pain & hyperuricemia [8,9]. Visceral Fat (VF) can be estimated at present only by using expensive instruments as bio impedance analyser (BIA), dual energy x-ray absorptiometry (DEXA) scanner, etc. this is neither feasible nor inexpensive. Measurement of WHR can be used as an appropriate technology for assessment of VF. Which finds correlation of visceral fat area (VFA) with WHR, WC and BMI in young healthy adults [10]. So, Waist-hip-ratio is acknowledged as the clinically accepted method of identifying patients with excess abdominal fat accumulation. WHR measurement is simple, handy, inexpensive tool which can be used as a substitute to measure VF [11].

So many studies conclude that exercising results on reduction of abdominal visceral fat [12], visceral adipose tissue [13] (VAT), body adiposity and central obesity [14]. Also suggests improvement or limiting progression of risks associated with obesity like diabetes [15], Hypertension (HTN) [16], osteoarthritis/osteopenia/osteosarcopenia [17,18] and metabolic as well as CVDs. Home-based exercises, gym, high-intensity-interval-training (HIIT), aerobics, etc are the commonly used interventions that has been studied on various factors of obesity. Regular exercise, yoga, pranayama helps to reduce weight and improve breathing by strengthening muscles [19].

Focusing on reduction of WHR, 2 contrasting elements of core training are used in this study. The isometric core exercise- plank, strengthens the core muscles effectively, also improving body's posture. Planks challenges the core musculature in 3 principal planes: sagittal, frontal, and transverse [20]. It also improves muscle activity and strength when done on different surfaces and with modifications [21]. Isotonic core strengthening exercises also builds strength while burning the fat around the abdomen with contracting action of abs. This study presents hypothesis that either various planks exercises and core strengthening exercises have significant effect on reduction of WC, HC, WHR and body fat percentage after 4 weeks or doesn't have any effect on the same on overweight individuals.

MATERIALS AND METHODS

The study was approved by ethical committee of university. Sample size was calculated with respect to parent article with help of biostatistics department. The sample size was 44, 62 willingly consenting subjects aged between 15 to 35 years, both men and women, fulfilling the inclusion criteria were included.

240 Individuals Screened from University campus

↓

78 Overweight (Based on BMI Classification)

↓

62 Consented & Participated

↓

Random Allocation

↙ ↘

Group A: Planks Group (PG) (n=31) **Group B: Core Strengthening Group (CSG) (n=31)**

There were 4 dropouts from this study due to some personal reasons, but are not considered in the study population. Demographic characteristics like Name, Age & BMI were taken. Outcomes measure like Waist circumference and Hip circumference were measured by non-stretchable inch tape [22], WHR was calculated by electronic calculator, Body fat percentage was taken by body fat analyser. All the outcome measures were measured pre and post the 4 weeks of exercise protocol. Subjects had to follow a set protocol with respective group protocol given for 4 weeks, 4 sessions a week. Following tables (Table no. 1 & 2) represents the schedule and exercise protocol of both the groups-

Table 1: Exercise protocol for each group for 30 days

Total 30 days=	Level 1 (2 weeks)	Level 2 (2 weeks)
Group A- Planks protocol	Wide Arm Plank Knee Side Plank (left & right).	Diagonal Plank hold Straight Arm Side Plank (left & right).
Group B- Core protocol	Mountain Climbers Squats	Cross Lunges Bicycle Crunches

Table 2:4 weeks schedule for each group

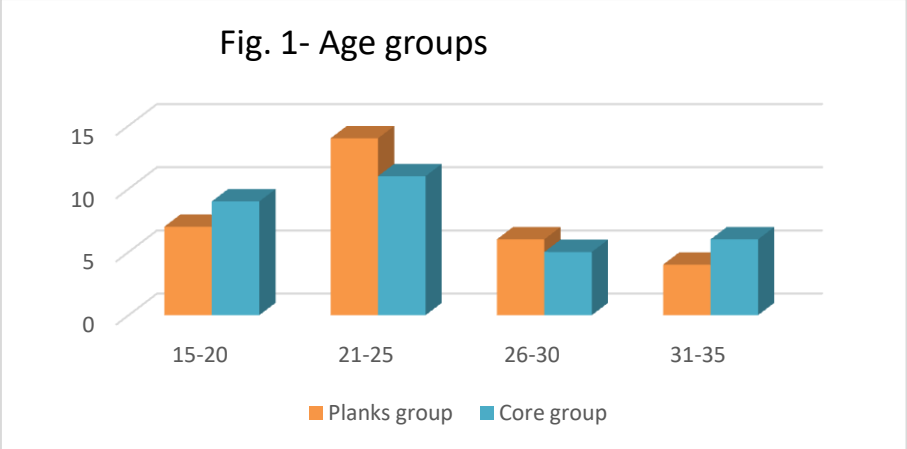
Sessions	Group A	Group B
Week 1 Session 1	15 sec hold	10 reps
Session 2	15 sec hold	10 reps
Session 3	20 sec hold	15 reps
Session 4	20 sec hold	15 reps
Week 2 Session 1	25 sec hold	20 reps
Session 2	25 sec hold	20 reps
Session 3	30 sec hold	25 reps
Session 4	30 sec hold	25 reps
Week 3 Session 1	35 sec hold	30 reps
Session 2	35 sec hold	30 reps
Session 3	40 sec hold	35 reps
Session 4	40 sec hold	35 reps
Week 4 Session 1	45 sec hold	40 reps
Session 2	45 sec hold	40 reps
Session 3	50 sec hold	45 reps
Session 4	50 sec hold	45 reps

Statistical analysis- It was done post the intervention by use of paired and un-paired t-test to analyse the data which was assessed on the basis of p value which should be < 0.05 to be significant. Results were obtained from statistical analysis with help of biostatistics department and use of SPSS Statistics 27.0.1 software.

RESULTS AND OBSERVATIONS:

Table 3: Demographic Data

Parameters	Mean ± SD	
	Planks group	**Core group**
Age (years)	24.09 ± 4.71	24.51 ± 5.06
BMI (kg/m^2)	29.4 ± 3.56	29.17 ± 3.42



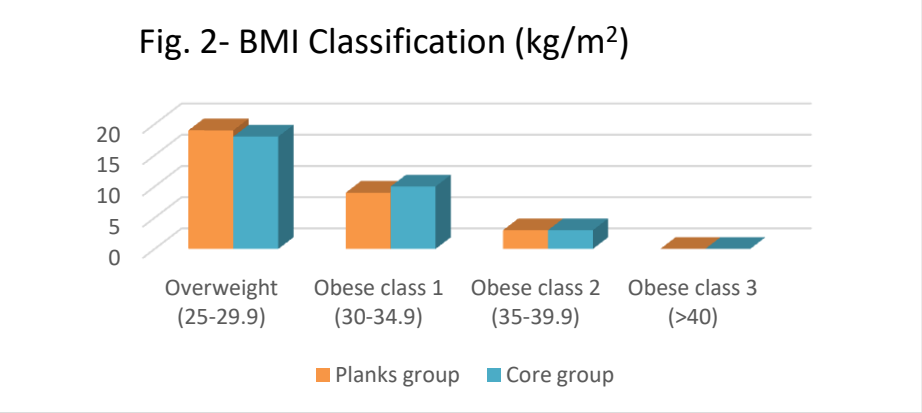


Table 4: Analysis of Planks group using paired t-test (n=31)

Parameters		Mean ± SD	*P* value	t value
Waist circumference (inches)	Pre	37.89 ± 4.57	<0.0001	4.803
	Post	32.34 ± 4.52		
Hip circumference (inches)	Pre	42.1 ± 4.99	0.0127	2.570
	Post	38.7 ± 4.98		
Waist-Hip Ratio	Pre	0.90 ± 0.054	<0.0001	4.485
	Post	0.83 ± 0.055		
Body fat percentages (%)	Pre	38.31 ± 5.19	0.755	0.313
	Post	37.9 ± 5.17		

Table 5: Analysis of Core group using paired t-test (n=31)

Parameters		Mean ± SD	*P* value	t value
Waist circumference (inches)	Pre	38.54 ± 5.47	<0.0001	4.657
	Post	32.16 ± 5.30		
Hip circumference (inches)	Pre	42.87 ± 4.55	<0.0001	3.443
	Post	38.96 ± 4.4		
Waist-Hip Ratio	Pre	0.9 ± 0.081	0.0062	2.839
	Post	0.84 ± 0.083		
Body fat percentages (%)	Pre	39.40 ± 8.104	0.786	0.2716
	Post	38.84 ± 8.076		

Demographic characteristics of all the individuals are shown in Figure no.1, 2 and Table no.3. Values in the table shows mean and standard deviation of Age and BMI of all 62 participants. BMI Parameter considered post the exercise

intervention in both the groups gave 28.5 ± 3.55 and 28.8 ± 3.40 as mean ± SD values of Planks group and Core group respectively.

Gender distribution was same i.e., 8 men and 23 women in both the groups. Though most of the participants both men and women had higher Waist-hip ratio values, 10 (16%) of total 62 had lower WHR, 5 in each group. One participant had WHR value as 1, which is not very common but an issue of a great concern.

As seen in Table no. 4 and 5, post exercise intervention mean and SD values in each outcome measure were less in comparison with baseline (pre) exercise intervention values in both the groups. The *P* value for each parameter (except body fat percentage) is significant as per statistical analysis. Thus, planks as well as core strengthening exercises both are significantly effective in reducing WHR of overweight individuals. Though the *P* value is not significant for body fat percentage, some amount of change is seen post the intervention in both the groups.

On comparing the analysed data of both the groups, *P* value of WC and WHR is extremely significant (<0.0001) while it is 0.0005 in HC parameter. For body fat percentage it is (NS) not significant (0.836). The mean percentage of difference between pre and post values is highest i.e., 17% for WC and 9% for HC in core group while it is 7% for WHR The mean percentage of difference between pre and post values is highest (%) for WC in core group while equal in both the groups.

DISCUSSION

This study aimed at determining effect of planks and core strengthening exercises on waist hip ratio of overweight individuals. The included exercise intervention program of study (isometric-planks VS isotonic-core strengthening exercises) may lead to regional adipose tissue or fat loss, possibly by contrasting regional adipose tissue metabolism. Some forms of exercises are also useful and significant for older population to improve their physical capacities and improvement in anthropometric measures [23]. The reduction of fat mass in trained localised muscle by endurance training is significantly greater than the fat mass change observed in the control/untrained muscle. Hence, focus of any isometric or isotonic exercise on abdominal fat will lead to reduction of fat mass around abdomen region.

A precious study done with basic elbow planks hold in planks group and sit ups, crunches, leg raises along with planks in abdominals group, done for 30 days showed a 3.06% and 2.38% change in waist circumference in Abdominals & Planks group respectively. While the abdominal skin fold measurements showed 15.16% and 11.64% change in the Abdominals and Planks group respectively [24]. This study gives higher value of percentages compared to the above study. This study has different and modified exercise protocol of 4 weeks focusing mainly on reduction of WHR.

Another study on effect of lumbar flexors and extensors muscle strengthening on WHR showed decrease in mean value from 35.5-33.9 in Waist Circumference, 41.7-40.1 in Hip Circumference and 37.7-36 in skin fold thickness at the abdomen between pre and post-test respectively [25]. Our study has greater values than above studies in mean differences, standard deviations of waist circumference and WHR as well (Table no. 4 & 5). New outcome measure i.e., body fat percentage also shows reduction in value post the intervention.

A study on effect of 6 weeks of yoga and aerobics on WC, WHR and BMI gave P value 0.0004 in WHR parameter post the intervention comparing both the groups [26]. P is 0.0001 in planks groups of our study in WHR parameter, which is extremely significant.
Since there was no significant difference between Planks group and core group proving that both the groups were equally effective in showing results. The limitations of this study were that, daily dietary intake as well as previous activity status of each participant was not checked, subjects more than 35 years of age were not included and long-term effect of the exercises were not taken into account due to a short study duration. Future studies on comparison of these exercises on outcome measures like EMG and analysis of individual's body type could be done.

CONCLUSION

Authors would like highlight, post the intervention, 14.8% and 8.9% mean differences were seen in waist circumference and hip circumference respectively in planks group, while the differences were 16.7% and 9.16% respectively in core group. WHR mean difference was 6.9% and 6.7% while change of body fat percentage was 1.2% and 1.45% in planks and core group respectively. Statistically seen according to WHR p value of both groups, planks are more in significance compared to core group in achieving the aim of reducing WHR. Clinically both groups are equally effective in achieving the aim of this project.

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