Original Research Article

Influence of six weeks of supine slow leg raising abdominal exercise on abdominal fat

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Abstract

Introduction: Around 20% of the population in Tamilnadu has central/abdominal obesity. Obesity related metabolic and cardiovascular complications are associated mainly with abdominal obesity. Though moderate or high intensity exercises do have some effect in reducing abdominal fat, there are only very few studies depicting the importance of spot specific abdominal exercises on abdominal fat. Supine slow double leg exercise is one such exercise practiced commonly. Hence the present study aims to find out the effect of slow leg exercise on abdominal fat. **Materials and methods**: The study was conducted in the department of physiology of a private medical college 5 days a week for 6 weeks. Out of the 40 overweight individuals recruited, 20 were included in the study and 20 in the control group. The parameters measured include Body Mass Index (BMI), Waist Hip Ratio (WHR) and Abdominal Subcutaneous fat (SAT) by ultrasound. **Results and discussion:** BMI,WHR and SAT had decreased significantly (p value < 0.001) in the slow leg raising group with no significant changes in BMI,WHR in the Control group except for significant increase in SAT. No significant difference existed between the study and the control group in the baseline parameters. **Conclusion:** Supine leg raise exercise when performed slowly, by exerting isometric force on the abdominal muscles, help to reduce the abdominal fat.

Key words: Abdominal fat, central obesity, Slow Leg raise exercise.

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Introduction

Obesity is increasingly prevalent worldwide due to physical inactivity and over consumption of high energy foods. According to a 2015 Indian study, 135 million and 153 million people in India have generalized and abdominal obesity.[1] The percentage of women and men who were obese in Tamilnadu is 24.4 and 19.8% and the prevalence is more in urban than rural population. Individuals with central or abdominal obesity were at increased risk for hypertension, coronary artery disease, dyslipidemia, diabetes mellitus, stroke, sleep apnea, osteoarthritis, cancer, gastro esophageal reflux and polycystic ovarian disease than individuals with generalized obesity.[2,3]

Abdominal fat is in two compartments: Visceral abdominal fat (VAT) and Subcutaneous abdominal fat (SAT). VAT is composed of mainly omental fat, mesenteric fat and retroperitoneal fat masses. SAT is stored beneath the skin. Though many studies had shown the significant association of visceral fat with metabolic complications, subcutaneous fat also was shown to correlate with obesity related complications. The increased free fatty acid release from the visceral and subcutaneous abdominal fat reduces hepatic insulin sensitivity and favor fat accumulation in the liver.[4,5]Abdominal obesity is associated with high triglycerides and low high-density lipoproteins. Leptin levels correlated with subcutaneous abdominal fat and increased leptin was found to be associated with vascular dysfunction and cardiovascular complications. Angiotensinogen from adipose tissue increases the risk for hypertension. Breast and endometrial cancer in women are due to the aromatase enzyme in adipose tissue which converts sterol to estrogen.[6]

As weight loss is the best remedy, whole body exercises were tried to reduce the body fat. But the result on abdominal fat was negligible with low and moderate intensity exercises. A significant reduction in both VAT & SAT was observed with high intensity intermittent exercises without change in diet in overweight and obese individulas.[7,8] High intensity exercises reduced abdominal fat by increasing the release of catecholamines, glucocorticoids and growth hormone in to the circulation. As adipose tissue has abundant receptors for all these hormones, increased lipolysis and fatty acid oxidation occurs. β adrenergic sensitivity of the adipose tissue also increases. A decrease in appetite also occurs due to increased release of corticotrophin releasing hormone in the post exercise period.[9]

Obesity was conventionally measured with body mass index (BMI), but BMI does not account for variation in regional fat distribution. According to WHO, BMI 24-29.9kg/m2 is considered as preobese /overweight and >30 kg/m2 is considered as obese. Waist circumference (WC) and waist hip ratio (WHR) are used as indirect measures of visceral abdominal fat, but cannot distinguish between the two fat depots.[10] Since these anthropometric measurements were associated with inter observer variations, ultrasound was found to be an easy, reliable, non-invasive method to measure abdominal fat. [11]

Studies on effectiveness of selective abdominal exercises in reducing abdominal visceral and subcutaneous fat were inconsistent. In a previous study done on 12 different types of abdominal exercises on abdominal fat, hanging straight leg raise test showed maximal activity in all the abdominal muscles[12] .Since this test will be highly challenging for the normal, non-athletic people to perform, in the present study supine double straight leg raise test exercise was chosen. Hence the purpose of the present study was to evaluate the efficacy of this simple exercise in reducing abdominal fat in overweight individuals.

Objectives

1. To assess the effect of supine slow leg raise exercise on Body mass index, Waist hip ratio and abdominal subcutaneous fat of overweight/obese individuals before and after 6 weeks of exercise training
2. To compare the effect of supine slow leg raise exercise on Body mass index, Waist hip ratio and abdominal subcutaneous fat in overweight/obese individuals with that of the controls before and after 6 weeks of exercise training.

Materials and Methods

The study was conducted in the department of physiology of a private Medical College &Hospital in Madurai over a period of 2 months from September to October 2017 after obtaining Institutional Ethical clearance. 40 healthy overweight males and females aged 19 to 23 years were chosen by simple random sampling from the list of all eligible students. After obtaining their informed consent, they were then assigned as SLR group (n=20), and control group (n=20)

randomly by using a randomization sequence generated in Microsoft Excel. Subjects were selected in such a way that their BMI >25, Waist Circumference >80cm in females and >94cm in males and Waist hip ratio > 0.9 for males and >0.85 in females. No restriction was put up on the diet pattern. Only subjects staying in the medical college hostel were included in this study to ensure that all will be almost consistently on the same diet pattern. Trained individuals, students with skeletal muscle disorders, with history of abdominal disorders /previous abdominal surgery, students suffering from cardiac, lung diseases and on medication were excluded from the study.

Description of intervention

The study was conducted in the physiology department at 4pm every day, 5 days a week for 6 weeks. The subjects were instructed to refrain from caffeine and alcohol. Every day, before starting exercises, subjects were instructed to do breathing for 3 minutes and warm up exercises for 5 minutes. After that subjects on loose clothing were asked to lie supine on the ground with legs extended and hands behind their head. They then must raise both the legs off the ground perpendicular to the hip (almost 70 degree) in full expiration without bending the knees. After raising the legs straight for a count of 2 (2 sec), the subjects must bring down both the legs in inspiration immediately for 2 counts (2sec). Without the feet touching the ground, subjects must do this maneuver for 15 times in a minute on day 1.

Data collection method & tools

Baseline data on all participants were collected using structured questionnaire. Body mass index (BMI) was assessed with weight in kilograms &height in meter square in the standing position with feet together. Weight was measured with electronic weighing scale (Doctor Beliram & sons, New Delhi) and height with a stadiometer. Waist circumference (WC) was measured in cms by placing the inch tape midway between top of the iliac crest and last palpable rib at the end of a normal expiration in an empty stomach and in a relaxed state. Hip circumference (HC) was measured around the widest portion of the buttocks. Waist hip ratio (WHR) was then calculated. Measurement of abdominal subcutaneous fat (ASC) was performed with a linear high frequency transducer, positioned transversely 1cm above the umbilicus, without exerting any pressure over the abdomen. The subcutaneous fat thickness was measured in centimeters as the distance between the skin and the outer surface of the abdominal muscles. Measurement was made at the end of quiet expiration.

Results and discussion

Statistics: The data was entered into MS excel and analyzed using SPSS v16. The values of BMI, WC and SAT before and after 6 weeks of slow leg raise exercise compared using paired t test and one-way ANOVA. Between group differences were analyzed using unpaired t test. P value < 0.05 will be the cut of to determine statistical significance.

Discussion

The baseline parameters of both the study and the control group were almost similar as shown by Table1 .In the control group, no statistically significant difference was observed for BMI & WHR but a significant difference was observed for SAT (p value 0.035) .The mean value, instead of decreasing had increased from the baseline value of 3.2600 to 3.2050 after 6 weeks. This could be attributed to the sedentary life style. Also, no statistically significant difference was observed between the control and the study groups after 6 weeks.

After 6 weeks, in the study group, there was a statistically significant decrease in the values of

BMI, WHR & SAT (Table 2).This is contradictory with the results of a previous study done on obese subjects who were on isocaloric diet.7 types of abdominal exercises were practiced for a duration of 8 weeks(10minutes/day of abdominal exercise) and no reduction in body weight, body fat %, abdominal circumference and SAT was observed.[13]The results of the present study coincides with the results of a study which compared vacuum therapy with the abdominal exercises on abdominal obesity, where a significant decrease in BMI,WC and skin fold thickness was reported after 8 weeks.[14] In another study done on obese women where both diet and abdominal exercises were prescribed for 12 weeks, a significant reduction in BMI, SAT, waist and hip circumference was noted. [15]

	Exercise protocol	Number of sets of leg raising exercise
Week 1	Breathing exercise (BE)3 minutes, warm up (WU)5 min, leg raising(LR) 1 minutes	1 set of LR exercise (15 times)
Week 2	BE 3 minutes, WU 5 min, LR 2 minutes	2 minutes rest in between each set 2 sets of LR exercise (30times)
Week 3	BE 3 minutes, WU 5 min, LR 2 minutes	2 minutes rest in between each set 2 sets of LR exercise (30 times)
Week 4	BE 3 minutes, WU 5 min, LR 3 minutes	2 minutes rest in between each set 3 sets of LR exercise (45 times)
Week 5	BE 3 minutes, WU 5 min, LR 3 minutes	2 minutes rest in between each set 3 sets of LR exercise (45 times)
Week 6	BE 3 minutes, WU 5 min, LR 4 minutes	3 minutes rest in between each set 4 sets of LR exercise (60times)

Table: 1 Baseline characteristics of study groups

Control vs. Slow SLR (unpaired t test)

	Control	SLR	p
	Mean±Standard Deviation	Mean±Standard Deviation	
BMI before	27.69±2.54	27.74±3.05	0.958
Waist Hip Ratio	.87±.06	.90±.05	0.061
Abdominal subcutaneous fat (cms)	3.26±.73	3.61±1.03	0.224

Table 1 show that there was no statistically significant difference between Control group and Slow Leg Raising (SLR) group in all the baseline parameters

Table: 2 within group difference in parameters before and after 6 weeks

Groups			Mean±Std. Deviation	N	Std. Error Mean	P
Control	Pair 1	BMI before	27.6950±2.53574	20	.56701	0.199
		BMI after	27.8050±2.38139	20	.53250	
	Pair 2	Waist Hip ratio before	.8655±.05558	20	.01243	0.072
		Waist Hip ratio after	.8735±.05344	20	.01195	
	Pair 3	Abdominal fat before	3.2600±.73154	20	.16358	0.035
		Abdominal fat after	3.3050±.71633	20	.16018	
Slow LR Group	Pair 1	BMI before	27.7425±3.04921	20	.68182	<0.001
		BMI after	25.4000±3.05958	20	.68414	
	Pair 2	Waist Hip ratio before	.8965±.04557	20	.01019	<0.001
		Waist Hip ratio after	.8540±.05707	20	.01276	
	Pair 3	Abdominal SC fat before	3.6100±1.03308	20	.23100	<0.001
		Abdominal SC fat after	2.8850±.96533	20	.21586	

According to Table 2,in the control group, there was no significant difference in the values of BMI & WHR before and after 6 weeks except for abdominal subcutaneous fat.
In the study group, all parameters had significantly decreased from the baseline values after 6 weeks of slow leg raising exercise.

Table 3: Between group differences before and after 6 weeks

	Control	SLR	p
	Mean±Standard Deviation	Mean±Standard Deviation	
BMI difference	-.11±.37	2.34±1.45	<0.001
Waist Hip Ratio difference	-.01±.02	.04±.03	<0.001
Abdominal subcutaneous fat difference	-.05±.09	.73±.17	<0.001

According to Table 3, a highly significant difference was observed between control and slow leg raising group after 6 weeks.

In the SLR exercise practiced during the present study, the subjects had to raise the legs slowly up for a count of two till 70◦ and then bring down for a count of two and then repeat the same without touching the ground. During the procedure, the legs should be kept extended without bending and stopped at 70 degree. This exhibits a stronger isometric force on the abdominal muscles to stabilize spine and also focuses all the different especially lower abdominal muscles. The rectus

works isometrically to fix the pelvis against iliopsoas contraction. If the legs were to be lifted up to 90 degree, the isometric effect on the abdominal muscles will be very minimal because maximum contraction of the iliopsoas is possible only when both the legs are near horizontal and not vertical.[16] without foot touching the ground, again both the legs have to be lifted. Due to very less relaxation time and more volume overload on the abdominal muscles with a slow leg raise, a significant decrease in abdominal fat was observed in the present study. If the exercise is performed rapidly in a faster pace, facet vertebral joint structures would be damaged thereby limiting the performance.

Specific diet is not prescribed, in the present study, to find out the effect of abdominal exercises alone on abdominal fat. A decrease in BMI indicates decrease in overall body weight .Decrease in WHR definitely indicate the decrease in abdominal fat.[17]The study was performed on only overweight individuals and not on normal subjects, as a significant decrease in abdominal fat was observed only in overweight and obese individuals.[18]As significant differences was observed between the study and the control group (Table 3), this study confirms the role of specific abdominal exercise in reducing abdominal fat.

Strength of the study is this is the first of its kind to record the effect of slow supine double leg raise exercise on abdominal fat. Warm up exercises were given initially and adequate counter poses and rest was given at the end of every day session. The duration and frequency of the exercise was increased gradually to obtain consistent results.

Limitation of the study is few more abdominal exercises could have been added to equally involve all the abdominal muscles. Waist Height ratio could have been measured. Serum triglycerides and HDL cholesterol levels could have been measured to correlate with the results of the present study.

Conclusion

Specific supine slow leg raise abdominal exercise significantly decreases abdominal fat as shown by a decrease in SAT, WHR and BMI. These exercises also prevent low back pain, inguinal hernia etc. by strengthening the abdominal muscles. When practiced regularly along with aerobic exercises, it could prevent over all morbidities associated with both generalized and central obesity

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Conflict of interest: Nil

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