

Effect of Double Straight Leg Raise Exercise Training on Abdominal Fat of Adolescent Population – An Interventional Study from Madurai, India.

P. S. L. Saravanan¹, S. Anu², A. Mohamed Rayeez³, G. Rajalakshmi Preethi⁴

¹Professor, Institute of Physiology, Madurai Medical College, Madurai

²Professor & Head, Department of Physiology, Velammal Medical College and Hospital, Madurai.

³Pre final MBBS, Department of Radiodiagnosis, Velammal Medical College and Hospital, Madurai.

⁴Associate Professor, Department of Radiodiagnosis, Velammal Medical College and Hospital, Madurai.

Received: August 2018

Accepted: August 2018

Copyright: © the author(s), publisher. It is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Central/abdominal obesity is associated with metabolic and vascular complications than whole body obesity. High intensity exercises were generally proven to reduce total body fat as well as regional fat. Conflicting results were observed with the effects of specific abdominal exercises on abdominal fat. Hence the present study was done to find out the sole effect of double straight leg raise exercise on abdominal fat before and after 6 weeks of training and to compare with that of the control group. **Methods:** A total of 40 obese students of a private medical college were recruited for the study and divided into control (n=20) and leg raising group (n=20). The study was conducted for 5 days a week for 6 weeks during September to October 2017. Body Mass Index (BMI), Waist Hip Ratio (WHR) and Abdominal Subcutaneous fat using ultrasound was measured. **Results:** Paired and unpaired t test was used for statistical analysis. A significant decrease in BMI and Abdominal subcutaneous fat (p value < 0.001, < 0.017) was observed in the leg raising group with no significant change in WHR (p value < 0.968). Control group showed no significant change in BMI & WHR (p value < 0.199, < 0.072) except for increase (p value < 0.035) in abdominal subcutaneous fat. **Conclusion:** Leg raising exercises help to reduce abdominal subcutaneous fat & Body weight but not the abdominal girth and if practiced along with other types of abdominal exercises may yield better results.

Keywords: Leg raise exercise, Abdominal fat, Obese

INTRODUCTION

Obesity is an emerging problem in the modern world due to sedentary life style and altered food habits leading to various health related morbidities and mortalities. In particular, individuals with abdominal obesity are not only prone for developing Hypertension, myocardial infarction, Type 2 Diabetes, stroke, sleep apnoea and cancer than whole body obesity.^[1,2] Excess abdominal fat, by increasing the secretion of resistin contributes to insulin resistance.^[3] Abdominal Visceral fat through its portal drainage is involved in hepatic lipogenesis, neoglucogenesis and peripheral insulin resistance by randle effect. Central obesity also causes asthma due to breathing at low lung volume and release of adipokines.^[4]

Though Diet or caloric restriction is the major weight loss strategy, exercises are recommended additionally as a preventive and treatment measure. Exercises like walking; jogging was advised to reduce the body fat. But this low to moderate Intensity aerobic exercise training programme was shown to reduce only gross body weight with no significant effect on the abdominal fat. High intensity resistance exercise training programmes showed promising results. There is evidence that high intensity exercises significantly reduced abdominal subcutaneous & visceral fat, particularly in overweight and obese subjects.^[5,6]

Regular training with these types of High intensity intermittent exercises increases the release of catecholamines (particularly epinephrine), glucocorticoids and growth hormone into the circulation inducing lipolysis from both subcutaneous and intramuscular fat depots. These hormones were also shown to increase mitochondrial fatty acid oxidation and decrease insulin resistance.^[7] Abdominal fat increases free fatty acid levels in the circulation resulting in metabolic disturbances. This is not only contributed by visceral fat but also by

Name & Address of Corresponding Author

Dr. S. Anu,
Professor and Head,
Department of physiology,
Velammal medical college and hospital
Anuppanadi, Madurai, Tamilnadu - 625009

abdominal subcutaneous fat in obese individuals.^[8] These resistance exercises improve trunk movement by increasing the strength of the abdominal muscles too. In spite of these advantages, exercise adherence is a constraint due to lack of time, motivation and inability to stick to the planned exercise schedule. A simple way to eliminate all these barriers but with good results could be short duration, high intensity specific abdominal exercises.

To promote the sale of specific equipments, many companies claim the sole role of abdominal exercises in reducing abdominal fat. Studies on effectiveness of selective abdominal exercises like double leg raise test, abdominal crunches, abdominal drawing in maneuver etc in reducing both abdominal visceral and subcutaneous fat were controversial. In a study done in 1965, where 6 isometric abdominal exercises practiced for 4 weeks, a significant reduction in abdominal subcutaneous fat was observed.^[9] Another study done in 1983 showed no change in abdominal fat and waist circumference of healthy individuals after 6 weeks of spot specific abdominal exercise training.^[10]

Abdominal fat is distributed as both visceral and subcutaneous fat. Defective disposal of subcutaneous fat results in spill over of fat into visceral adipose tissue. An increased waist-hip ratio is associated with high amount of visceral adipose tissue volume.^[11] Subcutaneous fat does not change with age like visceral fat, but changes with the degree of obesity.

Double straight leg lift test is a commonly recommended exercise to reduce abdominal fat in many fitness centers. The effectiveness of this simple exercise training in reducing abdominal fat especially in overweight / obese individuals was evaluated in this study.

Objectives

Among 40 medical students,

1. To assess the effect of double leg raise exercise on BMI, waist hip ratio and abdominal subcutaneous fat of obese individuals before and after 6 weeks of exercise training
2. To compare the effect of double leg raise exercise on BMI, waist hip ratio and abdominal subcutaneous fat with that of the controls before and after 6 weeks of exercise training.

MATERIALS AND METHODS

The present study was conducted in the department of Physiology, Velammal Medical college Hospital and Research institute, Madurai from September to October 2017 after obtaining Institutional Ethical Committee Clearance. A total of 40 healthy obese /overweight students of both the genders aged 19-23 years were chosen for this study by simple random sampling from the list of all eligible students. 20 students were assigned in the Leg Raising (LR)

Exercise group and 20 in the Control group randomly by using a randomization sequence generated in Microsoft Excel. The procedure was well explained to the subjects and their voluntary consent was obtained before the beginning of the study.

Subjects were selected in such a way that their BMI >25 and Waist hip ratio > 0.9 for males and >0.85 in females. 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, students suffering from cardiac, and lung diseases and on medication were excluded from the study.

Description of intervention

The study was conducted in the Physiology department at 4pm everyday, 5 days a week for 6 weeks. Control group subjects maintained their regular activities without any intervention. The subjects were instructed to refrain from caffeine and alcohol. After initial 5 minutes of warm up, exercise group subjects were asked to lie supine on the ground with legs extended and hands behind their head. They then have to 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 (1 sec), the subjects have to bring down both the legs in inspiration immediately for 1 count (1sec). Without the feet touching the ground, subjects have to do this maneuver for 30 times in a minute. The total duration of exercise every day is 2 minutes (1 session) for the first week. From second to fourth week, 2 exercise sessions will be performed with a resting period of 3 minutes in between. After 4th week, 3 sessions will be performed every day. At the end of 6 weeks, all the parameters were measured once again.

Data collection method & tools

Baseline data on all participants were collected using structured questionnaire. After overnight fasting, in the morning between 9-10 am all the baseline measures were recorded after allowing the subjects to relax for 5 minutes. Body mass index (BMI) was assessed with height in meter square & weight in kilograms with the subject standing straight, arms by the side and feet close together. Waist circumference 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 was measured around the widest portion of the buttocks. Measuring tape was placed in such a way that it should snug around the body and should not be tight. Measurement of abdominal subcutaneous fat was performed with a linear low frequency transducer, positioned transversely 1cm

above the umbilicus, without exerting any pressure over the abdomen.^[12] 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.

Statistics

The quantitative data was checked for normality and summarized using mean/median and Standard deviation / interquartile range as appropriate. The readings of BMI, Waist Hip ratio and abdominal subcutaneous fat before and after 6 weeks of LR exercise was compared using paired t test and one way ANOVA to compare dependant measures .Between group differences were analyzed using

unpaired t test. P value < 0.05 will be the cut off to determine statistical significance.

RESULTS

Table 1: Baseline characteristics of Control Vs LR group

	Control		LR Group		P
	Mean	Standard Deviation	Mean	Standard Deviation	
BMI	27.69	2.54	27.37	2.58	0.688
Waist Hip ratio	.87	.06	.88	.05	0.328
Abdominal fat	3.26	.73	3.54	.87	0.287

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

Groups		Mean	N	Std. Deviation	Std. Error Mean	P	
Control	Pair 1	BMI before	27.6950	20	2.53574	.56701	0.199
		BMI after 6weeks	27.8050	20	2.38139	.53250	
	Pair 2	Waist Hip ratio before	.8655	20	.05558	.01243	0.072
		Waist Hip ratio after 6 weeks	.8735	20	.05344	.01195	
	Pair 3	Abdominal fat before	3.2600	20	.73154	.16358	0.035
		Abdominal fat after 6 weeks	3.3050	20	.71633	.16018	
LR Group	Pair 1	BMI before	27.3675	20	2.57936	.57676	0.006
		BMI after 6 weeks	26.7400	20	2.52576	.56478	
	Pair 2	Waist Hip ratio before	.8825	20	.05300	.01185	0.968
		Waist Hip ratio after 6 weeks	.8820	20	.06204	.01387	
	Pair 3	Abdominal fat before	3.5350	20	.87375	.19538	0.017
		Abdominal fat after 6 weeks	3.3350	20	.90454	.20226	

Table 3: Between Group difference in parameters before and after 6 Weeks

	Control		LR		P
	Mean	Standard Deviation	Mean	Standard Deviation	
BMI difference	-.11	.37	.63	.92	0.002
Waist- Hip ratio	-.01	.02	.00	.06	0.518
Abdominal fat	-.05	.09	.20	.34	0.004

According to [Table 2], In the control group, there was no significant difference in all the following parameters before and after 6 weeks: BMI (p value 0.199), Waist Hip Ratio (p value 0.072) and Waist Circumference (p value 0.620). Whereas mean Abdominal fat has significantly increased from the baseline value of 3.260 to 3.2050 after 6 weeks(p value 0.035) and this could be due to the sedentary life style.

In the leg raising group, BMI has decreased significantly (p value < 0.001) and Abdominal fat has decreased significantly (p value < 0.017) from the baseline values. There was no significant difference in waist circumference and waist hip ratio after 6 weeks of exercise training.

According to [Table 3], a highly significant difference was observed between control and

interventional group for BMI and abdominal subcutaneous fat after 6 weeks.

DISCUSSION

The present study shows that double leg raise exercise significantly reduced the abdominal subcutaneous fat (p >0.017) and BMI (p >0.006) in the LG group (Table 2).Though 6 weeks of abdominal exercise reduced BMI and abdominal subcutaneous fat, there was no significant reduction in waist hip ratio (p >0.968)which shows that there was no reduction in visceral fat. A large waist circumference was associated with 2to 3 fold increase in diabetes and cardiovascular disease.

Since BMI is supposed to be the single most predictor of total adipose tissue volume, decrease in

BMI observed in our study shows that selective spot exercises definitely have a role in reducing overall body fat.^[13] There is also a definite decrease in abdominal fat as a strong correlation exists between BMI and the ultrasound measurement of fat thickness in obese individuals.^[14]

Waist hip ratio is a simple and convenient method to estimate abdominal fat. Even then it does not clearly distinguish visceral fat and subcutaneous fat. Previous studies had shown that waist circumference and waist hip ratio was not a sensitive indicator for measuring abdominal fat.^[15] The present study does not show a significant reduction in waist hip ratio, though the mean value decreased from 0.8825-0.8820. [Table 2]

Majority studies done on the influence of whole body exercise on abdominal fat in obese individuals, showed a significant reduction in abdominal fat.^[15] But this change is seen with only moderate/ high intensity exercise training showing a decrease in visceral fat without diet correction in subjects whose baseline BMI was more than 25 kg.m².^[16] In the present study, both control and study group subjects were selected in such a way that their BMI was more than 25 to get better results and it was also ensured that no significant difference in BMI, waist hip ratio and abdominal subcutaneous fat exists between the 3 groups [Table 1]

The results of the present study differs with the results of the study done in 2011 for the same duration of 6 weeks, where 24 obese subjects on isocaloric diet performed 7 types of abdominal exercises for 10 minutes a day excluding warm up.^[17] The results showed no significant reduction in body weight, body fat %, and abdominal subcutaneous fat and abdominal circumference. Though in the present study no significant change in waist hip ratio is seen in LR group, a significant reduction in both body weight and abdominal subcutaneous fat was observed [Table 2]. The results of the present study are consistent with a study done in 2015, where 40 obese women were divided into 2 groups.^[18] To one group both diet and abdominal exercises were prescribed for 12 weeks and to the second group diet alone was prescribed for the same duration. Though BMI, Abdominal subcutaneous fat (ultrasound measurement), waist and hip circumference significantly decreased in both the groups, there was no significant difference between the two groups. In the present study, we intentionally did not control diet and we wanted to know the exclusive effect of abdominal exercises alone on abdominal fat. Even without diet modification, the present study results showed a significant difference in abdominal subcutaneous fat in the LR group. Specific sit up exercise training for 27 days reduced only abdominal subcutaneous fat and not body weight, girth and total bodyfat.^[19]

Hence in the present study, on observing a significant difference in abdominal subcutaneous fat

and BMI between the control and the study group [Table 3], it was concluded that abdominal exercises definitely play a significant role in abdominal fat.

Strength of the study:

Exercises were monitored daily ensuring regularity. Intensity and duration of the exercise was gradually increased which would have helped the abdominal subcutaneous fat to decrease significantly.

CONCLUSION

The results prove that there was significant reduction in abdominal subcutaneous fat and BMI in the LR group than the control group. There was no change in the ratio of waist and hip circumference. This time saving, cost effective, non pharmacological measure can be regularly practiced along with caloric restriction and aerobic exercises to reduce the abdominal girth. It will help individuals with borderline obesity to prevent from developing obesity related health morbidities. Strengthening of abdominal muscles might also prevent low back pain.

Acknowledgement

We would like to acknowledge Dr. K. Jayashree, Assistant professor, Department of Community Medicine, Velammal Medical College for her help in statistical analysis and Ms. M. Dharani Devi, Technician, Department of Physiology, Velammal Medical College for her technical support.

REFERENCES

1. Nicklas BJ, Penninx BW, Cesari M, Kritchevsky SB, Newman AB, Kanaya AM, Pahor M, Jingzhong D, Harris TB. "Association of Visceral adipose tissue with incident myocardial infarction in older men and women: the Health, Aging and Body Composition Study". *Am J Epidemiol*. 2004; 160(8): 741-9
2. Razay G, Vreugdenhil A, Wilcock G. "Obesity, abdominal obesity and Alzheimer disease". *Dementia and Geriatric Cognitive Disorders*. 2006; 22 (20):173-176
3. Degawa-Yamauchi M, BJE, Juliar BE, Watson W, Kerr K, Jones RM, Zhu Q, Considine RV. "Serum Resistin (FIZZ3) protein is increased in obese humans". *Journal of Clinical Endocrinology and Metabolism*. 2003; 88(11):5452-5455
4. Shore S, Johnston R. "Obesity and Asthma". *Pharmacology & Therapeutics*. 2006; 110 (1):83-102
5. Kay SJ, Flatarone Singh MA. "The influence of physical activity on abdominal fat; A Systematic review of the literature". *Obese Rev* 2006 May; 7 (2): 183-200
6. Brian A. Irving, Christopher K. Davis, Arthur Weltman. "Effect of exercise training intensity on abdominal visceral fat and body composition". *Med Sci Sports Exerc*. 2008; 40 (11): 1863-1872
7. Stephan H. Boutcher. "High intensity intermittent exercise and fat loss". *J obes*. 2011; 2011: 868305
8. Bjorntorp P. "Metabolic difference between visceral fat and subcutaneous abdominal fat". *Diabetes Metab* 2000 Jun; 26 (3):10-2
9. Mohr D. "Changes in Waistline and Abdominal Girth and Subcutaneous Fat following Isometric Exercises". *Res Q*. 1965; 36(2):168-173

10. Vispute SS, Smith JD, Lecheminant JD, Hurley KS. "The effect of abdominal exercise on abdominal fat". J Strength Cond Res.2011 Sep (9):2559-64 doi:10.1519/JSC.Obo13e3181fb4a46
11. Ashwell M, Cole TJ, Dixon AK. "New insight into the anthropometric classification of fat distribution shown by computed tomography". Br Med J Clin Res Ed .1985; 290: 1692-4
12. Pineau JC, Lalys L, Bocquet M, Guihard-Costa AM, Polak M, Frelut ML et al. "Ultrasound measurement of total body fat in obese adolescents". Ann Nutr Metab.2010;56(1):36-44
13. Kvist H, Chowdhury B, Grangard U, Tylen U, Sjostrom L. "Total and visceral adipose tissue volumes derived from measurements with computed tomography in adult men and women: predictive equations". Am J Clin Nutr .1998;48: 1351-61
14. Semiz S, Ozgoren E, Sabir N. "Comparison of ultrasonographic and anthropometric methods to assess body fat in childhood obesity". International journal of obesity.2007; 31 (1):53-58
15. Kay SJ, Flatarone Singh MA. "The influence of physical activity on Abdominal fat; A Systematic review of the literature". Obese Rev 2006 ; 7(2): 183-200
16. Vissers D, Hens W, Taeymans J, Baeyens J-P, Pootmans J, Van Gaal L. "The effect of exercise on visceral adipose tissue in overweight adults: a systematic review and meta analysis". PLoS one .2013;8 (2): E56415
17. Vispute SS, Smith JD, Lecheminant JD, Hurley KS. "The effect of abdominal exercise on abdominal fat". J Strength Cond Res. 2011 ; Sep (9):2559-64 doi:10.1519/JSC.Obo13e3181fb4a46
18. Kordi R, Dehghani S, Naormohammarpour P, Rostami M, Mansournia MA. "Effect of abdominal resistance exercise on abdominal subcutaneous fat of obese women: a randomized controlled trial using ultrasound imaging assessments". J Manipulative physiol Thor. 2015; s 38(3):203-9
19. Katch FI, Clarkson PM, Kroll W, McBride T. " Effects of sit up exercise training on adipose cell size and adiposity". Res Q.1984; 55 (3):242-247

How to cite this article: Saravanan PSL, Anu S, Rayeez AM, Preethi GR. Effect of Double Straight Leg Raise Exercise Training on Abdominal Fat of Adolescent Population – An Interventional Study from Madurai, India. Ann. Int. Med. Den. Res. 2018; 4(5):PH13-PH17.

Source of Support: Nil, **Conflict of Interest:** None declared