

## Original Article

# COMPARATIVE STUDY BETWEEN MAT, SWISS BALL AND THERABAND EXERCISES ON ABDOMINAL GIRTH

Aarti Welling <sup>1</sup>, Peeyoosha Nitsure <sup>\*2</sup>.

<sup>1</sup> MPT Orthopedic Physiotherapy, KLE University Institute of Physiotherapy, KLE University, Belgaum, Karnataka, India.

<sup>\*2</sup> Assistant Professor, KLE University Institute of Physiotherapy, KLE University, Belgaum, Belgaum, Karnataka, India.

## ABSTRACT

**Background & Objective:** Obesity refers to a condition of having excessive amount of body fat. Not only the amount of excess fat needs to be considered but where in the body it is distributed is also of importance. The intra-abdominal fat carry a greater health risk than that stored elsewhere in the body. Various exercises have been designed for obesity but in particular the exercises designed for abdomen are using mat, swiss ball and theraband exercises. However, there is dearth in literature as to indicate which of the 3 is better and more effective. Hence, the study was conducted with the objective to study the comparative effect of 5 week training program between Mat, Swiss ball and theraband exercises on abdominal girth and skin fold thickness.

**Methods:** Sixty healthy individual aged 18 to 40 years were randomly assigned to all of 3 groups. Mat (n=20), Swiss ball (n=20) and theraband (n=20). Pre and post assessment was done using BMI, waist circumference, waist hip ratio and abdominal skin fold thickness.

**Results:** Within group analysis in all the three groups showed statistically significant reduction in all outcome (p<0.001). Between groups analysis showed no significant difference between the 3 groups.

**Conclusion:** The results reflected that 5 week exercise program on mat, swiss ball and theraband are equally effective in reducing abdominal fat.

**KEY WORDS:** Obesity, Abdominal Fat, Exercises, Mat, Swiss Ball, Theraband, Diet.

**Address for correspondence:** Peeyoosha Nitsure, Assistant Professor, Dept. of Orthopaedic Physiotherapy, KLE University Institute of Physiotherapy, Belgaum. Karnataka, India.  
Mobile No.: +919844821355, **E-Mail:** peeoo123@yahoo.com

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## INTRODUCTION

Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called "New World Syndrome" creating an enormous socioeconomic and public health burden in poorer countries [1].

The term obesity refers to the condition of having an excessive amount of body fat [2]. The World Health Organization has described obesity as

one of today's most neglected public health problems, affecting every region of the globe. For thousands of years obesity was rarely seen. It was not until the 20th century that it became common, so much so that in 1997 the World Health Organization (WHO) formally recognized obesity as a global epidemic [3]. As of 2008, The World Health Organization claimed that 1.4 billion adults are overweight and of these over 200 million men and nearly 300 million women

are obese [4]. According to the National Family Health Survey (NFHS) of India in the year 2006, the percentage of every married women aged 15–49 years who are overweight or obese increased from 11% in NFHS- 2 to 15% in NFHS-3 [5].

Obesity is accompanied by several metabolic complications and has been increasingly recognized as a risk factor for many serious conditions including coronary heart disease and noninsulin-dependent diabetes mellitus [6]. In general, the risk of developing complications increases with the level of obesity. However, not only the amount of excess fat needs to be considered but where in the body it is distributed is also of importance. The upper-body fat, and in particular that carried within the abdomen (intra-abdominal) carry a greater health risk than that stored elsewhere in the body. Thus, preferential reductions in abdominal fat during weight loss would seem necessary to reduce the health risks associated with obesity [7].

Abdominal obesity, also known as belly fat or clinically as central obesity is excessive fat around the abdomen. Abdominal obesity has steadily risen from 13 -38% in men and 19-60% in women during 1999-2000 [8]. There is High prevalence of abdominal obesity is a characteristic feature of Asian Indians and all South Asians [9]. In order to remain physically fit a fine balance between energy intake and energy expenditure should be maintained. Which means a negative net energy balance should be maintained to promote weight loss. Studies also suggest that addition of diet plan to a physical activity regimen provides added benefits with respect to weight loss, adipose tissue reduction, and the preservation of lean tissue [10].

Various exercises have been designed for obesity such as aerobic exercises, yoga, pilates and others. These exercises also help to reduce abdominal fat but in particular the exercises designed for abdomen are traditional mat exercises, swiss ball and theraband. Since decades studies have been made available on the use of various abdominal exercises to strengthen the abdominal muscles as well as to reduce abdominal fat. Several EMG studies on conventional [11], swiss ball [12] and theraband abdominal exercises [13] have been proven their efficacies

in activating the abdominal muscles while performing these exercises [13] have been proven their efficacies in activating the abdominal muscles while performing these exercises. Hence the literature review suggests that the traditional mat, Swiss ball and thera band exercises for the abdomen are effective in reducing the abdominal girth and fat. However, there is paucity in literature where comparisons are made between the above mentioned three methods suggesting which of the third is the best method. Thus, this study aims to compare the effect of 5week training program to reduce abdominal girth using mat, swiss ball and theraband exercises and to find best one of the three.

## MATERIALS AND METHODS

This study was a comparative study which was conducted at KLEU Institute of Physiotherapy College, JNMC Campus, Nehru Nagar Belgaum, India. All healthy obese subjects were screened for inclusion and exclusion criteria:

Subjects were admitted into the study if they met the following criteria:

1. Both male and female volunteer subjects who are apparently healthy
2. Age 18-40 years
3. Body mass index (BMI) 25- 29.9 kg/m<sup>2</sup> (pre-obese) and 30.0-34.9 kg/m<sup>2</sup> (obese class I) [14,15].
4. Waist hip ratio >0.9cms for males and > 0.8cms for females [16].

Subjects with any of the following were excluded:

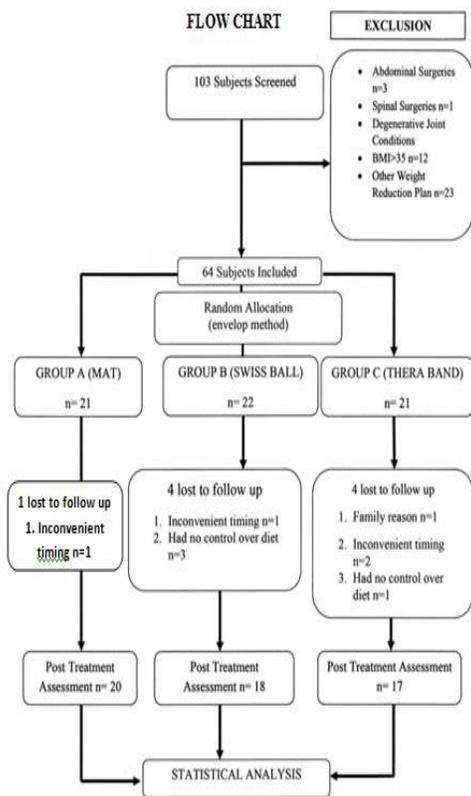
1. Subjects who have undergone abdominal surgeries 6months prior to the study
2. Subjects who have undergone spinal surgeries
3. Subjects with prior experience of mat, swiss ball and theraband exercises
4. Subjects with any degenerative joint conditions, acute low back ache, systemic conditions
5. Subjects on any other weight reduction plan e.g. medications, massage surgery during the study period.

Ethical clearance was obtained from institutional review board. Based on eligibility criteria participants were included. Prior to the

commencement of the procedure, the purpose of this study was explained and a written informed consent was obtained from all the participants who were willing to participate in this study. Pre and post assessment was done using 4 outcome measures body mass index, waist circumference, waist/ hip ratio and abdominal skin fold thickness measurements.

After initial assessment the subjects were randomly allocated into 3 groups with each group consisting of 20 subjects. Envelope method was used for the purpose of allocation of the subjects into the three groups.

Each group was given abdominal exercises and a low caloric diet plan for a duration of 5days per week for 5weeks.



Group 'A' was given mat exercises + diet plan, Group 'B' was given swiss ball exercises + diet plan and Group 'C' was given thera band exercises + diet plan. The mat exercise group received the following exercises [17] (Refer Fig1: photos 1-5)

1. Plank
2. V- Up
3. Oblique Crunch
4. Scissor Kicks
5. Abdominal Crunches

**Fig 1: MAT Exercises.**



For Swiss ball exercise group 175- 195cm Medium size ball or 195cm + Large size ball was used. The Swiss ball exercise group received the following exercises [18] (Refer Fig 2: photos 6-9)

1. Exercise ball abdominal curl up
2. Exercise ball abdominal oblique curl up in bridge
3. Knee tuck on exercise ball
4. Back extension on exercise ball

**Fig 2: SWISS Ball Exercises.**



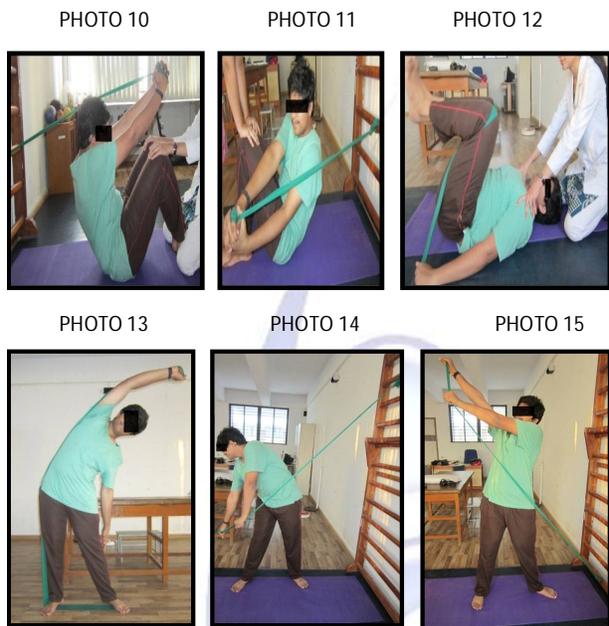
For the theraband group, Green Theraband with a resistance of 5.0lb and blue Theraband with a resistance of 7.5lb was used. The Thera band exercise group received the following exercises [19] (Refer Fig 3: photos 10-15)

1. Thera-Band abdominal crunch in supine
2. Thera-Band abdominal oblique crunch in supine
3. Thera-Band abdominal crunch (lower abs)

4. Diagonal chop/lift

5. Side Bends

Fig 3: Thera Band Exercises.



5-weeks of training program for 5 days per week were given to all the participants of the study [20].

- During the first week, the subjects performed 3 sets of 15 repetitions of each exercise.
- During the second week, the subjects performed 4 sets of 15 repetitions of each exercise.
- During the third and fourth weeks, the subjects performed 4 sets of 20 repetitions of each exercise.
- During the fifth week, participants performed 4 sets of 25 repetitions of each exercise.

All the volunteer participants of the study were given a common diet chart which was prepared by a certified dietician containing maximum of 1500 calories that includes separate plan for vegetarian and non vegetarian subjects during the course of the study all the participants were instructed to maintain a diary so as to keep a check on the diet.

After 5weeks the post-interventional responses were recorded for in the form of BMI, waist circumference, waist/ hip and abdominal skin fold thickness.

**Statistical Analysis:**

Statistical analysis of the present study was done using statistical package of social sciences (SPSS) version 17 so as to verify the results

obtained. Comparison of the pre and post intervention outcome measures within the group was done using paired t test whereas one way ANOVA was utilized to measure the difference between three groups Pair wise comparison of the 3 groups was done using Tukey's multiple post hoc procedure.

**RESULTS**

103 subjects were screened out of which 64 subjects who met the inclusion criteria participated in this interventional study. The mean age group of subjects in this study was between 18- 45. The mean age of the participants in group A was 26 ±6.05 years, group B 24.17 ±4.25 and group C was 23.65 ± 4.49 The difference in mean age of three groups was statistically not significant. The gender distribution in each group was such that there was 1 male and 19 female subject in the mat group, the swiss ball group included 18 female subjects with no male participants and in the theraband group there were 4 males and 13 female subjects.

**Table 1:** Comparison of MAT, SWISS BALL and THERABAND EXERCISE Groups with respect to BMI Scores.

| Groups                                   | Pretest      | Posttest     | Changes from pretest to posttest |            |
|--|--------------|--------------|----------------------------------|------------|
|  | Mean         | Mean         | Mean                             |            |
| Mat exercise                             | 25.38 ± 2.85 | 23.71 ± 2.76 | 1.67 ± 0.64                      |            |
| Swiss ball exercise                      | 27.20 ± 2.73 | 25.22 ± 2.19 | 1.98 ± 1.29                      |            |
| Thera band exercise                      | 25.69 ± 1.29 | 23.20 ± 1.20 | 1.45 ± 0.57                      |            |
| % of change in Mat exercise group        |              |              | 6.59%#                           | p=0.00001* |
| % of change in Swiss ball exercise group |              |              | 7.27%#                           | p=0.00001* |
| % of change in Thera band exercise group |              |              | 5.63%#                           | p=0.00001* |
| F-value                                  | 2.9551       | 2.3164       | 1.5638                           |            |
| p-value                                  | 0.0609       | 0.0487       | 0.219                            |            |

\*p<0.05, # applied paired t test

Results state an improvement in BMI when within group scores were analyzed with p value <0.001. But no statistical difference was noted when between group scores were compared. (Refer Table No.1) The results shown in table 2 states that significant improvement was also noted in waist/hip ratio when within group scores were analyzed with p value <0.001. No statistical difference was noted when between group scores were compared. (Refer Table No. 2)The results seen in table 3 states that significant within group improvement was seen in the

abdominal skin fold thickness measurements with p value <0.001 but no significant difference was seen when between group scores were compared. (Refer Table No. 3)

**Table 2:** Comparison of MAT, SWISS BALL and THERA BAND EXERCISE Groups with respect to WAIST/HIP ratio.

| Groups                                   | Pretest     | Posttest    | Changes from pretest to posttest |           |
|--|-------------|-------------|----------------------------------|-----------|
|  | Mean        | Mean        | Mean                             |           |
| Mat exercise                             | 0.87 ± 0.09 | 0.83 ± 0.06 | 0.07 ± 0.05                      |           |
| Swiss ball exercise                      | 0.89 ± 0.08 | 0.82 ± 0.04 | 0.06 ± 0.04                      |           |
| Thera band exercise                      | 0.88 ± 0.03 | 0.83 ± 0.03 | 0.04 ± 0.02                      |           |
| % of change in Mat exercise group        |             |             | 6.75%#                           | p=0.0003* |
| % of change in Swiss ball exercise group |             |             | 6.67%#                           | p=0.0002* |
| % of change in Thera band exercise group |             |             | 4.81%#                           | p=0.0001* |
| F-value                                  | 0.1126      | 0.4627      | 0.6176                           |           |
| p-value                                  | 0.8937      | 0.6321      | 0.5431                           |           |

\*p<0.05, # applied paired t test

**Table 3:** Comparison of MAT, SWISS BALL And THERA BAND EXERCISE Groups With Respect To Skin Fold Thickness Measurement.

| Groups                                   | Pretest      | Posttest     | Changes from pretest to posttest |            |
|--|--------------|--------------|----------------------------------|------------|
|  | Mean         | Mean         | Mean                             |            |
| Mat exercise                             | 34.95 ± 5.06 | 31.55 ± 4.96 | 3.40 ± 2.39                      |            |
| Swiss ball exercise                      | 39.72 ± 4.01 | 33.94 ± 4.02 | 4.78 ± 1.70                      |            |
| Thera band exercise                      | 41.18 ± 3.24 | 34.88 ± 4.14 | 3.29 ± 2.34                      |            |
| % of change in Mat exercise group        |              |              | 9.73%#                           | p=0.00001* |
| % of change in Swiss ball exercise group |              |              | 12.03%#                          | p=0.00001* |
| % of change in Thera band exercise group |              |              | 8.00%#                           | p=0.00001* |
| F-value                                  | 11.2083      | 9.5055       | 2.6209                           |            |
| p-value                                  | 0.0001*      | 0.0003*      | 0.0823                           |            |

\*p<0.05, # applied paired t test

## DISCUSSION

The present study was conducted to compare the effect of 5week training program between Mat, Swiss ball and Theraband exercises on waist hip ratio, abdominal skin fold thickness and BMI as to find out which of the three are better methods in reducing abdominal fat.

Till date the gold standard treatment for abdominal obesity is a combination of exercise with a low calorie diet plan. Keeping this into consideration all the subjects in the present study were given a common diet plan and a diet

chart with a maximum calorie intake of 1500Kcal which was maintained during 5weeks of intervention. Layman D et al examined the interaction of 2 diets. It was concluded that high protein diet + exercise resulted in greater loss of total body weight, fat mass and tended to lose less lean mass [21]. Studies which have been done on abdominal exercises have included subjects with different age groups. In the present study age group of 18- 45 was considered as it falls under the adult age group category [22]. Since natural menopause occurs in between 45 and 55 years hence age beyond 45 is considered as menopausal age group for females [23]. Literature review also suggest that as the age advances there is loss of both muscle and bone mass with the gain in fat, especially abdominal fat due to hormonal changes.

According to WHO body mass index (BMI) is one of the best indicator for generalized obesity and is classified as underweight, normal, pre obese and obese [15]. It was considered to include only 2 categories of BMI in the present study namely the pre obese and obese class as they do not fall under the category of morbid obesity. BMI is a good indicator of generalized obesity but its known disadvantage is that it cannot find the fat distribution in the body [24], hence keeping the objective of the present study into consideration waist circumference, waist hip ratio and abdominal skin fold thickness measurement are considered as more valid and reliable outcome measures [25,26]. Chan D and Watts G (2003) postulated that waist circumference, waist hip ratio are superior predictors of anterior subcutaneous abdominal adipose mass and posterior subcutaneous abdominal adipose mass [27].

For all the outcome measures of the 3 study groups namely mat, swiss ball and thera band exercise group showed significant difference when compared to their pre and post interventional values. These results were expected as per the literature review which resulted in studies that have shown effectiveness of all 3 methods of exercise in reducing abdominal fat.

In the present study the subjects in the mat exercise group showed significant reduction in abdominal fat. This could be because

strengthens the abdominal muscles would have firmed the waist line, improved posture and resulted in trimmer appearance [28]. Secondly a low calorie diet was maintained by the subjects as well as the intensity of exercise was progressively increases<sup>29</sup>. In contradiction to the present study, a study done by Vispute et al who noted that 6 weeks of abdominal exercise training alone was not sufficient to reduce abdominal subcutaneous fat and other measures of body composition [30]. This could be because a diet was not maintained as well as intensity of exercise was kept constant.

The effective results with mat exercise could also be because of higher activity of abdominal muscles in particular obliques and core muscle which is been proved in electromyography (EMG) studies [12].

The improvement seen on reduction of fat in swiss ball exercise group was due to the following reasons firstly when exercises are performed on unstable surface the level of muscle activity increases and in order to stabilize the spine muscle co- activation takes place suggesting a higher demand on the motor control system [31]. Secondly swiss ball exercises involve mid range work outs, more muscle activity is seen when exercises are performed in mid range [32]. Lastly higher abdominal muscle activity is noted when exercises are performed on swiss ball and is been proved in several studies done on electromyography (EMG) [33].

The improvement noted in thera band exercise group on abdominal fat could be because of the elastic resistance which does not rely on gravity and that it provides continuous tension to the muscles being trained. Another unique benefit could be that elastic resistance offers a linear variable resistance. This means as the range of motion of the exercise increases, the resistance provided by the elastic equipment increases. Due to this as the resistance increases, the number of muscle fibers that are being used in the exercising muscle increase. More the muscle fibers used, the greater the adaptations in muscle strength that can be achieved with the training program. These changes can be presumably associated with strength gains and thus helping in building lean body mass and

therefore resulting in reduction of fat. Resistance training requires more energy expenditure. As a result it helps in reducing and breaking down fat [34].

The researches performed on elastic resistance suggest that elastic tubing resistance can also provide more functional strength, greater ability to change muscle emphasis during exercises, greater muscle power development and easier use [29].

In the present study it was hypothesized that swiss ball exercise and thera band exercise would show to be more effective than the conventional mat exercise. As the literature review suggest that a study by Cosio-Lima LM et al stated that floor exercises primarily strengthen the hip flexors and only minimally affect the core abdominal muscles since they are performed on a linear plane. Performing curl-ups and back extensions on the physioball may be a better method of strengthening core muscles since exercises are performed on an unstable surface that stressed the musculature and resulted in increase in muscle activity [13].

In the conventional mat exercise there is no added resistance and only body weight acts as resistance but with thera band the subject is made to perform the exercises with added elastic resistance.

In the present study when pair wise comparison was done between the groups all the 3 types of abdominal exercises showed to be equally effective in other words no single type of exercise showed to be more superior than the other 2 types of exercise hence null hypothesis was accepted.

Equal effect which was seen in the present study could be because a fine balance between energy intake and energy expenditure was maintained [10]. Maintenance of negative net energy balance promotes weight loss. Hence the intensity of exercise has to be increased progressively which was done in the present study.

#### **LIMITATIONS:**

Due to shorter study duration long term effect of the 3 exercises on abdominal fat was not taken into account, gender distribution was unequal with less number of male participants in all the

3 groups, a better objective outcome like EMG, ultra sonography and dual energy X ray absorptiometry were not used.

## CONCLUSION

The results of this study conclude that a 5week exercises program on mat, swiss ball and thera band are considered to be equally effective in reducing abdominal fat. Future studies can be carried out incorporating different types of comparison and using a direct outcome measure thus trying to overcome the limitations

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**Conflicts of interest:** None

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