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ORIGINAL ARTICLE

A COMPARATIVE STUDY TO FIND THE EFFECTIVENESS OF SWISS BALL AND THERA BAND EXERCISE ON ABDOMINAL GIRTH AND QUALITY OF LIFE OF OBESE CHILDREN

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ABSTRACT

Background of study: Obesity refers to a condition of having excessive amount of body fat. The WHO has described obesity as one of today's most neglected public health problem, affecting every region of the country. The intra-abdominal fat carries a greater health risk than that stored elsewhere in the body. The study was attempted to compare the effectiveness of Swiss ball and Thera band exercise on abdominal girth and quality of life of obesity children. The objective of the study is to find the effectiveness of Swiss ball and Thera band exercise on abdominal girth and quality of life of obesity children. **Methodology:** This study is an experimental type design, comparative pre-post type. 30 children with obesity were selected and randomly divided into two groups. Children aged 8-12 and whose BMI values were 30-34.9 kg/m², children who had not continued a diet program for 3 months were included in the study. The children with any psychological conditions, or any other weight reduction plan, who cannot do exercise, above 12 and below 8 aged children were excluded in the study. The waist circumference, waist hip ratio and the pediatric quality of life inventory (Peds QL) was used as outcome measures. The study duration was up to 12 weeks. **Result:** Group A Swiss ball exercises showed marked improved than the Group B TheraBand exercises. **Conclusion.** The result of this study showed an improvement in reduction of abdominal girth of obese children.

Keyword: Obese child; Waist circumference; Hip -waist ratio; The pediatric quality of life inventory

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INTRODUCTION

Obesity is one of the most important health problems in both developing and developed countries¹. 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 countries².

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 epidemic³.

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 obese⁴. 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 mellitus⁵. In general, the risk of developing complications increases with the level of obesity.

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 1999-2000⁶.

Prevalence of obesity, particularly in children and adolescents, has gradually increased in recent years⁷. Excess of weight leads to more stress on musculoskeletal system and this causes both musculoskeletal injuries and postural deformities⁸. Motor performances of

children are also negatively affected by excess weight⁹.

Inadequate physical activity of overweight children leads to impaired postural control so more extremity injuries and more fractures are observed in this population¹⁰. As a result of these issues, overweight and obese children have lower level of health related QoL than their peers with normal weight¹¹.

Within the obesity treatment, planning a diet program and increasing physical activity are the basic approaches. Inactive life in childhood may cause various problems like obesity and cardiovascular diseases. A new diagnosis called “Exercise-Deficit Disorder” has been generated to emphasize this life style¹².

Participating in physical activity alone will not be a sufficient intervention to prevent or treat childhood obesity. However, it may support weight loss and decrease cardiovascular risk in the case of obesity¹³.

When the roles of physiotherapists in managing childhood obesity are investigated, they treat the pain developing from musculoskeletal system of obese children, try to prevent postural problems and plan effective exercise programs¹⁴.

Doing regular exercise contributes to treat childhood obesity and to solve the problems coming from obesity such as, musculoskeletal problems and low level of QoL. The primary benefit of exercising with a swiss ball as opposed to exercising directly on a hard flat surface is that body responds to the instability of the ball to remain balanced, engaging many more muscles. Those muscles become stronger over time to keep balance¹⁵.

Thera band used to perform strength training exercise without weights. Full body workouts with different varieties and different intensities will be performed using Thera band. Training with Thera band improves the flexibility, range of motion and muscle strength.

METHODOLOGY

This study was an experimental study design with comparative pre and post test type. This study included **30** obese children as samples. The study setting done at K.B.C.S. Vivekananda Vidyalaya, Veerapuram, Avadi. Simple random sampling method used to allocate the samples in two groups and the study conducted for a duration of 12 weeks.

Inclusion criteria: Children between 8-12 years old, Children whose BMI values were 30- 34.9 kg/m², Children who had not continued to a diet program for 3 months.

Exclusion criteria: Children with psychological conditions, Children on any other weight reduction plan, Children who cannot do exercises, Children above the age of 12 and children below the age of 8 were excluded from the study.

Thera band and Swiss ball are used as materials for the study. Waist circumference and Waist hip ratio were the outcome measures used in the study. The pediatric quality of life inventory (PedsQL) was used to determine and compare their quality of life (QoL) were used as measurement tools for the study.

Procedure: 30 children aged 8-12 were randomly selected in this study. The BMI was used as the assessment scale to find the obese children. Height and weight of the children was taken to calculate the BMI. For the obese children, the waist circumference and the hip

circumference were taken with the measurement tape. Waist circumference was measured at the umbilical level or lower rib level. Hip circumference was measured at the widest gluteal level. The pediatric quality of life inventory (PedsQL) was used to check their quality of life.

The 30 obese children are divided into two groups (GROUP A -15 & GROUP B -15). Group A was given Swiss ball exercise and Group B was given Thera band exercise.

GROUP – A (SWISS BALL):

- Plank on Swiss Ball: Subject lies in prone position with forearm supported on Swiss ball.
- Back Extension on Swiss Ball: Subject lies on prone lying Swiss ball was kept under abdomen. Arm should clasp behind head. Subject is instructed to trunk flexion and extension. This exercise is repeated for 5 times per day.
- Swiss Ball Crunch: Subject lies on supine lying where Swiss ball was kept under lumbosacral region with 90 degree of knee flexion. Arm should keep along body or crossed on the top of the chest. Lowering the torso into stretch position with stationary neck was the starting position. Subject was instructed to flex the hip by contracting abdomen and getting back into starting position.
- Exercise Ball Abdominal Curl Up in Supine: Subject lies on supine lying where leg should place on Swiss ball. Hand is clasped in chest region. Subject is allowed to lift the trunk upward until the shoulder region off, from the floor.

GROUP – B (THERA BAND):

1. Theraband abdominal crunch in supine: the subject is asked to lie back and the knees bent with the elbows and lift the shoulder blades off the floor. The subject is asked to hold 10 seconds and then relax practiced twice a day.
2. Theraband abdominal oblique crunch in supine: after attaching the ends of the band on the object. The subject is asked to extend one arm in front and grasp the middle of loop, by keeping elbows straight. The subject is asked to hold 10 seconds and then relax practiced twice a day.
3. Theraband trunk rotation in standing: securely attach one end of the band. Tell the patient to keep the feet flat on the floor and back straight. Grasp the other end of the band at chest level. Rotate shoulders away from the attachment, stretching the band. The subject is asked to hold 10 seconds and then relax practiced twice a day.
4. Theraband trunk extension – long sitting: the patient is asked to sit in floor and grasp the both end of band with the hands at the chest. The patient should keep the lumbar spine straight by extending the hip. The subject is asked to hold 10 seconds and then relax practiced twice a day.
5. Data analysis-The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24. Paired t-test was adopted to find the statistical difference within the groups & independent t-test (student t-test) was adopted to find statistical difference between the groups.

WC	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	105.66	8.79	105.20	5.84	.171	28	.865*
POST TEST	94.73	6.50	101.00	6.77	-2.58	28	.015**

(* - $P > 0.05$), (** - $P \leq 0.05$)

Table-1 Comparison of Waist Circumference Between Group – A And Group - B In Pre and Post Test

#HWR	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	.978	.022	.976	.976	.027	28	.829*
POST TEST	.829	.028	.975	.026	.218	28	.002**

Table - 2 Comparison of Hip Waist Ratio between Group – A And Group - B In Pre and Post Test

PH	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	40.59	2.46	40.11	15.11	.122	28	.904*
POST TEST	53.29	10.93	42.97	13.84	2.26	28	.031**

(*- $P > 0.05$), (**- $P \leq 0.05$)**Table- 3** Comparison of Physical Health Questionnaire between Group – A And Group - B In Pre and Post Test

EF	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	34.33	6.51	34.53	9.07	-.069	28	.945*
POST TEST	61.33	8.54	48.08	15.36	2.88	28	.008**

Table-4 Comparison of Emotional Functioning Questionnaire between Group – A And Group - B In Pre and Post Test

SF	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	30.00	7.31	31.66	6.98	-.638	28	.529*
POST TEST	59.33	9.42	50.74	22.97	1.34	28	.031**

Table -5 Comparison Social Functioning Questionnaire between Group – A And Group - B In Pre and Post Test

SF	GROUP - A		GROUP - B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE-TEST	39.80	16.01	40.67	11.34	-.172	28	.864*
POST TEST	69.42	9.28	52.86	20.49	2.85	28	.008**

(* - $P > 0.05$), (** - $P \leq 0.05$)

Table – 6 Comparison School Functioning Questionnaire between Group – A And Group - B In Pre and Post Test

#VARIABLES	PRE-TEST		POST-TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
Waist Circumference	105.66	8.79	94.73	6.50	12.72	.000***
Hip Waist Ratio	.978	.022	.829	.028	14.11	.000***
Physical Health	40.59	2.46	53.29	10.03	-4.71	.000***
Emotional Function	34.33	6.51	61.33	8.54	-11.34	.000***
Social Function	30.00	7.31	59.33	9.42	-10.18	.000***
School Function	39.80	16.01	69.42	9.28	-5.32	.000***

(*** - $P \leq 0.001$)

Table -7 Comparison of dependent variables within group – A between pre & posttest values

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A .There is a statistically highly significant difference between the pre-test and post-test values within Group A (***- $P \leq 0.001$).

#VARIABLES	PRE-TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
Waist Circumference	105.20	5.84	101	6.77	6.87	.002**
Hip Waist Ratio	.976	.027	.975	.026	1.00	.033**
Physical Health	40.11	15.11	42.97	13.84	-2.13	.049**
Emotional Function	34.53	9.07	48.08	15.36	-4.74	.002**
Social Function	31.66	6.98	50.74	22.97	-3.66	.003**
School Function	40.67	11.34	52.86	20.49	-3.81	.002**

Table -8 Comparison of Dependent Variables Within Group – B Between Pre & Post Test Values

RESULTS

On comparing the Mean values of Group- A & Group B on Waist Circumference, it shows significant decrease in the post test Mean values but (Group A- Swiss ball Exercises) shows 94.73 which has the Lower Mean value is more effective than (Group B – Thera band Exercises) 101.00 at $P \leq 0.05$.

On comparing the Mean values of Group- A & Group B on Hip Waist Ratio, it shows significant decrease in the post test Mean values but (Group A – Swiss ball Exercises) shows .829 which has the Lower Mean value is more effective than (Group B – Thera band Exercises) .975 at $P \leq 0.05$.

On comparing the Mean values of Group A & Group B on Physical Function, Emotional Function, Social Function & School Function, it shows significant increase in the post test Mean values but (Group A – Swiss ball Exercises) shows 53.29,61.33, 59.33 & 69.42 respectively which has the Higher Mean value is more effective than (Group B – Thera band Exercises) 42.97,48.08, 50.74 & 52.86 respectively at $P \leq 0.05$.

On comparing Pre-test and Post-test within Group A on Waist Circumference, Hip Waist Ratio, Physical Function, Emotional Function, Social Function & School Function shows highly significant difference in Mean values at $P \leq 0.001$

On comparing Pre-test and Post-test within Group B on Waist Circumference, Hip Waist Ratio, Physical Function, Emotional Function, Social Function & School Function shows significant difference in Mean values at $P \leq 0.05$.

DISCUSSION

The principle finding of the present study was that Swiss ball exercise was significantly more effective than TheraBand exercise in reduction of abdominal girth muscle among obese children as measured by hip circumference and waist circumference. It was noticed that there was improvement in above parameters in all the two groups.

This study supports the finding of; Kanika. D. Muniyar et.al [2018] showed that Swiss ball exercise are effective to improve the equilibrium and trunk stabilization. Wong Jang Yo et.al [2017] showed that the elasticity of the ball speculated to act as unstable ground and increase the balance.

Aarti Welling et.al [2015] showed that Swiss ball shows an improvement in reduction of fat and increases the muscle activity and stabilizes the spine muscle. Marcelo Cardoso de Souza et.al [2017] showed that the Swiss ball activates the core muscle stabilization and improve the mobility and functional capacity.

Prateek Srivastav et.al [2016] showed that Swiss ball increases the muscular activity of treatment abdominis and helps in the development of core stability. Jwajun Kim et.al [2015] showed that Swiss ball improved the respiratory function and trunk control. Gui Bin song et.al [2015] showed that the Swiss ball improved the trunk stability and symmetric development supported by strengthened muscle around the spine.

Emil Sundstrup et.al [2015] showed that the Swiss ball is effective for the rectus abdominis in EMG with a concomitant low rectus femoris activity. JEOUNG – Ah – et.al [2015] showed that the Swiss ball provides greater extension and flexion movements and improved core stability. Seong Gil Kim et.al [2014] showed that the Swiss ball increased the muscle activity and effective at increasing muscle activity.

The study demonstrated that the swiss ball exercise enhanced muscular activity and was successful in doing so. After completing the trunk stabilisation training programme of this study, core muscles such the rectus abdominis, erector spinae, quadratus lumborum, external oblique, and gluteus medius were more active¹⁶.

Both healthy children and obese children with chronic conditions benefit greatly from physical activity. To prevent and treat obesity, it is crucial to create physical activity plans that take into account each child's unique health situation¹⁷.

Previous studies have demonstrated that Swiss ball exercise elicits greater total core muscle work than mat exercise. These studies support our evidence and hence swiss ball exercises helps to reduce the obesity in childrens¹⁸.

In core stability programs using a Swiss ball, Thera-bands, and a mat, The thera-band group showed the most reduced VAS followed by the Swiss ball group, and the mat group. Hence shows that swiss ball exercise is effective¹⁹.

Similarly, the mean value of Group A post-test (94.73) of waist circumference, which when compared with Group B (101.00), Group A showed lesser mean value than Group B. The mean value of Group A posttest (.829) of hip waist ratio which when compared with Group B

(.975), Group A showed better effect than Group B.

The mean value of Group A posttest (53.29) of physical health questionnaire when compared with Group B (42.97), Group A showed better effect than Group B. The mean value of Group A posttest (61.33) of emotional functioning questionnaire when compared with Group B (48.08), Group A showed better effect than Group B. The mean value of Group A posttest (59.33) of social functioning questionnaire when compared with Group B (50.74), Group A showed better effect than Group B.

The mean value of Group A posttest (69.42) of school functioning Questionnaire when compared with Group B (52.86), Group A showed better effect than Group B. This study shows that the two groups improved in all the parameters after intervention, Group A showed a marked improvement than Group B.

Ethical Clearance: Ethical clearance has obtained from Faculty of Physiotherapy, Dr. MGR. Educational and Research Institute, Chennai, Tamil Nadu, Reference number: No: C-05/PHYSIO/IRB/2018-2019, Dated: 07/01/2019.

Conflict of interest: There was no conflict of interest to conduct this study.

Fund for the study: It was a self-financed study.

CONCLUSION

The result of this study showed an improvement in reduction of abdominal girth of obese children. Both was effective but while comparing the groups A and B. Group A (swiss ball) showed marked improvement in pedsQL Questionnaire, waist circumference and hip-

waist ratio than Group B (Thera band) in subjects with obesity.

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