



EFFECT OF PILATES EXERCISE PROGRAMME ON BMI, BALANCE AND RESPIRATORY FUNCTION IN OBESE ADOLESCENTS

Physiotherapy

Sneha Chavan*	Masters of Neuro Physiotherapy, Department of Neuro Physiotherapy. *Corresponding Author
Dr. Vidhi Shah	Professor, Masters in Pediatric Physiotherapy, Department of Pediatric Physiotherapy.
Pranjali Chavan	Masters of Pediatric Physiotherapy, Department of Pediatric Physiotherapy.

ABSTRACT

Background - Worldwide obesity affects the physical and mental performance of the adolescent individual. It affects balance and respiratory function and hence interventions are needed to reduce increased weight of the individual. Evidence supports that Pilates exercise programme works to reduce the obesity and increase the physical performance.

Objective - The objective of the study is to find out that effect of Pilates exercise programme on Body mass index, balance and respiratory function.

Methods - Total 60 participants were included in this study from various schools of Chinchwad, Pune. There was total 15 sessions of Pilate's exercises which were completed within 3 weeks.

Results - Mean age of 60 (M: F - 1:1) was 14.2±3.46 years. Mean BMI before exercise decreases from 27.70 to 26.97 kg/m² (p=0.028). Mean paediatric balance scale decreases from 43.73 to 49.23 (p=0.0001). There was significant improvement in FVC, FEV1 & PEFR among adolescents (p<0.05). Pilate's exercises are effective in reducing their weight of an individual and thus it improved their balance. Pilates worked on the core muscles which helped in reducing abdominal fat and thus their breathing capacity improved which leads to increase their respiratory capacity.

Conclusion - Pilate's exercise reduces the weight and improves adolescent's physical performance.

KEYWORDS

Pilates exercises, Adolescent, BMI, balance, Lung volumes

INTRODUCTION:

WHO has surveyed around 20 million overweight and obese children worldwide till this year which are above five years till adolescents. Prevalence of obese children between the age group of 10-16 years was about 13.14%. In Maharashtra, the prevalence was about 11-29% in 2010 and that of Pune between the age group of 9-19 years prevalence of males were 25.7% which was higher than females under the study which was done in 2010. The cause of obesity resulted into an increased energy content of diet, low levels of physical activity or exercises and increased sedentary lifestyle. Overweight or obesity can lead to increase in problem of respiratory diseases like asthma, behavioral and other psychological concern.¹ Obesity is the dynamic term as New World syndrome as it has wide impact on the social, economic and public health burden in poorer countries. Due to obesity there is imbalance in the calorie intake as the calorie is utilized. In the study of overweight and obesity, the rising problem in India done by Bhargava M et al concluded that children studying in private schools which are not belonging to the low socio economic status have high chances of getting overweight and obese due to their high socio economic status.² Thus, obesity is the mediator which causes inflammation like leucocytes or prostaglandins which tends to be the co factor of interleukin 6 and tumor necrosis factor alpha which produces by the macrophages and monocytes and thus is key role for C reactive protein which is the main stream to increase the obesity.³ The reason for high epidemic is as mentioned due to poor lifestyle like television watching for daily 5 to 6 hours, sitting constantly at one place for many hours or no physical sports or lazy attitude.⁴ Another study was the effect in respiratory function and hyper responsiveness in childhood obesity concluded that the respiratory capacity is reduced in overweight and obese patients. It mainly affects the lung volume and reduces its compliance.

Since obese children who fall are more likely to require long term care, preventing falls help obese children to maintain their independence. Many fall prevention programmes have been implemented in communities with regards of its effectiveness. Pilates exercises has been effective for strength, gait and balance in elderly individuals has been proven.

Obesity has increased body mass index (BMI) as there is increased weight with comparison to height. Hence, there is difficulty in balance with increased BMI. These children have the problems of balance due to increased weight and waist circumference with reduced lung capacity. Due to obesity, individuals have breathing difficulty with reduced physical activities. Hence, in this study, we had evaluated the balance, BMI and respiratory function with Pilates exercise programme.

MATERIAL & METHODS:

Interventional study was conducted in obese adolescents between 10 to 19 years (BMI < 25 kg/m²) over 3 weeks. The study protocol was approved by the ethics committee of Dr. D. Y. Patil college of Physiotherapy. Total 60 participants were recruited from various schools from Chinchwad, Pune. The total drop outs were about 10 in total from the study. Written informed consent was obtained from parents and participants. Adolescent with syncope, vertigo, deformity of lower extremities and recent fracture were excluded from study. Body mass index (BMI) was calculated from weight (kg) by weigh machine and height (m²) by measuring tape attached to wall. Maximum paediatric balance scale consist of 14 activities scoring 0 to 4 for each activity so maximum score can be 56 in an individual. Data was recorded before and afterwards on 2nd & 3rd week. Pulmonary function test was performed with the help of spirometry machine. Forced vital capacity (FVC), forced expiratory volume 1 second (FEV1) and FEV1/FVC was assessed before and 3rd week following exercise.

Pilate's exercises were given for 15 sessions within 3 weeks. The treatment had lasts for atleast 45 minutes. In this programme, 10 minutes was of warm up session followed by Pilate's exercises which was of 25 minutes and then lastly cool down exercises for 10 minutes, Details of Pilates exercises as per below table. (Table 1)

Table 1: Details of Exercises			
Exercises		Time limit	Total duration
Warm up exercises	Normal breathing	2 min	10 min
	Spinal rotation	5 count, 1 set	
	Scapula elevation	5 count, 1 set	
	Hip rolls	5 count, 1 set	
	Arm circles	5 count, 1 set	
Mat Pilates exercises	Hundreds level 1	5 counts, 2 set	25 min
	Spine stretch	5 counts, 2 set	
	Forward	5 counts, 2 set	
	Saw	5 counts, 2 set	
	Corkscrew	5 counts, 2 set	
Standing Pilates exercises	Hundreds level 2	5 counts, 2 set	
	Pilates front, side and back kicks	5 counts, 2 set	
	Pilates lunges	5 counts, 2 set	
Cool down exercises	Whole body stretch with breathe in and out	3 times	10 min
	Quadriceps stretch	5 counts	
	Hamstring stretch	5 counts	

Mat Exercises - Hundreds level 1- Patient in relaxed supine position

with arms alongside and legs lying on the ground with feet apart. When the exercise starts, lift the legs till 45 degrees of hip elevation with the arms trying to reach the arms and head lifting up. Pump both arms with breathing in and out. Set of 30-30-30 for complete 100 pumps and then relax the whole. While performing, there should be contraction of core muscles.

Spine stretch forward- Patient position should be long sitting position and head in neutral position, arms by the side and legs away from each other. Then reaching the arms forward with bending forward and there should be breathing pattern carried on while performing this exercise.

Saw - Patient position again like long sitting position with legs apart and stretching the arms to the side with flexing and twisting to the right. Again extend the left hand towards the right foot.

Corkscrew - Patient position lying on the back and both the legs on the ground. Then perform with breathe in and out with one leg toward the ceiling and drawing a circle. Both the hips should be performed equally with clockwise and anticlockwise direction.

Double leg kicks- Patient position in prone lying and arms side by the chest. Kick back with knee flexion. Exercise needs to be done with alternate breathe in and out.

Hundreds level 2 - This exercise is the second level of hundreds which is used to improve balance. Patient stands in position with the arms hanging, and stands on toes with legs apart. Flap both the hands with legs apart with breathing control.

Front, side and back kicks- Patient position in standing neutral and then trying kicking front, back and side with alternate breathing pattern.

Pilates lunges- Patient position in standing neutral position with arms both on the waist and then while performing lunge one leg forward with breathing control. Repeat this exercise with other leg too.

Cool down exercises- whole body stretching in standing with hamstring and calf stretches. Cool down was performed to relax the body and return to normal state. Each exercise was taught with benefit of how exercises are useful to the body and how an exercise works for the body. Breaks were taken in between when the subjects were exhausted or felt fatigue.

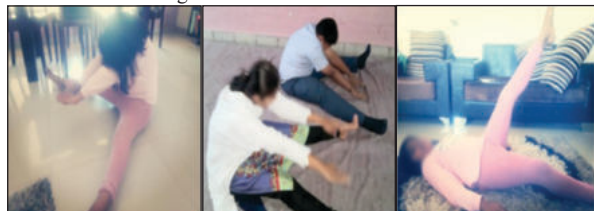


Image: Spine stretch forward

Image: SAW

Image: Corkscrew



Image: Double Leg Kicks

Image: Hundreds level 2

Image: Front & Back kicks

RESULTS:

Mean of 60 (Male 30, Female 30) study sample in this study was 14.2 years (SD ± 3.46). The outcome measure body mass index, paediatric balance scale and pulmonary function test (FVC, FEV1, FEV1/FVC and PEFR) was assessed after 15 sessions of exercise.

Mean BMI decreases till gradually till three week. Mean BMI before exercise was 27.70 kg/m² (SD ± 1.78) which decreases to 27.58 kg/m² (SD ± 1.78) after two week, and further decreased to 26.97 kg/m² (SD ± 1.82). There was significant reduction in BMI after three weeks in comparison with before exercises value ($p=0.028$). While mean

paediatric balance scale before exercise was 43.73 (SD ± 2.46) which increases to 45.15 (SD ± 2.18) after two week, and further increased to 49.23 (SD ± 2.12). There was significant increase in PBS after three weeks in comparison with before exercises value ($p=0.0001$). (Table 2)

Table 2: Paired statistics in BMI & PBS

Variable	Duration	Mean $\pm$ SD	P value
BMI	Before	27.70 $\pm$ 1.784	0.6355
	After 2 week	27.58 $\pm$ 1.788	
BMI	Before	27.70 $\pm$ 1.784	0.0287
	After 3 week	26.97 $\pm$ 1.82	
PBS	Before	43.73 $\pm$ 2.462	0.1805
	After 2 week	45.15 $\pm$ 2.185	
PBS	Before	43.73 $\pm$ 2.462	0.0001
	After 3 week	49.23 $\pm$ 2.118	

Mean FCV among study sample was increased from 1.99 lit (SD ± 1.19) to 2.33 lit (SD ± 0.21) in three weeks significantly similarly mean FEV1 and PEFR increases significantly in comparison with baseline prior exercise ($p=0.0001$ & 0.014 respectively). (Table 3)

Table 3: Paired statistics in lung volumes

Variable	Duration	Mean $\pm$ SD	P value
FVC	Before	1.99 $\pm$ 1.19	0.0001
	After 3 week	2.33 $\pm$ 0.21	
FEV1	Before	1.88 $\pm$ 0.29	0.0001
	After 3 week	2.11 $\pm$ 0.15	
FEV1/FVC	Before	107.18 $\pm$ 9.44	0.4436
	After 3 week	108.63 $\pm$ 11.15	
PEFR	Before	138.11 $\pm$ 26.97	0.014
	After 3 week	164.25 $\pm$ 29.12	

There was no significant improvement in BMI & PBS among adolescent after second week while there was significant improvement in it along with lung volumes after 3rd week following Pilate's exercises.

DISCUSSION:

In the present study we found out the Pilates exercise programme is effective on body mass, respiratory function and balance in obese adolescents within the age group of 10-19 years of age. In the present study, we found that there was significant improvement in body mass after 3rd week in comparison with before programme. From day 1 to post 2nd week, there was no significant difference found out. Similarly, Balance scale of obese adolescents significantly improve 3rd week after exercise in comparison with before programme. Significant improvement was seen in FVC and FEV1 and PEFR after 3 week with no significant difference found out with the difference of FEV1/FVC.

In the systematic review done by Jago R et al concludes that Pilates programme improves body composition which says further that, for obese adolescents pilates exercises reduced the body composition and improved their daily lifestyle. They have studied effect of pilates on body composition concluded that there were thirty samples of 11 years old girls which concluded that there is lowered percentile in the body mass after 4 weeks trial and Pilates promotes as a means of reducing obesity. In the comprehensive review of literature of after school based obesity prevention interventions.⁵

In obese individuals, there is weakness of core muscles which indirectly reduces the diaphragmatic activity. Due to decrease diaphragmatic activity, there is reduced inspiration. The primary inspiratory musculature is diaphragm which mostly does the action of inspiration and also acts in some amount of expiration. Pilates exercise works mainly diaphragmatic muscles mostly acts which controls and centralized with the help of this exercise programme and there is increase in the strength of diaphragmatic musculature which indirectly improves the inspiration and thus improving the lung vital capacity. The other outcome measure we observe is about the body mass (the composition) and balance. Due to Pilate's exercises, there is decreased body mass and waist circumference. Due to the focus on core exercises, there was reduction of fat percentage over the abdomen.⁶

CONCLUSION:

Pilate's exercise programme is effective in core muscle strengthening due to core muscle strengthening other factors of balance; weight and respiratory function (lung capacity) have also been improved. The study conclude that the Pilates exercise programme has been effective to reduce weight, improved balance and respiratory function (FEV1, FVC, PEFR) after 3 weeks of exercise programme.

REFERENCES:

1. Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting prevalence of overweight among 12-to 17-year-old urban adolescents in Hyderabad, India. *Obesity*. 2007 Jun;15(6):1384-90.
2. Madhavi Bhargava, S D Kandpal, Pradeep Aggarwal, Hem Chandra Sati. Overweight and Obesity in school children of a hill state in North India: Is the dichotomy urban-rural or socioeconomic? Results from a crosssectional survey. *PLoS One*.2016;11(5) e0156283. Published online 2016 May 26.doi:10.1371/journal.pone.0156283.
3. Kany S, Vollrath JT, Relja B. Cytokines in inflammatory disease. *International journal of molecular sciences*. 2019 Jan;20(23):6008.
4. Jago, R., Anderson, C., Baranowski, T., Watson, K., 2005. Adolescent patterns of physical activity: differences by gender, day and time of day. *Am. J. Prev. Med.* 28 (5), 447–452.
5. Jago R, Jonker ML, Missaghian M, Baranowski T. Effect of 4 weeks of Pilates on the body composition of young girls. *Preventive medicine*. 2006 Mar 1;42(3):177-80.
6. Wagner MO, Kastner J, Petermann F, Jekauc D, Worth A, Bös K. The impact of obesity on developmental coordination disorder in adolescence. *Research in developmental disabilities*. 2011 Sep 1;32(5):1970-6.