E-ISSN: 2707-7020
P-ISSN: 2707-7012
JSSN 2022; 3(2): 188-193
Received: 15-08-2022
Accepted: 17-09-2022

Dr. PK Senthilkumar
Associate Professor,
Department of Exercises Physiology and Bio-Mechanics, TNPESU,
Chennai, Tamil Nadu, India

Corresponding Author:
Dr. PK Senthilkumar
Associate Professor,
Department of Exercises Physiology and Bio-Mechanics, TNPESU,
Chennai, Tamil Nadu, India

Efficacy of Pilates exercise on health related fitness among overweight women

Dr. PK Senthilkumar

DOI: https://doi.org/10.33545/27077012.2022.v3.i2c.121

Abstract
The aim of this study was to determine the efficacy of Pilates exercise on health related fitness among overweight women. To achieve the purpose of the study thirty six overweight women were randomly selected as subjects and their age ranged between 30 to 35 years. They were divided into two groups. Group I acted as Pilates Exercise group (n=18), and Group II acted as control group (n=18). The experimental groups participated in the Pilates Exercise three days per week for a period of ten weeks. The subjects of the control group participated on their routine activities. To assess the cardiorespiratory fitness used Queens College step test and to measure Hip Range of Motionsit-and-reach test were used. The pre and post-test were conducted on cardiorespiratory endurance and flexibility of both experimental and control groups. The collected data were analyzed by using analysis of covariance (ANCOVA). The results revealed that there was a significant improvement on Maximal Oxygen Uptake and Hip Range of Motion. It was concluded that Pilates exercise is produced greater impact on Maximal Oxygen Uptake and Hip Range of Motion among Middle aged Women.

Keywords: Pilates exercise, maximal oxygen uptake and hip range of motion

Introduction
The World Health Organization (WHO) describes overweight and obesity as one of today's most important public health problems, which is escalating as a global epidemic (WHO, 2003) [19]. It is also increasingly recognized as a significant problem in developing countries and countries undergoing economic transition (Popkin, 2001) [15]. Overweight is generally defined as a deviation in body weight from some standard or "ideal" weight in relation to height. Health related fitness enhances one's ability to function efficiently and maintain a healthy lifestyle. Thus health related fitness is important for all individuals throughout life. "The five health-related components of physical fitness are more important to public health than are the components related to athletic ability (U.S. Centres for Disease Control and Prevention, 1996). Cardiorespiratory fitness reflects the functional capabilities of the heart, blood vessels, blood, lungs, and relevant muscles during various types of exercise demands. Cardiorespiratory fitness is related to the ability to perform large muscle, dynamic, moderate-to-high intensity exercise for prolonged periods (ACSM, 2005) [1]. The VO_2max is widely accepted as the criterion measure of cardiorespiratory fitness. The terms VO_2 max; aerobic power, aerobic capacity and maximal oxygen uptake are all terms used interchangeably. VO_2 max is expressed either as an absolute rate in litres of oxygen per minute (l/min) or as a relative rate in millilitres of oxygen per kilogram of body weight per minute (ml/kg/min). Oxygen uptake is considered the standard to measure the physiological intensity of exercise. VO_2 max may be defined as the highest oxygen (O_2) uptake accomplished by an individual breathing air at sea level (Astrand, 1952). Many of the fitness professionals indicated that the cardiorespiratory endurance is one of the most important fitness components in the health-related physical fitness components. It has been shown that VO_2 max for different people may be affected by several factors which include; age, gender, fitness and training, changes in altitude and action of the ventilator muscles (Noakes, Peltonen, & Rusko, 2001) [12]. The best measure of true VO_2max typically involves the exercise mode that recruits the greatest amount of musculature (Åstrand, *et al*., 2003) [3]. Muscular strength relates to the ability of the muscle to exert force. In other words, it is the maximal one effort force that can be exerted against a resistance, or the maximum amount of force that one can generate in an isolated movement of a single muscle group (ACSM, 2005 & Caspersen, Powell, and Christenson, 1985) [1, 4]. Muscular endurance relates to the

muscle's ability to continue to perform without fatigue (ACSM, 2005 & Caspersen, Powell, and Christenson, 1985) [1, 4].

In other words, it is the ability of the muscles to apply a submaximal force repeatedly or to sustain a submaximal muscular contraction for a certain period of time Flexibility is the functional capacity of the joints to move through a full range of movement (ACSM, 2005 & Caspersen, Powell and Christenson, 1985) [1, 4]. Flexibility is specific to each joint of the body. Muscles, ligaments, and tendons largely determine the amount of movement possible at each joint. Lisa Marie Bernardo (2007) [11] found that Pilates in healthy adults to improve flexibility, transverses abdominis activation, lumbar– pelvic stability, and muscular activity. Body composition is defined as the relative proportion of fat and fat-free tissue in the body. The assessment of body composition is necessary for a variety of reasons. There is a strong correlation between obesity and an increased risk of a variety of chronic diseases (coronary artery disease, diabetes, hypertension, certain cancers, hypedipidemia). Assessing body composition can be helpful for establishing optimal weight for health and physical performance. According to Pilates (1945) [13], his method is total coordination of body, mind, and spirit, promoting the uniform development of the body; restoration of good posture and physical activity; and revitalization of the mind and spirit. Pilates is an exercise approach developed that is based on body-mind spirit interaction combined with biomechanics, motor learning, and core stability (Latey, 2002) [10].The Pilates method is designed to stretch and strengthen muscles and improve coordination (Pilates, and Miller, 2003) [14]. The Pilates method focuses on building motions and activities that helps to strengthen minor muscles, which, in turn, helps to strengthen major muscles (Levine, Kaplanek, Scafura, and Jaffe, 2007).

Methods

To achieve the purpose of the study thirty six (N) =36 overweight women were randomly selected as subjects and their age ranged between 35 to 45 years. They were randomly divided into experimental and control groups. Group I acted as Pilates Exercise group (n=18), and Group II acted as control group (n=18). The experimental groups participated in the Pilates Exercise for a period of ten weeks. The subjects of the control group were not participated any of physical activities. Data was collected through standardized technique and calibrated equipments. Height was measured to the nearest 0.1 cm on a stadiometer with the participants shoeless. Body weight was measured to the nearest 0.1 kg using In Body 270 Bioelectrical machine. Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of the height in meters. The BMI was then categorized according to the recommendations of the World Health Organization. Hence, individuals with BMI of 25 to 29.9kg/m^2 are considered overweight. The cardiorespiratory fitness was assessed in terms of VO_2max by the test Queens College step test and to measure flexibility sit-and-reach test were used. Muscular strength was measured using a using the back and leg dynamometer and muscular endurance was measured using a curl-up test. Body composition was assessed by summing the values of triceps, biceps, sub-scapular and supra iliac skin-folds. Body density was calculated for each of the overweight women using gender specific regression equations. Body fat percent was calculated using the Sari's equation {Fat% = [(4.95/density)–4.5] x 100} (Durnin, and Womersley, 1974) [6]. Pilates Exercise Programincluded: 1). Warming-up phase for 10 minutes, the following exercise: Breathing exercise, Spinal rotation, Cat stretch, hip rolls, Scapula isolation and Arm circles. 2). The experimental group participated in 30 minutes three secessions per week for First two weeks, second two weeks 35 minutes three secessions per week, 40 minutes three secessions per week for third two weeks, fourth two weeks 45 minutes three secessions per week and, fifth two weeks 55 minutes three secessions per week. The Pilates Exercises such as, Hundred, Shoulder Bridge, Single Leg Circle, One Leg Stretch, Double Leg Stretch, Roll Up, Spine Stretch, Leg Pull Down, Leg Pull Up, Push Up, Pelvic Curl, Side Bend, Side Kick Front and Side Kick Back. 3). Cool down phase for 10 minutes consist of Flexibility Exercise and Stretching Exercise. The pre and posttest scores were collected on health related fitness component on both experimental and control groups. The collected data were analyzed by using analysis of covariance (ANCOVA). All the tests were examined the level of significant was fixed at 0.05.

Results of the study

The results presented in table I shows that the obtained adjusted post-test mean on VO_2Max of Pilate's exercises group and control group was 33.58 and 30.48.The obtained adjusted post-test 'F' ratio value of 75.23 was greater than required table F ratio of 3.37 to be significant at 0.05 level. Hence, it was proved that there was significant improvement on VO_2Max of the subjects due to the experimental treatment. Training results in an increase in the efficiency of oxygen transport within the body.

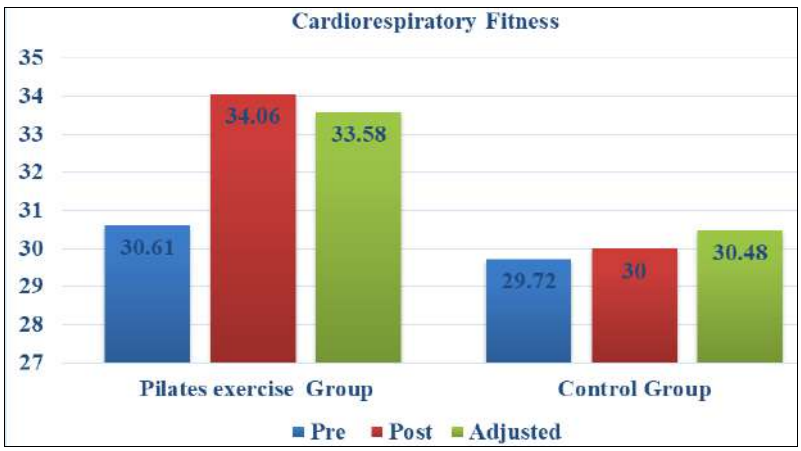

Fig 1: Bar diagram showing the Pre, Post and adjusted post-test means on Cardiorespiratory Fitness (VO_2 Max)

Table 1: Computation of ANCOVA on Cardiorespiratory Fitness

Test	Pilates Exercise Group	Control Group	SV	SS	Df	MS	F
Pre Test	30.61	29.72	B	7.11	1	7.111	1.05
			W	229.89	34	6.76	
Post Test	34.06	30.00	B	148.03	1	148.03	16.72*
			W	300.94	34	8.85	
Adjusted	33.58	30.48	B	84.05	1	84.05	75.23*
			W	36.87	33	1.12	
Mean Gain	3.44	0.28					

*Significant at 0.05 level of confidence for 1 and 34 (DF) = 3.37, 1 and 34 (DF) = 3.37

Table 2: Computation of ANCOVA on Muscular Strength

Test	Pilates Exercise Group	Control Group	SV	SS	df	MS	F
Pre Test	43.49	42.61	B	7.02	1	7.022	1.17
			W	203.48	34	5.98	
Post Test	46.54	41.94	B	190.67	1	190.67	21.25*
			W	305.02	34	8.97	
Adjusted	46.03	42.45	B	111.83	1	111.83	105.27*
			W	35.06	33	1.06	
Mean Gain	3.05	0.67					

*Significant at 0.05 level of confidence for 1 and 34 (DF) = 3.37, 1 and 34 (DF) = 3.37

The results presented in table II shows that the obtained adjusted post-test mean on Muscular strength of Pilate's exercises group and control group was 46.03 and 42.45.The obtained adjusted post-test 'F' ratio value of 105.27 was greater than required table F ratio of 3.37 to be significant at 0.05 level. Hence, it was proved that there was significant improvement on Muscular strength of the subjects due to the experimental treatment. Training results in an increase the size of muscle fiber within the body.

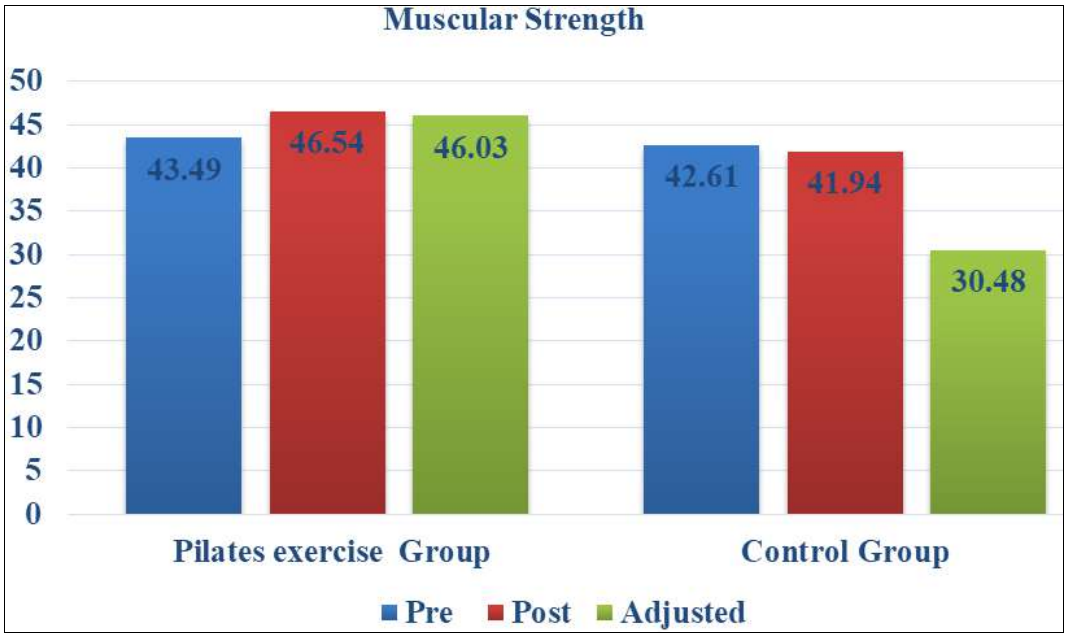

Fig 2: bar diagram showing the Pre, Post and adjusted post-test means on Muscular Strength

Table 3: Computation of ANCOVA on Muscular Endurance

Test	Pilates Exercise Group	Control Group	SV	SS	df	MS	F
Pre Test	18.78	19.39	B	3.36	1	3.361	1.25
			W	91.39	34	2.69	
Post Test	23.28	19.78	B	110.25	1	110.25	24.54*
			W	152.72	34	4.49	
Adjusted	23.61	19.44	B	151.18	1	151.18	119.25*
			W	41.84	33	1.27	
Mean Gain	4.50	0.39					

*Significant at 0.05 level of confidence for 1 and 34 (DF) = 3.37, 1 and 34 (DF) = 3.37

The results presented in table III shows that the obtained adjusted post-test mean on Muscular endurance of Pilate's

exercises group and control group was 23.61 and 19.44.The obtained adjusted post-test 'F' ratio value of 119.25 was greater than required table F ratio of 3.37 to be significant at 0.05 level. Hence, it was proved that there was significant improvement on Muscular endurance of the subjects due to the experimental treatment. Training results in an increase the muscle fiber capacity to sustain fatigue within the body.

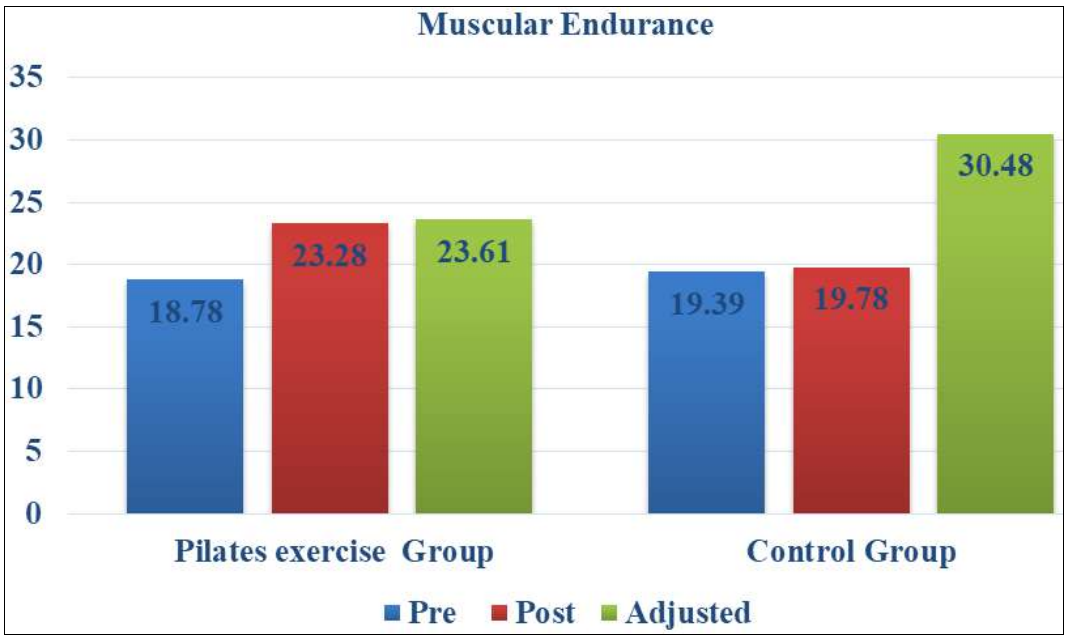

Fig 3: Bar diagram showing the Pre, Post and adjusted post-test means on Muscular Endurance

Table 4: Computation of ANCOVA on Flexibility

Test	Pilates Exercise Group	Control Group	SV	SS	df	MS	F
Pre Test	27.28	26.28	B	9.00	1	9.000	1.18
			W	259.22	34	7.62	
Post Test	31.83	26.17	B	289.00	1	289.00	35.47*
			W	277.00	34	8.15	
Adjusted	31.36	26.64	B	194.22	1	194.22	135.42*
			W	47.33	33	1.43	
Mean Gain	-4.56	0.11					

*Significant at 0.05 level of confidence for 1 and 34 (DF) = 3.37, 1 and 34 (DF) = 3.37

The results presented in table IV shows that the obtained adjusted post-test mean on Flexibility of Pilate's exercises group and control group was 31.36 and 26.64. The obtained adjusted post-test 'F' ratio value of 135.42 was greater than required table F ratio of 3.37 to be significant at 0.05 level. Hence, it was proved that there was significant improvement on Flexibility of the subjects due to the experimental treatment.

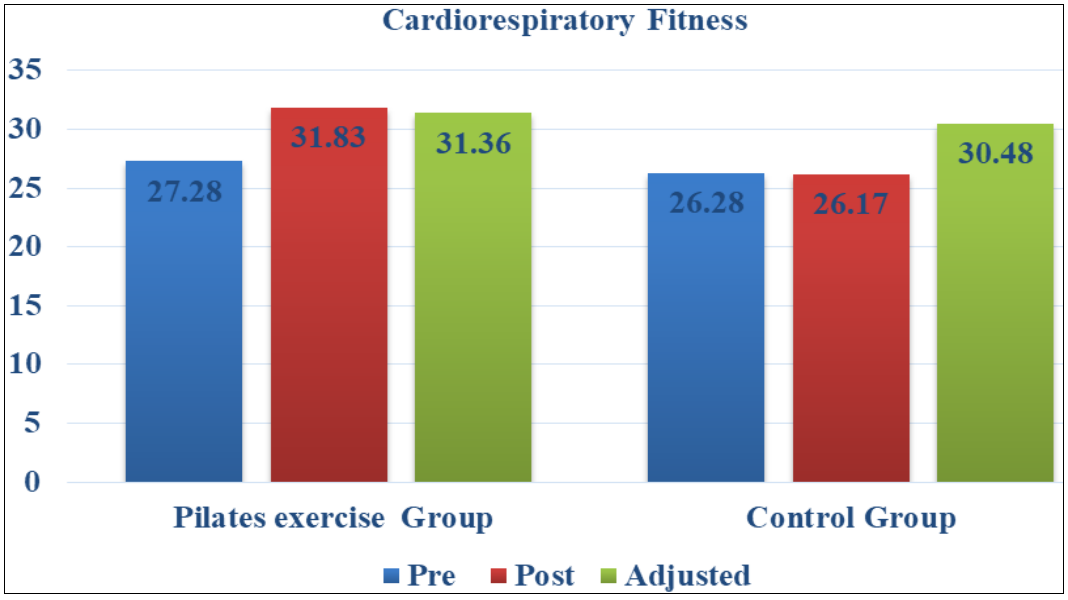

Fig 4: Bar diagram showing the Pre, Post and adjusted post-test means on Flexibility

Table 5: Computation of ANCOVA on Percentage of Body Fat

Test	Pilates Exercise Group	Control Group	SV	SS	df	MS	F
Pre Test	28.59	29.54	B	8.15	1	8.151	1.68
			W	164.58	34	4.84	
Post Test	25.58	29.42	B	132.90	1	132.90	25.18*
			W	179.43	34	5.28	
Adjusted	26.00	29.00	B	77.09	1	77.09	51.03*
			W	49.85	33	1.51	
Mean Gain	3.01	0.12					

*Significant at 0.05 level of confidence for 1 and 34 (DF) = 3.37, 1 and 34 (DF) = 3.37

The results presented in table V shows that the obtained adjusted post-test mean on Percentage of Body Fat of Pilate's exercises group and control group was 26.00 and 29.00. The obtained adjusted post-test 'F' ratio value of 51.03 was greater than required table F ratio of 3.37 to be significant at 0.05 level. Hence, it was proved that there was significant reduction on Percentage of Body Fat of the subjects due to the experimental treatment.

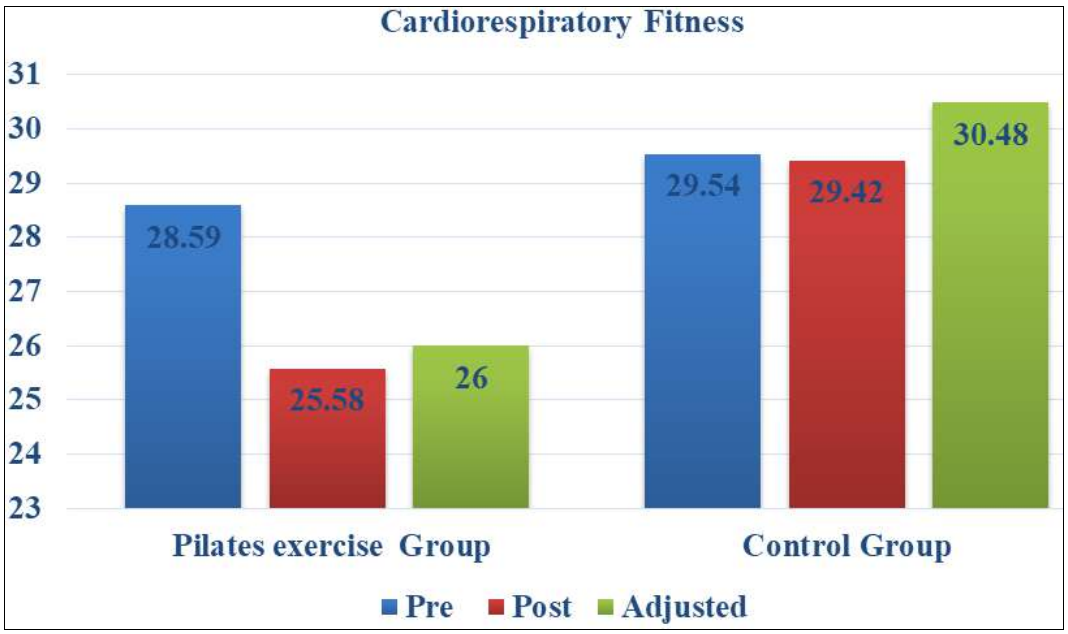

Fig 5: Bar diagram showing the Pre, Post and adjusted post-test means on Percentage of Body Fat

Discussion on findings

Pilate's workouts became increasingly popular in the fitness world. This popularity makes interest to conduct research on efficacy of Pilates Exercise on health related fitness among overweight women. The result of the present study specified that many of the changes occur in the cardiorespiratory system, and these lead to an improved ability to deliver oxygen to working muscles. Oxygen uptake is the amount of oxygen absorbed into the bloodstream during exercise. If more oxygen reaches working muscles, they will be able to work for longer at a higher level. Improving this capacity is one of the goals of Pilates Exercise. One of the primary mechanisms for increasing maximal oxygen uptake is the enhancement of central cardiovascular function. In general, the magnitude of the acquired training adaptation is proportional to the training stimulus and is also dependent on the individual's training experience and initial physical fitness level. However, in a few studies, the subjects who had a relatively low maximal oxygen uptake at the start of the training significantly increased their maximal oxygen uptake following the training program.

Females tend to be more flexible than males (Getchell, 1979) [7]. Differences in flexibility between young men and women may be due in part to structural and anatomical differences and the type and extent of activities performed. A range of body tissues can influence flexibility. These findings are in agreement with the findings of research reported earlier. Regular exercises help the development of the related to the health related physical fitness. Health related positive effects of physical fitness are on cardiovascular endurance, muscle strength, muscle endurance, body composition, flexibility and muscle relaxation (Herward, 1991) [8]. In a study, Rogers and Gibson,(2009) [16] carried out to determine the effect of 8 weeks mat work Pilates exercises improvements in body composition, muscle endurance and flexibility of the participants of the adults. Segal *et al*. (2004) [17] reported that Pilate's exercises had effect on increasing flexibility but no effect on the lean body weight, body weight and other body composition parameters in their study. Further, Shahana, Usha, and Hasrani, (2010) [18] determined the effect of a 12-week aerobic exercise programme improve health-related physical fitness components, such as cardiorespiratory endurance, flexibility, abdominal strength endurance and body fat in middle-aged women.

Conclusion

This study demonstrated that Pilates is a system of exercise,

when regularly practiced, will improve cardiorespiratory fitness, muscular strength, muscular endurance, flexibility and body composition. The Pilates exercise will have a noticeable impact on the body in terms of general well-being.

Reference

1. American College of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription (7th ed.). Philadelphia: Lippincott Williams & Wilkins; c2005.
2. American College of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription (7th ed.). Philadelphia: Lippincott Williams & Wilkins; c2005.
3. Åstrand PO, Rodahl K, Dahl HA, Stromme SB. Textbook of work physiology: Physiological bases of exercise (4th ed.). Champaign, IL: Human Kinetics; c2003.
4. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise and physical fitness: Definitions and distinctions for health-related research. Public Health Rep. 1985;100:120-131.
5. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise and physical fitness: Definitions and distinctions for health-related research. Public Health Rep. 1985;100:120-131.
6. Durnin JVGA, Womersley J. Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women aged from 16 to 72 years. Br. J. Nutrition. 1974;32:77-97.
7. Getchell B. Physical Fitness: A Way of Life. New York: Wiley; c1979. p. 1-53.
8. Herward UH, advanced fitness assesmend exercise prescription 1st edition. Texas; uman kinetics books; c1991. p. 12-13.
9. Heyward VH, Advanced Fitness Assessment and Exercise Prescription (5th Ed.). Champaign, IL: Human Kinetics; c2006.
10. Latey P. Journal of Bodywork and Movement Therapies. 2002;6(2):94-101.
11. Lisa Marie Bernardo. The effectiveness of Pilates training in healthy adults: An appraisal of the research literature. Journal of Bodywork and Movement Therapies. 2007;11:106-110.
12. Noakes TD, Peltonen JE, Rusko HK, Jr. Evidence that a central governor regulates exercise performance during acute hypoxia and hyperoxia. J Exp. Biol. 2001;2043225-3234.
13. Pilates J, Miller W. Return to life through contrology. Incline Village: Presentation Dynamics; c1945.
14. Pilates JH, Miller WR, Return to Life through Contrology. Miami, FL: Pilates Method Alliance; c2003.
15. Popkin BM. The nutrition transition and obesity in the developing world. J Nutr. 2001;131:871S-873.
16. Rogers K. Gibson AL, Eight-week traditional mat Pilate's training-program effects on adult fitness characteristics. Res Q Exercıse Sport. 2009;80(3):569-574.
17. Segal NA, Hein J, Basford JR. The effects of Pilates training on flexibility and body composition: an observational study. Arch Phys Med Rehab. 2004;85(12):1977-81.
18. Shahana A, Usha S, Nair SS, Hasrani. Effect of aerobic exercise programme on health related physical fitness components of middle aged women, British Journal of Sports Medicine. 2010;44:19.
19. WHO Nutrition http: www.who.int/nut/obs/ht, accessed in; c2003.