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Effects of Pilates on flexibility in young individuals

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Abstract
Background: Pilates is a physical fitness system developed in the early 20th century by Joseph Pilates, after him it was named as Pilates and Pilates called his methods as "Contrology. Flexibility is the ability of joint to move in full range without and limitations. Reduced flexibility can cause problems like back pain tightness. To assess the effectiveness of Pilates training on body flexibility of young individual with the help of V Sit o reach test and Shoulder reach test.
Methodology: A convenient sampling of 50 young individual including 40 female and 10 male were taken. The participate were assessed for flexibility pre and post intervention using V sit to reach test and Shoulder reach test. The intervention was carried out for 8 weeks.
Result: Baseline characteristics (pre interventional test score) were taken and analyzed. The mean ±SD for pre intervention was -2.83 -0.4677 and post intervention +1.42 +0.7025 of V sit to Reach test, the comparison was done by student paired t test (p Value – $p>0.001$, t value - 38.744, mean difference = -4.260) and the result was shown to be highly significant for V Sit to Reach Test. And for Shoulder Reach test Z test was applied, by applying Z test, it result was significantly highly significant ($p<0.01$).
Conclusion: The present study concluded that there is a significant improvement in flexibility by Pilates in young individuals.

Keywords: flexibility, Pilates

Introduction

Physical inactivity is currently a major issue worldwide and it was proved in 2016 that 28% of adult aged 18+ are insufficient in physical activity [1]. This physical inactivity cause a number of problem in day to day life like joint pain, muscular weakness and Low back pain One of the major reason for this is low flexibility [2].

Pilates is a total body conditioning exercise method combining flexibility and strength [3]. It was named after Joseph. H. Pilates, was born in 1880 near Dusseldorf Germany, He was born with multiple medical problems including rickets and asthma. And with a wish to make his body better as a young boy, and so he start exercise to make his body stronger [4]. Pilates then moved to UK and held in variety occupations, and later taught to inmates of prison camp for German nationals for fitness during world war 1 and later moved to New York, there he started an exercise studio in New York from the late 1920s to the 1960s, Sir Pilates wrote two books on his method and made some short films. Later in USA his methods was called as "Contrology" as it was seen effective on Depression [5].

Books wrote by Sir Joseph Pilates are, First was, Your Health; a corrective system of exercising That Revolutionizes the Entire Field of Physical Education (1934) by Joseph. H. Pilates and Judd Robbins (Editor) Second was Pilates 'Return to Life through Contrology. (1945) Joseph. H. Pilates, William J. Miller, Judd Robbins (editor) [6] Sir Joseph. H. Pilates died in 1967, After his death a number of his students carried out his teachings and taught it to number of individuals and as a result the, form of exercise was named as Pilates [5] His methods achieved popularity with dance professionals but were largely unknown to the local public [5]. Initially Pilates was practiced only by athletes and dancer but later become a popular trend in rehabilitation and fitness [5]. The aim of physical training is to attain better functioning of the body [7]. There are 6 fundamental principle of Pilates [8] they are:

1. Centering is said to be main point of Pilates method the core of the body is refers as center and called as "powerhouse".
2. Concentration focused concentration is important because it guide mind and body for the activates
3. Control the movement will be in control manner after and during exercise.
4. Precision to perform every exercise accurately.
5. Breath should be rhythmic with the activity because it is important for proper circulation and supply of oxygenated blood to all tissues of the body
6. Flow it is the smoothness of movement from one exercise to another during Pilate's session [8].

This principle help in reduce joint stress and increasing body awareness [9]. There are number of benefits of Pilates, some are; To increase strength and flexibility of Core muscle, helps in anxiety and Depression, improve body fluid circulation, Helps in reducing bone deterioration, works on the patients with chronic back pain injury [10]. There are different forms in which Pilates exercises are done, they are Mat Pilates, Chair Pilates, Ball Pilates, and Band Pilates. And different levels of Pilates; Beginner level, Intermediate level and each level consists of different exercises [11]. Flexibility is mostly described as the movement around a joint or set of joint and said to be ability to bend easily without breaking and reaching the goal in

layman's language, flexibility is one of the components on which physical fitness of individual depends [12]. Important Anatomical elements of flexibility are, Joints that are surrounded of synovial fluid and articular cartilage and as muscular elasticity increases joint mobility and flexibility increases, Ligaments, Tendons, Areolar tissue, Stretch receptors and Muscle tissue [13].

Types of Flexibility

1. Dynamic flexibility – is ability to perform dynamic movements within the full range of motion Joint
2. Static active flexibility- that is ability to stretch an antagonist muscle using only the tension in agonist muscle.
3. Static passive flexibility – that is ability to hold the stretch using body weight or external force [14].

There are different factors affecting and influence body flexibility such as, Different in every individuals, according to gender; Females are tends to be more flexibility than Male, according to level of physical activity and physical fitness of the individuals, according to age; it decreases with increasing age because of changes in collagen tissue and elasticity of the joint [14] Previous studies implement that there is a significant and similar improvement in both elderly and young group [10]. Every individuals have different level of flexibility and so everyone should be asses individually, to assess flexibility there are many methods, it can be measured as specific muscle group, specific joint which is required [10] for good body performance it is important to have flexible muscular system, Dangers of low flexibility are tight muscle, stiff joints, joint pain, improper muscle action and increasing risk of soft tissue injury. Flexibility can be restricted by internal or external factors like bulky muscle weak bones, ligaments tendons or any skin restrictions, age gender tight clothing or any injury. Flexibility can be measured by various test like V sit to reach test, fingertip to floor test, particular muscle flexibility test like Hamstring, back, shoulder reach test and many more.

Methodology

Source of Data: Young Individual with reduced flexibility.
Method of collection of data: By the principal investigator
Type of Data: Primary data
Study Design: Prospective Interventional pre and post study design
Sample size: 50
Participants: A sample of 50 young individual presenting for Pilates training
Sampling Method: Convenient Sampling
Study Duration: 8 week
Equipment's to be used: Pilates mat

Materials to be used

1. Record sheet
2. Measuring tape
3. Big scale
4. Pen
5. Pencil

Procedure

- Ethical Approval from Institutional Ethical Commit was taken, [Registration No BPT/INT/2018/20]
- All the participants were screened properly on the basis of inclusion and exclusion criteria. After obtaining, informed written consent form participants was taken and information about study and procedure was briefed to them.
- After successful selection of subjects their demographic data was collected.
- Then flexibility for every individual was taken, V it to reach test to check for hip back and hamstring muscle flexibility was done and to check shoulder flexibility Shoulder reach test was done.
- Flexibility records are kept for each individuals, pre and post intervention flexibility was measured.
- The intervention was carried out for 8 week, 2 sessions per week and for 60 minutes each. each session of Pilates consist of 5 min warm up and 5 minutes cool down period
- Exercise (Pilates) Protocol; starting with warm up, will consist of Stretching then for first 2 week session will be Pilates body awareness, movements and balance exercise (as Pilates challenge balance) from 3 week, the session was start with Pilates level 1 exercise (Introduction Moves) they are.

Introductory movements

1. The roll up
2. Roll down
3. One leg circle
4. Single leg stretch
5. Double leg stretch
6. Spine stretch.
   - This exercises were continued for 3 weeks (till 4, 5, 6 week) with specific increase in repetition
   - In last 2 sessions the repetitions were increased and hold time was increased
   - Every sessions end with cool down period which include stretching and relaxations
   - Flexibility was taken before and after the intervention period of 8 week.

Statistical Analysis

Table 1: Demographical data

	Total number	Percentage
Male	10	20%
Female	40	80%

	AGE	BMI
Mean	21.16	21.77
SD	1.31	1.59

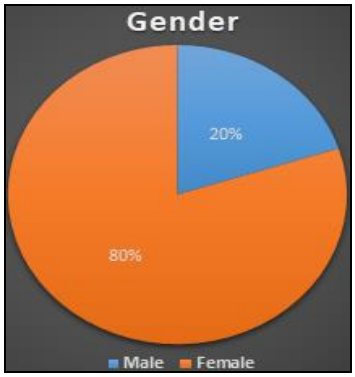

Fig 1: Demographic data

Table 2: Mean and SD

	Mean ±SD	Mean Difference	P value	T value
Pre	-2.83 -0.4677	-4.260	P< 0.0001 Extremely significant	38.744
Post	+1.42 +0.7025			

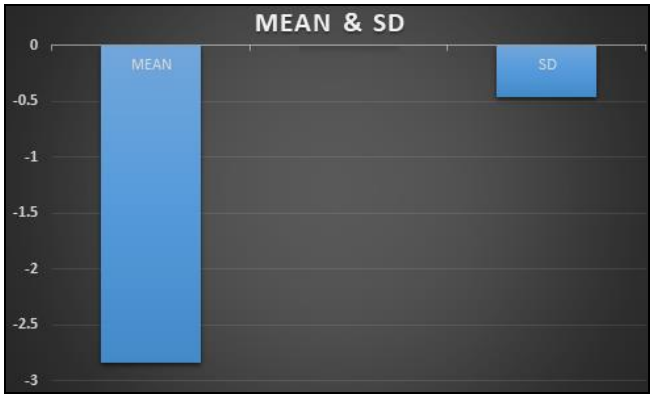

Fig 2: Pre Mean & Statical analysis of V sit to reach test

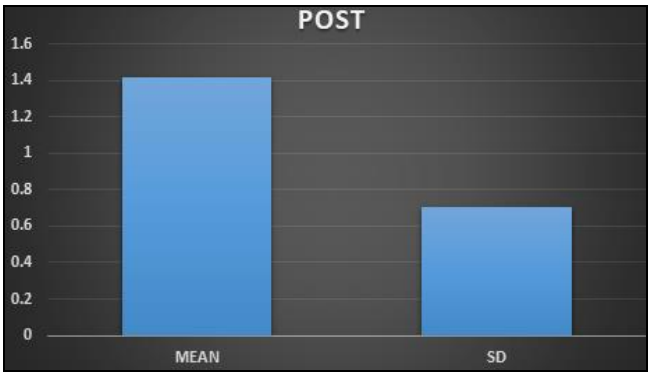

Fig 3: Post Mean &Stastical analysis of V sit to reach test

Table 3: Tabular representation of Flexibility by Shoulder reach test

Grade	Pre (%)	Post (%)
Fair	46%	28%
Poor	50%	0%
Good	4%	72%

By applying Z test, Difference between 2 proportional there is a Significant decrease in Shoulder reach test As Score of Fair from 23 (46%) at pre to 14(28%) at post Similarly for Score of Good, It was Significantly Increase Score Good 2 (4%) at pre to post 36(72%) which is significantly highly significant (p<0.01).

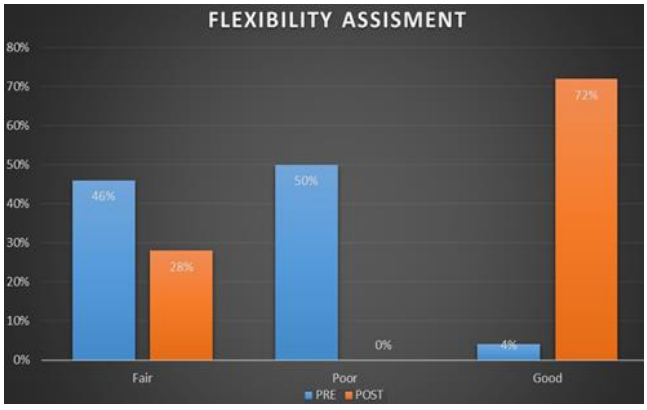

Fig 4: Pre and post value of Shoulder Reach Test

Result

Baseline characteristics (pre interventional test score) were taken and analyzed. The mean ±SD for pre intervention was -2.83 -0.4677 and post intervention +1.42 +0.7025 of V sit to Reach test, the comparison was done by student paired t test (p Value – p>0.001, t value - 38.744, mean difference = -4.260) and the result was shown to be highly significant for V Sit to Reach Test. And for Shoulder Reach test Z test was applied, By applying Z test, The Difference between 2 proportional, there is a Significant decrease in Shoulder reach test As Score of Fair from 23 (46%) at pre to 14(28%) at post Similarly for Score of Good there It was Significantly Increase Score Good 2 (4%) at pre to post 36(72%) which is significantly highly significant (p<0.01).

Conclusion

From present study it was concluded that Pilate's exercises have positive effect in improving flexibility of young individuals.

Discussion

The aim of the study was to see the Effects of Pilates in flexibility in young individual. Basic body awareness movement and Introductory Pilate (level 1) moves were used in the sessions, each sessions include warm up &cool down period. Some interesting insights and benefits about Pilates based exercise were found in the present study.

The result of the study shows that there is significant increase in Flexibility by mat Pilates for 8 weeks. which might be due to the maintenance of physical integrity and alignment as one stretches a muscle, or increases the range of motion promoting both flexibility and strength. This result was supported by the study of Phrompaet S, Paungmali A *et al*. Pilates used slow and controlled exercises that include static hold and dynamic strengthen and lengthen the muscles which helps in increasing flexibility, Pilates also works on global as well as stabilizes smaller muscles in the body, to prevent muscle imbalances [19]. It was explained that Neurophysiological properties of contractile tissues response to stretching exercise. When Pilates stretching position is applied, slow stretch to soft tissues and this result in activating the Golgi tendon organ. Difference between Active and passive muscle contraction is determined by Sensory receptors. Work of Golgi tendon organ is to inhibits alpha motor neuron activity as a result of decreased tension in muscles, permitting sarcomeres to lengthen. Besides the change of characteristics of contractile and non-contractile tissues during slow stretch, the working of Pilates can be explained by stress-strain curve, when gentle force is applied perpendicular to the cross-sectional area of the tissues. Initially, the wave collagen fibers are straightened. With additional tension stress, recoverable deformation occurs in the elastic range. Reaching the elastic limits results in heat release and new length. Additionally, the creep phenomenon can occur with low-magnitude and repetition of Pilates exercise in 45-minute sessions, twice a week, for 8 weeks [19]. Another study supporting this result was done by V.Bullo (2015) Conducted study about effects of Pilates on physical fitness in elderly and concluded that there is positive effects of Pilates exercise on increasing muscle strength flexibility, improvement in static and dynamic balance in elderly and also works on functional capacity to complete daily activity and quality of life, Polixeni THOMA1 conducted study about effects of mat

Pilates exercises on flexibility: A comparison between young and elderly women, The aim of the present case-control study was to compare the acute results of a repeated Pilates exercise session (1x10 times) on the flexibility of lower extremities joint ROM, between young adult and elder women, Pilates exercises performed in a dynamic slow pace and in full ROM, repeated 20 times, induced significant improvements in joint flexibility, among both age group and No such difference was noted.

Therefore from the present article it is proved that There is an significant effect of 8 weeks Pilates training on flexibility in young individuals

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