"THE EFFECTIVENESS OF A STRUCTURED EXERCISE PROGRAM ON CORE STRENGTH FOR BHARATNATYAM DANCERS"

Author. "Dr.Manasi sukhatankar [1],Miss.Hindawee Madhukar Saware[2]"
Assistant professor ,physiotherapy department , TMV's Jayantrao Tilak College Of Physiotherapy ,Pune.
Undergraduate Physiotherapy Students ,Physiotherapy Department ,TMV"s Jayantrao College Of Physiotherapy,Pune.

Abstract : In Bharatnatyam dancers, due to long-standing and maintaining posture, and poses like aramandi core play an important role in dancers . The upper and lower bodies are connected by the core the ability to control the core is what gives dance moves like leaps, turns and rapid direction changes their power and accuracy the objective of core strengthening exercises is to enhance and restore the ability to control the spine these exercises have been demonstrated to be an easy way to treat LBP the goal of this method is to retrain deep trunk muscle functions and the coordination of deep and superficial trunk muscles during functional dynamic and static tasks exercises for strengthening the core target the transverse and rectus abdominis the internal and external oblique the paraspinals the glutial pelvic floor and the hip muscles.

The participants are taught to control the intra-abdominal pressure effectively keeping the feedback dial in a small specific range the rise of the mean score indicates improved proprioceptive awareness and muscle coordination, both of which are imperative in achieving lumbo-pelvic stability this decrease in pressure drop also proves the existence of stronger muscles but more efficient neuromuscular control that is the participants were able to maintain optimal muscle activity with little compensatory movement or excessive over-recruitment of superficial muscles, this is in line with the therapeutic goal of core stabilization training that focuses on the quality of contraction and coordination and not just pure strength it is possible to recommend to the patient to have the deep stabilizing system of the trunk re-educated successfully due to the improvement in pressure control and reduction of pressure drop

Participants visualise and correct the mistaken patterns in the long run; this biofeedback facilitates improved motor learning, which translates to improved postural control and decreased chances of musculoskeletal dysfunction. The general implications of these findings on the practice of physiotherapy are in the treatment of lumbopelvic instability, low back pain and postural impairments.

IndexTerms **– Core strength, pressure biofeedback, Bharatnatyam dancers, core muscles, stability.**

I. INTRODUCTION

II. bharatnatyam dance is classical dance from an undergone various challenges, privious study it was found repeated araimandi and muzumandi position in dancers. there is shortness of iliacus and psoas major muscles resulting in imbalace trunk flexors and extensors. core muscle involves the local stabilisation system providing inter segmental motion and global system providing for rapid and powerful torque ,insufficient core stability result in low back pain which is most common in dancers pressure biofeedback is reported tool to used clinically for both assessment for deep trunk muscles,[5,7] Core strenghtning is important in bharatnatyam dancers as its improve stability of core muscles. The upper and lower bodies are connected by the core the ability to control the core is what gives dance moves like leaps, turns and rapid direction changes their power and accuracy the objective of core strengthening exercises[1]. to enhance and restore the ability to control the spine these exercises have been demonstrated to be an easy way to treat LBP the goal of this method is to retrain deep trunk muscle functions and the coordination of deep and superficial trunk muscles during functional dynamic and static tasks exercises for strengthening the core target the transverse and rectus abdominis the internal and external oblique the paraspinals the glutial pelvic floor and the hip muscles[3] overuse among dancers musculoskeletal injuries or issues are currently identified as a significant health concern dancers who participate in various dance styles run the risk of developing musculoskeletal injuries that affect their back lower limbs soft tissues and overuse due to neuromuscular changes in all the afflicted areas, they endure frequent episodes of pain and discomfort over time [6].

III. the last few years have seen a steady decline in physical activity and an increase in sedentary lifestyles due to the rapid advancement of technology this has lessened the strain on some formerly powerful muscles that were in charge of maintaining proper posture and preventing injuries, this is particularly true for the hip and trunk muscles which helped to prevent injuries and maintain proper posture. this is particularly true for the hip and trunk muscles that support upright posture against gravity a particular exercise, known as core stability exercise is becoming increasingly popular among clinical therapists. it targets the tansverse abdominis ,internal oblique, multifidus, quadratus lumborum and pelvic floor muscles in the trunk to ,prevent injuries to the lower extremities as well as low back pain the above mentioned muscles are attached on the lumbar vertebrae and part of motion segment in lumbar region in that way they are believed to provide segmental stability as a result of the lumbar segments contracting all together at the same time hence maintain the spine in most stable position known as local stability system. [9]

NEED OF THE STUDY.

According to evidence, low back pain is most common in Bharatnatyam dancers; however, there is are lack of evidence have observed the effects of adding core strength exercise. Study, of a structured exercise program on core strength is important because weakness of the core the in Bharatnatyam dancers can causefurther complications, to find out the strength of the deep abdominal muscles function pre and postintervention. Many of the Bharatnatyam dancers are suffering from low back pain, but they may not identify its causes due to the weakness of core muscles. Also, they are not concentrating on core strengthening exercises for low back pain so we need to study the effectiveness of a structured exercise program on core strength for Bharatnatyam dancers.

RESEARCH METHODOLOGY

This study is interventional study carried out to asses effectiveness of core strengthening exercise in Bharatnatyam dancers, using convenient sampling method total 34 participants were selected in the study ,pre intervention and post intervention assesement was conducted ,core strength was assessed by using pressure biofeedback ,then participants received the core strengthening exercise it's a 4 week exercise program ,3 sessions in a week .core strengthening exercise like prone leg extension ,cat n camel exercise ,plank exercise ,hold curl ups, swiss ball exercise, bridging exercise ,child pose exercise, bird dog exercise all exercise is done for 10sec hold and 10 repetitions .

3.1Population and Sample

34 participants were selected by convenience sampling method. Inclusion criteria included age group: 15 to 25 years, gender: female bharatnatyam dancers.

3.2 Data and Sources of Data

Pre and post intervention scores of pressure biofeedback was data sources. Data was collected at dance academies in Pune

3.3 Theoretical framework

Study is based on theoretical understanding that low back pain is linked with core weakness and in bharatnatyam dancers can cause excessive internal rotation of back and due to dance movements which affects stress on core muscles. There is strong correlation between core weakness and back pain. CSE focuses on deep abdominal muscles , enhance core biomechanics, core muscles strength and stability

IV. DATA ANALYSIS AND INTERPRETATION

Table no.1 Distribution of study participants according to their age in years

Age Group(yrs)	No of study participants	Percentage
15-20 yrs	18	52.94
21-25 yrs	16	47.06
Total	34	100
Mean±SD	20.20±3.54(15-25 years)	

52.94% of study participants were in the age group of 15-20 years, and 47.06% of study participants were in the age group of 21-25 years

Graph 1: Distribution of study participants according to their age in years

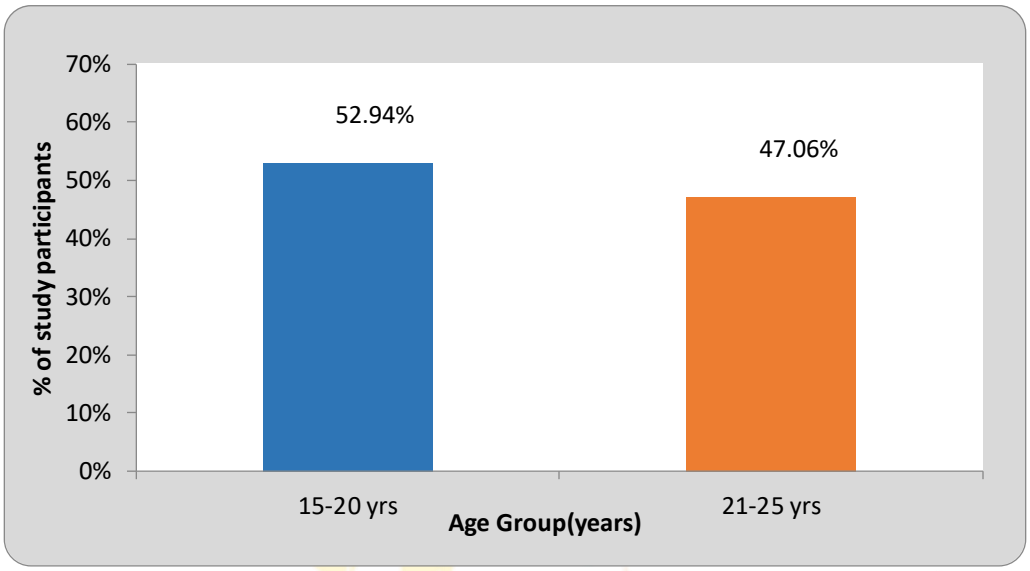


Table 2: Comparison of Pressure Bio Feedback unit score at pre- and post treatment(Student's paired t-test)

	Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Pre Test	63.97	34	1.44	0.24	2.20±0.53	23.89 P=0.0001,S
Post Test	66.17	34	1.46	0.25		

Mean pressure bio feedback unit score at pre test was 63.97±1.44 and at post treatment it was 66.17±1.46. By using Student's paired t test statistically significant difference was found in pressure bio feedback at pre and post treatment(t=23.89,p=0.0001).

Graph 2: Comparison of Pressure Bio Feedback unit score at pre and post treatment(Student's paired t test)

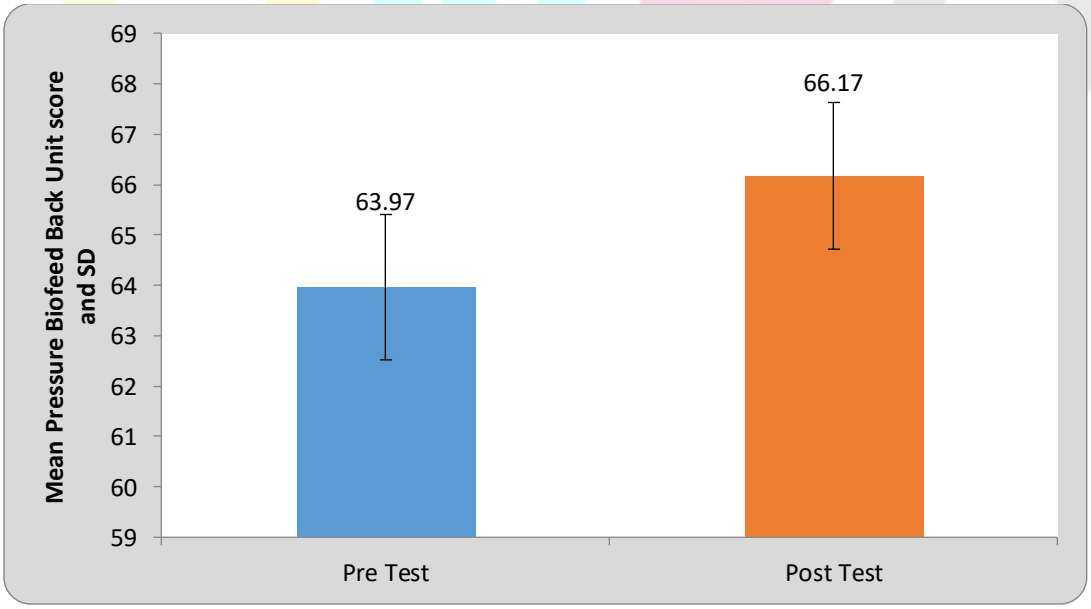
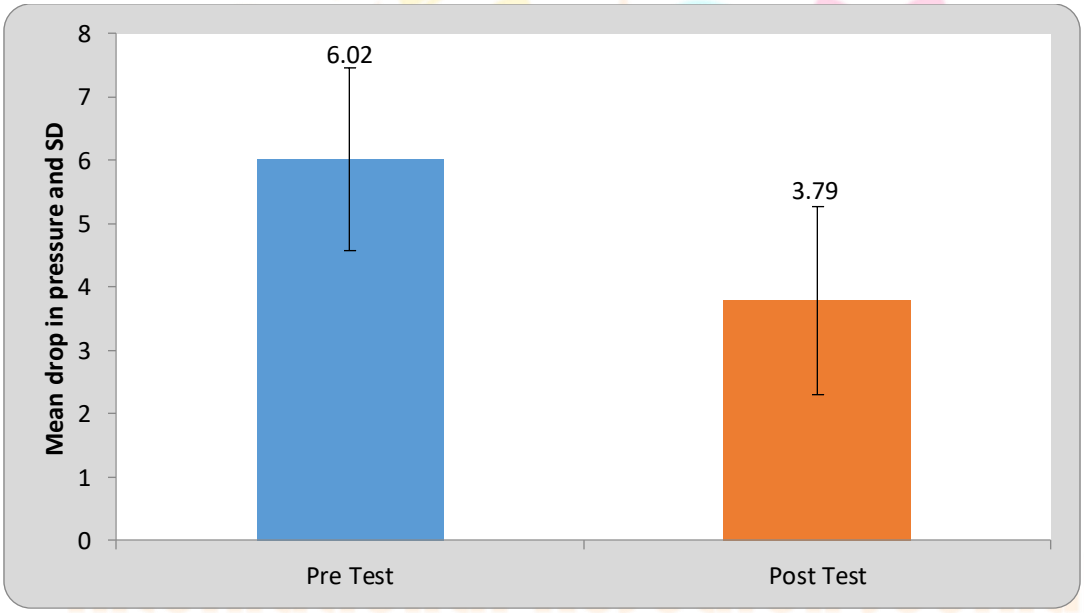


Table 3: Comparison of Drop in Pressure Bio Feedback unit score at pre and post treatment(Student's paired t test)

	Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Pre Test	6.02	34	1.44	0.24	2.23±0.55	23.53 P=0.0001,S
Post Test	3.79	34	1.49	0.25		

Mean drop in pressure bio feedback unit score at pre test was 6.02±1.44 and at post treatment it was 3.79±1.49. By using Student's paired t test statistically significant difference was found in drop in pressure bio feedback at pre and post treatment(t=23.53,p=0.0001).

Graph 3: Comparison of Drop in Pressure Bio Feedback unit score at pre and post-treatment (Student's paired t-test)



Statistical analysis was done by using descriptive and inferential statistics using Student's paired t-test, and software used in the study was SPSS 27.0 version, and $p<0.05$ is considered as the level

STATISTICAL ANALYSIS

The study on 34 Bharatanatyam dancers with a mean age of 15to25 years 20.11±3.71 years, showed a statistically significant improvement in core stability after the intervention. The mean pressure biofeedback score increased from **63.97±1.44 to 66.17±1.46** (p=0.0001), while the mean drop in pressure score decreased from **6.02±1.44 to 3.79±1.49** (p=0.0001). These findings indicate that the structured protocol effectively enhanced core muscle control and postural stability among Bharatanatyam dancers.

DISCUSSION

The age distribution showed that the majority of participants were young adults, with 47.06% in the 21–25-year-old age group and 44.12% in the 15–20-year-old age group. The mean age was 20.11 ± 3.71 years, with a predominantly adolescent and young adult population. This is a significant age range because core stability and motor control are highly trainable during these developmental stages.

The findings of the present study point out significant improvements in core muscle performance subsequent to the pressure biofeedback unit as a means of assessment and training. It can clearly be shown from the data that there was a statistically significant improvement in the participants' ability to maintain optimal pressure control, thereby indicating improved activation and endurance of the deep stabilising muscles of the core, which are so essential for spinal stability and postural control, specifically the transversus abdominis and multifidus muscles.

Responsiveness is maximum, and the relative youth of the participants further minimises any confounding due to degenerative musculoskeletal changes, hence strengthening the validity of the outcomes observed.

The overall pre-mean pressure biofeedback unit score was 63.97±1.44, while the post-treatment score rose significantly to 66.17±1.46. The mean difference of 2.20±0.53, with a t-value of 23.89 and a p-value of 0.0001, showed that the increase in mean was highly significant at $p < 0.05$. This can be explained by increased activation and control of deep abdominal muscles. During exercises for core stabilisation, the patients learn to regulate intra-abdominal pressure effectively by keeping the feedback dial within a narrow, target range. This rise in mean demonstrates better proprioceptive awareness and muscle coordination critical in maintaining the stability of the lumbo-pelvis.

These findings support those from previous literature that suggest pressure biofeedback training enhances the recruitment of stabilising muscles, especially when real-time feedback is provided to the participants. Improvement in post-test values reflects an improved ability to control and maintain pressure. Thus, it may be suggested that participants developed more precise motor control with enhanced endurance in maintaining core activation.

Decreased pressure drop illustrated not just stronger muscles, but also better neuromuscular control-maintaining optimal muscle activation with less compensatory movement or over-recruitment of superficial muscles. This corroborates the therapeutic objective of core stabilisation training that focuses on quality of contraction rather than mere strength.

Improved pressure control and reduction in pressure drop indicate successful re-education of the deep stabilizing system of the trunk. Pressure biofeedback offers a non-invasive monitor of subtle movements of the abdominal wall and pelvic region, giving the participant visual information with which they can correct faulty patterns. With use over time, such biofeedback enhances motor learning, which translates into more effective postural control and decreases the risk of musculoskeletal dysfunction. These results also extend to wider implications for physiotherapy practice, particularly in managing conditions that involve lumbopelvic instability, low back pain, and postural impairments.

CONCLUSION

The study conducted on 34 Bharatanatyam dancers (mean age 20.11±3.71 years) showed significant improvement in core stability after treatment.The pressure biofeedback unit score increased notably from 63.97 to 66.17 (p=0.0001), indicating enhanced muscular control.Similarly, the drop in pressure biofeedback score reduced from 6.02 to 3.79,reflecting better postural endurance.Overall, the intervention proved effective in improving core stability and control among Bharatanatyam dancers.

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