**The Effects of Twelve-Week Pilates Training on Static Balance and Abdominal Muscle Strength in Young Dancers**

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**SUMMARY**

The aim of this study was to examine the effects of a 12-week Pilates training program on Static balance and abdominal muscle strength in young dancers. Thirty-six female dancers formed local elementary school volunteered and randomly assigned as experimental group (EG, 17 children, Height: 148.2 cm, Weight 38.0 kg) or control group (CG, 19 children, Height 146.9 cm, Weight 38.4 kg). The EG underwent forty minutes Pilates Mat-work training, three times a week, for twelve weeks. The GC did not receive any regular physical training during this period. The static balance was measured by force platform as the center of pressure (COP) mean radius and sway area. The abdominal strength was measured by 30/60 seconds sit-ups test. One factor ANCOVA was used to examine the differences between groups after training. The significant level for statistic was set at \( p < .05 \). The results showed that the EG not only significantly decreased the COP radius and sway area in the open eye bilateral and in the closed-eye left-lateral standing tests, but also increased the times of 30/60 seconds sit-ups tests than CG after 12-week Pilates training program. The study demonstrated that 12-week Pilates Mat-work training could improve the performance of static balance and abdominal strength in young dancers.

**INTRODUCTION**

Dancing is a kind of special physical activity that belongs to the art of performance and jumping is one of the fundamental skills in dancing. Many movements such as “Woogon”, is a technique that requires the dancer to run fast, jump high, then hold still, for the best feeling of beauty. Without the proper balance control and muscle strength, it is hardly to perform well but easily get injury. Balance is preserved through the dynamic integration of internal and external forces and environmental factors [1] and has an important role in injury prevention and in athletic activities. Subjects with lower-extremity injuries have been shown to have an impaired balance, decreased proprioception and altered peripheral control of ankle muscle function when compared with non-injured subjects. Neuromuscular exercise can re-educate the proprioceptive system that restores normal neuromuscular coordination and reduces repetitive injuries [2].

In addition, the core muscles surrounding the spine and abdominal not only can generate strength and transfer it to the limbs to potential increase in power, but also responsible for protecting the spine, muscles in this process are the spinal flexors and extensors, and offer adequate support of the spine edge, spine borne dispersion burden.

Despite the increased popularity of Pilates mat exercises within the last two decades, little research has been conducted on its benefits in dancer population, especially in young population. Pilates mat exercises have been reported and suggested to be effective in improving static or postural balance on dancers in many review paper [3], however, limited original research to ascertain the benefits potential on static balance. In addition, to our knowledge, there is no prospective evidence data addressing the effects of Pilates mat exercise training on the development of balance performance in young dancers, therefore, the purpose of this study was to examine the effects of a 12-week Pilates training program on static balance and abdominal muscle strength in young dancers.

**METHODS**

Thirty-six elementary dancers equally and randomly assigned to experimental group (EG, 17 children, Height: 148.2 cm, Weight 38.0 kg) or control group (CG, 19 children, Height 146.9 cm, Weight 38.4 kg). All subjects received the same dance lessons as routine elementary curriculum but the experimental group underwent an extra Pilates mat exercises for 40 minutes, three times a week, for 12 weeks. An instructor who had 2 years of experience in Pilates mat exercises initiated the exercises. The study was approved by the ethics committee of the university, and informed consent was obtained from all their parents.

Static balance was evaluated by AMTI AccuSway force platform (100 Hz) in a series of assessment, including the measurements of open / closed eyes and double/single limbs standing. The foot canter of pressure (COP) was collected during each measurement which lasted for 10 seconds and then calculated as the COP radius, sway velocity, and sway area.

Abdominal strength was evaluated by 30 seconds / 60 seconds sit-ups test. Subjects were prepared by lying supine on the mat, arms across the chest, hands placed gently on the shoulders, knees at 90 degrees and feet flat on the ground. The subject
laid down on a mat with their knees bent at right angles and their hands were folded over their chest. The subject’s ankles were firmly held by a partner for support. The partner maintained count of how many sit-ups were performed. For a complete repetition, sit-up was performed to approximately a 30 degree angle, to touch the knee, and then the subject returned to the starting position. The subjects were instructed to not arch their back during the exercise and to keep their arms flat against their chest. The duration of this test lasted one minute. The subjects were instructed to do as many repetitions as possible. Repetitions were recorded in the middle (30 seconds) and at the end (60 seconds) of the test.

All statistical procedures were performed by using SPSS version for Windows 12 (Chicago, IL, USA). A mixed design, one-way ANCOVA was used to evaluate the difference between groups after training for each parameter. The statistic significance was set at $p < .05$.

RESULTS AND DISCUSSION

The Pilates Method was originally developed by Joseph Pilates during the First World War and brought to the United States in 19 century. The initial concept mixed elements of gymnastics, martial arts, yoga and dance, focusing on the relationship between body and mental discipline [4]. Joseph Pilates believed that the goal of a healthy person should be to attain a strong mind and use it to gain total control over his physical body. More recently, the traditional elements of the Pilates have been updated and incorporated into physical training and fitness. This modern Pilates approach can be defined as a comprehensive body–mind conditioning, the main goals of which are efficient movement, core stability and enhanced performance [5]. In this respect, Modern Pilates mat exercise trainees should think of their bodies as single integrated units, with the goal of establishing a stable central core around which all movements take place. Through this approach the quality but not the quantity of the movement is imposed and resembles the theory of weight training to gain optimum strength and endurance [6].

After twelve weeks of Pilates exercise training, 1) the EG not only significantly decreased the COP radius and sway area in the open eye bilateral and in the closed-eye left-lateral standing tests. 2), the average 30 seconds sit-ups in the EG and CG were 20.1 ± 4.7 times and 22.2 ± 3.0 times in pre-training, and changed to 24.9 ± 4.2 times and 19.2 ± 2.9 times after the twelve weeks period. The average 60 seconds sit-ups in the EG and CG were 34.9 ± 11.4 times and 36.5 ± 9.6 times in pre-training, and changed to 41.5 ± 9.4 times and 35.2 ± 8.1 times after the twelve weeks period. The results of the ANCOVA for the 30/60 seconds sit-ups tests (Figure 1) indicated a significant interaction between the trained/ untrained groups × pre/post repeated measures with post-training scores higher than pre-training scores in the EG ($F = 10.19 & 4.86$, $p < .05$).

Results from this study indicated that the young dancers who participate in 12 week Pilates (EG) not only improved the static balance performance, but also increase abdominal strength and abdominal endurance. These findings were in line with previous study which carried out in middle aged female subjects trained three times a week for 5 weeks significantly increased their 1-minute sit-up performance (14.0 times vs. 29.2 times) confirming and support that Pilates mat exercise increase muscular endurance [7]. Furthermore, Herrington & Davies (2005) study verified this and also indicated that the transversus abdominis is mainly, which helps maintain better lumbo-pelvic control [8]. With regard to the results of this study, Pilates mat exercises were found to be an efficient training method with significant changes in static and in abdominal strength young female dancers.

CONCLUSIONS

This study demonstrated that twelve weeks Pilates exercise can static balance and abdominal strength in young dancers. Therefore, Pilates exercise is beneficial and should be implemented into elementary dance curriculum.

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REFERENCES