

EFFECTS OF STATIC AND DYNAMIC BALANCE EXERCISES IN RHYTHMIC GYMNAST.

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Abstract: : As rhythmic gymnast has to balance on a narrow base of support (BOS) and on toes throughout the routine, therefore, they required good control, stability, and strength in limbs. Balance can be classified as static balance and dynamic balance. Static balance: In Rhythmic gymnastics,static balance is the ability to hold the body in a specific position while stationary, with the centre of mass over the base of support. Dynamic balance: Dynamic balance in Rhythmic gymnastics is the ability to control the body while moving in space. To study the effectiveness of static and dynamic balance exercises in rhythmic gymnast aged 5 to 10 years.A pre-test and post-test experinmental study was conducted on 46 participants aged 5 to 10 years 23 was assessed for static balace and 23 was assessed for dynamic balance.The 40 days intervention consisted of exercises – feet together with eyes closed, tandem standing on toes for static balance and jump and land on toes, single leg squat for dynamic balance.Static balance was assessed using the Stork Balance Test and Dynamic balance was assessed using the Y-Balance Test before and after the intervention.Statistical analysis was performed using the data was tested for normality using the Shapiro Wilk Test and was found to be non-normally distributed. Wilcoxon’s signed rank test was used to find out the pre and post differences within the group. Statistical Analysis was done using Jamovi Version 2.6 and the alpha value was set to 0.05. The p- value is <0.01 and greater effect sizes 0.88 indicated a statistically signifant improvement in balance and strenth following the intervention.

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Keywords:

Static balance, Dynamic balance, Rhythmic gymnastics, Postural stability, Stork balance test, Y-balance test.

INTRODUCTION

Gymnastics is a popular sport in European countries as well as Asian countries. Gymnastics is governed by the Federation Internationale de Gymnastique.

Rhythmic gymnastics – uses the elements of ballet, dance, and apparatus manipulation and performs routine of leaps and contortions that flow in time to music. The sport involves the use of five apparatus: ball, ribbon, hoop, clubs, and rope – on a floor area extending their movement by being on the base of toes throughout the routine.

As gymnast has to balance on a narrow base of support (BOS) and on toes throughout the routine, therefore, they required good control, stability, and strength in limbs.

Balance is defined as the condition in which all the force acting on the body is balanced such that the center of gravity (COG) or center of mass is within the stability limits, BOS. Balance can be classified as static balance and dynamic balance. Balance is a combination of innate sense and development of combined physical and mental training; therefore, balance is fundamental to gymnastics success, no matter how otherwise skilled and fit the athlete may be.

Static balance: In Rhythmic gymnastics, static balance is the ability to hold the body in a specific position while stationary, with the centre of mass over the base of support. Static balance is important for activities like standing on one leg or squatting.

Dynamic balance: Dynamic balance in Rhythmic gymnastics is the ability to control the body while moving in space. In rhythmic gymnastics, dynamic balance is important for fast speed.

The stork balance test is an excellent fitness test and no equipment is required; it is simple to set up and conduct anywhere. The athlete stands comfortably on both feet with their hands on their hips, the athlete lifts the right leg and places the sole of the right foot against the side of the left kneecap then the athlete is to hold this position for as long as possible. The assistant gives the command “GO,” starts the stopwatch, and the athlete raises the heel of the left foot to stand on their toes. The assistant stops the stopwatch when the athlete’s left heel touches the ground or the right foot moves away from the left knee. The assistant records the time. Three attempts for each of the leg and the average is recorded. Scores of the stork balance test are divided as poor (<10 s), fair (10–24 s), average (25–39 s), good (40–50 s), and excellent (>50 s).

The clinical application of the Y balance test (YBT) requires the measurement of leg length. It is a multidirectional test of balance, where a single-leg stance on one leg is required to be maintained on a plastic platform, while maximally reaching with the contralateral leg in anterior, posteromedial, and posterolateral directions with the distance reached being measured. The scoring was done on the bases of the composite reach distance (%) formula, i.e., the sum of the three directions/3 times the limb length

× 100. The purported benefits of the YBT are that it takes less time to complete and has a standard protocol.

NEED OF THE STUDY:

As the gymnastic trained for flexibility their joints land up into hypermobile which leads to lengthening up muscles double times the reduction in action myophile filament and elastic property and proprioception around the joints and cointeration between concentric, eccentric, anterior and posterior chain muscle which leads to reduced in muscle strength that eventually caused loss of balance but as a gymnast they has to be on toes for longer duration.They need to increase their strength and capability to stay upright and there is an importance of taking in their picture to train gymnast for balance therefore I am doing this study to improve strength as well as balance to boost their confidence and perform their routine.

Population And Sample

Sample Size: 46

Data And Sources Of Data

Study Design: Pre-test and post-test interventional study

Study Type: Interventional study

Study Settings: Sports

Theoretical Framework

The present study evaluated and compare the effects of static and dynamic balance training on young gymnasts. A total of 46 participants were included, that were equally divided into two groups: 23 were receiving for static balance training and 23 were receiving for dynamic balance training. The results demonstrated significant improvements in both static and dynamic balance after the intervention, with the static balance group showing greater improvement on both right and left sides. These findings suggests that balance training can improve postural control, stability, and neuromuscular coordination in young gymnasts.

There was homogeneity for both static and dynamic balance groups in terms of age and sports experience. This is probably the cause of differences observed after the intervention. The participants were of the age where motor coordination, proprioceptive acuity, and postural control are still into developing phase. At this point, the nervous system shows high plasticity, which allows to adapt rapidly to any kind of stimuli. This is the possible reason any intervention can lead to improvements in sensorimotor control and mobility.

There was a significant increase in both static and dynamic balance performance after-intervention in within-group analysis, with all p-values less than 0.01 and large effect sizes (0.88). These results shows that both training programs were effective in improving postural stability and balance overall. Improvement in balance by following training can be because of improvements in sensory input from visual, vestibular, and proprioceptive systems, along with better neuromuscular coordination. Balance training also improves the connection between sensory feedback and motor response, that results in quicker postural adjustments and greater stability during stance and movement. Similar findings were observed in another study where short-term balance training improved sway control, muscle activation strategies, and overall body alignment in young athletes.

A major finding of this study was that there was a better improvement in static balance. The mean difference in balance scores was higher in the static group on both sides, with moderate to large effect sizes (0.59–0.68). These findings are indicate the fact that static balance training, that includes maintaining a certain posture without movement, is a better basis for a developing postural control in early phases of athletic training. Static balance exercises help gymnasts to focus on body alignment, controls the center of gravity, and improves joint stabilization without having to perform complex movements. These tasks contribute to better co-contraction of agonist and antagonist muscle groups, which improves joint stability and reduces postural sway. Hence, static balance training is essential before progressing to dynamic balance or skilled movements, as observed in one of the studies.

Dynamic balance training involves control of posture and movement at the same time, allowing more complex neuromuscular consequences and relies more on visual and vestibular feedback. The present study shows significant improvement in the dynamic balance group as well. Young gymnasts as they are in their developmental stage, may find dynamic balance tasks more challenging, because there is a demand of higher levels of motor planning, spatial awareness, and muscular coordination, as observed in a study. This implies the need of longer exposure or progressive loading to develop dynamic balance training.

These findings are aligning with motor learning principles, which suggest developing static balance is needed for effective dynamic balance. According to the hierarchical model of motor development, children first learn to stabilize their body in space before mastering controlled mobility. Therefore, improvements in static balance gives a stable base from which dynamic balance skills can develop. Studies in pediatric and sports populations have also reported that static balance exercises improve postural orientation, proprioception, and muscle response timing which are the key components that help develop dynamic stability. The results of the present study support this sequential approach, suggesting that incorporating static balance training early in gymnastics conditioning can have some beneficial outcomes.

Both right and left sides showed comparable improvements, indicating that the training produced symmetrical neuromuscular adaptations. This is very relevant in gymnastics, where similarity is essential for performance and injury prevention. Asymmetrical balance or strength can lead to compensatory movement patterns and increase the risk of overuse injuries. The observed bilateral improvements suggest that the exercises used in both training protocols were balanced in design and equally effective across extremities.

The large effect sizes observed throughout the results is indicative of usefulness of the interventions. Effect sizes greater than 0.8, as per Cohen's interpretation, indicate strong practical significance in addition to statistical significance. This highlights that even short-duration balance training interventions can produce meaningful physiological adaptations in young gymnast. Such findings support the existing literature for early introduction of neuromuscular and balance training in young sports programs.

From a practical point of view, the results have important implications for gymnastics coaching and young sports conditioning. Hence, the present study demonstrated that both static and dynamic balance training significantly improve postural control and balance in young gymnasts.

RESEARCH METHODOLOGY

The 46 participants were taken for this study in sports settings Ethical clearance was taken from institution ethical committee. Procedure was explained to the subject. Consent was taken from the subject. 46 subjects was investigated between 5 to 10 years of age. None of the subject had serious illness when given exercise trial. The duration of intervention was 40 days. The set of exercises are selected which are feet together with eyes closed, tandem standing on toes with eyes closed for static balance

and jump and land on toes ,single leg squat for dynamic balance .The durations and repetitions of exercise were 10 reps 10 sets for static balance and 10 reps 3 sets for dynamic balance for 25 to 30 mins 5 days a week for 40 days.

Pre assessment and post assesment done using stork balance test and Y-balance test before and after implementation of protocol .Data obtained was statistically analysed .The data analysed showed significant improvement among the individual .The materials required was tape , stopwatch.Inclusion criteria was young age group (5-10).Both Genders (Male and Female)and subjects who are willing to participate in the process. Eclusion criteria was any cardiological and neurological deficit and certain ortho conditions were also excluded if it was hindering the process and non competative players.

DATA ANALYSIS & RESULT:

A total of 46 participants aged between 5 to 10 years were included in the study. The study population comprised both males and females met the inclusion criteria. All participants successfully completed the 40 days balance exercise training protocol, and no dropouts were reported. Descriptive statistics was done for age, no. of sport experienced and hypothesis Wilcoxon’s signed rank test was used to find out the pre and post differences within the group.

STATICAL ANALYSIS:

Result:

A total of 46 gymnasts were included in the study. 23 were assessed for static balance and 23 were assessed for dynamic balance. Descriptive statistics for Age and Duration of sports (in months) was done. The data was tested for normality using the Shapiro Wilk Test and was found to be non-normally distributed. Wilcoxon’s signed rank test was used to find out the pre and post differences within the group. Statistical Analysis was done using Jamovi Version 2.6 and the alpha value was set to 0.05.

Descriptive Statistics for Age and Months of Sports Experience (Static)

	Age (in years)	Months of Sports Experience
Mean	6.78	5.6
Median	6	5
Mode	6	5
SD	1.34	3.27
Minimum	5	1
Maximum	9	12

Interpretation:

The gymnasts in the static balance group had a mean age of 6.78 years and a mean sports experience of 5.6 months. The median and mode values for both parameters were close to their means (6 years for age and 5 months for experience), suggesting minimal skewness in data distribution. The standard deviation values (1.34 for age and 3.27 for sports experience) indicate moderate variability within the group. The minimum and maximum age ranged from 5 to 9 years, while the duration of sports experience ranged from 1 to 12 months. This suggests that the static balance group comprised relatively young gymnasts with varying but mostly limited sports exposure.

Descriptive Statistics for Age and Months of Sports Experience (Dynamic)

	Age	Months of Sports Experience
Mean	6.78	6.86
Median	6	6
Mode	6	6
SD	1.27	2.81
Minimum	5	3
Maximum	9	12

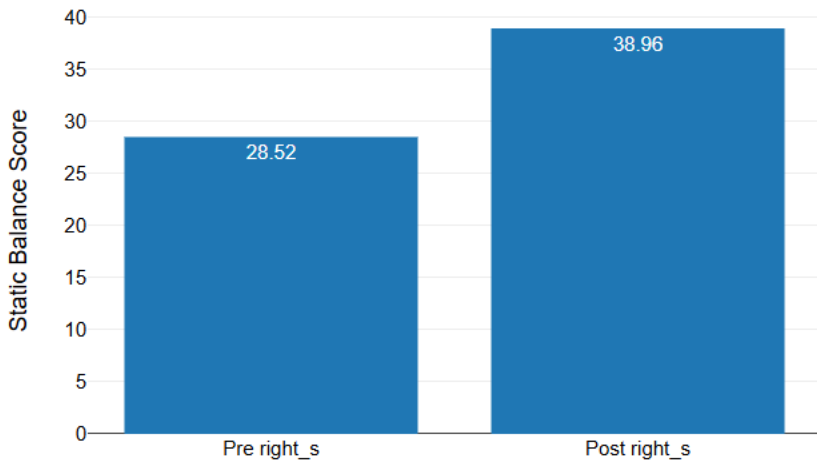
Interpretation:

In the dynamic balance group, the mean age was also 6.78 years, showing that both groups were age-matched. However, the mean duration of sports experience was slightly higher at 6.86 months, with a standard deviation of 2.81. The minimum and maximum ranges were 5–9 years for age and 3–12 months for experience. This reflects a similar demographic profile to the static group but with marginally greater average sports experience, ensuring comparability between the two groups.

Static Balance in Gymnasts

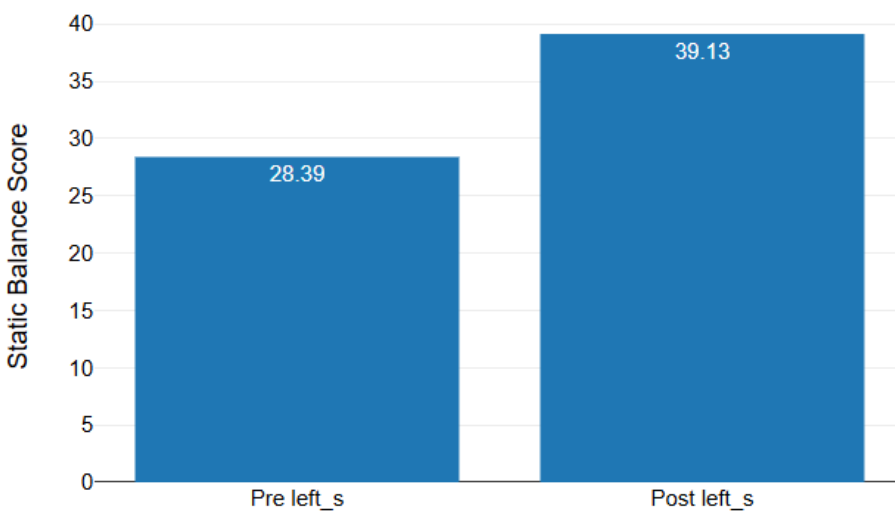
	Mean (Pre)	Mean (Post)	p-value	Effect Size
Right Side	28.52	38.96	<0.01	0.88

Static Balance: Pre and Post (right)



	Mean (Pre)	Mean (Post)	p-value	Effect Size
Left Side	28.39	39.13	<0.01	0.88

Static Balance - Pre and Post (left)



Interpretation:

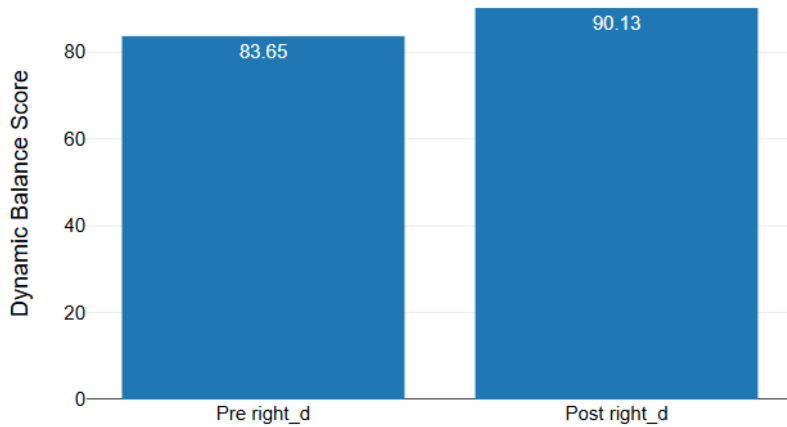
Static balance was measured on both right and left sides before and after the intervention. For the right side, the mean pre-test score was 28.52, which significantly increased to 38.96 post-intervention ($p < 0.01$), with a large effect size of 0.88. Similarly, for the left side, the mean increased from 28.39 to 39.13 ($p < 0.01$; effect size 0.88). These findings demonstrate a statistically significant and meaningful improvement in static balance on both sides following the intervention.

Dynamic Balance in Gymnasts

	Mean (Pre)	Mean (Post)	p-value	Effect Size
Right Side	83.65	90.13	<0.01	0.88

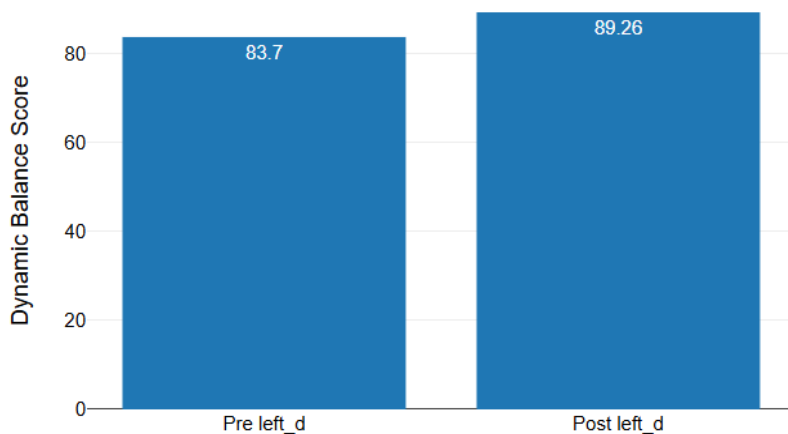
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Dynamic Balance: Pre and Post (right)



	Mean (Pre)	Mean (Post)	p-value	Effect Size
Left Side	83.7	89.26	<0.01	0.88

Dynamic Balance: Pre and Post (left)



Interpretation:

The dynamic balance performance also showed notable improvement post-intervention. On the right side, the mean score increased from 83.65 to 90.13 ($p < 0.01$; effect size 0.88), and on the left side from 83.7 to 89.26 ($p < 0.01$; effect size 0.88). These consistent improvements indicate that the intervention led to significant gains in

dynamic balance bilaterally, with a large effect size reflecting strong responsiveness to the training protocol.

Summary of Findings

The study included 46 gymnasts divided equally into static and dynamic balance training groups. Both groups were comparable in age and sports experience. Significant improvements were observed in both static and dynamic balance post-intervention on both sides ($p < 0.01$, large effect sizes).

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