

## ALTERATIONS OF FLEXIBILITY IN CHILDREN AFTER A 6-WEEK GYMNASTIC ACTIVITIES PROGRAM

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### ABSTRACT

*The present study was an attempt to find out the impact of participation in gymnastics program on flexibility after administering 6-week basic and core gymnastics related activities, six days a week and sixty minutes a day. To accomplish the objective of the study 15 male children aged 10-14 years (mean  $\pm$  SD: age; 12.07  $\pm$  1.33 years, standing height; 144.73  $\pm$  5.81 cm, body weight; 37.20  $\pm$  4.98 kg) were randomly drawn from the L.N.I.P.E, Gwalior, during summer coaching camp. The following six variables: flexibility of hamstring and low back, flexibility of lower back and hamstring muscles, flexibility of the hamstring muscles, flexibility of adductor muscle, flexibility of shoulder and flexibility of trunk and neck were measured as flexibility variables. Data was acquired in pair on the same set of subjects before and after the experiment. Distinction between the two responses estimated on the same experimental units were tested using Paired t-test for two related groups, where significance of the p value was  $< 0.05$ . A significant difference was found between two related groups. Mean value of flexibility of hamstring and low back, flexibility of lower back and hamstring muscles, flexibility of trunk and neck was highest among the children in the post-testing in comparison to that of pre-testing. On the other hand, flexibility of the hamstring muscles, flexibility of adductor muscle and flexibility of shoulder was least among the children after a 6-Week Gymnastics training program in comparison to that of before training program, with statistically significant difference ( $p < 0.05$ ). These data suggest that regular practice of gymnastic activities may improve the flexibility level of a child gymnast.*

**Keywords:** Flexibility, active children, gymnastics training program.

### 1. INTRODUCTION

In Gymnastics the developments are capable, conveyed in a brief timeframe, ordinarily against the power of the adversary. Flexibility is one of the essential things to go as our bodies enter adulthood and proceed to age and one's flexibility is a long lasting procedure. Flexibility is vital for gymnasts on the grounds that various tumbling aptitudes essentially is impossible if the gymnast is not flexible sufficient. Gymnast must be flexible to be fruitful in gymnastics. Gymnasts need to develop extremes ranges of motion all through their major joints of lower and upper extremity. A number of novice gymnasts have been missing adjusted ranges of motion at key joints and it might cause a hazard for damage. Novice gymnasts are gymnasts who are either totally new or possibly to some degree new in gymnastics and propelled gymnasts are viewed as the most noteworthy gymnastics experience level there is. For a few gymnasts that can take 4 years, or 6 years, or 8 years. Vivacious range of motion is basic to decrease of damage chance.

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Flexibility is a quality that can be improved, essentially by investing energy in it. Since, numerous gymnastics abilities require exceptional flexibility. Most gymnastics mentors would concur that flexibility is a basic part of gymnastics training and performance. Flexibility is much of the time incorporated into ability recognizable proof and screening measures for gymnasts (Brodie & Royce, 1998). Gymnasts should focus on enhancing their flexibility, mounting Shoulder and leg flexibility is critical in the right execution on each occasion. Gymnastics require intense extending of muscles, ligaments, and tendons. The flexibility of a joint relies upon numerous components including muscles and tendons length and suppleness, the shape of the bones and cartilage that shape the joint. Gymnastics is brimming with invigorating. Gymnasts can spring over an adjust shaft or effectively fly through the air over a vault. These aptitudes may conceivable, when gymnasts came to with broad and customary practice. Flexibility alludes to the range of movement and mobility around a joint, essentially demonstrates how far a body part can move around joints. Range of motion is relies upon muscle mass, the encompassing tissue, the structure of the joint, skin and muscle length (Michael, 2004). Range of motion can be accomplished by either dynamic strong constriction or by the detached development of the joint caused by some outer power (Roberts & Wilson, 1999). Our present basic comprehension of flexibility as the range of motion of a joint, or a related arrangement of joints, might be misinformed and sell out a more mind boggling component (Holt, Holt, & Pelham, 1995). Range of motion is reliant on both strength and flexibility is normally understood, however how to prepare the two characteristics for the world class gymnast specifically has not been all around investigated. Strangely, stretching activities of different types might be the single exercise movement in gymnastics that devours the best level of conditioning time. Flexibility can be hereditary; however it can likewise be created by stretching. For effectively stretching the muscles, each position ought to be kept up for a couple of many seconds, and the progress starting with one development then onto the next ought to be set apart by total relaxation. Regardless of whether there are particular stretching practices for each muscle gathering, the developments ought to dependably be synchronized with breathing's frequency and intensity. Three strategies for stretching to create flexibility have risen; ballistic stretching, static stretching, and proprioceptive neuromuscular facilitation techniques. Each of the three strategies have been appeared to increase Range of motion promptly after stretching (Sady, Wartman, & Blanke, 1982) and these three techniques is apply in their general preparing period of the gymnasts on regular basic. Unmistakably there are limited and clashing discoveries in this area. Additionally, little research has tended to gymnastics practice may enhance the flexibility of the children. In this paper, we address a related inquiry that has received little attention to date: whether there is any impact of participation in gymnastics on flexibility between post and pre-test score after administering gymnastics related activities? In this paper, we initially assess the confirmation that routine with regards to gymnastics activities enhances flexibility. The significant reason for this research is to see the impact of gymnastics activities on flexibility among the children.

## **2. METHODS AND MATERIALS**

### **2.1 Participants**

Fifteen male children, aged 10-14 years (mean  $\pm$  SD: age;  $12.07 \pm 1.33$  years, standing height;  $144.73 \pm 5.81$  cm, body weight;  $37.20 \pm 4.98$  kg), were randomly drawn from the Lakshmibai National Institute of Physical Education, Gwalior, during summer coaching camp and volunteered to act as subjects for the study. The group was classified into two categories pre-testing group and post-testing group. Data was acquired in pair on the same set of subjects before and after the experiment and two responses estimated on the same experimental units.

## 2.2 Testing Procedures

The six variables such as flexibility of hamstring and low back, flexibility of the lower back and hamstring muscles, hamstring flexibility, flexibility of adductor muscle, shoulder flexibility, and trunk and neck flexibility were selected to measure the flexibility of the children. Modified Sit and Reach test was utilized to estimate the flexibility of hamstring and low back. Modified Sit and Reach Box was applied. The score was communicated in number of centimeters. Three trials were given and best distance was noted. V Sit and Reach test measures the flexibility of the lower back and hamstring muscles. A tape was utilized for denoting the ground. After three practice tries, the student holds the fourth reach for three seconds while that distance was recorded in centimeters. 90/90 Active Knee Extension was utilized to evaluate the range of active knee extension in a position of hip flexion for estimating the hamstring flexibility. Goniometer was utilized to measure the thigh angle (degree). Groin flexibility test measures the flexibility of adductor muscle (inside of thighs) and estimated by ruler. The score was communicated in number of centimeters. Three trials were given and best distance was noted. Static flexibility Test of Shoulder (Rope) was utilized to screen the gymnasts shoulder flexibility. Records the distance between the tips of the athlete's thumbs and subtracts the shoulder measurement from thumb measurement and records the outcome. The score was expressed in number of centimeters. Three trials were given and best distance was noted. The Static Flexibility Test of Trunk and Neck was utilized to quantify the gymnast's trunk and neck flexibility. Repeat the test three times and the longest recorded vertical distance was measure in inches.

## 2.3 Statistical Analysis

The descriptive statistics was used to know the nature of data. All data are presented as Mean, Standard Deviation and Standard Error of Mean. Data was acquired in pair on the same set of subjects before and after the experiment. Distinction between the two responses estimated on the same experimental units was tested using Paired *t*-test for two related groups, where probability values of  $p < 0.05$  were used to determine significance. For this purpose, Statistical Package for Social Science (SPSS) version 20.0 was used.

## 3. RESULTS

The study was carried out to see the influence of gymnastics activities on the improvement of flexibility of the children. Since different research studies uncover that participation of gymnastics bring the enormous changes and assumes critical part in moulding the flexibility of the sportsperson. Thus analyst made here an endeavour to investigate the connection and significant influence on gymnastics training program on flexibility of the children.

**Table 1: Descriptive statistics for the data on flexibility of children before and after a 6-week gymnastic training program**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Flexibility of Hamstring and Low Back	36.39	15	1.76	0.46
	Post Flexibility of Hamstring and Low Back	44.61	15	2.81	0.72
Pair 2	Pre Flexibility of the Lower Back and Hamstring Muscles	16.97	15	2.13	0.55
	Post Flexibility of the Lower Back and Hamstring Muscles	22.73	15	2.40	0.62
Pair 3	Pre Hamstring Flexibility	143.80	15	4.02	1.04

	Post Hamstring Flexibility	122.73	15	3.45	0.89
Pair 4	Pre Flexibility of Adductor Muscle	13.73	15	0.96	0.25
	Post Flexibility of Adductor Muscle	7.40	15	1.18	0.31
Pair 5	Pre Shoulder Flexibility	24.80	15	2.86	0.74
	Post Shoulder Flexibility	15.53	15	2.36	0.61
Pair 6	Pre Trunk and Neck Flexibility	8.13	15	0.83	0.22
	Post Trunk and Neck Flexibility	11.20	15	1.01	0.26

To understand the nature of the data various statistics such as Mean, Standard Deviation and Standard Error of Mean has been calculated (Table 1). It is clear the mean value on flexibility of hamstring and low back, flexibility of lower back and hamstring muscles, flexibility of trunk and neck was highest among the children after a 6-Week gymnastics training program in comparison to that of before Training Program. It can be seen from the Table 1, that the mean value on flexibility of the hamstring muscles, flexibility of adductor muscle and flexibility of shoulder was least among the children after a 6-Week gymnastics training program in comparison to that of before Training Program. For these particular variables the lowest values indicated the effectiveness of the training program. However, whether this difference is significant or not has to be tested by using the Paired *t*-test for related samples.

**Table 2: The *t*-table for the data on flexibility of children after a 6-week gymnastic training program**

		Paired Differences				<i>T</i>	<i>df</i>	Sig. 2-tailed)	
		Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Pre Flexibility of Hamstring and Low Back Post Flexibility of Hamstring and Low Back	-8.23	3.40	0.88	-10.11	-6.34	-9.38	14	0.00*
Pair 2	Pre Flexibility of the Lower Back and Hamstring Muscles Post Flexibility of the Lower Back and Hamstring Muscles	-5.77	2.48	0.64	-7.14	-4.39	-9.02	14	0.00*
Pair 3	Pre Hamstring Flexibility Post Hamstring Flexibility	21.07	5.50	1.42	18.02	24.11	14.85	14	0.00*
Pair 4	Pre Flexibility of Adductor Muscle Post Flexibility of Adductor Muscle	6.33	1.40	0.36	5.56	7.11	17.56	14	0.00*
Pair 5	Pre Shoulder Flexibility Post Shoulder Flexibility	9.27	4.13	1.07	6.98	11.55	8.69	14	0.00*
Pair 6	Pre Trunk and Neck Flexibility Post Trunk and Neck Flexibility	-3.07	1.10	0.28	-3.68	-2.46	-10.80	14	0.00*

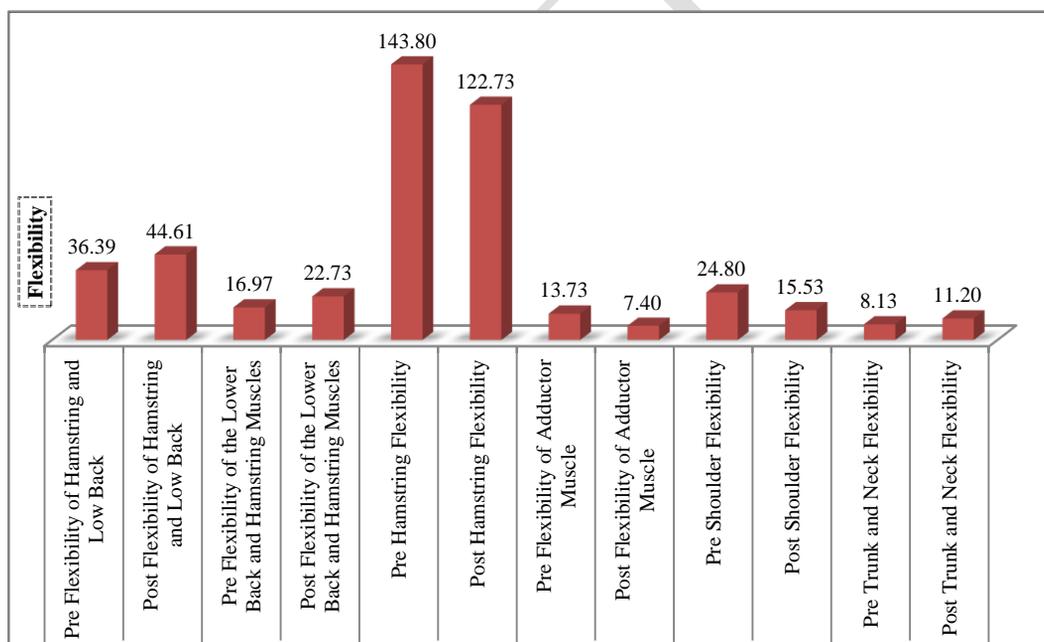
\*significant at 0.5 level

It can be seen from the Table 2, that the flexibility of hamstring and low back of children the value of *t*-statistics is -9.38, this *t*-value is significant as the *p*-value is 0.00, which is less than 0.05. The flexibility of the lower back and hamstring muscles of children the value of *t*-statistics is -9.02, this *t*-value is significant as the *p*-value is 0.00, which is less than 0.05. The flexibility of the hamstring of children the value of *t*-statistics is 14.85, this *t*-value is significant as the *p*-value is 0.00, which is less than 0.05. The flexibility of adductor muscle of children the value of *t*-statistics

is 17.56, this  $t$ -value is significant as the  $p$ -value is 0.00, which is less than 0.05. The flexibility of shoulder of children the value of  $t$ -statistics is 8.69, this  $t$ -value is significant as the  $p$ -value is 0.00, which is less than 0.05. The flexibility of trunk and neck of children the value of  $t$ -statistics is -10.80, this  $t$ -value is significant as the  $p$ -value is 0.00, which is less than 0.05. Thus, the null hypothesis of equality of flexibility level in the pre-testing and post-testing groups is rejected and it may be concluded that the flexibility of the children in the pre-testing and post-testing groups are different. Further it is clear the mean value of flexibility of hamstring and low back, flexibility of lower back and hamstring muscles, flexibility of trunk and neck is highest among the children in the post-testing in comparison to that of pre-testing. And flexibility of the hamstring muscles, flexibility of adductor muscle and flexibility of shoulder was lowest among the children after a 6-Week gymnastics training program in comparison to that of before training program. So, it may be concluded that the 6-Week gymnastics training program is successful in upgrading flexibility.

From the above findings it can be very easily understood by looking to the graphics in Figure 1; a graphical representation of the group means. From Figure 1, it is clear that the post-testing children group significantly higher level of flexibility as compared to the pre-testing children group.

**Figure 1: A graphical representation of the mean score on flexibility of children before and after a 6-week gymnastic training program**



#### 4. DISCUSSION

The reason for the investigation was to decide the changes in flexibility because of gymnastics training program in children. Toward the finish of this investigative approach, we underscore that there was a critical change found in flexibility due to 6-week regular practice of gymnastics. It can be seen from the Table 2, that a significant difference was found between two related groups. Mean estimation of flexibility of hamstring and low back, flexibility of lower back and hamstring

muscles, flexibility of trunk and neck is highest among the children in the post-testing in contrast with that of pre-testing in their flexibility. On the other hand, flexibility of the hamstring muscles, flexibility of adductor muscle and flexibility of shoulder was least among the children after a 6-Week gymnastics training program in comparison to that of before training program in their flexibility, with statistically significant difference ( $p < 0.05$ ). The finding is in concurrence with the results of (Thacker, Gilchrist, Stroup, & Kimsey, 2004). The method of diminishing hamstring tightness utilized as a part of gymnastic practices is to inactively and statically extend the hamstring muscles. The evidence uncovers that stretching clearly builds flexibility and, to the extent that flexibility may profit execution. In the training process, two types of stretching are regularly utilized; static (moderate extending of muscle groups and joints to most extreme and staying in this situation for 5-10 seconds) and dynamic (curving initially, extending and keeping up the extend). Muscle versatility assumes a noteworthy part, on the grounds that in various performed works out, muscle contraction starts before extending and calming the antagonists. Muscle flexibility may change to a substantial degree by neuro-psychological procedures impact of muscle relaxation and sorts of extending works out. It is viewed as that the diminishment in development by sufficiency adversary's flexibility is dictated by reflex activity guard, and by decreasing the degree of the constriction which opposes development. Studies demonstrate that frequently extending the muscles that are always abbreviated through your work posture or every day routine can ease and avoid endless agony. The use of static extending exercise system connected in exercises time brought about change in hamstrings muscle flexibility, flexibility of lower back, flexibility of trunk and neck, flexibility of adductor muscle and shoulder flexibility of the children. Although static stretching is the simplest and normally utilized stretching strategy in gymnastics coaching and preparing program. Stretching is a technique that creates joint versatility and strong flexibility which is a fundamental aptitude in a wide range of gymnastics activities yet particularly vital in performing gymnastics. Stretching exercises are simple and proficient methods for keeping up body's flexibility barring the hazard for wounds. Expanding hamstring flexibility was accounted for to be a viable technique for expanding hamstring muscle execution on particular Isokinetic conditions (Worrell, Smith, & Winegardner, 1994). A prior examination by Chan, Hong, and Robinson, (2001) who revealed that static stretching conventions are viable as far as enhancing flexibility of hamstrings. The system of activity is that static stretching exercise causes plastic stretching which brings about irreversible tissue stretching (Turner, Gossman, Nicholson, & Lemons, 1988). There are various kinds of stretching, and each has their particular reason and advantages. Static methods are likewise favourable as they are easy to complete and might be led for all intents and purposes anyplace. For greatest picks up in flexibility in the briefest conceivable time the PNF strategy is the most suitable. Studies recommend that a dynamic stretch is similarly as compelling and sometimes better, particularly before your exercise. Stretches are particularly essential in gymnastics. Hume, Hopkins, Robinson and Hollings (1993), expressed that flexibility was fundamentally connected with accomplishment. Along these lines, the advancement of gymnasts' flexibility is among of the most essential components of accomplishment, as is additionally upheld in many examinations (Douda, Tokmakidis, & Tsigilis, 2002; Nelson, Johnson, & Smith, 1983). Commonly, rhythmic gymnastics require the utilization of a significant level of flexibility and requests a high level of progress in this particular segment. The improvement of flexibility may enable gymnasts to perform all the more skillfully. Therefore, particular physical preparation enables gymnasts to create and keep up their physical capacities, which are fundamental in rhythmic gymnastics. (Douda *et al.*, 2002). A few past investigations have uncovered the significance of hip and shoulder flexion and extension in effective execution of the long swings (Yeadoon & Hiley, 2000). Previous studies (Busquets, Marina, Iruiria, Ranz, & Angulo-Barroso, 2011; Williams, Irwin, Kerwin, Hamill, van Emmerik, & Newell, 2015) have detailed that beginners, after a short period of training, indicate more fluctuation in functional

phases of development than specialists. It may generalize that participation of gymnastics activities gives abundant chance to build their flexibility and to get mastery to produce, performance among the children in regard of wellbeing and diversion circumstance.

## 5. CONCLUSION

The results of this investigation recommend that routine with regards to gymnastic movement assumes a substantial part in how well an individual may enhance their flexibility. So we ought to elevate the children to take part in gymnastics activities with the goal that they can be more flexible and can have the capacity to play out the easily day by day exercises. Better research is expected to decide the proper role of stretching in gymnastics, particularly as there are increasing numbers of gymnasts and developing acknowledgment that all gymnasts need to build their physical movement to enhance their flexibility. Additionally, explore should be performed with a sufficient control group. A six weeks training program is fairly short, accordingly a more drawn out preparing program is justified and the gymnastics groups could be extended to incorporate less highly trained gymnasts. Additionally, look into is required particularly longitudinal investigations keeping in mind the end goal to better record the advantages of a preparation program in gymnastics performance.

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