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## Effect of gymnastics exercises on balance ability of autistic children

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### Abstract

The objective of the study was to find out the effects of Gymnastics Exercises on Balance Ability of Autistic Children. A sample of twenty four (N= 24) boys age ranged between 10 to 14 years from Astha Rehabilitation Centre, Mohali, (Panjab) were purposively selected to act as participants for this experimental investigation. The chosen subjects were divided into four groups with six children in each group namely Group-A, B, C and Group D (Control Group). The daily, weekly and monthly Gymnastics exercise training schedule was prepared with the help of experts for all three experimental groups. Group-A was given gymnastics exercises training programme for six days in a week, Group-B was given this treatment (gymnastics exercises training) thrice a week and Group-C was exposed to the gymnastics exercises training programme only once in a week for sixteen weeks. Group-D as a control group did not receive any treatment except their daily routine programme of the institute. Flamingo Balance Test (Kansal, 2012) was conducted to evaluate the Balance ability of the subjects. To observe the significance of mean difference in scores of Balance ability of autistic subjects of each group, Analysis of Covariance (ANCOVA) was applied. Results revealed significant differences F-ratio  $[F(3,19)=12.25, p=0.001]$ . Scheffe's Post hoc test was carried out to see the degree and direction of differences in adjusted means of balance ability of Autistic children. The outcome of the study revealed that the maximum balance ability was significantly improved in experimental Group-A (mean =10.37) followed by Group-B (M=12.13) and Group-C (M=14.26) respectively. However, insignificant improvement was reported in control Group-D (M=16.07) with respect to the variable balance ability. Hence, it may be concluded that higher the frequency of specific gymnastics exercises training programme, more will be the improvement of balance ability among autistic children. Further, it is also concluded that specific gymnastics programme tend to play a key role in improving their balance ability and the disability of an individual does not hinder one's physical performance.

**Keywords:** autistic children, balance ability, gymnastics exercises

### Introduction

Good health and physical fitness cannot be taken for granted, especially with today's sedentary, automated and computerized life styles. Day to day technology is curtailing physical exertion from every day's activities. New inventions of science and technology such as time saving machines, electronic media and computerization in public and private sector have not only influenced the normal life of the people, but have greatly affected the physical fitness of people of all ages, which is causing enormous damage to the health. In this modern era, the children's physical and mental health level is decreasing day by day and a matter of concern for all. Such condition might be the major reason of many diseases such as blindness, low vision, cerebral palsy, autism, leprosy, hearing impairment, locomotors disabilities, mental retardation as well as multiple disabilities. The national sample survey organization (NSSO) considered disability a person with restrictions or lack of abilities to perform an activity in the manner or within the range considered normal for a human being was treated as having disability. It excluded illness/injury of recent origin (morbidity) resulting into temporary loss of ability to see, hear, speak or move. (S. Marg 2012) <sup>[9]</sup>. Disability is difficult to define since it varies in type, form and intensity. Understanding disability may require understanding these differences. According to the WHO, disability is any restriction or lack (resulting from impairment) of ability to perform in a manner or within the range considered normal for human being. In India, 1.67% of the 0-19 population has a disability.

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35.29% of all people living with disabilities are children. Only 1% of children with disabilities have access to school and 1/3 of most disabilities are preventable. Extensive research has been conducted on the determinants of participation in physical activity and on interventions that attempts to increase physical activity participation with relatively little research focusing more specially on sports (Eime *et al.*, 2013) [1]. Physical activity is important for children with and without disabilities alike as it promotes a healthy life style, but can benefit individuals with autism in unique ways (Morin, 2015) [6].

Autism is a complex neurological, developmental disorder that is typically diagnosed in childhood and often lasts throughout a person's life time. It is unclear whether ASD (Autism Spectrum Disorder) is explained more by rare mutations, or by rare combinations of common genetic variants. While the causes of autism are unknown and preventative measures have yet to be discovered (Geraldine & Michael, 2009) [2]. There does exist effective behavioral therapy that can result in significant improvements for many young children with autism. Exercise is especially important for children with autism early, during their sensitive period of development when their brain and behavior have the most plasticity (Lewis, 2004) [5] and especially gymnastic programmes provide many social benefits.

Gymnastics is a great sport for kids being a basic body movement oriented activity and thus, it has lots of benefits both physical and mental. Combination of gymnastics exercises can strengthen the child's nervous system, increase overall health and facilitate the development of body awareness and concentration (Saunders, 2011) [8]. Therefore, keeping the importance of gymnastics exercises in mind for the development of children with autism, the investigators, designed this study to assess the effects of Gymnastics exercises on balance ability of children having autism.

**Procedure:** On the basis of purposive sampling technique, total twenty four N= 24 boys of 10 to 14 years were selected from Astha Rehabilitation Centre, Mohali, (Panjab). They were divided into four groups with six children in each group namely Group-A, B, C and Group-D (Control Group). A specific daily, weekly and monthly Gymnastics exercise training schedule was prepared with the help of experts for all three experimental groups. Group-A was given gymnastics exercises training programme six days a week, Group-B was given this training programme thrice a week, and Group-C was given gymnastics exercises training programme only once a week for sixteen weeks. Group-D as a control group did not get any gymnastics exercises training programme except their daily routine programme of the institute. Balance ability of the subjects was evaluated by conducting Flamingo Balance Test, (Kansal, 2012) [4]. To observed pre and post test mean differences 't' test was applied. Analysis of Covariance (ANCOVA) was applied to observe the significance of mean difference in scores of balance ability of autistic children of each group followed by Scheffe's Post hoc test to see the degree and direction of differences in adjusted means. The level of significance was set at 0.05.

### Findings

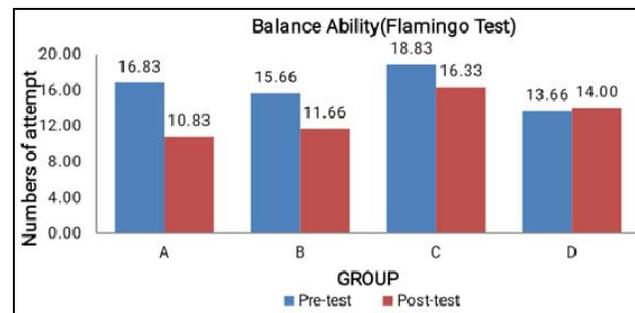
Descriptive statistics of variable balance ability measured by flamingo test of three experimental and control group has been given in table-1.

**Table 1:** Descriptive Statistics of Balance Ability (Flamingo Test) among various Groups of Autistic Children

Group	N	Pre-Test	Post-Test	Adjusted Mean	't'	P-Value
		Mean ± S.D	Mean ± S.D			
A	6	16.83 ± 4.07	10.83 ± 3.06	10.37	7.00*	0.001
B	6	15.66 ± 4.13	11.66 ± 3.50	12.13	4.47*	0.007
C	6	18.83 ± 6.08	16.33 ± 5.85	14.26	4.03*	0.010
D	6	13.66 ± 1.86	14.00 ± 1.67	16.07	0.50	0.638

\*Significant at 0.05 level

Table-1 depicts the mean and standard deviation value of pre and post test and adjusted mean of different groups of autistic children. An examination of table in pre testing of different groups of autistic children Mean ± SD were 16.83±4.07, 15.66±4.13, 18.83±6.08 and 13.66±1.86 of group A, B, C and D respectively. However, post testing Mean ± SD after treatment were 10.83±3.06, 11.66±3.50, 16.33±5.85 and 14.00±1.67 respectively in these investigated groups. Group-A, B, and C experimental groups shows statistically significant differences at 0.05 level of significance with t-value 7.00 (p=0.001), 4.47 (p=0.007) and 4.03 (p=0.010) respectively. Control Group-D did not yield any significant differences between pre and post test mean scores and the adjusted mean value of these investigated groups are 10.37, 12.13, 14.26 and 16.07 respectively. The graphical representations of mean scores of pre and post test of these four groups have also been exhibited in figure-1



**Fig 1:** Mean Scores of Pre-Test & Post-Test of Balance Ability (Flamingo Test) among Autistic Children

To observe the significance of mean difference in scores of balance ability (Flamingo Test) of autistic subjects of three experimental and a control group, Analysis of Covariance (ANCOVA) for the pre and post testing means of these groups has been given in table-2.

**Table 2:** Computation of Analysis of Covariance (ANCOVA) of Balance Ability (Flamingo Test) among various Groups of Autistic Children.

Protocol	Source of Variation	Sum of Squares	D F	Mean Square	F-Ratio	P-Value
Pre-Test	Between	84.16	3	28.05	1.51	0.241
	Within	370.33	20	18.51		
	Total	454.50	23	-----		
Post-Test	Between	110.45	3	36.81	2.50	0.088
	Within	293.50	20	14.67		
	Total	403.95	23	-----		
Adjusted Mean	Between	108.604	3	36.201	12.25*	0.001
	Within	56.113	19	2.953		
	Total	164.717	22	-----		

\*Significant at 0.05 level

To test the difference in mean gains for significance, analysis of covariance (ANCOVA) was applied and computed for adjusted mean scores in table-2. It may be observed from table that there was no significant differences among three experimental groups and a control group on pre test mean scores of balance ability measured by Flamingo test as the obtained F-ratio of 1.51 was statistically insignificant ( $P=0.241$ ) and providing confidence that initial samples came from the same population and are devoid of sampling bias. Whereas in post test mean scores of balance ability among these four groups, the obtained F-ratio of 2.51 was just touching the significance level ( $P=0.088$ ) thereby indicating some mean differences. There was a statistically significant difference in adjusted mean scores of balance abilities [ $F(3, 19)=12.25, p=0.001$ ] between three experimental and control groups of Autistic subjects after completion of different experimental treatments (Table 2). As the F ratio in analysis of covariance was significant thus, Scheffe's Post hoc test was carried out to see the degree and direction of differences in adjusted means of balance ability of Autistic subjects of various treatment groups after experiment and results thereof has been given in the following table- 3.

**Table 3:** Scheffe's Post Hoc Pair wise comparisons between Adjusted Means of Balance Ability (Flamingo Test) of various Groups of Autistic Subjects

Experimental Groups			Control Group	Mean diff	Standard Error	P-Value
Mean			Mean			
A	B	C	D			
10.37	12.13	--	--	1.76	0.99	0.555
10.37	--	14.26	--	3.89*	1.00	0.006
10.37	--	--	16.07	5.70*	1.03	0.000
--	12.13	14.26	--	2.13	1.03	0.316
--	12.13	--	16.07	3.93*	1.00	0.005
--	--	14.26	16.07	1.80	1.09	0.694

\*Significant at 0.05 level

Scheffe's Post hoc analysis in table-3 showed that there was a significant difference between experimental group A and group C ( $p=0.006$ ) and group A and control group D ( $p=0.000$ ). Experimental Group B and control Group D also indicated significant difference ( $p=0.005$ ). Comparing the adjusted means showed that the most balance ability was gained by experimental Group A (mean=10.37) after the sixteen week training programs compared to Group C and control Group D (mean=14.26, 16.07 respectively). Experimental Group B also improved balance ability (mean=12.13) significantly as compared to control Group D having mean score of 16.07.

**Discussion:** In this study, the experimental Group-A, B, and C showed statistically significant differences with regards of balance ability of autistic children. It has been revealed from the results that experimental group A had shown higher balance ability in comparison to their counter parts. Similarly, group B had also shows significant performance to build up balance ability as compared to Group C and control group D. This is due to influence of regular exercise of group A and thrice a week training schedule of group B which improve balance ability of autistic children. However, group C has also shown slight progress as compared to control group D. Similar trends were also shown in the study conducted by Kaale *et al.* (2014) [3] wherein they reported that the treated children achieved significantly larger improvements in joint attention and joint engagement from baseline to 12-month

follow-up compared with those in the control group. Similarly, Paynter and Peterson (2013) [7] also reported that bubble training is genuinely beneficial in the context of autism statistically significant gains were made by trained children. Control children showed no significant gains of any kind despite their close match to trained children at pre test. However, MacDonald *et al.* (2011) had reported that older children with autism spectrum disorder are significantly more physically inactive, compared to younger children. Children with autism have a similar trend in physical activity patterns compared to their peers without autism.

### Conclusion

Autistic boys of experimental Group-A, B and C had shown varied gains in their balance abilities. As a result of specific gymnastics exercise training programme, Autistic boys (Group- A) supplemented their balance ability more as compared to their other counter parts (Group-B and C), as they were getting training six days a week whereas Group-B was getting training thrice a week and Group-C was receiving this only once a week. Results of this study established the beneficial effects of gymnastics exercises in the context of autism only when gymnastics exercise training programme were carried out regularly daily for a longer period by the autistic children. It is concluded that the effect of the regular participation or physical exercises tend to automate the muscle strength and neuro- muscular coordination, and enable to perform physical exercise more efficiently and smoothly. Hence, gymnastics exercise training programme may play a key role in shaping the motor skills in the form of balance ability of disabled children having autism.

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