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Response of Children with Down Syndrome To Physical Activity Programme On Motor Proficiency And Functional Abilities

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Abstract
Down syndrome occurs because of an abnormality characterized by an extra copy of genetic material on all or part of the 21st chromosome. The study was done with a purpose know the response of children with Down syndrome to physical activity programme on motor proficiency and functional abilities. 30 children (15 each in experimental and control group) having Down syndrome between the age group of 10-18 years were selected. Training programme of 55 minutes only to the experimental group was given, thrice a week for a period of 12 weeks. Bruininks Oseretsky test for motor proficiency (BOTMP), which provides an overall view of a child's motor development, was administered. For assessing functional ability Fr. Thomas Felix's Functional ability questionnaire (Felix, 1994) was used. Descriptive Statistics and Analysis of covariance (ANCOVA) were employed as statistical tool. The analysis of data revealed that the experimental group improved significantly in six of the motor proficiency skills and in all three functional ability variables by following 12 weeks of the physical activity programme. However, in rest eight motor proficiency skills, positive improvement was present; but it was not enough for statistical significance.

Introduction

Down syndrome occurs because of an abnormality characterized by an extra copy of genetic material on all or part of the 21st chromosome. Every cell in the body contains genes that are grouped along chromosomes in the cell's nucleus or centre. There are normally 46 chromosomes in each cell, 23 inherited from our mother and 23 from our father. When some or all of a person's cells have an extra full or partial copy of chromosome 21, the result is Down syndrome.

Down syndrome as 'mongolism' and is no doubt the most cytogenic cause of mental retardation, it is an autosomal chromosomal condition that result in short stature, distinct facial feature physical and cognitive difference that separate from other manifestation of mental retardation. Individuals with Down syndrome usually have cognitive development profiles indicative of mild to moderate mental retardation. However, cognitive development in children with Down syndrome is quite variable. Children with Down syndrome often have a speech delay and require speech therapy to assist with expressive language. In addition, fine motor skills are delayed and tend to lag behind gross motor skills. Although many with the condition experience developmental delays, it is not uncommon for those with Down syndrome to attend school and become active, working members in the community (Buckley, 2000).

Development of locomotors proficiency often depends on how soon and how well child attain static and dynamic balance. Children with Down syndrome are known to have lower level balance ability; motor program for children with Down syndrome should be similar to those for non-mental retarded children.

Socially Down syndrome children are generally quite mature. They are usually affectionate, relaxed, friendly, cooperative and concerned with others (Winnick, 1979). The greatest general development is found in Down syndrome, individual who are reared at home and well stimulated, optimum progress occurs when facilities are positive and training begins early and is comprehensive (Sinclair, 1986).

The present study intends to determine the effect of Physical Activity programme on Motor Proficiency and Functional Abilities in children with Down syndrome. On the basis of the literature reviewed, hypothesis framed was; Physical activity training programme would have a positive effect in motor proficiency functional abilities in the children with Down syndrome.

Purpose: To know the response of children with Down syndrome to physical activity programme on motor proficiency and functional abilities.

Methodology

Sample: Thirty children having Down syndrome between the age group of 10-18 years from Jeevan Prakesh Institute, Murinjapalam, Trivandrum were selected as the subject for the study. They were randomly assigned to experimental group (N=15) and control group (N=15).

Training Programme: Training programme was given thrice a week for a period of 12 weeks, sessions lasting for minimum of 55 minutes only to the experimental group. Training session started with a warm up of 10 minutes and ended with cooling down. The detail of training capsule is given below.

Table: 1 **Bi Weekly Physical Training Programme for the Experimental Group**

weeks	*Training programme*	*sets*	*Repetition*	*Recovery*
First - second	Walking	1	2 minutes	2 minutes
	Steps ups	1	5	2 minutes
	Curl ups	1	5	2 minutes
	Running relay	1	1	2 minutes
Third - fourth	Walking	1	2 minutes	2 minutes
	Steps ups	2	5	2 minutes
	Curl ups	2	5	2 minutes
	Partner relay	1	1	2 minutes
Fifth - sixth	Walking	1	3 minutes	1 minutes
	Steps ups	1	8	2 minutes
	Walking between line	1	5 meters	2 minutes
	Ball relay	1	1	2 minutes
Seventh – eighth	Jogging	1	2 minutes	2 minutes
	Walking on line	1	5 meters	2 minutes
	Shuttle run	1	2 X 10 Yards	2 minutes
	Ball relay	1	1	2 minutes
Ninth-tenth	Jogging	2	1 minutes	1 minutes
	Jumping jacks	1	5	2 minutes
	Shuttle run	2	2 X 10 Yards	2 minutes
	Ball relay	1	1	2 minutes
Eleven – twelfth	Jogging	2	2 minutes	1 minutes
	Jumping jacks	1	5	1 minutes
	Shuttle run	2	2 X 10 Yards	1 minutes
	Movements in different direction	1	1	2 minutes
	Ball relay	1	1	1 minutes

Tools: Bruininks Oseretsky test for motor proficiency (BOTMP), which provides an overall view of a child's motor development (Bruininks Oseretsky, 1978) was administered. It's a most diagnostics test used by adapted physical education for making placement decision and also to measure the specific abilities of Down syndrome children. The sub variables of the motor proficiency are Running speed and agility (30 Yards shuttle run in nearest $1/10^{th}$ of second), Balance (Standing on a preferred leg on a balanced beam for 10 seconds recorded in nearest seconds and Walking forward heel to toe on a balance beam recorded to the nearest whole number), Bilateral coordination (Tapping feet alternately while making wile with fingers and jumping up and clapping hands recorded in numbers), Strength (standing broad jump record to the nearest inches), Upper limb coordination (Catching a tennis ball 5 times with both hands tossed from 10 feet and assessed through the correct catches taken to the whole number and Throwing a ball to the target with preferred hand at an eye height target 5 feet away recorded in numbers out of 5 trails), Response speed (Stopping a falling stick with preferred thumb record to the nearest centimetre), Visual motor control (Drawing a line through a straight path with preferred hand recorded in number of errors committed, Copying a circle with a preferred hand and Copying overlapping a pencil with preferred hand), Upper limb speed and dexterity (Sorting shape cards with preferred hand and making dots in wider with preferred hand recorded to nearest number).

Fr. Thomas Felix's Functional ability questionnaire (Felix, 1994) was used. It is a 26 items five point rating scale that measures three domains of functional ability: Psycho-social, Cognitive and Language.

Statistics: The essential descriptive statistics such as Arithmetic Mean and Standard Deviation, which help to describe a data distribution, were calculated. Analysis of covariance (ANCOVA) for finding the

significance of adjusted post test mean difference between control and experimental group was employed. Level of significance chosen was 0.05.

Result and discussion

Table 2: **Descriptive Scores of Various Tests in Down syndrome Children**

Tests	Number of Subjects	Pre Mean	Pre Std. Deviation	Post Mean	Post Std. Deviation	Adjusted Post Mean	Adjusted Post Std. Deviation	Percentage Gain/Loss
Running speed and agility	15	11.88	7.51	12.55	6.67	13.44	1.13	5.64
Running speed and agility	15	14.34	7.06	14.19	6.90	13.30	1.13	-1.05
Standing preferred leg balance	15	14.34	7.06	14.19	6.90	11.10	0.09	-1.05
Standing preferred leg	15	8.03	7.81	7.84	7.69	10.94	0.09	-2.28
Walking heel to toe	15	1.53	0.99	2.33	1.23	2.20	0.14	52.17
Walking heel to toe Control	15	1.27	1.22	1.33	1.18	1.46	0.14	5.26
Tapping feet alt.	15	0.00	0.00	0.13	0.35	0.22	0.09	Undefined
Tapping feet alt. Control	15	0.20	0.41	0.33	0.49	0.25	0.09	66.67
Jump up clap Experimental	15	0.40	0.51	0.80	0.68	0.83	0.14	100.00
Jump up clap Control	15	0.47	0.52	0.73	0.70	0.71	0.14	57.14
Standing broad jump	15	40.60	22.60	46.47	18.19	45.37	1.62	14.45
Standing broad jump Control	15	38.20	43.23	39.13	41.49	40.23	1.62	2.44
Catch a toss ball	15	1.20	1.74	1.87	2.03	1.97	0.18	55.56
Catch a toss ball Control	15	1.40	1.18	1.60	1.12	1.50	0.18	14.29
Throwing ball to target	15	1.47	1.60	2.73	1.33	2.73	0.18	86.36
Throwing ball to target	15	1.47	1.30	1.73	1.03	1.73	0.18	18.18
Response speed	15	15.27	15.06	19.87	13.08	20.25	4.11	30.13
Response speed Control	15	20.87	19.29	25.73	17.97	25.35	4.11	23.32
Drawing line Experimental	15	0.40	0.51	0.67	0.49	0.69	0.08	66.67

Drawing line Control	15	0.47	0.52	0.47	0.52	0.44	0.08	0.00
Copying circle Experimental	15	0.60	0.51	0.87	0.35	0.85	0.10	44.44
Copying circle Control	15	0.53	0.52	0.67	0.49	0.68	0.10	25.00
Copying overlapping	15	0.53	0.52	0.80	0.41	0.76	0.11	50.00
Copying overlapping	15	0.33	0.49	0.60	0.51	0.64	0.11	80.00
Sorting shapes Experimental	15	1.93	1.94	3.67	1.72	3.69	0.24	89.66
Sorting shapes Control	15	2.00	1.96	2.33	1.54	2.31	0.24	16.67
Making dots in circles	15	7.80	6.35	10.80	6.01	10.86	0.61	38.46
Making dots in circles Control	15	7.93	6.19	8.13	5.76	8.08	0.61	2.52
Psycho social Experimental	15	14.07	6.52	17.73	7.12	19.83	0.63	26.07
Psycho social Control	15	18.60	8.72	18.00	7.87	15.90	0.63	-3.23
Cognitive Experimental	15	24.00	10.70	28.13	12.35	30.69	0.53	17.22
Cognitive Control	15	28.87	12.87	29.20	12.80	26.65	0.53	1.15
Language Experimental	15	15.47	7.21	21.40	7.63	25.47	0.49	38.36
Language Control	15	23.60	11.37	23.47	11.38	19.40	0.49	-0.56

Table: 2 shows the nature and characteristics of various test scores in both the experimental and control groups (i.e. number of subjects in each group, means, standard deviation, mean of adjusted post test, standard deviation of adjusted post test & percentage mean difference). A lot of diversity is observed as the data is related to a special type of population (Down syndrome Children).

Analysis of covariance was carried for the post test general scores of all the test items after eliminating the effect of pre test scores. Adjusted post test mean scores were subjected to ANCOVA to test whether there was any difference in the adjusted post test mean scores in the test items of experimental and control groups.

Table: 3 **ANCOVA for Adjusted Post Test Scores of Experimental & Control Groups**

Test Items	Source	Sum of Squares	df	Mean Square	F-Value	P-Value
Running speed and agility	Between Groups	0.15	1	0.15	0.01	0.93
	Within Groups	505.48	27	18.72		
Standing preferred leg balance	Between Groups	0.16	1	0.16	1.49	0.23
	Within Groups	2.87	27	0.11		
Walking heel to toe	Between Groups	4.03	1	4.03	14.86*	0.00
	Within Groups	7.32	27	0.27		
Tapping feet alt.	Between Groups	0.01	1	0.01	0.06	0.81
	Within Groups	3.40	27	0.13		
Jump up clap	Between Groups	0.11	1	0.11	0.36	0.55
	Within Groups	8.32	27	0.31		
Standing broad jump	Between Groups	198.35	1	198.35	5.02*	0.03
	Within Groups	1067.29	27	39.53		
Catch a toss ball	Between Groups	1.62	1	1.62	3.19	0.09
	Within Groups	13.73	27	0.51		
Throwing ball to target	Between Groups	7.50	1	7.50	15.21*	0.00
	Within Groups	13.32	27	0.49		
Response speed	Between Groups	190.33	1	190.33	0.76	0.39
	Within Groups	6760.72	27	250.40		
Drawing line	Between Groups	0.48	1	0.48	4.96*	0.03
	Within Groups	2.58	27	0.10		
Copying circle	Between Groups	0.23	1	0.23	1.55	0.22
	Within Groups	3.95	27	0.15		
Copying overlapping	Between Groups	0.12	1	0.12	0.62	0.44
	Within Groups	5.04	27	0.19		
Sorting shapes	Between Groups	14.26	1	14.26	16.10*	0.00
	Within Groups	23.92	27	0.89		
Making dots in circles	Between Groups	58.03	1	58.03	10.46*	0.00
	Within Groups	149.75	27	5.55		
Psycho social	Between Groups	106.12	1	106.12	18.62*	0.00
	Within Groups	153.92	27	5.70		
Cognitive	Between Groups	117.13	1	117.13	28.36*	0.00
	Within Groups	111.50	27	4.13		
Language	Between Groups	231.05	1	231.05	70.36*	0.00
	Within Groups	88.67	27	3.28		

* Significant at 0.05 level, F 0.05(1,27) = 4.22

The above Table: 3 revels that there lies significant difference between the adjusted post test means of two groups as calculated value (given within brackets) are more than table value (df, 1/27) 4.22 in Walking heel to toe (F-value = 14.86, p= 0.00), Standing broad jump (F-value = 5.02, p = 0.03), Throwing ball to target (F-value = 15.21, p= 0.00), Drawing line (F-value = 4.96, p = 0.03), Sorting shapes (F-value = 16.10, p= 0.00), Making dots in circles (F-value = 10.46, p = 0.00), Psycho social (F-value = 18.62, p= 0.00), Cognitive (F-value = 28.36, p= 0.00) and Language (F-value = 70.36, p= 0.00).

Whereas no significant difference was found in Running speed and agility (F-value = 0.01, p = 0.93), Standing preferred leg balance (F-value = 1.49, p= 0.23), Tapping feet alternatively (F-value = 0.06, p= 0.81), Jump up clap (F-value = 0.36, p= 0.55), Catch a toss ball (F-value = 3.19, p= 0.09), Response speed (F-value = 0.76, p= 0.39), Copying circle (F-value = 1.55, p= 0.22) and Copying overlapping (F-value = 0.62, p= 0.44) as calculated F- Values were less than table value (df, 1/27) 4.22.

Discussion of findings

Children with Down syndrome tend to use a typical posture in static positions, such as while sitting the legs tend to be widely abducted providing a wide base and eliminating the need for weight shift. In sitting, children with Down syndrome tend to avoid rotating the trunk to retrieve objects; instead, they may lean far forward with a rigid trunk or scoot in the sitting position to move toward a desired object. Down syndrome children generally enjoy music and possess on often astounding gift of mimicry.

The analysis of data revealed that the Experimental group improved significantly in six of the motor proficiency skills and in all three functional ability variables by following 12 weeks of the physical activity programme.

Findings in relation to upper limb co-ordination and hand eye co-ordination showed significant improvement in performance of Experimental group. These were characterized by integrating visual information with limb movement. The improvement might be due to the improvement of neuromuscular coordination, proper stimulation of the impulse from sensory nerve to motor nerve. Activity improved were rolling the ball through a given target, drawing line, shorting shapes and making dots in circle.

Strength improved as a result of 12 weeks of training programme. It might be due to nervous recruitment, proper muscles involvement through right movement pattern and concentric contraction of the muscle. At the same time training activity like curl up, body resistance training and step up and down exercises helped the improvement of strength.

The findings of the study indicated significant improvement in psycho social ability. It improved as result of influences such as peer pressure, and interpersonal relationships. Due to the training programme students learn to share, they started motivating each other, discussing about the recreational game, making correction and helping each other, talking the problems with teacher which they were facing during the activity and helping the teacher to administer the activity when their turn was over. Likewise due to interaction and socialization they developed good personality which in turn improved psychosocial ability.

Cognition showed significant improvement following 12 weeks of physical activity programme. It might be due to improved attention and perception. Due to their interest in recreational game and physical activity they were more attentive through which they perceived movement effectively. As a training programme progress with minimum demonstration by the teacher, the students were able to grasp the movement.

The findings of the study indicate significant improvement in language. Physical activity programme enhance the development of language through knowing different words and equipments name which were used during the training programme. The subjects used specific terms to encourage their friends during activity and they asked relevant doubts regarding recreational games to the teacher. These all might have helped to improve language among the subject.

Former findings of Barbara H Connolly (1993), Shields N and Dodd K J (2008), Rimmer (2004), Kimbrough, Johnson and Frey (1999) do support the result of the present study.

Conclusion

The analysis of data revealed that the experimental group improved significantly in six of the motor proficiency skills and in all three functional ability variables by following 12 weeks of the physical activity programme. However in rest eight motor proficiency skills positive improvement was present, but it was not enough for statistical significance. It is firm belief of authors that if sample size, duration and quality of activities imparted are increased to a certain level then the rest of the variables too will show statistical significance.

"This research is dedicated to all the children with down syndrome across the world"

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