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Assessment of Motor Skills in Autism Spectrum Disorders

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ABSTRACT:
Background: Motor deficits are common and extensive in neurodevelopmental disorders, autism spectrum disorder in particular (ASD). Additionally, motor deficiencies are probably the cause of difficulties with social communication, which may be the first sign of atypical development in ASD.
Objective: The purpose of this study was to examine the degree of mobility impairment in kids with autism spectrum disorders (ASD).
Patients and methods: A cross-sectional study was carried out in Assiut University Child Hospital. All children with autism from the age of 3 years to 18 years in Neurological Outpatient Clinic in Assiut University Pediatric Hospital diagnosed using the Movement Assessment Battery for Children (M-ABC) were included.
Results: There was significant difference between improvement after physiotherapy (Not yet, No improvement and Improved) and Medical treatment (Antipsychotics). There was highly significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and compliance, and there is no significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and outcome.
Conclusion: The physical health of children with ASD improved as a result of the physiotherapy sessions, including agility, coordination, usable skills, and powerful, quick legs. Additionally, it became simpler to exercise in a group, at home, or in private sessions with a professional.
Keywords: Autism spectrum disorder, motor control, motor function, cross sectional study, Assuit University.

INTRODUCTION

Motor deficits are common and extensive in neurodevelopmental disorders, particularly autism spectrum disorder (ASD). In contrast to the other developmental categories, however, self-care behaviours including feeding, dressing, and using the restroom and sensori-motor development are still understudied, daily living abilities, which we shall refer to as self-care abilities, can be challenging for some ASD youngsters [(1)].

Autism is a complicated neurobehavioral illness marked by inflexible, repetitive behaviours as well as difficulties with social interaction, language development, and communication. ASD is the name given to this ailment nowadays due to the wide range of symptoms. It covers a wide range of signs, abilities, and degrees of impairment. The degree of ASD can range from a minor impairment that only slightly restricts otherwise normal life to a catastrophic disability that may necessitate institutional care [(2)].

The best reasons for these problems are not intellectual disability (intellectual developmental disorder) or general developmental delay.Intellectual handicap and autism spectrum condition frequently co-occur, therefore social communication must be below the level anticipated for general developmental maturity in order to identify both illnesses [(3)].

Independent living depends on daily living skills (DLS), which cover matters like maintaining personal hygiene, preparing meals, and managing money. In contrast to their cognitive talents, many people with autism spectrum disorder struggle with everyday living skills, according to research [(4)].

The purpose of this study was to examine the degree of mobility impairment in kids with autism spectrum disorders (ASD).

PATIENTS AND METHODS

A cross-sectional study was carried out in Assiut University Child Hospital. Patients with autism from the age of 3 years to 18 years in Neurological Outpatient Clinic in Assiut University Pediatric Hospital were included.

Inclusion criteria: All children with autism from the age of 3 years to 18 years diagnosed using the Movement Assessment Battery for Children (M-ABC).

Exclusion criteria: Children younger than three years old, those with neurological diseases, and those who have cerebral palsy.

Methods:
Full clinical history: including age, sex, residence, consanguinity, similar conditions in family.

Detailed examination including vital signs, anthropometric measures, systematic examination.

Movement skills measured their movement using the Movement Assessment Battery for Children (MABC). Exam taking is advised by the European Academy of Childhood Disability. The Movement Assessment Battery for Children (MABC-2) standard exam was used to collect data, which is the most complete diagnostic tool yet developed for evaluating motor activity and identifying developmentally conditioned

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motor deficit in children. Individual children's partial subtest results have been transformed into percentile ranges to enable comparison with the norm for the Czech intact population at the specified age. The percentiles fall between 1 and 10.

The median performance in the population of a certain age is used to represent the 50th percentile up to 99th percentiles. Three categories of results were created: no motor disorders, at-risk for motor disorders, and substantial motor disorders.

Ethical Approval:

The study was approved by the Ethics Board of Assiut University. An informed written consent was obtained from guardians of each participant in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Data analysis was performed by SPSS software, version 28 (SPSS Inc., PASW statistics for windows version 28. Chicago: SPSS Inc.). Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) for non-normally distributed data, and mean and standard deviation (SD) for normally distributed data after testing normality using Kolmogrov-Smirnov test. Chi-Square Monte Carlo tests were used to compare qualitative data between groups as appropriate. Kruskal-Wallis and One Way ANOVA test were used to compare between 3 studied groups. P value $\leq$0.05 was considered significant.

RESULTS

Table 1 summarizes the demographic data of the studies groups. There were significant differences between studied groups as regards Residence and Age.

Table (1): Comparison between the different studied groups according to demographic data.

Demographic data	Total (n=28)		Improvement after physiotherapy						Test of sig.	P-value
			Not yet (n=5)		No improvement (n=8)		Improved (n=15)			
	No.	%	No.	%	No.	%	No.	%		
Sex										
Male	17	60.7	3	60.0	5	62.5	9	60.0	χ^2= 0.199	^{MC}p= 1.000
Female	11	39.3	2	40.0	3	37.5	6	40.0		
Age (years) Mean ± SD.	5.67 ± 1.80		3.66 ± 0.65		6.61 ± 1.44		5.84 ± 1.76		F= 5.826*	0.008*
Sig. bet. Groups	p_1=0.007*, p_2=0.029*, p_3=0.497									
Residence										
Assiut	26	92.9	3	60.0	8	100.0	15	100.0	χ^2= 7.261*	^{MC}p= 0.026*
El menia	1	3.6	1	20.0	0	0.0	0	0.0		
Manflout	1	3.6	1	20.0	0	0.0	0	0.0		
Age at diagnosis Mean ± SD.	3.39 ± 0.86		3.30 ± 0.67		3.50 ± 0.46		3.35 ± 0.18		F= 0.100	0.906

χ^2: Chi square test MC: Monte Carlo

F: F for ANOVA test, Pairwise comparison between each 2 groups was done using Post Hoc Test (Tukey)

p: p value for comparing between the studied groups

p_1: p value for comparing betweenNot yet and No improvement

p_2: p value for comparing betweenNot yet and Improved

p_3: p value for comparing between No improvement and Improved

*: Statistically significant at $p \leq 0.05$

IQR: Inter Quartile Range

Table 2 shows that there is significant difference between improvement after physiotherapy as regards manual dexterity (drawing trail) and Balance.

Table (2): Comparison between the different studied groups according to differnet motor skills

Variable	Total (n=28)		Improvement after physiotherapy						χ^2	^{MC}p
			Not yet (n=5)		No improvement (n=8)		Improved (n=15)			
	No.	%	No.	%	No.	%	No.	%		
Motor Skills :Fine and gross motor skills	28	100.0	5	100.0	8	100.0	15	100.0	–	–
1- Manual dexterity (posting coins)	19	67.9	1	20.0	6	75.0	12	80.0	5.677	0.060
2- Manual dexterity (threading lace)	11	39.3	0	0.0	3	37.5	8	53.3	4.301	0.113
3- Manual dexterity (drawing trial)	15	53.6	1	20.0	3	37.5	11	73.3	5.212	0.090
4- Ball skills (catching ball)	11	39.3	0	0.0	1	12.5	10	66.7	9.717*	0.006*
5- Ball skills (throw ball)	20	71.4	2	40.0	5	62.5	13	86.7	4.373	0.115
6- Balance	14	50.0	0	0.0	6	75.0	8	53.3	6.843*	0.025*

χ^2: **Chi square test**, MC: **Monte Carlo,** p: p value for comparing between the studied groups, *: Statistically significant at $p \leq 0.05$

This table shows that there is significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and Medical treatment (Antipsychotics).

Table (3): Comparison between the different studied groups according to medical treatment and physiotherapy

Medical treatment (antipsychotics)	Total (n=28)		Improvement after physiotherapy						χ^2	^{MC}p
			Not yet (n=5)		No improvement (n=8)		Improved (n=15)			
	No.	%	No.	%	No.	%	No.	%		
Bad	6	21.4	0	0.0	5	62.5	1	6.7	14.782*	0.003*
Good	19	67.9	3	60.0	3	37.5	13	86.7		

χ^2: Chi square test MC: Monte Carlo

p: p value for comparing between the studied groups, *: Statistically significant at $p \leq 0.05$

This table shows that there is highly significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and compliance.

Table (4): Comparison between the different studied groups according to different parameters

Variable	Total (n = 26)		Improvement after physiotherapy						χ^2	^{MC}p
			Not yet (n = 3)		No improvement (n = 8)		Improved (n=15)			
	No.	%	No.	%	No.	%	No.	%		
Consanguinity	9	32.1	1	20.0	5	62.3	3	20.0	4.291	0.108
Family history of similar condition	6	21.4	2	40.0	0	0.0	4	26.7	3.458	0.161
Associated neurological disorders	2	7.1	0	0.0	0	0.0	2	13.3	1.248	0.680
Cerebral palsy	1	3.6	1	20.0	0	0.0	0	0.0	3.442	0.184
Phenulkentonuria	3	10.7	1	20.0	1	12.5	1	6.7	1.348	0.740
Epilepsy	3	10.7	0	0.01	1	12.5	2	13.3	0.675	1.000
Attention deficit hyperactivity disorder(ADHD)	1	3.6	0	0.0	1	12.5	0	0.0	2.502	0.458
Down syndrome	4	14.3	0	0.0	1	12.5	3	20.0	0.914	0.793

χ^2: Chi square test MC: Monte Carlo

p: p value for comparing between the studied groups, *: Statistically significant at $p \leq 0.05$

Table 5 shows that there is no significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and outcome.

Table (5): Comparison between the different studied groups according to outcome

Outcome	Total (n = 5)		Groups						χ^2	MCp
			Not yet (n = 0)		No improvement (n = 1)		Improved (n=4)			
	No.	%	No.	%	No.	%	No.	%		
Early intervention	2	40.0	0	0.0	0	0.0	2	50.0	4.119	0.590
Medical ttt and physiotherapy results in improvement	1	20.0	0	0.0	0	0.0	1	25.0		
Bad compliance to medical ttt and physiotherapy	1	20.0	0	0.0	1	100.0	0	0.0		
Good compliance	1	20.0	0	0.0	0	0.0	1	25.0		

χ^2: Chi square test

p: p value for comparing between the studied groups.

DISCUSSION

Despite being the leading authority in the field of mobility and development, physical therapy (PT) is not mentioned in The Clinical Practice Guidelines (CPG) for the assessment of children with ASD. Because restrictions on motor activities have never been regarded as the primary disabilities associated with ASD, a PT is not involved in either the screening or the intervention [(5)].

This is why this study was selected to be conducted to detect the children with autistic spectrum disorders through a check list to detect degree of impairment.

This cross-sectional study was conducted at neurological outpatient clinic in Assiut University pediatric hospital including 28 patients comes to Assiut university pediatric hospital with clinical manifestation of autism. The trial lasted somewhere between six and twelve months. The study groups differed significantly in terms of sex and age at diagnosis, with a male predominance of Male: Female (60.7: 39.3). With a mean age of 5.67 years, the majority of them were male. Significant differences existed between the studied groups in terms of residence and age. According to Improvement after physiotherapy, there is significant difference between not yet and no improvement and significant difference between Not yet and improved as regards demographic data.

Our results were similar to study of **Yin *et al.*** [(6)] 82 (82%) of the participants were men, and 18% were women, according to their report. The children's ages varied from five to twelve. The present study showed that there was significant difference between improvement after physiotherapy as regards irritability and Cognitive impairment. There was significant difference between improvement after physiotherapy as regards manual skills (drawing trail) and Balance. Highly significant difference was found between improvement after physiotherapy (Not yet, no improvement and improved) and number of sessions per weeks. There was insignificant difference between improvement after physiotherapy (Not yet, no improvement and improved) and outcome.

Our results were similar to study of **Srinivasan *et al.*** [(7)] Triadic context, which comprises the child, a skilled trainer, and an adult model, was subsequently applied to a group of 36 ASD kids.

The participants were divided into three categories: rhythm, robotic, and comparison. The co-author is an expert in Applied Behavior Analysis (ABA) and a music educator, trained all of the teachers, who were either paediatric physical therapists or graduate-level PT/kinesiology students. The comparison group encouraged fine motor abilities including pinching, gripping, colouring, drawing, cutting, and glueing, gross motor abilities like balance, bilateral coordination, mimicry, interpersonal synchronisation, and manual dexterity were the focus of the rhythm and robotic groups. Eight weeks of training were spent with each of the three groups, with four 45-minute sessions per week. The second study, by **Colebourn *et al.*** [(8)] focused on a nine-year-old ASD kid who showed fine motor, gross motor and communicative deficits in addition to repetitive movement patterns such hand flapping and clapping for self-stimulatory purposes.

The boy underwent a 20-week gross motor intervention in conjunction with ABA techniques to enhance his overhand throwing skills. The entire training was broken down into three phases: participation, motor learning/target practise, and an initial four-week period of motor planning practise. The youngster had PT sessions 13 times and ABA sessions 75 times, each lasting thirty minutes and ten minutes. In the third study, which was carried out by **El Shemy *et al.*** [(9)]**,** 30 ASD children had rhythmic auditory stimulation-assisted gait training in addition to a particularly designed physical therapy programme (RAS). The training programme for the kids in the control group lasted an hour, three times a week for three months, Encouraging anticipatory systems, balance training from various postures, bending and standing back up, gait training with various obstacles,

and climbing and descending stairs on alternate foot were all incorporated in the workouts to strengthen the trunk and extremities. Numerous systematic evaluations have found that children with ASD who received movement or exercise therapy demonstrated improvements in their social, behavioural, and cognitive outcomes [10,11,12]. The effects of motor or exercise intervention on the motor outcomes of children with ASD were evaluated in two systematic investigations [13].

In order to understand the impact of motor intervention on motor outcomes as a whole, these reviews incorporated the results of various different types of therapies, including hippotherapy, aquatics, and physical education. However, improvements in motor outcomes were seen throughout all reviews. A comprehensive review found that individuals with ASD may have unique mechanisms underpinning the growth and generalisation of their motor abilities, necessitating the use of a variety of learning strategies for the greatest learning results. **Moraes *et al.*** [14] that examined motor learning in children and adults with ASD. Their findings support teaching motor skills to children with ASD through visual rather than spoken instructions. They also discovered that non-professional teachers were just as good at teaching motor skills to kids with ASD as video, siblings, peers, and robots. A 48-week physical education intervention had a considerable influence on involvement, according to **Toscano et al.** [15].

The one other study **Lanning *et al.*** [16] comparing group involvement after a 12-week equine-assisted intervention found no statistically significant effects. The scant research on participation outcomes is disappointing given the significance of motor activity for kids with ASD. **Sorensen *et al.*** [17] claims that physical activity has been shown to be crucial for children with ASD who practise different exercises. It is known that customised and individualised programmes based on each child's physical ability and situation is particularly helpful in lowering the risk of injury. This increases the amount of time ADS kids may spend with other kids while while lowering their chance of getting hurt. Additionally, **Draudvilienė *et al.*** [18] showed that after PS (physiotherapy sessions) treatments, the children's balance improved by 21.32%, coordination by 23.36%, and physical and functional attributes like speed (13.18%) and explosive leg strength (37.14%).

According to **Gidley *et al.*** [19] more challenging tasks that require mastering new techniques for controlling or modifying the arm's movements in response to a shift in visual information can be challenging for people with ASD. These tasks include ones where the only mechanical disturbances are visual, and the individuals examined have never encountered any of these unusual disturbances.

The work by **Minshew *et al.*** [20] demonstrated the shift in perspective from seeing ASD as a disorder of localised brain malfunction to one where ASD is seen as a disorder of large-scale neural systems with changes in cortical system connectivity. White matter changes during development and their impact on intra-hemispheric connection are to blame for this.

This was supported by **Mostofsky *et al.*** [21] who found a link between growing radiate white matter volume and functional impairment in ASD children, which manifested as a decline in fundamental motor skills. In our study, there was significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and Medical treatment (Antipsychotics). There was highly significant difference between improvement after physiotherapy (Not yet, no improvement and improved) and compliance.

CONCLUSION

The physical health of children with ADS improved as a result of the physiotherapy sessions, including agility, coordination, usable skills, and powerful, quick legs. Additionally, it got easier to work out in a group, at home, or with a professional in private sessions.

DECLARATIONS

- **Consent for Publication:** I confirm that all authors accept the manuscript for submission
- **Availability of data and material:** Available
- **Competing interests:** None
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- **Conflicts of Interest:** The authors declare no conflicts of interest regarding the publication of this paper.

REFERENCES

1. **Allen G (2006):** Cerebellar contributions to autism spectrum disorders. Clinical Neuroscience Research, 6:195–207.
2. **Abrahams B, Geschwind D (2010):** Connecting genes to brain in the autism spectrum disorders. Archives of Neurology, 67(4),395–399.
3. **Barbaro J, Dissanayake C (2013):** Early markers of autism spectrum disorders in infants and toddlers prospectively identified in the Social Attention and Communication Study. Autism, 17(1):64.
4. **Kern J, Trivedi M, Garver C *et al*. (2006):** The pattern of sensory processing abnormalities in autism. Autism, 10:480–494.
5. **Ministry of Health (MOH) (2014):** Clinical practice guidelines: management of autism spectrum disorder in children and adolescents, Putrajaya: Malaysia Health Technology Assessment Section (MaHTAS). https://www.moh.gov.my/moh/attachments/CPG%202014/CPG%20Management%20of%20Autism%20Spectrum%20Disofer%20in%20Children%20and%20Adolescents.pdf
6. **Yin C, Yin A (2019):** Review on the Efficacy of Physical Therapy Intervention on Motor Skills of Children with Autism Spectrum Disorder. In 3rd International Conference on Special Education, 39-43.

7. **Srinivasan M, Kaur I, Park T *et al*. (2015):** The effects of rhythm and robotic interventions on the imitation/praxis, interpersonal synchrony, and motor performance of children with autism spectrum disorder (ASD): A pilot randomized controlled trial. Autism Res Treat., 2015:736516. doi: 10.1155/2015/736516.
8. **Colebourn A, Golub-Victor A (2017):** Developing overhand throwing skills for a child with autism with a collaborative approach in school-based therapy. Pediatric Physical Therapy, 29(3):262-269.
9. **El Shemy S, El-Sayed M (2018):** The impact of auditory rhythmic cueing on gross motor skills in children with autism.Journal of Physical Therapy Science, 30(8):1063-1068.
10. **Sowa M, Meulenbroek R (2012):** Effects of physical exercise on autism spectrum disorders: A meta-analysis. Research in Autism Spectrum Disorders, 6:46-57.
11. **Bremer E, Balogh R, Lloyd M** (**2015**): Effectiveness of a fundamental motor skill intervention for 4-year-old children with autism spectrum disorder: A pilot study. Autism, 19:980-991.
12. **Tan B, Pooley J (2016):** A meta-analytic review of the efficacy of physical exercise interventions on cognition in individuals with autism spectrum disorder and ADHD. Journal of Autism and Developmental Disorders, 46:3126-3143.
13. **Healy S, Nacario A, Braithwaite R *et al*. (2018):** The effect of physical activity interventions on youth with autism spectrum disorder: A meta-analysis. Autism Research, 11:818–833.
14. **Moraes I, Massetti T, Crocetta T *et al*. (2017):** Motor learning characterization in people with autism spectrum disorder. Dementia and Neuropsychologia, 11:276–186.
15. **Toscano C, Carvalho H, Ferreira J (2018):** Exercise effects for children with autism spectrum disorder: Metabolic health, autistic traits, and quality of life. Perceptual Motor Skills, 125:126–146.
16. **Lanning B, Baier M, Ivey-Hatz J *et al*. (2014):** Effects of equine assisted activities on autism spectrum disorder. Journal of Autism and Developmental Disorders, 44:1897–1907.
17. **Sorensen C, Zarrett N (2014):** Benefits of physical activity for adolescents with autism spectrum disorders: A comprehensive review. Review Journal of Autism and Developmental Disorders, 1:344–353.
18. **Draudvilienė L, Sosunkevič S, Burkauskienė A *et al*. (2020):** The benefit assessment of the physiotherapy sessions for children with autism spectrum disorder. Baltic Journal of Sport & Health Sciences, 3(118):25-32.
19. **Gidley J, Bastian A, Donchin O *et al*. (2008):** Acquisition of internal models of motor tasks in children with autism. Brain, 131:2894–2903.
20. **Minshew N, Williams D (2007):** The new neurobiology of autism: cortex, connectivity, and neuronal organization. Arch Neurol., 64:945–950.
21. **Mostofsky S, Goldberg M, Landa R *et al*. (2000):** Evidence for a deficit in procedural learning in children and adolescents with autism: implications for cerebellar contribution. J Int Neuropsychol Soc., 6:752–759.