



# Autistic features in relation to motor function and quality of life in children with autism spectrum disorder

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## Abstract

**Background:** Although motor limitations are not currently considered clinical manifestations of autism spectrum disorder (ASD), they should not be ignored because of their high incidence and considerable influence on functional activity. **Objective:** This study aimed to investigate the relationship between autistic features, motor function, and quality of life (QoL) in children with ASD. **Methods:** Sixty children diagnosed with ASD from both sexes participated in this study. They were assessed for autistic features, motor skills, and QoL using the Childhood Autism Rating Scale, Peabody Developmental Motor Scale, and the Arabic version of the Pediatric Quality of Life generic core scale. **Results:** There was a significant negative correlation ( $p < 0.001$ ) between autistic features and QoL and a significant negative correlation ( $p < 0.001$ ) between autistic features and gross motor function, with Pearson correlation coefficients of -0.794 and -0.736, respectively. While the Pearson correlation coefficient was 0.834, there was a significant positive correlation ( $p < 0.001$ ) between gross motor function and QoL. With a p-value ( $p < 0.001$ ), linear regression analysis revealed that autistic features are a highly significant predictor of QoL and gross motor function. Furthermore, gross motor function was a highly significant predictor of QoL ( $p < 0.001$ ). **Conclusion:** Autistic features adversely affect motor function and QoL in children with an autism spectrum disorder.

**Keywords:** Autistic features; autism spectrum disorder; children; motor function; quality of life

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## INTRODUCTION

ASD is a group of persistent developmental disorders characterized by deficits in social communication and interaction, limited interests, and repetitive behaviors [1]. Children with ASD have severe challenges with their social, psychological, and emotional well-being compared to typically developed children (TDC). Particularly, children with ASD struggle with age-appropriate play and social engagement [2–4], peer relationships [5,6], and emotional reactions [5–11]. These problems, along with poor communication skills and abnormal behavior, frequently result in poor social competence. Compared to TDC, those with ASD also have a higher prevalence of depression, anxiety, and stress [10,12]. Moreover, they suffer from allergies, physical health, sleeping, and gastrointestinal problems [12–15]. Although motor limitations are not currently considered a clinical manifestation of ASD, they should not be ignored due to their high incidence and considerable influence on functional performance [16].

Although motor difficulties are common, little is known about the general QoL of ASD children. Parents can identify developmental problems as early as 14 months, and the earlier they are identified, the more severe the motor delay is likely to be [17]. Despite being more active than TDC, children with ASD ages 2 to 5 display significant gross motor delays [18]. Ozonoff and colleagues [19] indicated that motor impairments in children with ASD are not a result of cognitive skill deficits. It is theorized that traditional ASD traits are associated with brain deficits [20]. Children with ASD were found to have slower movement speeds during timed movements, reduced postural stability, difficulties with gait and balance, and promotor impairments [21,22]. According to a recent research, children with ASD experience sensorimotor integration problems more frequently than TDC [23].

A clearer picture of the multidimensional effects of gross motor development in young children with ASD would encourage early evaluation and management of this impairment [24]. Studying the relationship between autistic features to motor function and QoL in children with ASD will provide physical therapists with valuable information that may be helpful to identify the factors affecting the child's functional performance, and design a proper rehabilitation program for such cases. Limited studies are available regarding the relationship between autistic features to motor function and QoL in children with ASD. Therefore, this study aims to investigate the relation of autistic features to motor function and QoL in children with ASD. We hypothesized that there is a negative relation between autistic features to motor function and QoL in children with ASD.

## MATERIALS AND METHODS

### Participants

Sixty children diagnosed with ASD from both sexes (35 girls and 25 boys) participated in this study. They were selected from governmental hospitals and schools for children with special needs in Sohag Governorate. Inclusion criteria were: Both sex, age ranges from three to five years, mild to moderate autistic features according to CARS, and they were able to sit alone independently. Exclusion criteria: Significant auditory or visual defects, history of psychiatric disorder (e.g., attention deficit hyperactivity disorder), or cerebral palsy. Table 1 contain the descriptive statistics for variables among the study group.

Table 1. Descriptive statistics for variables of the study group.

Variables	Mean $\pm$ SD	Range
Age (years)	4.12 $\pm$ 0.56	3-5
Weight (Kg)	16.74 $\pm$ 2.28	13-21
Height (m)	1.01 $\pm$ 0.09	0.87-1.2
Gross motor quotient	46.67 $\pm$ 3.61	42-53
CARS score	34.93 $\pm$ 1.74	30-36.5
Peds QL total score	29.61 $\pm$ 3.79	25-36

CARS, Childhood autism rating scale; Kg, Kilogram; m, Meter; Peds QL, Pediatric Quality of life generic core scale; SD, Standard deviation

### Outcome measures

Autistic features were assessed using CARS, QoL was assessed using Peds QL, and gross motor function was assessed using PDMS-2.

#### *The Childhood autism rating scale (CARS)*

CARS is an instrument for diagnosis created to assess children who may be with autism aged two years old and older [25]. CARS is presented as a questionnaire and is completed based on reports from parents, teachers, or other caregivers as well as observations of the child's behavior made by a professional. It is a 4-point rating scale consisting of 15 items that cover a variety of cognitive, communicative, emotional, and social functions. CARS generates a raw score that is used to classify symptoms into one of three severity levels: minimal to none, mild to moderate, or severe. Each item receives a score between 1 and 4, with 1 denoting behavior appropriate for the level of age and 4 denoting severe deviation from the norm for the age level. When a behavior seems to fall into two categories, the midpoints (1.5, 2.5, and 3.5) between them are used. Each item was evaluated and given a score. The sum of all rated items yields the total raw CARS score, which ranges from fifteen to sixty. More severe levels of ASD are indicated by higher scores.

#### *Peabody developmental motor scale (PDMS-2).*

It is a fine and gross motor scale that is norm-referenced and used to assess motor development in children who have a motor development delay. As a discriminative measure, it has excellent reliability and validity. The results of the tests could be shown as raw, standard, age-equivalent, percentile, and quotient scores [26,27]. In this study gross motor quotient score was used.

#### *Pediatric Quality of life generic core scale (Peds QL)*

It is used to assess QoL in healthy children and adolescents as well as those with acute and chronic conditions. The Peds QL Generic Core Scales are made up of four scales: Physical Functioning, Social Functioning, Emotional Functioning, and School Functioning. The 0-4 scale items should be converted to the following values for a reverse score: 0=100, 1=75, 2=50, 3=25, and 4= 0. The score for each subtest was calculated then the total score was calculated with higher scores indicating better results [28,29]. In this study, the total scale score was used to assess the QoL of the children with ASD.

### Statistical analysis

The statistical package for social sciences, version 23.0, was used to analyze the recorded data (SPSS Inc., Chicago, Illinois, USA). When their distribution was parametric, the quantitative data were shown as mean, standard deviation, and ranges. Using Kolmogorov-Smirnov, data were examined for normality. To evaluate the level of association between two sets of variables, the Pearson's correlation coefficient (r) test was used. To test and estimate a quantitative variable's dependence on one or more independent variables, linear regression is used. The accepted margin of error was set at 5% with a 95% confidence interval. The level of significance was set as  $p < 0.05$ .

To avoid type II error, a pilot study was performed before the study to estimate the sample size, using G\*POWER statistical software (Franz Faul, Universitat Kiel, Germany; version 3.1.9.2) [Exact tests- correlational study, effect size = 0.44;  $\alpha=0.05$ ] and indicated that the proper sample size for the current study is N=34 provided 80% power, but the number was increased to 60 to show appropriate results.

### Ethics

This is a cross-sectional assessment study. This study is approved by the ethical committee of the Faculty of Physical therapy under the number "REC\012\004081". All parents are informed about the study's objectives and procedures. All of the children's parents signed the consent form.

## RESULTS

The results revealed that there was a significant negative correlation ( $p < 0.001$ ) between autistic features and QoL, and a significant negative correlation ( $p < 0.001$ ) between autistic features and gross motor function, with Pearson correlation coefficients ( $r$ ) of -0.794 and -0.736, respectively. While the Pearson correlation coefficient ( $r$ ) was 0.834, there was a significant positive correlation ( $P < 0.001$ ) between gross motor function and QoL (table 2). With a p-value ( $p < 0.001$ ), linear regression analysis revealed that autistic features are a highly significant predictor of QoL and gross motor function. Furthermore, with a p-value ( $p < 0.001$ ), gross motor function is a highly significant predictor of QoL (table 3).

Table 2. Correlation between autistic features, QoL, and gross motor function among the study group, using Pearson Correlation Coefficient.

Correlation( $r$ -value) between	CARS score	Peds QL total score
Peds QL total score	-0.794**	-
Gross motor quotient score	-0.736**	0.834**

CARS, Childhood autism rating scale; Peds QL, Pediatric Quality of life generic core scale; QoL, Quality of life;  $r$ , Pearson Correlation Coefficient; \*\*, p-value  $< 0.001$ .

Table 3. Linear regression analysis.

Indicators		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
		$\beta$	$\pm SE$	Beta		
Autistic features as a predictor for different QoL	Constant	90.208	6.098	-	14.794	$< 0.001^{**}$
	Autistic features (CARS)	-1.735	0.174	-0.794	-9.950	$< 0.001^{**}$
Autistic features as a predictor for different gross motor functions	Constant	100.194	6.464	-	15.501	$< 0.001^{**}$
	Autistic features (CARS score)	-1.532	0.185	-0.736	-8.291	$< 0.001^{**}$
Gross motor function as a predictor for different QoL	Constant	-11.237	3.564	-	-3.153	0.003*
	gross motor function (Gross motor quotient score)	0.875	0.076	0.834	11.495	$< 0.001^{**}$

$\beta$ , Regression coefficient; QoL, Quality of life; SE, Standard error; \*\*, significant; \*, highly significant

## DISCUSSION

This study aimed to investigate the relation of autistic features to motor function and QoL in children with ASD. The results revealed that there was a negative correlation between autistic features and QoL as well as gross motor function. There was a positive correlation between gross motor function and QoL. Linear regression analysis revealed that autistic features are a highly significant predictor of QoL and gross motor function. Additionally, gross motor function is a highly significant predictor of QoL.

The findings of the current study can be attributed to the fact that children with ASD are socially isolated and do not engage in active play with peers, which is the primary contributing factor to child motor development and functional performance. This is consistent with previous studies which reported that as a result of their social difficulties, children with ASD spend less time playing, whether they are alone or with other kids. The main component of young children's "active play" is movement. Active play helps young children develop their social, motor, adaptive behavior, and daily living skills. Young children's social, motor, adaptive behavior, and daily living skills are all developed through active play. Additionally, it motivates them to play games with their peers and engage in physical activity [30–33].

The results of the current study indicated a negative correlation between autistic features and motor performance. Gross motor development and physical functioning require mastering high-level skills through integration between body systems (neuromuscular, vestibular, somatosensory...). Children with ASD show slower and delayed development compared to TD peers as they do not engage in social settings which ensure skill acquisition in early ages by imitation and trials. Our results are supported by previous studies which stated that motor planning, motor control, and coordination are necessary for developing basic gross motor skills. In social settings, these abilities are frequently learned through imitation, which may result in that toddlers with ASD developing at a significantly slower rate than would be anticipated for their chronological age. ASD was found to be closely related to motor function [20,33].

In addition, the results of a prior study by Lopez-Espejo et al. [34] revealed a negative correlation between the PedsQL physical health score and the existence of generalized hypotonia, confirming the hypothesis that abnormal muscle tone is linked to functional motor impairment in children with ASD. ASD frequently has a long-term negative impact on mental, physical, social, and academic development, affecting the well-being of individuals with ASD [35–37]. Furthermore, previous studies showed that all different aspects of daily functioning can be affected by psychosocial impairments, such as deficiencies in social skills (e.g., eye contact), diminished social capabilities (e.g., peer relationships), and reduced social-emotional connections [35,37,38]. QoL is a multidimensional concept, with individual characteristics and environmental factors influencing its psychological, physical, and social components [39,40].

The study by de Vries et al [41] found that children with motivational problems and social miscommunication had lower physical QoL, while children with reduced poor cognitive flexibility, social motivation, and emotional control had reduced social and emotional QoL. Additionally, their findings demonstrated that children with poor working memory, motor planning, and organization skills had reduced school QoL.

Previous research reported that gross motor development predicts calibrated autism severity and is linked to fundamental ASD characteristics such as communication and social skills, the performance of daily living activities living, and adaptive behavior [42–44]. Previous studies have also found that all domains of QoL, including physical function, are significantly lower in children aged two to eight with ASD than in TDC and children with other chronic conditions. These domains are negatively related to external and internal behavioral problems in people with ASD [45–47].

Early intervention for children with ASD is very important. The findings of this study add to a growing body of research suggesting that early intervention for children with ASD should consider their motor development. Early intervention for young children with ASD to manage gross motor delays may improve gross motor performance and have a positive impact on social interaction [24,48–51].

## **LIMITATIONS**

The current study has certain limitations that should be considered. As this study included children aged three to five years diagnosed with mild ASD, the results cannot be generalized to older children. The current study did not include a control group with an appropriate sample size to assess the degree of deviation from normal development. Therefore, the authors recommend further studies to explore the factors that may preclude motor development in children with ASD such as cognitive development and perceptual function.

## **CONCLUSION**

Based on the results of the current study, we can conclude that children with ASD show delayed motor development and low QoL performance. Moreover, they are predicted to have a slower rate of development and delayed skill acquisition. Accordingly, it is recommended that physical therapists and other health professionals should consider engaging children with ASD in early

rehabilitation programs including physical therapy, occupational therapy, and social/behavioral therapy.

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