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Motor Milestones and Autism Spectrum Disorder: Insights from Denver II-Based Assessments

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ABSTRACT

Motoric impairments are not among the primary challenges faced by children with autism spectrum disorder (ASD), but many studies have found that various motoric impairments are often encountered in children with ASD. This study focused on identifying the gap in gross motor milestones in children with ASD. The study involved 15 children with ASD, consisting of 14 boys and 1 girl, aged 3-6 years. After conducting a developmental screening using the Denver-II, it was found that the average gap in motor development was approximately 1 year and 7 months behind what is expected, with the three motor development tasks most frequently not mastered by children with ASD compared to typically developing children their age being the ability to throw a ball upwards, jump forward, and stand on one foot for a few seconds.

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1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a persistent neurodevelopmental disorder characterized by deficits in social interaction and communication, as well as restricted and repetitive behaviors in interests and activities (Lauritsen., 2013; Noriega, & Savelkoul, 2014; Livingston & Happé., 2017). ASD often coexists with various comorbid disorders (Mannion& Leader., 2013; Matson & Goldin., 2013; Casanova, et.al., 2020). Although motor impairments are not included in the main characteristics of autism and are usually not classified as comorbid disorders, research shows that many children with autism have lower motor skills compared to typically developing children (Miller, et al., 2024; Liu, Capistran & ElGarhy., 2021; Liu & Breslin., 2013).

Research conducted to assess motor skills in children aged 7-10 years with autism using the Movement Assessment Battery for Children (M-ABC2), showed that only 2 of the 8 skill subcomponents showed significant specific deficits in children with autism, namely catching a ball and statistical balance. (Whyatt & Craig, 2012). Meta-analysis research reveals that children with ASD have a wider stride width, slower walking speed, and longer gait cycles. (Lum et al., 2021). Some studies show that autistic children have lower balance, agility, postural control, and fine motor skills (Stins & Emck, 2018; Lim et al., 2017; Lidstone et al., 2020).

From the various studies presented, none have focused on examining the gap in motor skill development delays in children with ASD. One of the oldest developmental screening instruments is the Denver, which was revised in 1992 with the publication of the Denver-II (Glascoe et al., 1992). Nevertheless, the Denver-II has a high sensitivity of 83% (Jeon et al., 1997). One advantage of using the Denver-II for screening is that it allows us to determine the child's developmental equivalence in terms of age, enabling us to measure the developmental gap.

This study focuses on examining the developmental gap in gross motor skills among children with ASD under the age of 6. It is also expected to provide an overview of which sub-aspects of gross motor skill development have not been mastered by children with ASD compared to children with typical development.

2. METHODS

This study is a qualitative study involving 15 children with ASD ranging from 3 to 6 years consisting of 1 girl and 14 boys. The subjects of the study had received a diagnosis of ASD from a psychologist who had previously been screened using M-CHAT and matched with the DSM-5 autism spectrum disorder criteria. All subjects had obtained permission from their parents to undergo developmental screening.

The instrument used is Denver-II which is conducted on children with ASD who have not received intervention in therapy. The assessment is prioritized on gross motor and fine motor aspects. Based on the development screening data, the development gap will be calculated and the development tasks that have not been mastered by children with typical development at their age will be recorded.

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3. RESULTS AND DISCUSSION

Based on the developmental screening results using Denver II, which focused on assessing gross motor development in 15 children with ASD aged 3 to 6 years, the data shows that all children demonstrated gross motor skills below their chronological age. In general, these delays varied from the mildest, such as subject DZ, who was only 5 months behind, to significant delays, such as subject CKA, with a gap of 2 years and 7 months. Most children had delays exceeding 1 year. This indicates that gross motor impairments are quite significant in this group of children with ASD.

Table 1. Results of Gross Motor Development Screening.

No	Name	Sex/ Gender	Chronological Age (Years-Months)	Developmental Age (Years-Months)
1	AXL	M	4 Y -1 M	2 Y -7 M
2	ARS	M	5 Y- 11 bM	3 Y -11 M
3	AHD	M	3 Y -7 M	1 Y- 10 M
4	ARS	F	4 Y- 10 M	2 Y- 6 M
5	D	M	3 Y- 2 M	1 Y -6 M
6	FAA	M	3 Y -5 M	1 Y- 9 M
7	MGR	M	3 Y- 9 M	3 Y -3 M
8	NAL	M	5 Y- 7 M	4 Y- 0 M
9	AMG	M	4 Y- 7 M	3 Y -10 M
10	BNF	M	3 Y -5 M	3 Y- 3 M
11	CKA	M	5 Y-2 M	2 Y -5 M
12	DRA	M	3 Y- 2 M	1 Y -3 M
13	DZ	M	3 Y- 5 M	3 Y- 0 M
14	RHK	M	3 Y- 5 M	1 Y -10 M
15	AND	M	3 Y- 4 M	2 Y -7 M

The difference between the children's chronological age and their gross motor skill age, based on the Denver-II assessment, shows an average gross motor delay of 19 months, or approximately 1 year and 7 months. The subject with the largest delay was CKA, with a gap of 31 months, while the child with the smallest gap was DZ, with a delay of only 5 months. This data indicates that although the level of delay varies among individuals, most children with ASD experience significant gross motor developmental delays. These delays affect fundamental skills that should typically be mastered according to the developmental stages of children with typical development.

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Table 2. Developmental Gap in Gross Motor Skills of Children with ASD.

No	Name	Sex/Gender	Developmental Gap (Months)
1	AXL	M	17
2	ARS	M	24
3	AHD	M	21
4	ARS	F	28
5	D	M	20
6	FAA	M	20
7	MGR	M	6
8	NAL	M	19
9	AMG	M	21
10	BNF	M	24
11	CKA	M	31
12	DRA	M	11
13	DZ	M	5
14	RHK	M	19
15	AND	M	21

Based on the motor milestones, children with ASD have a range of one to four developmental tasks that they have not yet mastered for their age. The three developmental tasks that are most often not mastered are throwing a ball overhead, jumping forward, and standing on one leg.

Table 3. Gross Motor Milestone that have not been achieved.

No	Name	Sex/ Gender	Chronological Age (Years-Months)	Developmental Age
1	AXL	M	4 Y -1 M	Throw the ball with one hand upwards Jump forward Stand on one leg
2	ARS	M	5 Y- 11 bM	Stand on one leg Hop on one leg Walk on heels
3	AHD	M	3 Y -7 M	Kick the ball forward Throw the ball overhead Jump forward Stand on one leg
4	ARS	F	4 Y- 10 M	Throw the ball overhead Jump forward Stand on one leg
5	D	M	3 Y- 2 M	Walk Backward Jump Upward Jump forward

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Table 3 (Continue). Gross Motor Milestone that have not been achieved

No	Name	Sex/ Gender	Chronological Age (Years-Months)	Developmental Age
6	FAA	M	3 Y -5 M	Kick the ball forward Jump forward Stand on one leg
7	MGR	M	3 Y- 9 M	Stand on one leg
8	NAL	M	5 Y- 7 M	Jump on one leg Stand on one leg
9	AMG	M	4 Y- 7 M	Jump on one leg Stand on one leg
10	BNF	M	3 Y -5 M	Jump forward
11	CKA	M	5 Y-2 M	Throw the ball with one hand upwards Jump forward Stand on one leg
12	DRA	M	3 Y- 2 M	Walk backward Kick the ball forward Throw the ball overhead Stand on one leg
13	DZ	M	3 Y- 5 M	Jump forward Stand on one leg
14	RHK	M	3 Y- 5 M	Kick the ball forward Throw the ball overhead Stand on one leg
15	AND	M	3 Y- 4 M	Throw the ball overhead Stand on one leg

Based on the assessment using Denver-II, which focused on measuring gross motor skills, there is a gap between the chronological age of children with ASD and their gross motor skill age for developmental tasks that should be mastered by children of the same age. The subject with the biggest delay showed a gap of 31 months, while the child with the smallest gap experienced a gross motor delay of only 5 months. On average, children with ASD exhibited a gross motor delay of 19 months, or approximately 1 year and 7 months. This data indicates that although the degree of delay varies among individuals, most children with ASD experience significant gross motor developmental challenges. These delays affect fundamental skills that should typically be mastered according to the developmental stages of children with typical development.

The gross motor delays in children with ASD align with previous studies that indicate children with ASD often experience difficulties in motor coordination, balance, and motor planning (Whyatt & Craig, 2012; Lum et al., 2021). These challenges affect skills such as throwing a ball overhead, jumping, and balancing on one foot, which require complex coordination between muscles, vision, and the entire body.

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Physiologically, these delays can be associated with motor nervous system dysfunction, which hampers the development of gross motor skills (Miller et al., 2024). Additionally, children with ASD experience deficits in both static and dynamic balance (Travers et al., 2013), which can affect their ability to perform activities such as walking on their heels or standing on one foot. Environmental factors and the lack of early motor-focused interventions may also contribute, as parents of children with ASD often prioritize enhancing language skills and addressing behavioral issues (Green et al., 2010; Bradshaw et al., 2017; Tarver et al., 2019; Bearss et al., 2015). This underscores the importance of early interventions to optimize motor development in children with ASD.

4. CONCLUSION

This study found that children with ASD exhibit significant delays in gross motor development, with an average gap of 1 year and 7 months. The three most difficult gross motor skills for children with ASD to master are throwing a ball overhead, jumping forward, and standing on one foot. These findings highlight the importance of early detection and appropriate intervention to address gross motor delays in children with ASD. With systematic therapy and support tailored to the individual needs of the child, gross motor skills can be significantly improved.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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