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Original Article

Longitudinal study changes in coordination development disorder in preschool children[1]

Acompanhamento longitudinal das alterações no transtorno do desenvolvimento da coordenação em crianças pré-escolares

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Abstract

Objective: To follow changes in the diagnosis of Typical Motor Development (MD) and the probable Coordination development disorder (pCDD) diagnostics in preschoolers for 24 months. **Method:** Two data collection designs were elaborated: 1) Longitudinal design of 12 months (Long-1) consisting of 201 children, with an average initial age of 3.6 ± 0.5 years old; 2) Longitudinal design of 24 months (Long-2) composed of 27 children, with an average initial age of 3.6±0.5 years old. The assessment tool used was the Movement Assessment Battery for Children 2 (MABC-2). For data analysis, the Kolmogorov-Smirnov, Shapiro-Wilk, Wilcoxon, and Friedman tests were used, adopting p <0.05. **Results:** The results of MD in Long-1 revealed a high prevalence of probable pCDD with 24.4% in the 1st evaluation and 19.4% in the 2nd evaluation. In the MD, we observed a manual dexterity improvement and a reduced ability to throw and receive during the 12 months. In manual dexterity tasks, girls were better than boys in the 2nd evaluation, and for the task of throwing and receiving boys were better at two of the evaluations. The results of MD in Long-2 showed a prevalence of 18.5% of pTDC in the first evaluation, 7.4% after 12 months, and 22.2% after 24 months. There was an increase in the score in manual dexterity over the 24 months, however, there was a decline in the balance tasks between the 3 assessments. **Conclusion:** It is concluded that the typical DM and the probable DCD did not show constant and consistent development during motor evaluations over 24 months, showing oscillation in

[1] All current ethical procedures were complied and approved by the Permanent Committee for Research Ethics in Human Beings, under Opinion 0127.0.093.000-11.

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the classification of probable coordination development disorder and/or typical motor development.

Keywords: Child Development, Motor Skills, Motor Disorders, Preschool.

Resumo

Objetivo: Acompanhar, ao longo de 24 meses, as alterações entre o diagnóstico de Desenvolvimento Motor Típico (DM) e o provável Transtorno do Desenvolvimento da Coordenação (pTDC) em pré-escolares. **Método:** Foram elaborados dois *designs* de coleta: 1) *Design* longitudinal de 12 meses (Long-1), constituído por 201 crianças, com idade inicial média de 3,6±0,5 anos; 2) *Design* longitudinal de 24 meses (Long-2), composto por 27 crianças, com idade inicial média de 3,6±0,1 anos. Como instrumento de avaliação, foi utilizado o *Movement Assessment Battery for Children 2 (MABC-2)*. Os dados foram analisados usando os testes *Kolmogorov-Smirnov, Shapiro-Wilk, Wilcoxon* e *Friedman,* adotando p<0,05. **Resultados:** Os resultados do DM no Long-1 revelaram alta prevalência do pTDC de 24,4% na avaliação inicial e 19,4% após 12 meses. No DM, observou-se aumento na destreza manual e diminuição na habilidade de lançar e receber após 12 meses. Nas tarefas de destreza manual, as meninas foram superiores aos meninos após 12 meses, sendo os meninos superiores na tarefa de lançar e receber nas duas avaliações. Os resultados do DM no Long-2 evidenciaram prevalência de 18,5% de pTDC na primeira avaliação, de 7,4% após 12 meses e 22,2% após 24 meses. Ocorreu aumento do escore na destreza manual ao longo dos 24 meses, no entanto, ocorreu declínio nas tarefas de equilíbrio entre as 3 avaliações. **Conclusão:** O desenvolvimento motor típico e o provável Transtorno do Desenvolvimento da Coordenação não apresentaram constância e consistência entre as avaliações motoras ao longo de 24 meses, demonstrando oscilação na classificação de provável transtorno de desenvolvimento da coordenação e/ou do desenvolvimento motor típico.

Palavras-chave: Desenvolvimento Infantil, Destreza Motora, Transtornos Motores, Pré-escolar.

1 Introduction

The study of Motor Development (MD) provides an understanding of how children typically develop their motor skills to diagnose developmental problems based on assessments (Payne & Isaacs, 2007) such as the Coordination Development Disorder (CDD), which is characterized by marked impairment in learning and performance of motor skills. The diagnosis of CDD is based on the Diagnostic and Statistical Manual of Mental Disorders - 5th edition (DSM-5) and involves the evaluation of four criteria: A) The learning and execution of coordinated motor skills are below the expected level for age, given the opportunities for learning skills; B) Difficulties in motor skills significantly interfere with activities of daily living and impact academic/school productivity, pre-professional and vocational activities, leisure and fun; C) The onset of symptoms occurs in the initial period of development; and D) Difficulties in motor skills are not better explained by intellectual retardation, visual impairment or other neurological conditions that affect movement (American Psychiatric Association, 2013).

Developmental researchers have suggested that intra-subject variability exists as characteristics of typical development (Darrah et al., 2009; Newell et al., 2003; Rosenbaum, 2006; Van Geert & Van Dijk, 2002). In this sense, studies (Borba & Valentini, 2015; Danks et al., 2012; Eldred & Darrah, 2010; Sansavini et al., 2014) have been conducted to verify changes in the MD. However, research has revealed inconclusive results regarding intrasubject variability for MD. While some studies prove the influence of factors on MD variability in children, [maternal/paternal education, family socioeconomic level and social vulnerability (Borba & Valentini, 2015), the age at which babies and children and the child's cognitive performance are assessed (Darrah et al., 2009). In contrast, other studies (Moffitt et al., 1993) show that the MD level has remained constant over time (Danks et al., 2012; Sansavini et al., 2014).

As for CDD, researchers have suggested the occurrence of intra-subject variability, showing periods of stability and others of change (Sugden & Chambers, 2007). Therefore, we observed that the literature still presents fragility regarding this statement since research indicates that the disorder occurs over time (Blank et al., 2019) and even that children can remain with significant motor impairment (Gaines & Missiuna, 2007) while other children showed improvement and overcoming the disorder (Farhat et al., 2016; Cairney et al., 2010; Sugden & Chambers, 2007).

In this sense, although children with early diagnosis (around 5 and 7 years old) show improvement in CDD, many had a greater amount of motor difficulties when evaluated 10 years later and compared to their peers without a diagnosis of CDD (Cantell et al., 1994; Losse et al., 1991). This shows the importance of motor assessment carried out by researchers and clinicians (Smits-Engelsman et al., 2015) and early monitoring by parents, educators, and health professionals (Oliveira et al., 2018; Caçola & Lage, 2019) since the literature is not enough as to the information on the motor behavior of children with CDD over time, especially regarding the pre-school age (3 to 5 years old). Most longitudinal researches are concentrated from the age of 5 (Cantell et al., 1994; Losse et al., 1991; Skinner & Piek, 2001; Sugden & Chambers, 2007), showing a knowledge gap to be explored in this study.

In a literature review, in the last 10 years, studies were conducted with children of preschool age. However, evaluating only MD, without emphasizing CDD (Danks et al., 2012; Darrah, Senthilselvan & Magill-Evans, 2009; Eldred & Darrah, 2010), the Movement Assessment Battery for Children test was used in only one of the studies (Danks et al., 2012), which aims to identify children with CDD. In the Brazilian reality, longitudinal investigations have been concentrated between zero and 18 months, with only children with typical development and preterm births (Borba & Valentini, 2015; Pereira et al., 2016; Souza et al., 2010), demonstrating the need for studies with children with CDD at later ages.

Therefore, considering the relevance that the early diagnosis of changes and variations in motor development should be interpreted cautiously given that variations occur in childhood, this study aimed to monitor changes in the diagnosis of motor development and probable disorder in the development of coordination of preschool children.

Through this study, we expect to contribute to the understanding of the need for early assessment and monitoring overtime of children with CDD by parents, teachers, occupational therapists, speech-language therapists, and other health professionals who work with child development.

2 Method

This study is characterized as quantitative, and mini-longitudinal. The Permanent Committee for Ethics in Research with human beings approved the study under Opinion 0127.0.093.000-11, authorized by the Education Secretariat (SEDUC) and filling out the informed consent form by parents or guardians.

SEDUC reported that 4029 children aged 3 to 5 years old were enrolled in the school year and the location of 54 daycare centers (CMEIs). Then, the city was divided into regions (Northwest, Northeast, Southwest, and Southeast), using its geographical location.

For the calculation of the sample size, we used the equation for finite sample, with a significance level of 95%, with an estimation error of 5%, and with an expected proportion of 20% (Richardson et al., 2012). Thus, the required sample size was 246 children, considering 70% of losses and refusals. One daycare center was drawn from each region, except the Northwest region, which was added one more daycare center due to be the region with the largest number of children, totaling 5 daycare centers.

Considering the need for children with a percentile ≤15% (CDD), according to the criteria of the Movement Assessment Battery for Children - 2 (MABC-2) motor test by Henderson et al. (2007), 246 children would be needed for sample representation, in which 395 Informed Consent Terms - ICF were delivered, and, of these, 353 returned. Of the 353 terms that returned, 25 children refused to participate in the evaluations or were absent on the days scheduled for data collection, totaling 328 children evaluated. However, throughout the study, one of the daycare centers refused to continue to participate in the evaluations, causing a sample loss of 59 children, totaling 269 children evaluated.

After the first evaluation, two methodological designs were created, a 12-month longitudinal (Long-1) and a 24-month longitudinal (long-2). The sample losses over the 3 evaluations occurred due to transfers from school, city, refusal of the child to participate in the evaluation, and non-return of the ICF by the legal guardians.

We used the following inclusion criteria: children aged 3 and 5 years old from municipal centers for early childhood education, without physical or mental disabilities. The exclusion criteria were: refusal to participate in the motor test, non-return of the informed consent form by the legal guardians since each year the guardians were asked for authorization for evaluation.

3 Participants

The study included 228 children aged between 3 and 5 years old, enrolled in municipal daycare centers, in which 87.5% of the children evaluated did not perform systematic physical activity, 27.8% of the children showed socioeconomic status characterized as “upper middle class”, and 72.2% from the “lower middle class”. Regarding the parents' marital status, 62.5% of the children live with parents in a common-law marriage.

4 Instruments

To assess MD and CDD, we used the Battery I (3 to 6 years old) of the Movement Assessment Battery for Children - 2 (MABC-2) test (Henderson et al., 2007), which was validated for Portuguese by Valentini et al. (2014), showing that the test is valid

and discriminates well against Brazilian children, with the following psychometric properties: α = 0.78 for the general test, α = 0.77 for manual dexterity, α = 0.52 for the ability to throw and receive, and α = 0.77 for the balancing skill. Each test task results in a standard score, generating the total test score and also giving degrees of percentiles to identify the MD level, classifying the child according to the degree of motor difficulty. According to the test criteria in this study, we considered that children with a score ≤ 15% had suspected motor coordination problems, called probable CDD, and children with a percentile> 15 were considered to have typical development (TD).

5 Procedures

After the first evaluation, two methodological designs were created, a 12-month longitudinal (Long-1) and a 24-month longitudinal (Long-2), as shown in Table 1.

Table 1. Methodological design of the studies.

12-month Longitudinal Methodological Design (Long-1)			
Collection Period			
Starting age	**1st assessment (initial)**	**Final age**	**2nd assessment (+12 months)**
3 years old	144 evaluated children	4 years old	114 evaluated children
4 years old	125 evaluated children	5 years old	87 evaluated children
Total	269 evaluated children	Total	201 evaluated children
24-month Longitudinal Methodological Design (Long-2)			
Collection Period			
1st assessment age (initial)		3 years old	59 evaluated children
2nd evaluation age (+12 months)		4 years old	36 evaluated children
3rd assessment age (+ 24 months)		5 years old	27 evaluated children

Source: The authors.

Initially, all researchers (two master's and one doctoral student) were trained for one month, twice a week, in the fields of the different tasks of MABC-2. Intra and inter evaluator reliability was established for each test task by the Intraclass Correlation Coefficient (ICC), with a 95% confidence interval. In general, the results showed very strong (CCI: 0.91≤0.99; P <0.001) and strong (0.75≤0.90; P <0.001) correlations, both intra and inter evaluators.

The collections took place in daycare centers, during class time. Children were assessed individually, with an average duration of 20 minutes, involving an opportunity to become familiar with each task, obeying the protocol established by the test.

6 Data Analysis

For the sample description, we used frequency and percentage as measures for categorical variables. For the numerical variables, initially, we verified the normality of the data based on the Shapiro-Wilk (Long-2) and Kolmogorov-Smirnov test (Long-1). As the data did not present a normal distribution, median (Md) and Quartiles (Q1; Q3) were used to characterize the results. In the inferential analysis, we used the Mann-Whitney "U" test to compare the groups (gender), and the Wilcoxon test (evaluations 1 and 2) and Friedman (evaluations 1, 2, and 3) compared the evaluations. The significance adopted was $p < 0.05$.

7 Results

The results of the MD assessment of children belonging to Long-1 revealed that the prevalence of probable coordination development disorder (pCDD) decreased from 49 (24.4%) to 39 (19.4%) and the number of children with typical motor development increased from 152 (75.6%) to 162 (80.6%) from the initial assessment to the assessment after 12 months.

When comparing the MD results from the first to the second Long-1 assessment (Table 2), we found a statistically significant difference in the tasks of manual dexterity ($p = 0.001$) and throwing and receiving ($p = 0.004$), indicating that there were improvement in the performance of the manual dexterity task and a decrease in the performance of the task of throwing and receiving.

Table 2. MD comparison between Long-1 assessments 1 and 2 (n=201).

VARIABLES	Assessment 1 (initial)	CI 95%	Assessment 2 (+12 months)	CI 95%	*p-value*
	Md (Q1; Q3)		Md (Q1; Q3)		
Manual dexterity	9.0 (6.0; 12.0)	8.26-9.21	10.0 (8.0; 12.0)	9.17-10.01	**0.001***
Throwing and receiving	10.0 (8.0; 13.0)	10.16 -11.16	10.0 (8.0; 12.0)	9.53-10.33	**0.004***
Balance	9.0 (7.0; 11.0)	9.09-10.10	9.0 (7.0; 12.0)	9.13-10.15	0.973
Motor development	9.0 (7.0; 12.0)	8.87-9.89	9.0 (7.0; 12.0)	9.00-9.88	0.476

*Significant difference: $p<0.05$ – Wilcoxon Test; Long-1: Longitudinal design 1; CI: Confidence Interval. **Source:** The authors.

Table 3 shows the comparison of MD between the initial assessments and after 12 months of Long-1 according to gender and between genders.

Table 3. Comparison of MD between Long-1 assessments 1 and 2 according to gender.

Variables	Assessments	Boys (n=98) Md (Q1; Q3)	CI 95%	Girls (n=103) Md (Q1; Q3)	CI 95%	*p-value*
Manual dexterity	1 (initial)	9.0 (5.0; 11.2)	7.67-9.09	9.0 (6.0; 12.0)	8.43-9.70	0.153
	2 (+12 months)	9.0 (7.0; 11.0)	8.52-9.70	10.0 (8.0; 12.0)	9.45-10.64	**0.035***
		P=0.016*		***P=0.003****		
Throwing and receiving	1 (initial)	11.0 (9.0; 14.0)	10.48-11.98	10.0 (8.0; 12.0)	9.46-10.77	**0.031***
	2 (+12 months)	10.0 (9.0; 12.0)	9.81-10.95	9.0 (8.0; 12.0)	8.93-10.07	**0.009***
		P=0,021*		*P=0.077*		
Balance	1 (initial)	9.0 (6.0; 11.0)	8.64-10.12	9.0 (7.0; 11.0)	9.09-10.49	0.320
	2 (+12 months)	8.0 (6.75; 12.0)	8.63-10.20	10.0 (7.0; 12.0)	9.20-10.52	0.220
		P=0.878		*P=0.794*		
Motor development	1 (initial)	9.0 (6.0; 12.0)	8.58-10.20	9.0 (7.0; 12.0)	8.72-10.01	0.882
	2 (+12 months)	9.0 (7.0; 11.0)	8.55-9.85	9.0 (7.0; 12.0)	9.63-10.00	0.325
		P=0.889		*P=0.393*		

* Significant Difference (p<0.05) – Mann-Whitney "U" test for groups and Wilcoxon test for evaluations; Long-1: Longitudinal design 1; CI: Confidence Interval. **Source:** The authors

When analyzing comparison between the genders in the initial assessments and after 12 months for MD, there was a statistically significant difference (Table 3) in manual dexterity tasks in assessment 2 (p = 0.035), revealing better performance for girls, and in throwing and receive tasks in the initial assessment (p = 0.031) and after 12 months (p = 0.009), showing superior performance for boys.

For the intra-group comparison (initial evaluation and after 12 months), we identified a statistically significant difference (Table 3) in the tasks of manual dexterity (p = 0.016) and throwing and receiving (p = 0.021) of the MD for boys, pointing out that there was an improvement in performance in the tasks of manual dexterity and a decrease in the tasks of throwing and receiving. For girls, there was a statistically significant difference in manual dexterity tasks (p = 0.003), indicating that there was an improvement in the performance of manual dexterity tasks.

To compare MD for 24 months, 27 children were followed up in 3 assessments, with an interval of 12 months between each one (Long-2). The follow-up showed a variation between 7.4 and 22.2% in the case of children who presented the prevalence of pCDD, while children with typical motor development varied between 77.8 and 92.6% between the 3 assessments. We observed that the number of children with pCDD fluctuated during the 3 assessments, declining from the first to the second assessment and rising from the second to the third assessment. For children with typical motor development, the opposite

happened, increasing from the first to the second assessment, and subsequently decreasing from the second to the third assessment (Table 4).

Table 4. Frequency and percentage regarding the motor classification of children in Long-2 (n=27).

Motor development		Assessment 1 (Initial)	Assessment 2 (+ 12 months)	Assessment 3 (+24 months)
		f (%)	*f* (%)	*f* (%)
MD	Probable CDD	5 (18.5)	2 (7.4)	6 (22.2)
	Typical development	22 (81.5)	25 (92.6)	21 (77.8)

MD: Motor development; CDD: Coordination development disorder; Long-2: Longitudinal design 2. f: frequency. **Source:** The authors.

Table 5 shows the comparison of the children's MD score in the 3 Long-2 assessments.

Table 5. Comparison of children's motor development in the 3 Long-2 assessments (n=27).

Variables	Assessment 1 (initial)	CI 95%	Assessment 2 (+12 months)	CI 95%	Assessment 3 (+24 months)	CI 95%	*p-value*
	Md (Q1; Q3)		Md (Q1; Q3)		Md (Q1; Q3)		
Manual dexterity	5.0 (4.0; 9.0)	5.16-7.42	10.0 (9.0; 12.0)	9.51-11.66	9.0 (7.0; 12.0)	8.55-10.62	**0.001***
Throwing and receiving	12.0 (9.0; 13.0)	9.79-12.57	11.0 (10.0; 15.0)	10.79-13.50	10.0 (10.0; 12.0)	9.75-11.87	0.288
Balance	12.0 (9.0; 17.0)	10.63-14.10	8.0 (6.0; 11.0)	7.60-10.17	6.0 (9.0; 12.0)	8.04-10.84	**0.001***
Motor development	9.0 (7.0; 11.0)	8.07-10.89	8.0 (9.0; 12.0)	9.04-11.77	7.0 (9.0; 12.0)	8.42-11.06	0.432

*Significant difference (p<0.05) – Teste de Friedman: Manual dexterity (Assessment 1 with 2 and 3 – p=0.001); Balance (Assessment 1 with 2 and 3 – p=0.001); Long-2: longitudinal design 2. **Source:** The authors.

When comparing the MD results from the first to the third assessment (Table 5), we found a statistically significant difference between the scores of the tasks of manual dexterity (p = 0.001) and balance (p = 0.001). Thus, in the tasks of manual dexterity, the children had the lowest result, while for balance tasks the children obtained the highest result. While manual dexterity evolved from the initial evaluation to after 12 months, the opposite occurred from the evaluation after 12 months to after 24 months, demonstrating a decline in manual dexterity. On the other hand, balance suffered a decrease in performance from the initial assessment after 12 months, evolving from the assessment after 12 months to after 24 months, suggesting that MD is not constant and consistent between 3 and 5 years old.

8 Discussion

The results of this study showed that MD is not constant and consistent, that is, it changes with age, fluctuating in the acquisition and maintenance of motor skills performance (Table 4). We observed intrasubject variability in children with typical MD, and these results are similar to those in the study by Danks et al. (2012), who identified

that the typical MD has changed over time. Similarly, Darrah et al. (2009) revealed intrasubject variability for the development of gross and fine motor skills at different times of assessment, and Eldred & Darrah (2010), who analyzed the behavior of MD using cluster analysis, identified intrasubject variability in all children investigated. These studies suggest that there is more than one typical development pattern, even when children with similar patterns are grouped, reinforcing the concept that typical development occurs with variability instead of consistency in the acquisition of skills (Hadders-Algra, 2000; Touwen, 1978).

However, studies have also shown consistency with increasing improvement for typical MD, revealing the discrepancy in the literature regarding the behavior of MD over time (Borba & Valentini, 2015; Formiga et al., 2010; Maia et al., 2011; Souza et al., 2010).

The observed evidence suggests that, like the typical MD, the probable CDD also did not show a constant and consistent characteristic over the 12 and 24 months of assessments (Table 4), suggesting that stability and change are a natural consequence of biological, psychological, and social development in childhood (Sugden & Chambers, 2007). According to this, studies that investigated the behavior of CDD in 4 years (Sugden & Chambers, 2007) and 10 years old children (Cantell et al., 1994) support the findings of this study, when they demonstrate that there is an individuality regarding the stability and change of the disorder and that children with CDD show varying profiles over some time. Such different profiles may be related to events that occurred in the child's life and must be considered (Bronfenbrenner & Morris, 1998).

Longitudinal studies have shown that children with CDD continue to exhibit motor problems until adolescence (Cousins & Smyth, 2005). In this study, we found that approximately 50% of children demonstrated persistence of CDD over 2 years, although still in the age group of 3 to 5 years old. Regarding persistence in the CDD, Cantell et al. (2003) concluded that children with severe motor problems tend to persist over time, while children with moderate motor problems can recover. However, evidence indicates that these people continue to demonstrate more difficulties than their peers who were never diagnosed with the motor problem (Losse et al., 1991).

When comparing MD according to genders, there was a statistically significant difference (Table 3) in manual dexterity tasks (after 12 months), revealing better performance for girls, while boys demonstrated better motor performance in the tasks of throwing and receiving (initial evaluation and after 12 months). Early childhood studies suggest that boys and girls have similar MD during the first two years of life (Eickmann et al., 2007; Saccani & Valentini, 2010; Venturella et al., 2013), but at a later age, motor differences begin to appear, as occurred in this study and also mentioned by Cliff et al. (2009), with boys being better at locomotion skills and girls better at controlling objects (Hardy et al., 2010). In the Brazilian context, Silva et al. (2016) reinforce the results of this research when evaluating preschoolers aged 4 to 5 years old, emphasizing the better performance of boys in ball skills. However, when evaluating Brazilian children aged between 3 and 10 years old, Spessato et al. (2013) identified differences only for older children (7 to 10 years old), with better performance of boys in locomotion and object control skills.

The findings of this research bring important information to the literature about the behavior of motor development in preschoolers with and without motor difficulties. Despite its relevance, the main limitation of this study was the sample size of the 24-month

methodological design, which restricted the power of data analysis. However, these children were monitored throughout the preschool period, showing the scenario of MD and probable CDD in this period of life. This fact enabled us to verify the trajectory of motor development in a precise and reliable way. Other variables involved in MD could have been investigated to better understand the changes that occurred in the children's motor development, such as the quality of the family environment and the daycare center.

The main practical implication is the necessary assessment and monitoring of children at an early age to refer them to intervention programs. Intervention programs are extremely important as they have the potential to minimize the consequences of motor problems in adulthood (Cousins & Smyth, 2003; Fitzpatrick & Watkinson, 2003).

9 Final Considerations

The results of this study showed that the typical motor development does not occur constantly and consistently over time, that is, it changes with age, with fluctuation in the acquisition and performance in different motor skills. The presence of the probable Coordination Development Disorder was also not constant and consistent over time, with the variability of presence or absence after 12 and/or 24 months of the initial assessment. Comparing girls and boys, girls performed better in manual dexterity skills and boys in throwing and receiving skills.

This study has relevant implications for parents, all professionals in the educational system, and health professionals who monitor child development. Such implications refer to the assessment of the motor development of children at an early age and their follow-up based on therapeutic intervention over time. For further studies, we suggest the inclusion of variables in the analysis related to the children's characteristics, such as weight, height, body mass index, and environmental variables, such as the quality of the home and school environment to better understand how these Individual differences affect the variability of intra-subject motor development.

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Viviane Aparecida Pereira dos Santos: She was the main responsible for the elaboration of the article from the elaboration of the project, submission to the ethics committee, the Department of Education, schools, parents, and preschoolers involved. She also participated in data collection, making the results spreadsheets and statistical analysis. Finally, she wrote the initial version of the article, reviews, and final formatting. Luciana Ferreira: She participated in the review of the article, in checking the results, in the statistical reanalysis, in updating the references, and in building the final version of the article. Jorge Both: He participated in the definition of methods, data analysis, collaborated with the discussion, and the results. Nayara Malheiros Caruzzo: She participated in the conducting the collections, making the results spreadsheets and statistical analysis. José Luiz Lopes Vieira: He was the supervisor of the doctoral thesis that resulted in the construction of the article, and guided the entire methodological process from the initial idea to the final version of the article. All authors approved the final version of the text.

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