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Global Motority And Balance: Comparison Of Motor Development Levels Of Typical And Neurodivergent Children

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Abstract
The main objective of this study was to evaluate and compare the level of motor development in terms of global motor skills and balance in typical children and children with Neurodevelopmental Disorders (NDD). Ten children participated, divided into Control Group (CG): 5 typical children; and Neurodivergent Group (NG): 5 neurodivergent children; from primary school, first years, aged between 7 and 10 years. The Motor Development Scale (EDM) by Rosa Neto (2015) was used to analyze and classify global motor skills and balance. The results of the Global Motor Quotient (QM2) classification were mean normal for the GN and upper normal for the GC (GN:105.2±8.31 - GC: 122.4±12.68, p=0.034) denoting a significant difference between the groups. We conclude that the motor development of children with neurodevelopmental disorders is adequate, although there is a significant disparity when compared to typical children. The importance of generating different strategies and stimuli is emphasized, as well as the participation in Physical Education as a facilitating tool for the improvement of these skills.

Keywords: *Motor development. Neurodevelopment. Physical Education.*

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I. Introduction

Motor development is characterized by changes in motor behavior, maturation of the central nervous system, which is also modified by the interaction with the environment and the stimuli offered during the development of the individual. The changes are part of an orderly and gradual process, in which one change leads to another and thus successively to another and so on (Rebelo et al., 2020).

Typical motor development is the gradual emergence of a child's potential abilities within an expected age range, beginning with the first simple newborn movements and newborn movements and over time becoming more varied and complex. These movements adapt to more refined and selective patterns and skills over a long process (Gusman et al., 2017).

Individuals with impaired motor development may have difficulty in walking, running, climbing stairs, holding objects, and performing other common physical activities. They may also have difficulty communicating and socializing due to problems with speech, facial expression, and other social skills (Diniz, Leite, 2022).

The main neurodevelopmental disorders (NDD) include attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), Intellectual Disability (ASD), Intellectual Disability (ID), Dyscalculia and Dyslexia. These disorders cause alterations in neuropyschomotor development, which are characterized by neurological disorders that impact the individual's life through deficits in social, motor, cognitive and communicative, cognitive and communicative skills. These disorders are attributed to genetic factors, there is a combination of biological, psychosocial and even environmental factors (Gorla; Souza, Buratti, 2021).

Children with NT present difficulties in social skills, conceptual and practical skills. Social skills include responsibility, problem solving and the ability to follow rules. Conceptual skills include the ability to understand time and finances. Finally, practical skills include motor skills, the ability to use tools and carry out activities of daily living (Gorla; Souza, Buratti, 2021).

The Motor Development Scale (EDM) by Rosa Neto (2015) is an option that literature different elements of psychomotor education that are defined and indicative of the elements of psychomotor education that are defined and indicative of the motor age of the child. The EDM consists of seven areas of assessment: fine motor coordination, global motor coordination, spatial organization, temporal organization, balance, spatial organization, temporal organization, equilibrium, body schema and laterality. In this study, two elements were specifically analyzed: global motor skills and balance. balance, taking into account that individuals with NT can present a wide variety of motor challenges, including difficulties with balance, fine and gross motor coordination, basic and advanced motor skills, muscular strength and endurance, among others (Santos, Melo 2018).

By identifying the specific needs of each individual, Physical Education professionals and Physical Education professionals and teachers can develop intervention programs that fit the conditions of children, whether they are typical or with NT (Diniz, Leite, 2022).

Given this situation, the aim of this study was to evaluate and compare the level of motor development in terms of global motor skills and balance in typical children and children with NT, in order to guide parents and teachers towards adequate motor development.

II. Methodology

Population and sample

This research is characterized as quantitative, descriptive and comparative nature. The population of this study consisted of ten elementary school children from a private school of a public school in the city of São Miguel do Oeste, Santa Catarina, Brazil.

The sample was divided into two groups:

Control Group (CG): 5 children aged 7 to 10 years, 3 boys and 2 girls. They were not diagnosed with neurodevelopmental disorders.

Neurodivergent Group (NG): Formed by 5 children aged 7 to 10 years, 3 boys and 2 girls, who had a report proving a neurodevelopmental disorder, such as Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder (ADHD), Dyscalculia and Dyslexia.

Analysis tool

The EDM is composed of several test batteries to assess the motor development of children aged 2 to 11 years, covering 6 dimensions of human motor skills. Its aims to perform a psychomotor assessment of children that encompasses a set of tests of varying difficulty to measure the motor development of children (Rosa Neto, 2015).

For this research, only the global motor skills and balance tests were used. balance tests, which were applied from level 7 to 11, as shown in Table 1.

Table 1 - *Motor Assessment Tests.*

	Level 7	On all fours: Biped position with eyes open, arms relaxed, standing on the right leg, the sole of the left foot will rest on the right knee, forming the number "4". Hold this position for 10 seconds. Rest for 20 seconds, the same exercise with the other leg.
	Level 8	Squat: Bipedal position with eyes open facing the wall, arms relaxed, perform uma bend your knees with your hands on the wall (heels and knees together), after 10 seconds of body stability hands and extend arms laterally. Hold the position for 10 seconds.

Balance	Level 9	With the torso flexed: Biped position with eyes open, feet together with slight elevation of the heels (3 to 5 cm), hands resting on the back: flex the torso at a right angle and hold position for 10 seconds.
	Level 10	On tiptoe, eyes closed: Biped position with eyes closed, feet together with heels (3 to 5 cm from the ground), arms relaxed along the body, stabilize this position for a 10 second interval.
	Level 11	Lame foot, eyes closed: Biped position with eyes closed, standing on one leg, the other remains bent at a right angle, thigh parallel to the right, arms along the body, hold for 10 seconds. Rest for 20 seconds, the same exercise with the other leg.
Global Motricity	Level 7	Lame foot: With eyes open, jump over a distance of 3 meters with the left leg, right leg bent at right angles to the knee, arms relaxed, arms relaxed along the body. After a 30-second rest, do the same exercise with the other leg.
	Level 8	Jump a height of 40 cm: With feet together jump without impulse a height of 40 cm.
	Level 9	Jump in the air: With arms relaxed along the body, back of the hands glued to the buttocks gluteal region during the execution of the jump. The child will perform the movement with knees bent and heels touching palms of hands.
	Level 10	Lame foot, wooden rectangle rectangle rectangle: Knee bent at an angle, arms relaxed, 10 cm from the foot resting on the painted or painted line on the floor place the rectangle rectangle. A child should take it push it with the foot to the end of the lane or line. Or wooden rectangle move away from the foot more than 30 cm.
	Level 11	Jump over a chair: Jump over a chair supported by the examiner. The examinee stands in front of the chair with a distance of approximately 20 cm and performs the jump without touching the examiner.

Source: Rosa Neto (2015).

The tests were applied as explained in the manual, starting with the child's chronological age (CI) and ending when the child did not perform the proposed test correctly. In cases where the child was unable to perform the chronological age test, the lower age test was carried out. The result was considered positive if the child succeeded in the test, in which case a score of one was recorded. In the tests that required right and left-handed ability, a score of one was recorded if the child managed to perform the task with both sides, and half if they managed to do it with just one. If the test had a negative result, zero was recorded.

A child will have a low level of motor development when their motor age is lower than their chronological age. They may have adequate motor development when their motor and chronological ages are the same, and positive motor development when their motor age is higher than their chronological age.

According to Rosa Neto (2015), global motor skills refer to motor skills that involve broad and coordinated movements of the whole body and are considered fundamental for performing motor activities in general and for quality of life in general.

It involves the development of physical skills, including strength, balance, coordination and muscle control. The motor element, balance, is a fundamental skill for carrying out motor activities in general, emphasizing that balance is closely linked to body and spatial perception, coordination and posture, and that it is essential for carrying out activities of daily living and for quality of life in general.

Data Analysis and Statistics

The classification protocol proposed by the EDM (Rosa Neto, 2015) was used to analyze the data obtained, calculating the children's motor and chronological ages and comparing them. comparing them. They were also analyzed using the descriptive technique, arranged in mean and standard deviation. The Student's t-test for independent samples was used to compare the groups. Student's t-test for independent samples was used to compare the groups $p<0,05$.

III. Results And Discussion

This study had a sample of 10 children, divided into two groups of five, CG and NG. groups of five, CG and NG. Both groups contained two girls and three boys, which were identified by numbers to keep their identities preserved. The NG has five children who together have seven reports, described in Table 2.

Table 2 - *Reports.*

Disorder	**N (%)**
ADHD	2 (40%)
Austism	2 (40%)
Dyslexia	1 (20%)
Discauculia	1 (20%)
Intellectual disability	1 (20%)

Source: The authors (2024).

As can be seen from the above, of the 5 children who are part of the NG, 2 (20%) have an ADHD report, another 2 (20%) have an ASD report, 1 (10%) has a Dyslexia report, 1 (10%) has a Dyscalculia report and 1 (10%) has an Intellectual Disability report. It can be seen that the percentage exceeds 100%, which is worth the 5 children, this is because the number of reports is greater than the number of children, that is, two of these children have a combination of two reports.

The authors Costa and Gomes (2020) state that children with ADHD have some altered impairment of motor coordination, thus making daily activities difficult, since children with this disorder have a delay in the acquisition of maturity in the prefrontal region and pathways related to the motor skills prefrontal region and pathways related to blocking inappropriate responses, attention, working memory and motor control precision.

According to Gusman et al. (2017), there have been reports of patients with ASD in relation to motor motor impairments, generally of low amplitude, as well as deficits in the of neuro-motor developmental milestones, difficulty understanding, clumsy body movements clumsy body movements, hypotonia, postural control and motor incoordination.

In addition to mathematical, reading and writing difficulties, children with Dyslexia and Dyscalculia also have movement disorders which affect activities that require fine and gross motor coordination, as well as major difficulties with laterality. They can also affect visual-motor coordination, for example, copying skills (Rocca et al, 2020).

Intellectual disability is characterized by deficits in generic mental abilities, difficulties in social, conceptual and practical skills, which include responsibility, problem-solving and the ability to follow rules, the ability to understand time and finances, motor skills, the ability to use tools and perform activities of daily living (Rocca et al, 2020).

With regard to the characterization of the study participants, the data is arranged as follows Table 3.

Table 3 - *Characterization of participants.*

Variable		CG	NG
Age (months)		103 ± 1.3	104.4 ± 1.3
Sex			
Sex	Female	2 (40%)	2 (40%)
	Male	3 (60%)	3 (60%)
Height (cm)		127.76 ± 4.1	130.14 ± 8.9
Weight (kg)		27.29 ± 4.1	27.28 ± 5.3
BMI		17.5 ± 1.9	15.9 ± 0.8

Source: The authors (2024).

In terms of chronological age, the averages are similar (CG:103±1.30 - GN:104.4±1.30). Analyzing the sexes, it is possible to see that the samples are paired, i.e. both groups have 2 (40%) females and 3 (60%) males. When analyzing the heights, a small difference was observed between the groups, keeping the (CG: 127.76±4.1 - GN: 130.14±8.9), in which it was possible to see that the children had similar statures. children had similar statures. The same situation occurred with regard to weight, (GC: 27.29±4.1 - GN: 27.28±5.3) and BMI (GC: 16.7±1.9 - GN: 15.9±0.8), i.e. there was no considerable difference. a considerable difference was obtained.

The data relating to the analysis of Chronological Age (CI) and General Motor Age (GMI) expressed in months, are shown in Table 4.

Table 4 – *Data from CI and GMI*

	CI	GMI
NG	104 ± 2.05	108 ± 3.45
CG	103 ± 3.14	132 ± 2.46

Source: The authors (2024).

When analyzing the CI with the IMG, it can be seen that the NG has a positive result of 4 months, while the CG is positive at 29 months, in other words, both are positive, but the CG has comparing them, we have a difference of 25 months of development.

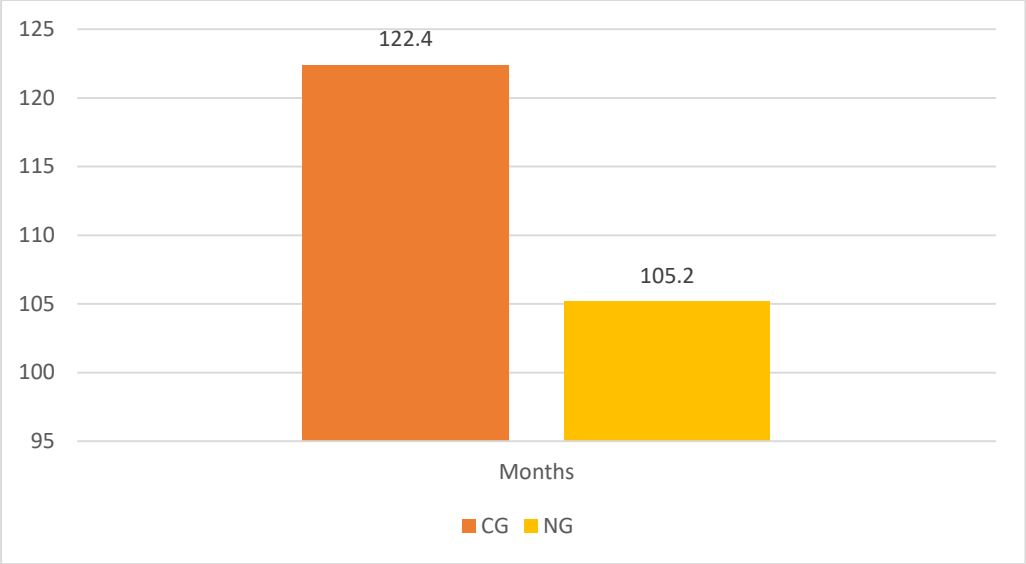
According to the studies found by Castro et al. (2015), motor development is related to biological age. development is directly related to biological age, several factors can influence it such as environmental conditions, which is a key element for social, intellectual and emotional development. Understanding the importance of the child's interaction with the environment, and how much it can improve skills, we can understand the difficulties of children with neurodivergent disorders in relation to motor behavior, as there are often dysfunctions in social issues, making stimulation complex. social issues, making it complex to stimulate play for the development of these children.

According to Rosa Neto et al. (2016), it is of the utmost importance to carry out motor assessments on children, as this allows us to identify various factors as early as possible, including warning signs and any

alterations in motor development, risk factors, whether environmental or not, and to analyze the possible alterations observed, differentiate the types of fragility and monitor neuropsychomotor performance in the child's different stages of development.

After obtaining the CI and BMI data, separate tests were carried out by age level on two elements of Rosa Neto's (2015) battery: global motor skills (QM2) and balance (QM3). The data relating to the analysis and comparison of the Global Motricity Motor Quotient (QM2) expressed in months is shown in Graph 1.

Graph 1- *Regarding the Global Motor Quotient*



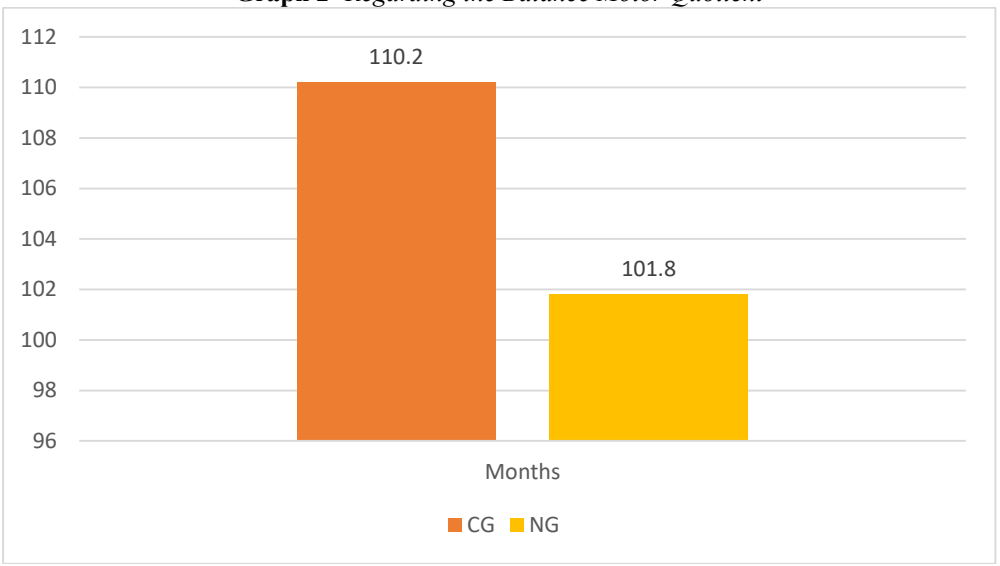
Source: The authors (2024).

Graph 1 shows a QM2 score of medium normal for the NG and a score of higher normal for the CG (NG=105.2±8.31 - CG=122.4±12.68). There was still a significant difference (p=0.034) when comparing the groups. However, both groups showed the development considered appropriate for their chronological age, but the NG showed lower performance, while the CG showed advanced development compared to their chronological age.

In a study on ASD, Vito and Santo (2020) report that they have found several studies that point to motor delays in children with neurodevelopmental disorders, as well as difficulties in acquiring motor skills. motor skills compared to typical children, which is similar to the result found in this study.

The data relating to the analysis and comparison of the Balance Motor Quotient (QM3) expressed in months is shown in Graph 2.

Graph 2- *Regarding the Balance Motor Quotient*



Source: The authors (2024).

Graph 2, referring to the QM3, shows a small difference between the groups, but it was not significant in the Student's T-test. In this sense, both groups are at a level considered normal, the NG is at the low normal level, while the CG is at the medium normal level (GN=101.8±12.85 - GC=110.2± 11.62).

Gonzaga et. al. (2015), states that when comparing studies related to global motor skills, balance and other motor aspects, in most of the results found, children with neurodivergent disorders had a general motor age below that expected for their chronological age, showing that delayed motor development may be a characteristic among them. development may be a characteristic among them, which was not found in this study's population.

In the study by Rosa Neto et al. (2010), carried out with 101 neurotypical children aged 6 to 10, 96% had normal motor development (subdivided into high, medium and low normal), which coincides with the findings of this research, where 100% of the CG were classified as having medium normal development. In the studies by Dos Anjos et al. (2017), most of the Neurodivergent children were in the same classifications as in this study, opening up possibilities for reaffirming the hypotheses raised in the research that children with Neurodevelopmental Disorders can present difficulties in their motor profile and performance. and motor performance.

IV. Conclusion

Analysis of the data revealed an interesting perspective, contradicting some expectations and data in the literature, as it showed that the motor development of children with Neurodevelopmental Disorders is adequate. However, it is crucial to that when we compare these results with typical children, we notice a significant disparity, especially in global motor skills. The typical children showed remarkable progress in various aspects of motor skills, revealing the existence of important nuances to be explored.

Thus, considering the results of this study reinforces the importance of not only identifying differences in motor development, but also promoting effective strategies in Physical Education classes, which can be used as facilitating tools, through stimuli, structured and guided physical activities, promoting the improvement of motor motor skills and also stimulating cognitive, social and emotional development.

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