Fronteiras: Journal of Social, Technological and Environmental Science
http://periodicos.unievangelica.edu.br/fronteiras/
ISSN 2238-8869

Article

Psychomotricity and Microcephaly: A Longitudinal Case Study with an Adolescent

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RESUMO

No Brasil, o Ministério da Saúde considera a microcefalia como um agravo emergencial na saúde pública, e a psicomotricidade por sua vez oferece um trabalho por meio de atividades direcionadas ao sistema motor da criança. Essas atividades têm o propósito de auxiliar no entendimento do próprio corpo e de seus potenciais, e desempenham um papel significativo na formação do desenvolvimento global, atuando como um componente fundamental no processo de aprendizagem do indivíduo. Neste sentido o objetivo do estudo foi verificar o efeito das sessões de psicomotricidade no desenvolvimento motor de um adolescente de 15 anos com microcefalia. Trata-se de estudo de caso longitudinal com duração de quatro meses de intervenção, três vezes por semana com duração entre 30 a 40 minutos. Para os resultados, houve uma melhora na pontuação em todos os elementos psicomotores avaliados em que para o coordenação e equilíbrio de 04 pontos para 08 pontos, no esquema corporal de 01 para 05 pontos, lateralidade de 06 pra 11 pontos, estruturação espacial de 05 para 10 pontos e para orientação temporal de 01 para 05 pontos. Percebeu-se uma melhora no esquema corporal e orientação temporal em que antes o adolescente era classificado com Imagem de corpo vivido (até 3 anos); e após intervenção classificado como Reorganização do corpo vivido (3 a 4 anos e 6 meses). Embora ainda o adolescente tenha tido uma classificação muito aquém para sua idade quantitativamente, percebeu-se qualitativamente uma melhora quanto ao reconhecimento de si mesmo e do outro, face a face, melhora nos termos espaciais, na progressão de tamanho e reprodução de estruturas espaciais e no entendimento de algumas noções temporais. Foi possível concluir que 16 (dezesseis) semanas de prática de atividades psicomotoras foram capazes de produzir melhoras sobre o desenvolvimento em tarefas que envolvem equilíbrio, força, coordenação e lateralidade e noção espacial.

Palavras-chave: desempenho psicomotor; microcefalia; adolescente.

ABSTRACT

In Brazil, the Ministry of Health considers microcephaly as an emergency problem in public health, and psychomotricity, in turn, offers work through activities directed at the child's motor system. These activities are intended to assist in understanding one's own

Submissão: 19/06/2023 Aceite: 05/10/2023 Publicação: 27/10/2023

v.12, n. 3, out. 2023 • p. 239-249. • DOI http://dx.doi.org/10.21664/2238-8869.2023v12i3.239-249.

body and its potentials, and play a significant role in shaping global development, acting as a fundamental component in the individual's learning process. Thus, the objective of the study was to verify the effect of psychomotricity sessions on the motor development of a 15-year-old adolescent with microcephaly. This was a longitudinal case study with 4 months of intervention, three times a week lasting between 30 and 40 min. Improvement in the score in all psychomotor elements evaluated was noted, from 4 points to 8 points in Coordination and balance, 1 to 5 points in the body schema, from 6 to 11 points in laterality, from 5 to 10 points in spatial structuring, and from 1 to 5 points for temporal orientation. There was an improvement in the body schema and temporal orientation, in which the adolescent was previously classified as having a lived body image (up to 3 years old), and after intervention classified as reorganization of the lived body (3 to 4 years and 6 months). Although quantitatively the adolescent still had a classification far below his age, there is a qualitative improvement in terms of recognition of himself and others; face to face; spatial terms; progression of size and reproduction of spatial structures; and understanding of some temporal notions. Therefore, 16 weeks of psychomotor activities led to improvements in developmental tasks involving balance, strength, coordination and laterality, and spatial notion.
Keywords: psychomotor performance; microcephaly; adolescent.

Introduction

Psychomotricity, first described in 1909 and continues to be relevant until today (Le Bouch, 1986; Oliveira, 1997; Fonseca, 2008; Fonseca, 2010; Falcone, 2018; Ferraz, 2021), consists of developing motor structures (sensory and neurological) that undergo a maturation process through activities that foster children's motor system development, contributing to the knowledge of their body and potentials. This is also an important factor to potentiate global development, as a fundamental basis in the learning process of the individual (Rossi, 2012; Sandri, 2010). These improvements work in an integrated manner, that is, improvement in one motor activity affects the other motor systems (Yogui, 2021).

Adequate psychomotor work can avoid or at least minimize learning difficulties in children in the development phase since a good motor organization is a primary factor in their cognitive and sensory-motor development (Almeida, 2009). Thus, psychomotor activities are the foundation of school learning, as to write and maintain attention, the child must necessarily dominate his body and express himself graphically in a well-defined manner (Oliveira, 2018). It is necessary to reinforce that the development of reading and writing is linked to the mastery of language and the symbolization ability of the child (Florêncio, et al., 2021).

Some children face difficulties in activities and cannot keep up with the rhythm of their classmates of their age. This can be due to intellectual disability, or because the child does not adapt well to the environment (Lordani, 2020). Thus, psychomotor education can be seen as preventive because it conditions the child to better develop in his environment and can be used as an educational method in the treatment of individuals who present with minimal or severe motor retardation (Fernandes et al., 2018). This situation can occur as in the case of children with microcephaly, a neurological disease in which the size of the head is below average when compared to children of the same sex, thus hampering a complete development and resulting in a delay in neuropsychomotor development, in addition to mental retardation (Sa 2013; Sousa et al., 2017; Pinto; 2013; Cunha, et al. 2022).

Microcephaly occurs, most often, because the brain does not grow at a normal rate (Pinheiro et al., 2017). The growth of the skull is determined by the brain, which occurs *in utero* and during lactation, and may predispose the child to suffer various consequences such as mental retardation, paralysis, convulsions, and stiffness in the muscles. Usually, the child needs lifelong care to develop (Assunção, 2018; Costa et al., 2020).

In addition to this deficiency, several other factors can jeopardize the normal course of a child's development, such as biological or environmental conditions that can increase the likelihood of deficits in the child's neuropsychomotor development (Gallahue & Ozmun, 2013). If the child presents a poorly constituted motor development, he/she may present problems in writing, reading, graphic direction, and syllable ordering,

among others (Rossi, 2012). The greater the number of risk factors, the greater the possibility of developmental impairment (Gallahue & Ozmun, 2013).

In Brazil, the Ministry of Health considers microcephaly as an emergency problem in public health, with important impacts on the quality of life of children and the whole family, since it requires comprehensive care that includes awareness and attendance of all involved (Brasil, 2016). Pimentel, Catrini, and Arantes (2021) emphasize the importance of further studies with children with neurological alterations, not reducing the subject to motor and cognitive disarrangement. Based on the above, and given the potential of psychomotor work and due to the impact of microcephaly on child development, interventions directed to this group are required so that, in some way, children develop with less impairment. Accordingly, this study aims to verify the effect of psychomotricity sessions on the motor development of an adolescent with microcephaly.

Methods

This was a longitudinal case study of a 15-year-old adolescent with microcephaly. Initially, an invitation was provided to the mother, and she signed an informed consent form (ICF) which was delivered to the researchers. All procedures followed the recommendations of resolution no. 466/2020 of the National Health Council (*Conselho Nacional de Saúde* - CNS), with approval by the Research Ethics Committee under Opinion nº 2.147.331. After signing the ICF, the study site (mother's house) was selected, prioritizing the well-being of the individual who has a disability and requires special care.

The Manual of Psychomotor Evaluation by Oliveira (2018) was used to evaluate the psychomotor profile of the child, assessing the following elements: motor coordination, body schema, laterality, spatial structuring, and temporal structuring. The author classifies psychomotor development by stages, which corresponds to the expected outcomes for age as follows: lived body image (up to 3 years old); reorganization of the lived body image (3 to 4 years and 6 months); indications of the presence of perceived body image (5 to 6 years); perceived body image (7 years old); reorganization of the perceived body image (8 to 9 years); indications of presence of the represented body (10 to 11 years old); and represented body image (from 12 years old).

At first, a psychomotor evaluation was performed in the adolescent's own home due to the familiarity of the environment.

The psychomotor assessment lasted approximately 30' to 40'. For motor coordination ability, tests were performed involving global motor coordination such as walking, running, asymmetry of eyes open and closed and posture when sitting. The dissociation of movements such as opening and closing the hands, dissociation of the hands and dissociation of the feet was analyzed. In fine motor coordination and manual eyeglasses, activities involving vision were developed with the coordination of performing movements such as cutting, tracing labyrinths and holding the pencil. Balance tests were performed by asking the adolescent to stand on one foot, with eyes open, and then he was asked to close his eyes while continuing with one foot. Soon after, they were asked to jump while supporting themselves with only one foot and then clap their hands while jumping. For the body scheme, the drawing of a human figure was evaluated, which could be of oneself or of the father, of the mother. Control over their body, relaxation movements of the shoulders, arms and hands, if they knew the body parts and if they could imitate the gestures were also evaluated. In laterality, manual dominance was verified, based on which hand the adolescednt usually picks up things from, combs his hair, throws the ball and writes. Ocular dominance was done by identifying which eye she uses first to see through a keyhole and pedal dominance by identifying which foot dominance is.

After this evaluation, 30- to 40-min interventions were performed approximately three times a week (according to the child's situation on the day. Most of the time, the adolescent remained calm, but some days he presented peaks of anxiety, when something displeases him), in a 4-month period.

The intervention sessions were planned based on the results of the first evaluation, and all psychomotor elements were performed and evaluated, emphasizing on the psychomotor developmental elements where the child has delay, according to what was expected for age.

The following schedule was used for the application of the activities during the 4 months of intervention.

The information was collected and analyzed in the quantitative and qualitative aspect. Qualitative analysis was based on observations of practical sessions. To this end, Bardan's content analysis was used. This analysis is characterized as a research technique, which follows a systematic sequence and brings consistency to what was researched (SOUSA; SANTOS, 2020; BARDIN, 2022). And for the quantitative analysis, data treatment was based on descriptive statistics using the calculation of means (∑), standard deviation (SD), frequency and percentage (%). Data were analyzed using SPSS for Windows version 20.0 with a significance level of 5% ($p \leq 0.05$).

Table 1: Schedule of the proposed activities in 4 months.

Month	Activities developed
First month	Emphasis on overall and fine motor coordination, with balance exercises, body axis control, hand and foot dissociation, coordination of both hands and feet, and body relaxation
Second month	Continuation of activities of the previous month. Beginning of activities with emphasis on laterality and spatial orientation, activities with ball and positioning of the body relative to some objects, directing the child in relation to the environment and places and to be located in space, and topographic vision
Third month	Continuation of activities of the previous month. Beginning of activities to improve temporal notion with rhythm exercises; locomotion in alternating rhythms, songs, and accompaniment with palms and musical instruments; and logical sequence continuing the temporal notion, with direction towards the organization of stories (beginning, middle, and end).
Fourth month	Continuation of activities of the previous month. Beginning of exercises of logical sequence continuing temporal notion, directing towards the organization of stories (beginning, middle, and end); all the psychomotricity activities previously worked on were continued At the end of the intervention, psychomotor evaluation tests were reapplied to observe if there was progress in the child's development.

Source: author's

Results

The qualitative results of the two time periods, pre- and post-intervention, will be presented. The results of the first application of the battery revealed that the adolescent had substantial difficulty with balance and motor coordination and could not maintain attention in the proposed activities.

In the first coordination test, the adolescent walked partially arched and ran with difficulty. Moreover, in the activities of dissociation of movements, he presented with difficulty wherein he could not perform tasks simultaneously with his arms and legs. In the fine coordination and hand-eye coordination tests, he could not complete the mazes, having difficulty in clipping. He also performed poorly in hand coordination, but with good pencil grip.

Regarding balance, both in static and dynamic balance activities, he had difficulty with immobility with eyes closed, immobility with one foot, clapping of hands, and jumping with one leg.

In the body schema test, the adolescent had no knowledge about his body and had difficulty in some parts such as the pupil, thumb, elbow, heel, neck, hip, eyelashes, wrist, ankle, and eyelids, among others. In drawing the human figure, his drawing was distorted with irregular strokes, and he was unable to imitate gestures, demonstrating a lack of control over the body.

In the laterality test, verifying lateral dominance, it was observed that, among the activities requested in the psychomotor battery, the adolescent was classified as having cross-dominance, being right-handed for the hand and eye and left dominant for the leg. In most tests, he missed the activities, demonstrating lack of knowledge, regarding his perception of the body axis, left and right direction, and spatial organization (more, less, ascending order, visual memorization, and reproduction of spatial structures).

Regarding spatial structuring, the adolescent displayed knowledge regarding spatial term, notion of size, ascending order, and empty elements, but performed the activities with hesitance. He also presented difficulty in reproduction of spatial structures.

In the temporal structuring test, he had no recognition of temporal and time notions (morning, afternoon, night, yesterday, tomorrow, cold, and hot) and could not perform rhythmic activities due to difficulties in distinguishing the duration of intervals in the rhythmic structures requested.

After 4 months of intervention, he presented small improvements in psychomotor components, being able to perform the activities more accurately, paying more attention to guidance, and with less attention deficit. He began to perform the activities more relaxed and with less muscle stiffness, completing the movements and performing them with more coordination. He also performed movements with more safety and balance in some exercises not performed previously. We also observed an improvement in the recognition of self and others; face to face; spatial terms; progression of size and reproduction of spatial structures; and understanding of some time points. However, he still presented with difficulty in rhythm, where he is unable to perform the reproductions of rhythmic structures.

Table 1 shows the quantitative results before and after the intervention. Before the intervention, he was classified in two stages: I (image of lived body [up to 3 years] and in the stage of development) and IA (reorganization of the lived body [3–4 years] far below his age, due to the impact of microcephaly). After the intervention, there was an improvement in the battery scores in all psychomotor elements analyzed, with improvements in the classification of motor coordination and balance and temporal structure. However, it is noteworthy that the child should fit his body image represented for children aged 12 years or more.

Given these results, there was an improvement in psychomotor elements; however, despite the improvement, his psychomotor development is still well below the average of for his age.

Table 1. Profile of the psychomotor development of the child before and after psychomotor intervention.

Variables	Before intervention								Post-intervention							
	Points	I	IA	IB	II	IIA	IIB	III	Points	I	IA	IB	II	IIA	IIB	III
C.B	04		x						08		x					
B.S.	01	x							05		x					
Lat.	06		x						11		x					
S.O.	05		x						10		x					
T.O.	01	x							05		x					

Legend: Coordination and balance (C.B.), body schema (B.S.), laterality (Lat.), spatial orientation (S.O.), temporal orientation (T.O.), lived body image (I), reorganization of the lived body image (AI), indications of presence of perceived body image (IB), perceived body image (II), reorganization of the perceived body image (IIA), indications of represented body presence (IIB), image of the represented body (III).

Discussion

Microcephaly causes changes in gait coordination with crucial effects on the development of locomotor activity (Marcuzzo et al., 2008, Santana, 2019) and consequently severe global hypertonia (muscle stiffness) arises, which results in locomotion difficulties (Eickmann, 2016; Pimentel, 2021).Nevertheless, in the present study, after psychomotricity activities for 4 months in three 40-min sessions per week, there was improvement in the performance of activities of daily living, leading towards a greater functional locomotor independence, making him more confident and assured.

In a study which evaluated the effects of psychomotor exercises on balance performed in an aquatic environment in two children with Down syndrome, Ribos et al. (2016) found that the exercises provided an improvement in general motor age, motor quotient, and balance in both participants. These results were also found in the present study. Information regarding contraction force and the simultaneous and coordinated activation of motor fibers are transmitted leading to movement control, providing a dynamic movement (Oza & Giszter, 2014).

In patients affected by neurological diseases, there is a reduction in motor functions, strength, and muscle resistance and increased spasticity, contractures, and pain in these individuals (Nepomuceno & Alcantara, 2018). However, physical exercises do not guarantee the disappearance of the sequela, but may slow its progression, especially regarding muscle stiffness and slow movements (Paiva et al., 2010). This is demonstrated in the current study, in which improvements in psychomotor levels were achieved, with important gains in development, despite the adolescent's motor difficulties. Furthermore, the study by Machado et al. (2022), when analyzing the motor development of a child with autism spectrum disorder (ASD) through an integrative review, found that motor interventions were able to promote better levels of mobility in the child, demonstrating important gains in motor development, despite difficulties.

In the vast majority of cases, microcephaly is accompanied by motor and cognitive alterations that change according to the degree of brain involvement (Brasil, 2016). Furthermore, according to Teixeira et al. (2019) and Gonçalves et al. (2012), children with ASD are also subject to delays in motor development, with deficits in both fine and gross motor skills. These delays are evident early in the child's life and should be treated in intervention programs, as was performed in the present study, in which improvement in the development of his motor skills was noted.

Accordingly, children need early and immediate stimulation of motor functions, considering that they do not present a notion of space and location of a body part; in addition to tonicity, adequate muscle strength should be established to be safely situated in different environments (Barata & Branco, 2010). Physical exercise can provide physical and psychological benefits for children and adolescents with neurological disorders, regardless of the neuromuscular impairment of each individual (Pedro, 2019). For example, body practices experienced by children can increase the speed of processing information such as memory and attention and reduce sensory deficits (Almeida, 2019).

Ramos (2019) emphasized that exercise is associated with significant improvements in executive functions, information processing speed, memory, and motor functions. These exercises—when through ludic, playful activities—would provide an integral development in which their knowledge-building capabilities would help them become decisive towards the formation of their own, original ideas and transforming reality through their imagination (Tartuci & Flores, 2021).

Through play, the child brings to life another world. This also fosters his relationship with adults, with other children, and with the social environment; thus, this learning process harmoniously encompasses the knowledge linked to cognitive, affective, and social factors, leading to long-term learning (Yogui, 2021). These statements were very well represented in the present study during the performance of a playful intervention, through games, wherein improvement in the motor development and self-esteem of the studied adolescent was achieved.

When comparing the effect of 12 weeks of psychomotor activity on the motor performance of people with disabilities, Resende et al. (2015), concluded that the performance of psychomotor activities can produce significant improvements in their motor performance. Barbosa and Van Munster (2012), looking at the level of motor development of patients with attention deficit hyperactivity disorder submitted to a psychomotricity program, revealed that the group showed improvement, with good performance. Accordingly, the results found in the present study showed that, after a 16-week intervention, using psychomotor activities, improvements in the adolescent's motor functions were observed.

Rossi (2012) aimed at assessing the importance of psychomotricity in early childhood education, aiming at balance and motor and intellectual development, since the structure of psychomotor education is the fundamental basis for the child's learning progress. Thus, psychomotricity contributes to the overall development of the child. The same was observed in the present study, in which psychomotricity helped in the development and performance of tasks involving balance, strength, and muscle coordination and overall development of the individual.

In the study conducted by Orbano Silva et al. (2018), there was an investigation of motor coordination and body scheme in children aged 2 to 6 years. The results of the comparison between the genders of kindergarten students drew attention, as girls performed more satisfactorily than boys. These findings corroborate the conclusions of the present study, in which the girls showed a prominence in relation to the boys in the development of the body schema. These results highlight the importance of directing efforts towards the improvement of motor aspects, particularly in the male context.

In the study carried out by Venâncio (2020), an evaluation of the psychomotor intervention in children was carried out, and it was found that, in a period of two months, there was an improvement in all the evaluated motor aspects. These results underscore the importance of carrying out psychomotor assessments, as from the moment a diagnosis is obtained, the teacher can prescribe appropriate exercises. This discovery is in line with the present study, which predicted the identification of the child's developmental stage and based on these

results, it was possible to promote activities to help children who are delayed to reach the expected standard for their age group.

Ribeiro, Bladore and Dessuy (2022), the objective was to investigate the influence of psychomotricity on the motor development of students aged between 4 and 6 years. During the pre- and post-intervention assessment, the children showed significant improvements in fine motor skills, temporal organization and balance, according to the motor age variable. These results are consistent with the findings of the present study, in which a 4-month intervention was offered and an improvement was observed that was within the expected average for the age group.

Conclusion

We can conclude that a 16-week psychomotor activity was able to produce improvements on the motor development of an adolescent with microcephaly, mainly by improving development in tasks involving balance, strength, coordination and laterality, and spatial notion.

It is important to highlight the need for motor evaluation of an individual with microcephaly because the interventions employed will be based on this evaluation, ensuring that potentialities are explored and improvements are demonstrated in the child's weak points, to promote greater functional autonomy, independence in activities of daily living and, consequently, improvement in the quality of life.

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