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# INFLUENCE OF THE ENVIRONMENT ON CHILDREN'S FUNCTIONALITY

# Influência do ambiente sobre a funcionalidade de crianças Influencia del ambiente para la funcionalidad de niños

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#### **ABSTRACT**

**Objective:** To evaluate the functional profile of riverside children to correlate the influence of the environment on the performance of their activities related to self-care, mobility, and social function. **Methods:** A descriptive and cross-sectional study conducted in the municipality of Cachoeira do Arari, Pará, Caracará community, in May 2017, with 50 children, aged from 5 years to 7 years and 6 months, and their respective caregivers. A child identification questionnaire was applied as an inclusion criterion and the selected participants were assessed through the Pediatric Disability Assessment Inventory (PEDI) and the sociodemographic interview (ABEP). The data were submitted to the Shapiro-Wilk adherence test and then to the chi-square and Pearson correlation tests, with a significance level of 5%. **Results:** The children showed adequate functional performance for the following areas: Functional skills in self-care (HFAC) (70%, p <0.001); Functional mobility skills (HFM) (72%, p <0.001); Functional skills in social function (HFFS) (94%, p <0.001); Caregiver assistance in self-care (ACAC) (94%, p <0.001); and Caregiver assistance in social function (ACFS) (66%, p <0.001), except for Mobile caregiver assistance (ACM). A moderately positive correlation was found between the areas: HFFS and HFAC (r = 0.618, p <0.001), ACAC and HFAC (r = 0.641, p <0.001), ACM and HFM (r = 0.673, p <0.001), ACFS and HFAC (r = 0.581, p <0.001), and ACFS and HFFS (0.647, p <0.001). **Conclusion:** It was observed that riverside children have a functional profile appropriate to the age group and that the environment did not negatively influence their activities related to self-care, mobility, and social function.

Descriptors: Child; Physiotherapy; Cultural Characteristics.

## **RESUMO**

Objetivo: Avaliar o perfil funcional de crianças ribeirinhas a fim de correlacionar a influência do ambiente no desempenho das suas atividades relacionadas ao autocuidado, à mobilidade e à função social. Métodos: Estudo descritivo e transversal realizado no município de Cachoeira do Arari, Pará, comunidade Caracará, em maio de 2017, com 50 crianças, de 5 anos a 7 anos e 6 meses, e seus respectivos cuidadores. Aplicou-se um questionário de identificação infantil como critério de inclusão e avaliaram-se os participantes selecionados por meio do Inventário de Avaliação Pediátrica de Incapacidades (PEDI) e pela entrevista sociodemográfica (ABEP). Submeteram-se os dados ao teste de aderência de Shapiro-Wilk e, em seguida, aos testes do qui-quadrado e de correlação de Pearson, com nível de significância de 5%. Resultados: As crianças apresentaram desempenho funcional adequado para as áreas: Habilidades funcionais em autocuidado (HFAC) (70%, p<0,001); Habilidades funcionais em mobilidade (HFM) (72%, p<0,001); Assistência do cuidador em função social (ACFS) (66%, p<0,001), exceto



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na Assistência do cuidador em mobilidade (ACM). Uma correlação moderadamente positiva foi encontrada entre as áreas: HFFS e HFAC (r=0,618, p<0,001), ACAC e HFAC (r=0,641, p<0,001), ACM e HFM (r=0,673, p<0,001), ACFS e HFAC (r=0,581, p<0,001) e ACFS e HFFS (0,647, p<0,001). **Conclusão:** Observou-se que as crianças ribeirinhas apresentam perfil funcional adequado à faixa etária e que o ambiente não influenciou negativamente nas suas atividades relacionadas ao autocuidado, à mobilidade e à função social.

Descritores: Criança; Fisioterapia; Características Culturais.

#### RESUMEN

**Objetivo:** Evaluar el perfil funcional de niños ribereños para correlacionar la influencia del ambiente para el rendimiento de sus actividades relacionadas con el auto cuidado, la movilidad y la función social. **Métodos:** Estudio descriptivo y transversal realizado en el municipio de Cachoeira de Arari, Pará, comunidad Caracará, en mayo de 2017 con 50 niños entre 5 y 7 años y 6 meses y sus respectivos cuidadores. Se aplicó un cuestionario para la identificación infantil como criterio de inclusión y se evaluaron los participantes elegidos a través del Inventario de Evaluación Pediátrica de Discapacidades (IEPD) y por la entrevista sociodemográfica (ABEP). Se ha puesto los datos a la prueba de adherencia de Shapiro-Wilk y, a continuación, a las pruebas de Chi-cuadrado y correlación de Pearson con el nivel de significancia del 5%. **Resultados:** Los niños presentaron el rendimiento funcional adecuado para las áreas: Habilidades funcionales en el auto cuidado (HFAC) (70%, p<0,001); Habilidades funcionales en la función social (HFFS) (94%, p<0,001); Asistencia del cuidador para el auto cuidado (ACAC) (94%, p<0,001); Asistencia del cuidador para la función social (ACFS) (66%, p<0,001), excepto en la Asistencia del cuidador en la movilidad (ACM). Ha sido encontrada una correlación positiva moderada entre las áreas: HFFS y HFAC (r=0,618, p<0,001), ACAC y HFAC (r=0,641, p<0,001), ACM y HFM (r=0,673, p<0,001), ACFS y HFAC (r=0,581, p<0,001) y ACFS y HFFS (0,647, p<0,001). **Conclusión:** Se observó que los niños ribereños presentan el perfil funcional adecuado para su franja de edad y que el ambiente no ha influenciado de manera negativa con sus actividades relacionadas con el auto cuidado, la movilidad y la función social.

Descriptores: Niño; Fisioterapia; Características Culturales.

#### INTRODUCTION

Health promotion consists of a set of strategies, at the individual and collective levels, tracking and problematizing the determinants factors of health and disease conditions as a way of producing health. These factors can be analyzed in the school environment, through an intersectoral policy of the Ministry of Health and the Ministry of Education, the Health at School Program, instituted in 2007, which provides for actions that vary according to the level of education and include the assessment of health conditions; health promotion and prevention of diseases and conditions; and the permanent training of health and education professionals. A very common action is the assessment of the child's full development and its risk factors for the delay<sup>(1,2)</sup>.

Neurological development during childhood depends on physicals health and genetic disposition and progresses under the influence of the social context and the environment<sup>(3)</sup>. To perform daily activities, motor skills and social interaction are necessary. Motor development is based on actions that a person takes when interacting and moving task objects and themselves around a task environment<sup>(4,5)</sup>.

Children in urban areas often live in better conditions than children in rural areas, thanks to higher standards of health, protection, education, and sanitation. However, urban advances have been uneven, and millions of children in marginalized urban settings face daily challenges and disenfranchisements<sup>(6)</sup>.

Unlike the urban context, riverside children constantly live with the presence of forests and rivers, and their activities are related to those developed by adults, especially by their parents. They participate in all moments of community life, at work, at home, at leisure, and in religious activities. The games most frequently observed in the riverside community were make-believe or role-playing, followed by other types of outdoors activities, such as swimming in the river, flying a kite/kite, playing ball, climbing trees, running in the terraces and bridges, look for objects in the woods and go canoeing<sup>(7)</sup>.

Amid biodiversity and culture, with varied peculiarities, such as the extractive way of life, the riverside communities suffer from the lack of electricity, lack of basic sanitation and, mainly, with the precarious access to public policies in the areas of education and health<sup>(8)</sup>. Among environmental factors, home and family play a major role during the early years of childhood. Parent education, socioeconomic status, family size, and interaction with siblings are the main elements of the child's close environment<sup>(9,10)</sup>.

In a common scenario among municipalities with riverside populations, according to the United Nations Development Program<sup>(11)</sup>, the municipality of Cachoeira do Arari, Pará is among the worst in the Municipal Human Development Index (0.546), which suggests that its inhabitants have few social opportunities for development and may be at a disadvantage concerning their participation and social inclusion.

Due to socioeconomic and structural conditions, the present study aims to assess the functional profile of riverside children, to correlate the influence of the environment on the performance of their activities related to self-care, mobility, and social function.

#### **METHODS**

This is a descriptive, cross-sectional, and an exploratory study, of a quantitative nature, carried out in the municipality of Cachoeira do Arari, in the Caracará community, Pará, in May 2017.

Children duly enrolled in municipal schools and their respective caregivers participated in the study. Considering a local population of 97 children registered and who met the inclusion criteria, the probabilistic sample was calculated, obtaining n = 50 (51.55%) children, a proportion that varied in the confidence interval (95%) between 33. 4% and 53.2%.

As inclusion criteria, we considered children between 5 years and 7 years and 6 months, of both sexes, whose caregivers were available to respond to the assessment instruments with information regarding the functionality and socioeconomic profile of families. As an exclusion criterion, children who had any biological risk (complications in the pre, peri and postnatal periods, such as prematurity, low birth weight, placental detachment, vaginal bleeding, perinatal asphyxia, biochemical and hematological disorders, microcephaly, malformations, and congenital infections) were considered, with associated disorders (such as mental retardation, neurological or orthopedic problems, and presence of sensory, visual or auditory disorders) and/or signs of abnormal patterns of neuromotor development identified in the questionnaire previously answered by those responsible / child caregivers.

Data collection took place in the schools that the children attended, at the time of greatest convenience for the caregiver, in a pleasant place to encourage the interviewee's participation and after signing the Free and Informed Consent Form and the Child Assent Term.

The following evaluation instruments were used for data collection: the Pediatric Disability Assessment Inventory (PEDI), Brazilian version validated in 2005<sup>(10)</sup>, applied through a structured interview with the parents who spend more time with the child, in order to describe, in detail, the child's functional performance. The version was translated and adapted from the original North American Pediatric Evaluation of Disability Inventory following all the criteria and procedures described in the literature, which included the stages of translation, cultural adaptation and development of Brazilian standards, being carried out by the Departments of Occupational Therapy and Physiotherapy at the Federal University of Minas Gerais. Its normative data, which constituted the Brazilian standardization sample, were obtained from 276 children from the Metropolitan Region of Belo Horizonte<sup>(10)</sup>.

PEDI consists of the areas of self-care, mobility and social function, which are composed of three parts: I - Functional skills, which measures the child's ability to perform certain functional skills; II - Caregiver assistance, which assesses the usual amount of help provided during the performance of basic functional activities and III - Modification of the environment, which identifies the number of functional activities for which modifications are needed<sup>(10)</sup>.

Sociodemographic interviews were also used in order to provide data on individual characteristics of the mother and spouse (marital status, religion, etc.), family and demographic composition (type of family, number of children and birth order, number of resident people, number of rooms, etc.), and data on education, income and paid employment of parents, adapted from the script of the Brazilian Association of Research Companies (ABEP), entitled Criteria for Economic Classification Brazil<sup>(12)</sup>.

To standardize the application of the instruments and measure the reliability of data collection, the intraclass correlation coefficient (ICC) was previously applied, obtaining the replicability considered excellent (ICC>0.90, p<0.05).

The collected data were submitted to the Shapiro-Wilk adherence test and then to the chi-square and Pearson correlation tests, with a previously adopted level of significance of 5% (p<0.05). For the analysis, we used the Statistic Package for Social Sciences (SPSS), version 24.0.

This study was approved by the Research Ethics Committee of the University of the Amazon - UNAMA, with Opinion No. 2.017.531.

## **RESULTS**

Fifty children and their respective main caregivers participated in the survey. Table I shows the sociodemographic characteristics of the children. Of these, 52% (n = 26) were male, 54% (n = 27) were 6 years old and 44% (n = 22) were in the kindengarten period 3.

Table II characterizes the caregivers. Of these, 50% (n = 25) were the child's mothers; 46% (n = 23) grandmothers and 4% (n = 2) parents. In addition, 70% (n = 35) were part of a nuclear family formation, 70% (n = 35) had incomplete primary education and 72% (n = 36) of the mothers were fishermen.

The study participants stated that the child's pregnancy was not planned in 56% (n = 28) of the cases, with 28% (n = 14) of the children being born from the first pregnancy and 34% (n = 17) of the mothers in the 5th pregnancy or more.

Among families, 62% (n = 31) received classification in class D, following the classification of ABEP $^{(10)}$ , which distinguishes groups according to the possession of household goods items.

Table I - Children's socio-demographic characteristics (n = 50). Cachoeira do Arari, Pará, 2017.

Sample characterization - children	n	%	<b>p</b> <sup>(1)</sup>
Child's sex			
Feminine	24	48.00	0.777
Masculine	26	52.00	0.777
Child's age			
5 years	15	30.00	
6 years	27	54.00	0.004**
7 years	8	16.00	
Child's education			
First grade	19	38.00	
Second grade	9	18.00	0.062*
Kindengarten 3	22	44.00	

<sup>(1):</sup> Pearson's chi-square test for trend (p <0.05); \*: significant values; \*\*: highly significant values

In the present study, children showed adequate functional performance in all areas of PEDI (p <0.05), except for Assistance of caregivers in mobility, in which the proportions were equivalent, with 56% (n = 28) of children with adequate performance and 44% (n = 22) of children with delayed performance. In the case of delayed development, it is observed that the caregiver's assistance for mobility presented a relevant number of children (44%, n = 22), according to Table III.

In Table IV, it is observed that the children presented adequate performance (score between 30 and 70) in the Functional Skills in social function ( $\mu$  = 46.32), and in Caregiver Assistance in self-care ( $\mu$  = 45.89) and Social Function ( $\mu$  = 48.00), children's performance was better than in other skills and assistance, within the normal range.

Table V shows that the Self-Care area (HFAC) obtained a positive association with Functional Mobility Skills (HFM) and Social Function (HFFS), indicating that the greater the functionality in social and motor activities, the greater the child's ability to performing self-care tasks, such as dressing, eating and personal hygiene.

There was also a positive association between HFAC and ACAC (r = 0.641; p < 0.05) and mobility (ACM) (r = 0.500; p = 0.000), indicating that the greater the result in HFAC, the greater the score of ACAC and ACM, consequently, the higher the level of independence of the child in these areas.

HFM has a significant association, of moderate magnitude, with ACM (r = 0.673; p = 0.000), indicating that the greater the child's capacity in functional mobility activities, such as transfers and locomotion in environments, the smaller the amount of help provided by the caregiver and the greater the independence of mobility.

Table II - Sociodemographic characteristics of caregivers (n = 50). Cachoeira do Arari, Pará, 2017.

Sample characterization - caregivers	n	%	p¹
Family type			
Mononuclear	4	8.00	
Nuclear	35	70.00	0.000**
Nuclear extended	11	22.00	
Mother's schooling			
Incomplete Elementary School	35	70.00	
Complete primary education	2	4.00	
Incomplete high school	7	14.00	0.000**
Complete high school	4	8.00	0.000
Incomplete higher education	1	2.00	
Don't know	1	2.00	
Mother's profession			
Fisherwoman	36	72.00	
Housewife	8	16.00	
Servant	3	6.00	0.000**
Public employee	1	2.00	0.000
Autonomous	1	2.00	
Student	1	2.00	
Child's birth order			
<b>1</b> st	14	28.00	
2 <sup>nd</sup>	10	20.00	
3 <sup>rd</sup>	7	14.00	
4 <sup>th</sup>	10	20.00	0.000**
5 <sup>th</sup>	5	10.00	0.000**
6 <sup>th</sup>	2	4.00	
$7^{th}$	1	2.00	
13 <sup>th</sup>	1	2.00	
A gestação foi planejada?			
Yes	22	44.00	0.004**
No	28	56.00	0.001**
Number of pregnancies			
1	2	4.00	
2	12	24.00	
3	12	24.00	0.011*
4	7	14.00	
5 or more	17	34.00	
Social classification			
C1	2	4.00	
C2	10	20.00	0.000**
D	31	62.00	0.000**
Ē	7	14.00	

<sup>(1):</sup> Pearson's chi-square test for trend (p <0.05); \*: significant values; \*\*: highly significant values

Table III - Classification of children's performance in the areas assessed by the normative score of the Pediatric Disability Assessment Inventory - PEDI (n=50). Cachoeira do Arari, Pará, 2017.

PEDI	Performance Adequated Delayed Advance		anced	<b>p</b> <sup>(1)</sup>			
	n	%	n	%	n	%	
HFAC	35	70.0	15	30.0	0	0.0	<0.0005**
HFM	36	72.0	14	28.0	0	0.0	0.0002**
HFFS	47	94.0	0	0.0	3	6.0	<0.0001**
ACAC	47	94.0	3	6.0	0	0.0	<0.0001**
ACM	28	56.0	22	44.0	0	0.0	0.396
ACFS	33	66.0	9	18.0	8	16.0	<0.0001**

HFAC: Functional Skills in Self-Care; HFM: Functional Mobility Skills; HFFS: Functional Skills in Social Function; ACAC: Caregiver Assistance in Self-Care; ACM: Caregiver Assistance in Mobility; ACFS: Caregiver Assistance in Social Function (1): Pearson's chi-square test for trend (p <0.05); \*: significant values; \*\*: highly significant values

Table IV - Performance of children in the areas assessed by the normative score of the Pediatric Disability Assessment Inventory - PEDI (n = 50). Cachoeira do Arari, Pará, 2017.

Variable	Mean	±DP	Minimum	Maximum
HFAC	37.13	12.71	Below 10	69.80
HFM	38.31	14.43	Below 10	58.10
HFFS	46.32	10.18	34.60	78.10
ACAC	45.89	9.47	16.30	62.50
ACM	34.80	14.54	Below 10	58.40
ACFS	48.00	22.19	Below 10	90.00

HFAC: Functional Skills in Self-Care; HFM: Functional Mobility Skills; HFFS: Functional Skills in Social Function; ACAC: Caregiver Assistance in Self-Care; ACM: Caregiver Assistance in Mobility; ACFS: Caregiver Assistance in Social Function; SD: standard deviation

Table V - Correlation between functional skills and caregiver assistance (n = 50). Cachoeira do Arari, Pará, 2017.

Correlated variables		Correlation coefficient (r)	р
HFM	HFAC	0.464	0.002
HFFS	HFAC	0.618	0.000
HFFS	HFM	0.463	0.001
ACAC	HFAC	0.641	0.000
ACAC	HFM	0.416	0.005
ACAC	HFFS	0.383	0.006
ACM	HFAC	0.500	0.000
ACM	HFM	0.673	0.000
ACM	HFFS	0.462	0.001
ACM	ACAC	0.410	0.004
ACFS	HFAC	0.581	0.000
ACFS	HFFS	0.647	0.000
ACFS	ACAC	0.393	0.012
ACFS	ACM	0.280	0.088

HFAC: Functional skills in self-care; HFM: Functional mobility skills; HFFS: Functional skills in social function; ACAC: Caregiver assistance in self-care; ACM: Caregiver assistance in mobility; ACFS: Caregiver assistance in social function

# DISCUSSION

The riverside children evaluated in the present study showed adequate functional performance for the HFAC, HFM, HFFS, ACAC, ACFS areas, except for the ACM. The environment did not negatively influence their functional profile.

The research was carried out in the school environment, which is an adequate place for the practice of health promotion, tracking and problematizing the determinants of health, and disease conditions as a way of producing health. In the PSE, those factors that may interfere with the child's integral development and that result in a risk of delay are identified<sup>(1,2)</sup>.

Child development is a process that evolves with chronological age and depends on the child's biology and environmental conditions, and may take culture into account, with its values and beliefs, as the task, individual and environment restrictions may affect motor performance, compromising basic motor competence<sup>(13,14)</sup>.

Amid nature, children can be surprised by the possibilities that the natural space offers and also favors the stimulation of the senses (smell, touch, taste, vision, and hearing), the contact with the four elements of nature -

earth, fire, water and air, the approximation with the local fauna and flora, the exploration of motor skills and abilities (climbing trees, digging, climbing, running etc.), exercises for autonomy and socialization, is something positive for the education and development of children<sup>(15)</sup>.

However, problems related to the difficulties of part of the population's access to basic services and goods can be even more compromising when this deficiency impacts the first years of life, which can cause damage to the development of the subject<sup>(16)</sup>. The findings of the present study corroborate the literature, being analyzed as a favorable environment for development since in the parts of Functional Skills and Caregiver Assistance, children have a development considered adequate.

A study carried out in a community with infrastructure, cultural and population characteristics similar to this study, observed that environmental factors were not a barrier to the neuropsychomotor development of riverside children from the Amazonian community Panacauera, where most children did not have developmental delay<sup>(17)</sup>, corroborating the results of the present research. Among the minority of Panacauera children classified late, the field language was detected as the main affected area.

The family corresponds to the child's main context of interrelationships. The quality of the familiar environment and relationships leads to the evolution of child development. Parent education, socioeconomic status, family size, and interaction with siblings are major elements of the child's environment<sup>(18)</sup>. Of the main caregivers, 50% were mothers, corroborating the fact that women are still the main caregivers of people with disabilities, something that in Brazil is culturally determined<sup>(19)</sup>.

Biological risk factors (pre, peri, and post-natal events that result in damage to health), and environmental factors, such as difficulties in school learning and low socioeconomic status can contribute to delayed motor development<sup>(20)</sup>. In the results of the current research, it was observed that 62% of families are classified in class D; however, most children have adequate functionality.

The individual's functionality is due to the relationship between his health condition, physiological structures and functions, capacity, and performance in activities and social participation. It is prioritized, as a health component, considering the environment as a facilitator or as a barrier to the performance of activities and participation<sup>(21)</sup>.

Given the context of the riverside community, the environment can be considered as a facilitator, because most children present an adequate functional performance. One of the most used instruments to assess functionality is the PEDI, which, in the model of the World Health Organization, includes, together with the International Classification of Functionality, Disability - CIF, an expanded analysis about disability, taking into account the evaluation of activity and participation levels when the individual performs a task or action in a real-life situation<sup>(21,22)</sup>.

PEDI contributed to the identification of individual disabilities and the most compromised functions in children<sup>(23,24)</sup>. Thus, the test was used to provide a detailed description of the child's performance, to trace the functional profile, and also to cover the age established by the study.

According to the data obtained in the present study, through the PEDI normative score, the functional performance shown by the sample in all areas assessed by the test is considered adequate for the Brazilian population. The normative score represents the expected performance of Brazilian children with typical development, since for each age group the normative score between 30 and 70 is considered within the normal range<sup>(8)</sup>.

In the result of the ACM area that assesses the amount of help provided by the caregiver, during the performance of some basic functional activity, 44% of the children evaluated in the current research show a delayed functional performance. This data corroborates the findings of another study<sup>(21)</sup>, where the highest rate of delay was in the ACM dimension. It can be justified because mothers have a high number of children and, to streamline day-to-day activities, they provide more help than necessary, thus being able to explain the percentage of delay in the area.

Caregiver assistance is directly associated with the child's performance in the functional skills of self-care and mobility<sup>(24)</sup>, and the child's level of independence is related to his/her performance. Thus, the higher the level of performance in the functional abilities of children in the areas of self-care and mobility, the smaller the amount of caregiver assistance offered to the child during functional activities.

It was also found that the reduction of assistance provided by the caregiver in mobility activities allows greater independence for children in this area so that they will perform the self-care functional activities with better performance<sup>(24)</sup>. Such data confirms the result found in the current research, also emphasizing that the greater the functionality in social and motor activities, the greater the child's ability to perform self-care tasks.

In the 2017 Basic Education School Census<sup>(25)</sup>, children aged 4 to 5 years are attending pre-school, and those aged 6 to 9 years are attending elementary school (initial years). In comparison to national data, the children in the current survey attend the series according to the age group established.

One of the factors that can negatively influence the educational level of children is the low level of mothers' education, as the children of women with a low level of education tend to enter school later and leave it early, and this short time demonstrates the difficulty in progressing in their studies<sup>(26)</sup>. However, in the findings of the present study, it was observed that even mothers with a low level of education did not influence their child's school grade.

As study limitations, there is a scarcity of studies that characterize the riverside populations, which hinders the theoretical foundation of new research and the development of actions for health promotion respecting regional, socioeconomic, and cultural aspects.

#### CONCLUSION

It was observed that riverside children from the community of Caracará, within the age range of 5 years to 7 years and 6 months, have the functional profile appropriate to their age group, according to the Pediatric Disability Assessment Inventory (PEDI), except for Assistance of caregivers in mobility, and that the environment has not negatively influenced their activities related to self-care, mobility, and social function.

The higher the performance in Functional Skills, the less the amount of help from the caregiver.

## **CONFLICTS OF INTEREST**

The authors declare that there is no potential conflict of interest in this study.

#### CONTRIBUTIONS

Dayse Daniele de Oliveira Silva and Juliana Maciel de Queiroz contributed to the preparation and design of the study; the acquisition, analysis and interpretation of data; and the writing and / or revision of the manuscript. Adrielly Elane Sousa Maia, Ana Paula Monteiro de Araújo, Hannah Nazareth Muribeca Athar and Paula Cristina Soares Mesquita contributed to the acquisition, analysis and interpretation of data; and the writing and / or revision of the manuscript.

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