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Artigo Original

DESENVOLVIMENTO MOTOR E FATORES ASSOCIADOS DE CRIANÇAS ENTRE 36 E 42 MESES EM UM CONTEXTO DO BAIXO AMAZONAS

MOTOR DEVELOPMENT AND ASSOCIATED FACTORS IN CHILDREN BETWEEN 36 AND 42 MONTHS IN THE LOW AMAZON REGION

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RESUMO

Objetivou-se neste estudo investigar a relação entre desenvolvimento motor infantil, condições sóciodemográficas e ambiente familiar de crianças. Foram avaliadas 300 crianças entre 36 e 42 meses matriculadas na rede pública de ensino da educação infantil do município de Parintins/AM e seus respectivos pais ou responsáveis. Os instrumentos utilizados foram: TMGD-2, AHEMD e ABEP. As razões de prevalência (RP) foram obtidas por regressão de *Poisson* mediante análise hierarquizada. A prevalência de atraso do desenvolvimento foi de 76%. Estiveram significativamente associados a este desfecho sexo da criança e renda familiar. Os meninos apresentaram 31% mais risco de atraso no desenvolvimento motor do que as meninas. Crianças pertencentes a famílias com renda mensal de até R$1.499,00 e de R$1.500,00 a R$2.499,00 tiveram, respectivamente, 1,77 e 2,15 mais probabilidades de apresentarem atraso do desenvolvimento do que as crianças pertencentes a famílias com renda mensal igual ou superior a R$2.500,00. Os resultados servirão de base e estímulo para intervenções com pais, professores e diretores das creches do município de Parintins/AM, no sentido de esclarecer e propiciar ambientes saudáveis e com estimulação adequada para as crianças, auxiliando em seu desenvolvimento.
Palavras-chave: Desenvolvimento motor. Oportunidades de estimulação motora. Condições sóciodemográficas. Condições ambientais.

ABSTRACT

The aim of this study was to investigate the relationship between infant motor development, socio-demographic and the child's home environment conditions. We evaluated 300 children aged between 36 and 42 months, who were enrolled in public schools for early childhood education in the city of Parintins/AM, together with their parents or guardians. The instruments for data collection were TMGD-2, AHEMD and ABEP. Prevalence ratios (PR) were obtained by Poisson regression by hierarchical analysis. The prevalence of developmental delay was 76%. The child's gender and family income were statistically associated with the outcome. Boys had 31% more risk of developmental delay than girls. Children from families with income up to R$1,499.00 and from R$1,500.00 to R$2,499.00 were, respectively, 1.77 and 2.15 more likely to have developmental delay than children from families with monthly income equal to or higher than R$2,500.00.The results will form the basis and stimulus for interventions with parents, teachers and principals of kindergartens in the city of Parintins/AM, to clarify and provide healthy environments and with adequate stimulation for children, assisting in their development.
Keywords: Motor development. Opportunities for motor stimulation. Socio-demographic conditions. Environmental conditions.

Introduction

Motor development is a process of continuous changes that occur in the motor behavior of an individual resulting from the interaction between hereditary and environmental factors[1]. Particularly in early infancy, environmental conditions – such as the quality and quantity of stimulation opportunities, encouragement, and efficient instruction – play a decisive role in acquiring patterns of important motor behavior and, consequently, avoiding the occurrence of motor delays in this period of life[2], since they have a negative effect on motor development in later childhood and adolescence[3].

Previous studies have investigated possible associations between motor delays observed in infants in early childhood and the low opportunity for motor stimulation in the home environment[4-6]. Results found in different contexts in Brazil have reinforced this relationship[7-9]. Household environments that do not offer appropriate stimuli fail to provide the child with the development of adaptive motor behaviors resulting from experiences related to the environment in which they live[10], especially if there is no effective action by a mediating agent in this process[11].

Also, socio-demographic factors, such as family income, parental schooling, the number of adults and children in the household, the child's gender and even the architecture of the house, have been taken into consideration in the investigations of motor delays in early childhood[7,8,12-15]. In general, the households of families from the lower socioeconomic stratus did not present favorable conditions for motor stimulation; the smaller supply of materials of gross and fine motricity and variety of stimulation seem to be associated with the children motor delays[7,13]. Also, parents' schooling and the number of adults in the household are factors negatively associated with low stimulation[12,13]. These factors, therefore, seem to hinder the organization of a home environment favorable to motor stimulation[12,16] and, consequently, to explain motor delay in children.

The present study aims to evaluate the relationship between infant motor development, socio-demographic conditions and home environment of children aged 36-42 months in the low Amazon region. We understand that adequate levels of motor development are associated with the opportunities conceived for the child in a family environment full of stimuli and that the socio-demographic characteristics of these environments can also influence this process. The low Amazonas region presents limited conditions of logistics and access for its residents, as well as the prevalence of low-income families. In this perspective, it is essential to investigate whether the presence of motor stimulation opportunities of children residing in this region is enough to allow for a good motor development and what factors are most associated with motor delays.

Methods

Participants

This is a school-based study with a cross-sectional design, encompassing all children aged 36-42 months – duly enrolled in the public school system of early childhood education in the city of Parintins/AM – and their parents or guardians. The city of Parintins/AM has thirteen educational centers for children between the ages 3-5 years, with ten educational centers located in the urban zone and three in the rural area. The children enrolled in these centers, aged 36-42 months, totaled 368. Of these 368 children, there were 68 losses: 54 children did not turn up at the time of the motor assessments, 2 parents and/or guardians did not hand in the Informed Consent Form (ICF) and 12 of the parents and/or guardians did not authorize the children's participation in the research. Therefore, the final study sample consisted of 300 children.

Context

The research was carried out in the city of Parintins, located in the lower Amazon region of the state of Amazonas, northern Brazil. According to the Brazilian Institute of Geography and Statistics[17], Parintins/AM has 110,411 inhabitants, the second most populous city in the state. Its Gross Domestic Product (GDP) is R$ 673,333 million reals and the per

capita GDP is R$ 6,504.35 reals per year, with a Human Development Index (HDI) of 0.658, which is a median HDI[18] according to the United Nations Development Program (UNDP).

Tools

Affordances in the Home Environment for Motor Development (AHEMD), developed by Rodrigues, Saraiva and Gabbard[19], translated and validated for Brazil to assess the quantity and quality of motor stimulation opportunities that the family context makes available for children's development. The questionnaire is directed to those responsible for children aged between 18-42 months and consists of five subscales: (1) outside space, (2) inside space, (3) stimulation variety, (4) fine motor toys and (5) gross motor toys. These subscales are classified, hierarchically, into four levels and the total score of the questionnaire ranges from 5 to 20 points, which is finally classified into a standardized scale of three categories: 1) low (5 to 9); medium (10 to 15) and high (16 to 20).

Test of Gross Motor Development - Second Edition (TGMD-2), developed by Ulrich[20] with the objective of assessing the motor development in children aged 3 through 10 years and 11 months and validated for Brazilian children by Valentini[21]. It consists of a normative evaluation of the broad motor skills and involves locomotor and control of objects assessments. 3 to 5 specific motor criteria are observed for each skill of the test, referenced to the mature fundamental movement patterns. The sum of the results obtained for each evaluation, according to the age and gender of each child, is converted into a score that results in a percentile or broad motor quotient (descriptive classification), classifying the children as very poor, poor, below average, average, above average, superior and very superior. Descriptive classification below average, poor and very poor identifies delay in motor development. According to the criteria established by Valentini[21] it is necessary that the test be filmed for further analysis.

The Questionnaire of Economic Classification by the Brazilian Association of Market Research Institutes (ABEP)[22], is an instrument of economic segmentation that uses the survey of domiciliary characteristics (the presence and quantity of some household items of comfort and the schooling level of the head of the family) to differentiate the population, classifying it in different strata, which, for a more effective analysis in the present research were grouped in: A and B, C, D and E.

Procedures

The research was approved by the Ethics Committee in Human Beings Research of the Universidade Federal do Amazonas - UFAM (Opinion number 1,134,314) and sent for acceptance by the Municipal Secretary of Education of Parintins/AM to consent to the research. A pilot study with 26 parents and/or guardians and 26 children, prior to the beginning of the data collection and not included in the present study, was carried out for the adequacy of motor assessments, questionnaires and logistics. After a meeting with the managers of the early education schools in the city of Parintins/AM, a schedule was established for the collection in schools and for meetings with the children's parents and/or guardians in the age group of 36-42 months. In these meetings, we presented the research proposal and requested the signing of the Informed Consent Term.

Data collection was first performed with the parents/guardians, who completed the AHEMD and the ABEP questionnaire, and then with the children, through motor assessments with the TGMD-2. All data collection was carried out within the children's

educational centers of Parintins/AM, in places and times scheduled by the researcher. The scoring of the motor assessment videos took place in a laboratory of the Instituto de Ciências Sociais, Educação e Zootecnia - ICSEZ / UFAM, adopting the triple blind system, in which two professors from the Federal University of Amazonas (UFAM) and the researcher individually analyzed each child. They were also responsible for punctuating the motor development of all children from the videos. Analysis of each video took approximately 30 minutes per child. The agreement between the reviewers, using the Kappa test was 0.83, $p < 0.001$ (optimal agreement).

Statistical analysis

We built our database on the Epidata software and corrected it through double scanning. The statistical analysis was performed in the statistical package SPSS 18.0 for Windows through univariate analysis with the description of the children's socio-demographic and environmental conditions; bivariate analysis consisting of crossing the exposure variables with the outcome using contingency tables (chi-square test); and, finally, the multivariate analysis, performed by Poisson regression model with robust variance to investigate the joint effect of the exposure variables on the outcome. This test was chosen because it is a cross-sectional study with a non-rare outcome.

The multivariate analysis was performed according to the hierarchical model shown in Figure 01, which allows to verify whether the association between the outcome and the factors under study is direct or mediated by the effect of the other variables. The effects of the variables that are at the same hierarchical level work as confounding factors for the others of the same level and those of lower levels. The variables with a value of $p < 0.20$ in the bivariate analysis remained in the final model. The significance level adopted for all analyzes was $p < 0.05$.

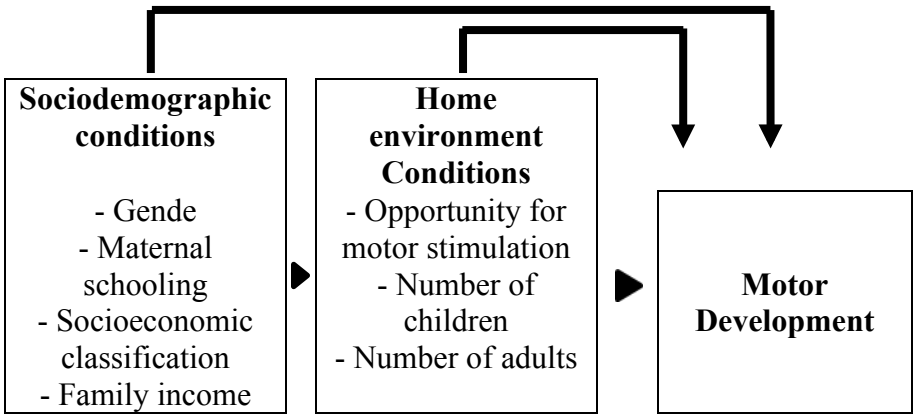

Figure 1. Theoretical model of hierarchized analysis for determining child motor development aged between 36-42 months in the city of Parintins/AM.
Source: The authors.

Results

The description of study participants, according to their socio-demographic and home environmental conditions, is shown in Table 1.

Table 1. Description of Participants.

Variables	Frequency	
SOCIO-DEMOGRAPHIC CONDITIONS	n	%
Gender		
Male	133	44.3
Female	167	55.7
Mother's schooling		
Elementary Education	186	62
Secondary Education	94	31.2
Higher Education	20	6.7
Socioeconomic classification		
D & E	21	7
C	242	80.7
A & B	37	12.3
Family income (R$)		
Up to 1,499	130	43.3
1,500-2,499	110	36.7
2,500 or above	60	20
HOME ENVIRONMENT CONDITIONS		
Opportunities of motor stimulation (AHEMD)		
Low	167	55.7
Average	85	28.3
High	48	16
Number of children		
1 - 2	61	20.3
3 - 4	239	79.7
Number of adults		
4 - 5	203	87.7
3	64	21.3
1 - 2	33	11

Source: The authors.

The bivariate analysis showed that male children, with mothers with elementary and secondary education, and belonging to class D/E and C increase the prevalence ratio of motor delays. As for environmental conditions, children from families with income up to R $ 1,499.00 and between R $ 1,499.00 and R $ 2,000.00, low and medium motor stimulation opportunity at home, with 1 or 2 children and less than 2 adults in the household, also showed an increase the possibility of motor delays. All variables had p_{wald} <0.20 in the bivariate analysis, and were then included in the multivariate analysis.

Multivariate analysis was carried out with adjustments for confounding factors, sociodemographic conditions (level 1) and environmental conditions (level 2). After the adjustments, the variables related to the children's gender and family income were associated with the outcome. Males presented a 31% higher risk of motor development delays than females. Children belonging to families with monthly income of up to R$ 1,499.00 and R $ 1,500.00 to R $ 2,499.00, respectively, were 1.77 and 2.15 more likely to present developmental delays than children belonging to families with monthly income equal to or greater than R $ 2,500.00, respectively. Prevalence, crude and adjusted prevalence ratio between motor development delay, sociodemographic conditions (level 1) and environmental conditions (level 2) are presented in table 2.

Table 2. Prevalence, crude and adjusted prevalence ratio (PR) between motor development delay, socio-demographic conditions (level 1) and environmental conditions (level 2), in children from 36 to 42 months of Parintins (AM) (n = 300).

Factors/Outcome	Motor Performance							
Gender	**Delay N (%)**	**Normal N (%)**	**PR Crude**	**(CI95%)**	**p*-value**	**PR adj****	**(CI95%)**	**p*-value**
Male	118 (88.7)	15(11.3)	1.35	(1.19-1.53)	<0.001	1.31	(1.13-1.50)	<0.001
Female	110 (65.9)	57 (34.1)	1			1		
Mother's schooling								
Elementary Education	155 (83.3)	31 (16.7)	1.85	(1.14-3.02)	0.013	1.4	(0.78-2.50)	0.265
Secondary Education	64 (68.1)	30 (31.9)	1.51	(0.92-2.50)	1.070	1.22	(0.69-2.15)	0.493
Higher Education	9 (45.0)	11 (55.0)	1					
Socio-economic class								
D & E	18(85.7)	3(14.3)	1.67	(1.17-2.39)	0.005	0.82	(0.55-1.22)	0.324
C	191(78.9)	51(21.1)	1.54	(1.12-2.12)	0.009	0.76	(0.54-1.07)	0.121
A & B	19(51.4)	18(48.6)	1			1		
Family Income (R$)								
Up to 1.499	103 (79.2)	27(20.8)	1.9	(1.39-2.60)	<0.001	1.77	(1.28-2.46)	<0.001
1.500-2.499	100 (90.9)	10 (9.1)	2.18	(1.61-2.96)	<0.001	2.15	(1.56-2.96)	<0.001
2.500 or above	25(41.7)	35(58.3)	1			1		
Ahemd								
Low	130 (77.8)	37 (22.2)	1.33	(1.04-1.72)	0.025	0.98	(0.74-1.29)	0.890
Average	70 (82.4)	15(17.6)	1.41	(1.09-1.83)	0.009	1.03	0.76-1.94)	0.858
High	28 (58.3)	20 (41.7)	1			1		
Number of children								
1 - 2	53 (86.9)	8 (13.1)	1.19	(1.05-1.34)	0.007	1.12	(0.99-1.26)	0.072
3 - 4	175 (73.2)	64 (26.8)	1			1		
Number of adults								
4 - 5	166 (81.8)	37 (18.2)	1.35	(1.02-1.79)	0.038	1.18	(0.91-1.54)	0.221
3	42 (65.6)	22 (34.4)	1.08	(0.78-1.50)	0.634	1.03	(0.77-1.38)	0.829
1 - 2	20 (60.6)	13 (39.4)	1			1		

Remarks: CI 95% confidence interval.
* Wald chi-square test, obtained by the Poisson regression model with fit for robust variances.
** First level adjusted for the child's gender, mother's schooling, social class and family income.
Second level adjusted for gender, family income, motor stimulation opportunities, number of children at home, number of adults at home.
Source: The authors.

Discussion

The objective of this study was to investigate the relationship between child motor development, sociodemographic conditions and the child's home environment. Aligned with a trend reported in the literature, we observed a high prevalence of motor delays in children[23-27]. The study conducted by Nobre[23], which evaluated the motor performance of schoolchildren from different contexts (semi-arid, coastal and mountain area) of Ceará/Brazil, through TGMD-2, reported 90% motor performance below the 5 percentile (very poor). Other studies carried out in Brazil[24], Portugal[25] and Spain[26] have also identified a high prevalence of delayed motor development in children in early childhood.

The male children in this study were more at risk of motor delays than the female, a result similar to what was reported by Zajonz, Müller and Valentini[27] who investigated 43 children in social vulnerability aged between 6 and 18 months. The results showed that 44.2% of the children had motor development delays (63.2% male and 36.84% female).

The family income, considered as an indication of the family's social situation, was associated to the children's motor development delay in this research. The probability of delay was higher in the poorer strata when compared to the higher income stratum.

Corroborating with this finding, the study by Bradley and Corwyn[28] identified that low socioeconomic status and poor relationships within the family context may impair child development, both motor and social. Zamberlan and Biasoli-Alves[29] found a similar result, identifying also psychosocial risks for the children's development. Effegen[30] stresses that a high socioeconomic level of families is related to certain favorable conditions such as greater parental schooling, greater access to information and greater purchasing power. Although family income is relevant to a child's development, other factors such as parental education or the home environment structure may influence the child's developmental process.

Maternal schooling and socioeconomic status were not associated with motor development delay (MDD) after adjusting for confounding factors in the present study. However, a linear decrease in the prevalence of children with MDD was observed as these variables increased, a decrease that was detected significantly in the bivariate analysis. Different studies[13,31] point to the importance of maternal schooling for the child's motor development of different age groups, which seems to be due to the fact that mothers with higher education have, in general, more knowledge about child development and the possibility of stimulating them. Defelipo et al.[13] evaluated the opportunities present in the home environment for the motor development of 239 infants aged 3 to 18 months and identified a significant association of maternal schooling with the opportunities present in the home environment.

Environmental conditions, especially the opportunities for motor stimulation offered to the child in the environment in which it occurs, have been widely studied today. Rodrigues, Saraiva and Gabbard[19] stress that the low classification of motor stimulation opportunities in home environments has been pointed out as a possible harmful factor in children's motor development. In this study, we found that 55.7% and 28.3% of the families offered low and medium level of motor stimulation opportunities, respectively. In both strata, the percentage of MDD was high, surpassing 77%. Dearing and Taylor[32] investigated the implications of changes in the family income and the home environment quality in 1,364 women and their newborn children living in or near 10 urban and suburban areas in the United States. They used the data from the National Institute of Child Health and Development and found positive associations between increase in family income and increase in the quality of the physical and psychosocial environment of childhood. In this sense, we can think of the existence of overlapping associations regarding family income, the opportunity for home stimulation and the delay in child motor development.

We did not find any single effect of environmental stimulation on infant motor development. Pizzo et al.[33] also demonstrated that the low opportunity of stimulation for child development, observed in 24 children aged 36 to 42 months in the city of Maringá-PR, did not influence children's motor performance. It may be thought that alternative environments in which children are inserted, other than their home environment, as in the case of day-care centers, may be offering additional stimulation for motor development, providing for the lack of stimuli found in their homes.

The number of siblings and adults present in the home environment are mentioned as environmental factors that may influence on child motor development. Martins et al.[31] identified an association between the home environment and the number of siblings. Families with more than four siblings in the same household are associated with a negative environment[30,31]. Caçola et al.[34] consider this variable as a risk to the environment quality, since large families tend to be less stimulating. In this study, having fewer siblings and more adults in the home environment was associated with child developmental delay in the bivariate analysis, but this association did not remain after adjusting for confounding factors.

Conclusions

The present study contributed to shed light to important aspects of child motor development in a poorly researched population. The results will serve as a basis and stimulus for interventions with parents, teachers and directors of day care centers in the city of Parintins/AM, in order to clarify and provide healthy environments with adequate stimulation for children.

As limitations of this study, we can point out the impossibility of establishing definitive causal relations because of its cross-sectional nature. Also, considering that the motor stimulation opportunities offered to the children of this study were evaluated only in the home environment, future descriptive and interventional work is suggested, using environments that are parallel to the home, such as day care centers, grandparents' home, the neighborhood. These other environments may offer additional stimuli for the child's motor development and, through their study, it will be possible to gain a better understanding of the relationship between the environment and the motor performance of children up to 46 months old. We point out to the need of planning broader actions in public policies that take in consideration the aspects investigated here, in order to optimize opportunities for the motor development of children in the low Amazon region.

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