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Environmental resources, types of toys, and family practices that enhance child cognitive development

Recursos ambientais, tipos de brinquedos e práticas familiares que potencializam o desenvolvimento cognitivo infantil

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Keywords

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Play and Playthings
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ABSTRACT

Purpose: To identify the factors associated with the cognitive development of children from 24 to 42 months of age, as well as to characterize the availability of toys and resources present in the family environment, and the parental practices that signal family stability. **Methods:** Cross-sectional analytical study conducted with children regularly enrolled in public and private educational institutions of a medium-sized city. Cognitive development was assessed by means of the Bayley test and the quality of the environment was evaluated using the Adapted Family Environment Resource Inventory (FERI). The children were allocated into two groups based on the cognitive test result and compared regarding activities performed at home; reports of outings and trips in the last year; presence of regular scheduled activities; activities developed with parents; toys the child has or has had; presence of newspapers, magazines, and books at home; the person responsible for monitoring the child during day-care; and routines of the child and family. **Results:** Of the 104 children evaluated, 72% were enrolled in the public education network and 69% belonged to economic classes C and D. Regarding cognitive development, 55% had above-average development. In the bivariate analysis, it was observed that greater availability of toys and materials for the child and higher economic levels were related to better scores on the cognitive development test. These remained as predictors of cognitive development in binary logistic regression analysis. **Conclusion:** Greater availability of resources in the family environment and economic levels were positively associated with cognitive development in children.

Descritores

Desenvolvimento Infantil
Jogos e Brinquedos
Relação Familiar
Pré-escolar
Poder Familiar

RESUMO

Objetivo: Identificar fatores associados ao desenvolvimento cognitivo de crianças de 24 a 42 meses de idade, assim como caracterizar a disponibilidade de brinquedos e recursos presentes no ambiente familiar e as práticas parentais que sinalizam estabilidade familiar. **Método:** Estudo transversal analítico realizado com crianças regularmente matriculadas em instituições de ensino públicas e privadas de uma cidade de médio porte. O desenvolvimento cognitivo foi avaliado por meio do teste Bayley e a qualidade do ambiente que vive a criança foi avaliada utilizando-se o Inventário de Recursos do Ambiente Familiar- RAF adaptado. Para conhecimento do nível econômico das famílias utilizou-se o Critério de Classificação Econômica Brasil 2015 (CCEB). As crianças foram alocados em dois grupos com base no resultado do teste cognitivo e comparadas quanto às atividades e rotinas da família e recursos presentes no domicílio. **Resultados:** Das 104 crianças avaliadas, 72% são matriculadas na rede de ensino público, 69% pertencentes as classes econômicas C e D. De acordo com o desenvolvimento cognitivo, 55% obtiveram desenvolvimento acima da média aritmética. Na análise bivariada observou-se que os passeios e viagens realizados pela criança, maior escolaridade materna e paterna, vínculo com creches particulares, assim como a maior disponibilidade de recursos e níveis econômicos maiores foram relacionados a melhores escores cognitivos. Os dois últimos fatores permaneceram como preditores do desenvolvimento cognitivo na análise de regressão logística binária. **Conclusão:** Maior disponibilidade de recursos no ambiente familiar e níveis econômicos foram positivamente associados ao desenvolvimento cognitivo.

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INTRODUCTION

Development is defined as a process of changes in physical, neurological, cognitive, and behavioral structures, which emerge in an orderly manner and are relatively long-lasting[1]. Child development is multifactorial, resulting from a combination of biological, environmental, family and social, and risk or protection factors, which culminate in unique and peculiar development[2], resulting in an orderly progression of motor, cognitive, language, socioemotional, and self-regulatory development[3]. According to the World Health Organization (WHO), this phase is extremely sensitive for the development of the human being, being a moment for the formation of the whole emotional and affective structure, and the development of fundamental areas of the brain related to personality, character, and learning ability[4]. The first three years of life, especially, which are known as early childhood or, more recently, very early childhood[5], are even more essential for child development, because at that moment, they are favored by brain plasticity, the so-called sensitive period of brain development[6].

Development, when it occurs satisfactorily, mainly in the first years of life, contributes to the achievement of the subject's potential to become a more resolved citizen, able to face the adversities that life offers, thus being able to intervene in the social and economic disparities of our society[7]. Multiple factors influence the acquisition of skills, including health, nutrition, safety, care, and early learning; these domains interact with each other and can be mutually reinforced through the natural development process[3].

However, this natural development of children may be at risk due to certain factors, whether biological (malnutrition, infections, anemia, prematurity), psychosocial (inadequate cognitive stimulation, exposure to violence, poor or absent family care), or sociodemographic (poverty)[3]. The existence of one or more factor may characterize adversities in the child's life path, and scientific evidence links adverse environmental variations during early life (from the fetal period to childhood) to long-term changes in brain volume, microstructure, and connectivity. Moreover, the accumulation of adversities, since before conception, and in prenatal and early life, can hinder brain development[3], increasing the risk of young children manifesting developmental problems[8]. Therefore, early detection of these risk factors that can influence child development is important[8].

Low socioeconomic status and poverty are considered risk factors for child development, not only because they limit the acquisition of goods, but also influence access to educational content. In cases of extreme poverty, the individual becomes vulnerable, that is, with a greater chance of not achieving their maximum development potential, due to being deprived of stimuli and experiences that promote development and learning[3]. Poverty and adverse childhood experiences have long-term effects on brain development and cognition, while unfavorable socioeconomic status is associated with deficits in language and cognition at the age of three and even worse problems at the age of five[3].

The family environment plays an important role in mediating the well-being of children exposed to an environment with low socioeconomic status. In cases of developmental delays, positive parenting practices and a variety of other factors, such as parental mental health and the absence of violence in the family environment, play a particularly significant protective role in partially mediating the negative effects of socioeconomic vulnerability[9,10]. The family is the first environment where the child is inserted, and it needs to be a mediator between the child and society, being seen as a space for child socialization. Family stability, signaled by reliable and stable interpersonal relationships, regular routines, and organization of the home environment, has been identified as a protective factor against behavioral problems. On the other hand, a chaotic domestic environment, with great daily instability, disorder, and lack of temporal regularity, constitutes a risk factor for the intensification of problems[11].

Studies have shown that the variable with the greatest impact on child development is stimulation in the family environment[12], with positive influences on cognitive[12], neuropsychomotor[13], and language[14] performance. Family difficulties are significantly associated with an increased risk of child behavior problems and developmental delay. The family environment and its relationships form the basis for promoting the child's socio-affective and cognitive development. Thus, the family can act as a stimulator and protector in this process by providing parental support, varied and quality experiences, and by providing interaction with adults and children through routines and regular family gatherings that signal some degree of family stability[15]. However, it can also be a risk factor when depriving the child of a structured family environment with adequate stimuli[12].

Within the family environment, play should be routine for children, especially when performed with family members[16]. Playing with toys in various ways reflects exploration and discovery of possibilities. This can increase opportunities for the development of creativity and imagination, as well as skill development[17]. The type of toy can improve the development of sensations and fine motor skills, and enhance the child's cognitive ability, as it can also be a form of training for their ability to think, reason, and weigh up risks, so that the child can face a changing environment more easily[16]. It is therefore necessary to understand which resources or toys enhance children's cognitive development, in order to offer such toys to children in their daily routines, so as to provide stimulation or avoid possible delays.

The present study aimed to identify factors associated with the cognitive development of children from 24 to 42 months of age, as well as to characterize the availability of toys and resources present in the family environment, and the parenting practices that signal family stability.

METHOD

This is a cross-sectional analytical study, carried out from November 2016 to February 2017. This study is part of a broader research project approved by the Institutional Research Ethics Committee, number CAAE - 55459916.0.0000.5108.

Sample

The sample was calculated from a total of 576 children, regularly enrolled in the nine preschool units in the municipality of Diamantina (MG). For the calculation, prevalence of below average cognitive development was estimated as equal to 28.3%[18] with a desired accuracy of 5%, and a 95% confidence interval, resulting in 86 children. A further 20% was added to this value for losses, totaling 103 children.

Children of typical development, aged between 24 and 42 months (the average age that children enter schools), enrolled in public and private daycare centers in the municipality, and duly authorized by their parents, were eligible for the study. Those whose parents did not sign the ICF; children with cerebral palsy or syndromes that affect cognition and linguistic aspects; children diagnosed with autism or neurodegenerative diseases; and children with hearing loss were excluded, this information being reported by parents or by the school.

A total of 104 children, aged between 24 and 42 months, with a median of 35 months, and their respective family members participated in the study. Of the children, 53 (51%) were male and 51 (49%) female. As for the educational institution, 75 (72%) were enrolled in public education and 29 (28%) in private schools. Regarding the socioeconomic classification, the families were distributed as follows: seven families belong to category A; 24 to category B; 21 to category C1; 27 to category C2; and 24 to category D-E.

Instruments

To assess child development, the Bayley III instrument, third edition, was used, as it is the gold standard, traditionally known, and widely used in clinical practice and in scientific research to assess child development[19]. The main objective of the test is to identify children with developmental delay in the age group from one to 42 months in the domains: cognitive, language (expressive and receptive), motor (fine and coarse), socioemotional, and adaptive behavior. For the present study, only the cognitive scale was used and as per the manual[20]; the balanced score was used, where ten is the average score with a standard deviation of ± three points.

The quality of the environment in which the child lives was assessed using the Family Environment Resource Inventory - FERI[15], with adaptations, that is, items aimed at children outside the study age were removed from the instrument[13]. The FERI aims to evaluate the resources of the family environment in three domains: 1) Resources that promote proximal processes: this includes participation in stimulating experiences for development, such as outings and trips; opportunities for interaction with parents; availability of toys and materials that present a challenge when thinking; availability of books, newspapers and magazines; and adequate use of free time; 2) Activities that signal stability in family life: such as routines, regular family gatherings, and the child's cooperation in domestic tasks; and 3) Parental practices that promote the family-school bond: direct involvement of parents in school life, such as participation in meetings[15]. For the analysis, the sum of points (gross score) and the formula gross score / maximum score of the topic were considered to obtain the relative score; the higher the score obtained on the FERI, the higher the quality of the environment.

In this study, to know the economic level of families, the ABEP Brazilian Economic Classification Criterion (BECC) was used. The instrument assigns a score per item based on three variables: family purchasing power, education of the person of reference, and public services that the family has at home. Then an overall score is generated, ranging from 0 to 100 points, which ultimately classifies the family's socioeconomic level on an increasing ordinal scale ranging from E to A1[21]. For analysis purposes, the classes were categorized into two groups: high socioeconomic level for A, B, and C1 and low socioeconomic level for C2, D, and E[22].

Procedures

Initially, authorization was obtained from the Municipal Secretariat to carry out the research. Prior contact was made with the directors of the private and public daycare centers in Diamantina for clarification on the research and authorization. The informed consent form (ICF) and the economic questionnaire were then sent in the backpacks of all children of an age compatible with the study, to be filled out by the parents. Subsequently, shifts were carried out at the educational institutions during the children's arrival and departure times to conduct the semi-structured interview with the parents, using the standardized FERI questionnaire.

The Bayley Child Development Scale was applied after training the applicators. The training was conducted by a physiotherapist, trained in the application of the test, and at the end of the training period, reliability among the examiners was assessed and the Intraclass Correlation Index (ICC) obtained was 0.95%. The Bayley III cognitive scale was applied by 04 examiners on a relay scale. Application took place in a room made available by the school, on the day and time scheduled by the coordination of the educational institution, always carried out by two examiners.

For analysis purposes, the result of the Bayley cognitive test was dichotomized by a score of ten on the balanced score, as this is the average test score, the standard deviation of which is ± three points. The children were allocated into two groups based on the result of the Bayley cognitive test, namely: below-average group and medium or higher group.

Data analysis

The collected data were initially transferred to the *Statistical Package for the Social Sciences* (SPSS) version 19.0, where an exploratory analysis of the database and descriptive analyses of the participants and the study variables were performed.

The Shapiro-Wilk test was used to analyze the normal distribution of continuous variables and the data are presented in mean ± SD. The sample characterization variables were compared between groups using the Mann-Whitney test. The comparison of the distribution of categorical variables between the groups was performed using the chi-squared test and these are presented by absolute number and relative frequency.

For the analysis of the maternal and paternal education variables, the answers were dichotomized into two categories according to the Law of Guidelines and Bases of National Education[23]: Primary Education and Higher Education.

To analyze the quality of the family environment, the results of each FERI question were considered separately, namely: 1) Activities performed by the child at home; 2) Outings carried out with the child; 3) Scheduled activities that the child performs regularly; 4) Activities developed with parents; 5) Toys that the child has or has had; 6) Presence of newspapers or magazines at home; 7) Presence of books at home; 8) Who accompanies the child in the daycare center; 9) Child's routine; and 10) Family routine. The items evaluated in question 4, toys that the child has or has had, were analyzed separately according to the cognitive development of infants. However, for the multivariate analysis, only the result of question four, formed by the sum of the child's resources, was considered.

In the hierarchical binary linear regression model, variables with $p < 0.10$ in the bivariate analysis were considered and only those with $p < 0.05$ remained in the model. Interactions between the variables in the final model were examined and the variables "maternal education" and "type of day care" were removed from the final model. The quality of the model was assessed by the *Hosmer-Lemeshow* method and by the adjustment measure - *2 log likelihood* (-2LL). The analysis of residues in the final model was performed to detect significant *outliers*.

RESULTS

According to the cognitive development results, 57 (55%) children achieved above average development and 47 (45%) below average. According to the Bayley III, 7 (6.7%) were classified as having much higher cognitive development, four (3.8%) higher, 14 (13.5%) medium-high, 32 (30.8%) with medium development, 42 (40.4%) medium-low, and five (4.8%) borderline.

Table 1 shows the socioeconomic characteristics of the studied population and their relationship with cognitive development. It was possible to observe that lower economic level (C2, D and E), type of public daycare, and less maternal and paternal education were the variables associated with cognitive development below the average of the children evaluated.

Figure 1 describes the characteristics of the family environment and parenting practices.

Of the activities carried out at home by the child, the most reported by parents or guardians was "watching TV" and "playing at home" (92.3%). Of the activities carried out together with the parents, "playing" (94.2%), "watching TV programs" (76.9%) and "reading books" (71.2%) were the most frequent. Regarding children's resources, walking toys (83.7%), ball, kite, marbles (77.9%), and toys with colors and shapes (76%) were the most cited.

The relationship between the resources of the family environment measured by the FERI in ten questions and the children's cognitive performance can be seen in Table 2.

It was observed that the outings and trips taken with the child, as well as the greater availability of toys and materials for the infant (resources of the family environment) are related to better scores on the cognitive development test.

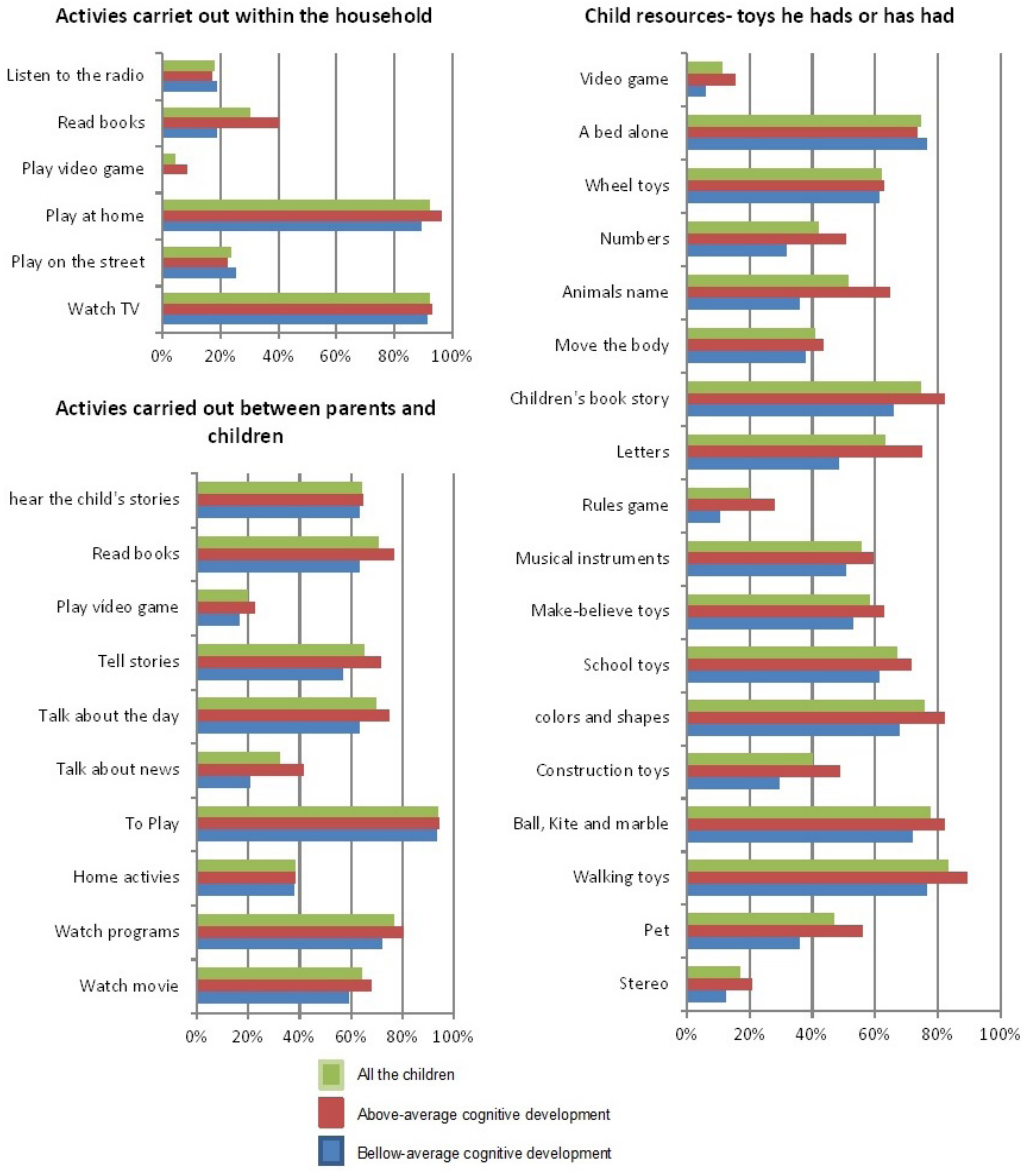
The results of the binary logistic regression can be seen in Table 3. In the hierarchical binary linear regression model, the variables that had a $p < 0.10$ in the bivariate analysis were considered, namely: economic level, type of daycare, maternal education and parenting, outings and trips, and family environment resources (children's toys). In the final model, only those with $p < 0.05$ remained, namely: family environment resources (children's toys) and economic level.

The independent variables of family environment and economic level were considered significant predictors for distinction between children with cognitive development below and above average. It is observed that children with more resources available at home were 39.8 times more likely to have a better score on the cognitive development test, while children from families classified with A, B and C1, according to the Brazilian Economic Classification Criterion, presented as 2.96 times more likely to have better cognitive test results.

Table 1. Socioeconomic characteristics described according to cognitive development, 2017

		Cognitive Development				Chi-squared test	p-value
		Below average (n=47)		Medium or higher (n=57)			
		n	%	n	%		
Sex	Female	20	42.6%	31	54.4%	1.44	0.230
	Male	27	57.4%	26	45.6%		
Economic level	A, B, C1	14	29.8%	36	63.2%	11.49	0.001*
	C2, D, E	33	70.2%	21	36.8%		
Maternal education	Primary Education	35	83.3%	31	54.4%	9.11	0.003*
	Higher Education	07	16.7%	26	45.6%		
Type of daycare	Private	5	10.6%	24	42.1%	12.68	< 0.001*
	Public	42	89.4%	33	57.9%		
Paternal education	Primary Education	37	92.5%	34	64.2%	10.1	0.001*
	Higher Education	03	7.5%	19	35.8%		

*Statistically significant
n= number of children



Caption: b = regression coefficient; S.E = Margin of error; OR = Chance ratio; CI = Confidence interval

Figure 1. Characteristics of the environment and parental practices

Table 2. Home routines

	Maximum possiblescore	Cognitive Development						Mann-Whitney test
		Below average (n=47)			Medium or higher (n=57)			
		Median	1st Quartile	3rd Quartile	Median	1st Quartile	3rd Quartile	p vallue
Activities performed by the child at home	6.00	3.0	2.0	3.5	2.0	2.0	3.0	0.154
Outings and trips	19.00	3.0	2.0	5.0	5.0	3.0	7.0	0.016*
Scheduled activities	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.154
Parents' activities with children at home	10.00	6.00	5.0	7.0	6.00	5.0	8.0	0.131
Child's Toys	18.00	8.0	6.0	12.0	11.00	8.0	14.0	0.003*
Presence of newspapers and magazines at home	7.00	1.00	0.00	1.00	1.00	0.00	1.00	0.367
Presence of books at home	7.00	3.00	2.0	4.0	3.00	2.0	5.0	0.364
Accompaniment of the child in the daycare center	12.00	8.00	7.0	8.0	8.00	8.0	10.0	0.169
Appropriate time for activities	12.00	8.00	6.0	10.0	8.00	5.5	10.0	0.660
Family gatherings	12.00	9.0	7.0	10.0	9.0	7.5	10.0	0.744

*Statistically significant

Table 3. Hierarchical binary logistic regression for dependent variable "cognitive development"

Independent variables	b ± S.E	OR	CI (95%)a	p-value
Family environment features	3.68 ± 1.65	39.86	1.54-1028.6	0.026*
Economic level	1.08 ± 0.54	2.96	1.02-8.63	0.046*
Outings and trips	0.85 ± 1.75	0.43	0.14-13.79	0.636
Paternal education	0.17 ± 0.69	1.19	0.30-8.63	0.800

Model quality according to Hosmer and Lemeshow = 0.57
*p= significance level < 0.05
a = confidence interval

DISCUSSION

This research sought to know the factors associated with the cognitive development of children aged 24 to 42 months and it was observed that the studied factors influenced cognitive development. Considering that the children participating in the present study do not have structural or functional alterations to their organic systems, the factors evaluated seem to have a direct influence on the experiences of the children and reflect in their performance on cognitive tasks.

In the bivariate analysis, the type of educational institution; parental education; economic level; resources in the family environment such as toys with rules, logic, numbers, and assembly; and outings and trips taken by the child were the variables associated with better cognitive development. However, in the final model, only the variables of resources in the family environment and economic level remained.

In this study, most children attended public schools. A systematic review on the influence of environmental factors on child development found a prevalence of delay in different development domains and associated risk factors when considering children attending public daycare centers[10]. Another study compared the cognitive and motor development of children from the same socioeconomic level, but from public and private educational institutions, and found worse performance in all areas of development in children in public daycare centers[19]. A possible justification is the fact that private daycare centers have better physical structure, better toys, and more suitable activities than public daycare centers, according to evaluations of the Brazilian educational system[24]. In the present study, the type of day care variable did not remain associated with cognitive development in the final model. However, it is necessary to reinforce the importance of investing in public education, since those who attend public institutions already seem to have less environmental and parental resources for better development. In addition, investment in child development policies and programs is one of the WHO's goals at local, national, and global levels[3].

Low maternal and paternal education were factors associated with worse development. Of the children with below-average development, 83.3% and 92.5% of their mothers and fathers, respectively, had only primary education. Mothers and fathers with higher educational levels have opportunities for better jobs and tend to provide a better quality general family environment, with a greater supply of materials and toys that encourage learning, which provides greater enrichment and a wider variety of experiences for the child[10]. A study shows that the quality of the environment in which the child is inserted, and the quantity of books present at home, were positively predicted by maternal and paternal education[25]. Although parental education did not remain in the final model of the present study as a predictor of children's cognitive development, it is directly associated with the family's economic level, being one of the items considered for classification of the economic level[21].

According to the results, the options for playing and the type of toy the child has also influence cognitive development. There was a statistical difference between children with above and below average cognitive development regarding the possession of toys with letters ($p = 0.011$), toys with animal names ($p = 0.006$), and games with rules ($p = 0.035$). Study on the development of communication in children aged one to three years and its relationship with the family environment revealed a positive association between the toys the child has at home and the best communicative profile[14]. The development of language, logic, and the ability to concentrate are more acute in children who use toys involving numbers and riddles, which require logical reasoning, abstract thinking, and speed of reasoning for the effectiveness of play[26]. In contrast, a study related the quantity of toys present in the environment with the quality of play. It was noted that when fewer toys are available, children engage in longer periods of play, allowing them to explore the object more deeply and in a more creative way[17]. A possible justification is the fact that families that do not have the resources to offer a large amount of toys, can guarantee quality by playing with their children, reinforcing the important role of the family in mediating the negative effects of the child's exposure to an environment with low socioeconomic level[5,6].

The act of playing enables the child's learning process, as it facilitates the construction of reflection, autonomy, and creativity, being crucial for the development of important skills such as attention, memory, imitation, and imagination[27]. It is important to note that in the context of economically disadvantaged families, there is a reduction in resources and learning materials, which directly influences the child's development[9].

When comparing the children of the two groups, those with below-average development with those of the medium or higher group, a positive association was observed between the outings and trips taken by the child in the last year ($p = 0.016$) and the best cognitive development. The realization of specific outings to different places in the last twelve months (71.6%), such as the forest, the circus, the cinema or theater, the amusement park, and the beach, was associated with the best academic performance of students from a Brazilian city[28]. When participating in an outing, the child experiences several types of different stimuli, knows new cultures, and encounters people who are not present

in their day-to-day lives, providing the opportunity for wealth and variety of stimuli, which determine their future prospects and the development of new skills[8]. A high-quality educational institution, in turn, appears as a mediator of psychosocial risk, being able to provide children with experiences that enhance development, which can minimize the needs arising from disadvantaged economic conditions and a family environment devoid of resources[24].

In the multivariate analysis, the resources of the family environment and the economic level that the child is inserted in remained as the main factors associated with cognitive development. It was observed that children from families classified as A, B, and C1 by the Brazilian Economic Classification Criterion were 2.96 times more likely to have better results in the cognitive test when compared with families classified as C2, D, or E. Low quality of the home environment may be associated with low monthly income and less variety of resources and incentives, with deprivation of new opportunities for the infant[3,10]. Child poverty has been reported to be more strongly associated with worse cognitive development rates and school learning difficulties over time[9]. A study found that family income, in addition to demographic variables, was associated with suspected developmental delays in 176 children with typical development, aged 24 months[29]. The child poverty rate is, therefore, a key indicator of the health and well-being of a society, being an important index that determines how childhood income and deprivation compromise the healthy development of children and the emergence of new opportunities[9].

In the present study, children with more resources available at home were 39.8 times more likely to have a better score on the cognitive development test. Such data corroborate with a study carried out with 350 children in the age group from17 to 42 months, where they observed that in a univariate linear regression, the increase of one point in the scale of the HOME inventory implied an increase of 0.659 in cognitive performance[12]. The physical environment in which the child lives, whether in the family or school context, when organized and with possibilities for interaction, becomes a resilience factor in the face of physical or psychological adversities[30]. To become a promoter, the environment needs to provide the child with a variety of stimuli and opportunities, in line with the findings of this research.

The present study has limitations, such as the fact that the resources of the family environment are investigated through semi-structured interviews, subject to the bias of memory and social desirability.

The findings suggest that the resources of the family environment and the types of toys that the child has may be more important factors to be considered than just the educational institution that the child attends, which reinforces the importance of the family as a foundation for child development .

Thus, the present study meets a current demand in pediatric care, with regard to the constitution of indicators that attribute quality to the child's development. Parents' education[10], the family's economic level[3], and the resources present in the family environment[9,10] determine opportunities for children to interact with other people, especially parents, and for experiences that stimulate cognitive development, reinforcing the importance of an environment rich in physical and human resources for enhancing the child's abilities.

CONCLUSION

When investigating factors such as type of educational institution, parental education, economic level, resources in the family environment, and outings and trips taken by the child, only the resources in the family environment and economic level were the variables associated with better cognitive development.

The resources of the family environment and the types of toys that the child has may be more important factors to be considered than just the educational institution that the child attends, which reinforces the importance of the family as a foundation for child development.

It is necessary to outline strategies aimed at reflecting on the role of the family and the school in the first years of life, especially in cases of greater socioeconomic vulnerability, in order to minimize inequalities and their influence on the future opportunities of these children.

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Author contributions

LP participated in data analysis, writing and drafting the article; SCG participated in the review of the manuscript content and approval of the final version; RLSM participated in the design, planning and co-orientation of the project; JNPN participated in project planning and review of the manuscript content; JNS conducted work orientation, analysis and data interpretation statistics, and revision of the manuscript.