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Original Article

MOTOR AND COGNITIVE DEVELOPMENT PREDICTORS OF INFANTS OF ADOLESCENTS AND ADULTS MOTHERS

PREDITORES DO DESENVOLVIMENTO MOTOR E COGNITIVO DE BEBÊS DE MÃES ADOLESCENTES E ADULTAS

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RESUMO

Pouco se sabe sobre a repercussão para o desenvolvimento do bebê dos fatores ambientais e das tarefas cotidianas as quais a mãe adolescente está exposta. Por isso o presente estudo propôs identificar as associações e os preditores do desenvolvimento motor e cognitivo de bebês filhos de mães adolescentes e adultas. Foram avaliados 40 bebês com idade entre 0 e 18 meses, tendo 20 bebês em cada grupo - mães adolescentes e adultas. As avaliações foram através da *Alberta Motor Infant Scale* e *Bayley Scale of Infant Development*; *Affordances in the Home Enviroment for Motor Development*, *Knowledge of Infant Development* e *Daily Activities of Infant*. Observou-se forte associação entre motricidade e cognição (r^2=0,88) em ambos os grupos estudados. Entre os bebês de mães adolescentes, a idade paterna, espaço domiciliar, a mãe não trabalhar fora de casa, escolaridade dos pais, quantidade de brinquedos e adultos na residência, as práticas parentais e o conhecimento dos pais se mostraram preditores do desenvolvimento motor. Para o desenvolvimento cognitivo, mostraram-se preditores o fato dos pais morarem juntos, a quantidade de quartos na residência e as práticas parentais. No grupo de bebês de mães adultas, o desenvolvimento cognitivo, parto cesariano, os pais morarem juntos, quantidade de quartos na residência, e as práticas parentais foram preditores do desenvolvimento motor. Já como preditores do desenvolvimento cognitivo, permaneceram no modelo de regressão o desenvolvimento motor, quantidade de dias na UTI, número de quartos na residência e prática parentais. A interdependência entre cognição e motricidade, as características da família e da residência, e as práticas parentais foram os principais determinantes da trajetória do infante.

Palavras-chave: Adolescência. Gravidez. Cognição. Destreza motora.

ABSTRACT

Little is known about the impact of environmental factors and daily tasks for the infant development which the adolescent mother is exposed. Therefore the present study was to identify associations and predictors of motor and cognitive development of infants of adolescent and adult mothers. Participated 40 babies aged between 0 and 18 months, 20 babies in each group - adolescent and adult mothers. Alberta Motor Infant Scale, Bayley Scale of Infant Development; Affordances in the Home Environment for Motor Development, Knowledge of Infant Development and Daily Activities of Infant was used for assessments. A strong association between motor skills and cognition (r^2 = 0.88) in both groups was observed. The predictors of motor development in the adolescent mother group were paternal age, home space, the mother does not work outside the home, parents' educational level, number of toys and adults in the household, parenting practices and knowledge of parents The predictors of cognitive development were parents living together, the amount of rooms in the residence and parenting practices. In the adult mother group, the predictors of motor development were the cognitive development, caesarean birth, parents living together, amount of rooms in the residence and parenting practices. As predictors of cognitive development, remained in the regression model the motor development, number of days in the ICU, number of rooms in the residence and parental practice. Conclusions: The interdependence between cognition and motor skills, family and residence characteristics, and parenting practices were the main determinants of infant trajectory.

Keywords: Adolescent. Pregnancy. Cognition. Motor dexterity.

Introduction

Human development is a process that derives from changes in the motor, cognitive, affective and physical domains. The motor and cognitive domains of development are in constant interaction, being strongly influenced by each other[1]. Consequently, when it comes to child development studies, it is vital to understand the many connections in which the child

is inserted as well as the different factors that may be associated with child development and possible delays in this process[2].

Teenage motherhood involves a context of biological, family, social and emotional implications that affect adolescents, their children and society as a whole[3]. Adolescent pregnancy is associated with many unfavorable factors for the baby, such as high anemia rates[4,5], low birth weight and prematurity[4,6-8], low APGAR5 score, low intelligence quotient and higher prevalence of mental deficiency[8].

However, the risks arising from early pregnancy are not always related to the adolescent's biological immaturity, but rather to contextual and deprivation factors brought by the poverty situation adolescent mothers face[9,10]. Poor education and socio-cultural context, low socioeconomic level, lack of a social support network are factors that can negatively influence experiences lived during teenage motherhood[11]. In a recent study, babies of adolescent mothers showed worse development in motor skills in the supine position, according to an AIMS assessment, compared to babies of adult mothers[12].

Despite all possible intercurrences involving teenage motherhood, this situation can be perceived as positive by the adolescent, representing the possibility of a desired social status, of social recognition or as an alternative to adapt to the context of poverty[13]. When the experience of motherhood is difficult for the adolescent, it becomes a heavy burden, greater than she can bear; it can be considered a negative experience for both mother and baby. By contrast, when the adolescent receives appropriate support, keeping her as the protagonist of care, the weight of this experience is gradually lightened, thus becoming a positive experience for the mother-baby dyad[14]. Oftentimes, the insecurity of adolescent mothers regarding childcare may allow grandmothers to take on the role of mother and provide positive support in the baby care process[15].

However, little is known about the impact that biological, environmental and daily tasks adolescent mothers are exposed to have on a child's development. Thus, more research is needed to investigate the multiple individual, environmental and routine practices that involve teenage motherhood and how these factors interfere with the outcome of development of the young mother's child. Given this need, the present study aimed to identify associations and main predictors of motor and cognitive development of babies born to adolescent and adult mothers.

Methods

Participants

Descriptive, comparative and associative study, approved by the Research Ethics Committee of the University of origin (No 2008018). The sample was intentional, counted with a small number of adolescent mothers who accepted to participate in, and joined the research, which justifies the sample size. The study included 40 babies aged between 0 and 18 months, children of adolescent mothers (n=20) and adult mothers (n=20), from Children's Education Schools and residences on the outskirts of cities, with similar characteristics in terms of household structure, internal and external space of the residences, socioeconomic and cultural level of the families, in the south of Brazil.

Free and informed consent terms were sent to all parents of children aged 0-18 months attending the schools participating in the study. Likewise, through community agents of Basic Health Units, we visited the residences of families with children within the age group of the

study. The participants included in the study were those whose parents agreed to participate in it and signed the consent form. Exclusion factors were fractures, central and peripheral nerve injury, musculoskeletal infection and acute diseases.

Instruments

Motor development was assessed through the Alberta Motor Infant Scale (AIMS)[16,17], an instrument that has been validated and standardized for the Brazilian population[18,19], which assesses spontaneous movement and motor skills of newborns up to 18 months of age. The scale is composed of 58 items grouped into four subscales: prone (21 items), supine (9 items), sitting (12 items) and standing (16 items)[16]. Each motor item observed in the child's repertoire receives 1 (one) score and each motor item not observed receives 0 (zero) score. What the child performs in each sub-scale is summed to obtain the raw score (0-58 points), which is converted into a motor development percentile and categorizes motor performance as normal (percentile≥25), suspect (percentile between 5 and 25) or delayed (percentile ≤5)[16,17].

Cognitive development was assessed by means of the Bayley Scale of Infant Development – second Edition (BSID-II). The BSID-II evaluates the development of children aged 1 to 42 months old and is composed of three subscales – mental, motor and behavioral. This study adopted the Mental Scale, which assesses the child's level of cognitive, social and language development through memory capacity, habituation, problem solving, initial number concepts, generalization, classification, localization, language and social skills.

For each age group there is a specific set of items. When the child responds positively to the stimulus or performs the activity correctly he or she receives credit (01 point); otherwise, he or she does not receive any credit (0). At the end, the items that the child scored are summed so as to obtain the raw score, which will be related to the age so as to determine the mental development index, which categorizes cognitive performance as advanced (above 119), within normal limits (between 85 and 114), slightly delayed (between 70 and 84) and significantly delayed (below 69)[20].

Parents or legal guardians were given a questionnaire for sample characterization, with questions referring to date of birth, sex, type of delivery, gestational age, APGAR score, birth weight, length and cephalic perimeter, length of ICU stay, mechanical ventilation period and monthly family income.

To analyze the home environment, the Portuguese-adapted version of the Affordances in the Home Environment for Motor Development - Infant Scale (AHEMD-IS) was adopted, specifically the 3-18 month scale[21,22]. The AHEMD-IS is an instrument that performs a quantitative and qualitative assessment of the domestic environment, addressing questions related to the characterization of children and families; the physical space of the residence (internal and external); children's daily activities (time spent at home, time they stay awake at home); toys and materials in the residence (amount and variety)[23]. This questionnaire also included, for use in the present study, questions regarding father's age, whether the mother/caregiver works away from home, number of siblings, the participating child's order of birth and breastfeeding time in months.

The assessment of the parents'/legal guardians' positioning practices was performed using the Daily Activities of Infant Scale (DAIS)[24], an instrument that assesses daily activities executed by parents or legal guardians with the baby, more specifically the opportunities they give for children to develop their antigravity postural control and to explore movements around the environment. Composed of 8 dimensions (feeding, bathing, changing of clothes, lap, light and active games, outing and sleep), organized into three groups of answers (A, B

and C), being an ordinal scale that starts from activities of smaller A) to greater (C) opportunity for development[24]. The parents/legal guardians were asked to check only the position the child used to stay to perform each of the activities illustrated in the questionnaire.

The parents' knowledge about child development was assessed using the Portuguese-adapted version of the Knowledge of Infant Development Inventory (KIDI)[25]. This instrument has 75 questions related to health, norms, principles and parenting. The present study used only those related to the period of skill development, totaling 20 questions. The score is obtained by dividing the number of correctly answered questions by the total number of answered questions; thus, the values vary from 0 (little knowledge) to 1 (great knowledge)[25].

Procedures

The free and informed consent form were obtained from the schools and parents/legal guardians that allowed the participation of the baby in the present study. The participants were assessed individually with the AIMS and the Bayley II; the parents and/or legal guardians answered the socio-demographic questionnaire, the AHEMD-IS, the KIDI and the DAIS. All assessments were performed by the same physiotherapist, trained to use the instruments, in a safe and familiar environment to the child (school or home), always in the presence of the mother or a legal guardian. The assessments carried out with the babies - AIMS and Bayley II – were recorded by means of filming, being later analyzed by two independent and blinded assessors to control possible biases in the motor and cognitive assessment.

The diversified use of instruments allowed them to be grouped into blocks. In the individual's factors block, the following variables were grouped: sex, type of delivery, prematurity, gestational age, birth weight, length and cephalic perimeter, APGAR score at the 1st and the 5th minutes, length of neonatal ICU stay and motor score obtained in the AIMS and cognitive score in the Bailey.

The environmental factors block encompassed socioeconomic variables (monthly family income, parents' age and education, parental cohabitation, main caregiver's job) and the physical environment of the house (type of residence, number of bedrooms, internal and external spaces of the house, availability of toys to the infant, number of adults and children in the residence). The task factors block grouped variables that concerned the infant's routine, considering maternal practices (measured by the AHEMD and the DAIS), caregivers' knowledge about child development (measured by the KIDI), and the breastfeeding period to which the babies were exposed.

Statistical analysis

Data were analyzed on SPSS (version 20.0). Mean and standard deviation or median and interquartile range and qualitative ones by absolute and relative frequencies described quantitative variables. For comparisons between groups, the Student's t-test was used for quantitative variables, and the Chi-square test for qualitative variables. For associations between variables, the Spearman correlation test was used, having as decision criterion values above 0.60 as indicative of strong correlation, between 0.30 and 0.60 moderate correlation, and values below 0.30, weak correlation[26].

For control of confounding factors and assessment of independent variables (individual, environment and task factors) associated with the total raw scores of motor and cognitive performance (dependent variables), a Linear Regression multivariate analysis was applied with the Backward extraction method, using the last model proposed for each of the three blocks. Several variables of the individual's factors block (type of delivery, prematurity, gestational age, birth weight, length and cephalic perimeter, APGAR score at the 1st and 5th

minute, length of ICU stay, and motor and cognitive score), of the environment (monthly family income, parents' age and education, cohabitation and caregiver's job, type of residence, number of bedrooms, internal and external spaces, availability of toys, number of adults and children in the residence) and of the task (AHEMD practices, DAIS and KIDI score, breastfeeding period) remained in the model. The level of statistical significance adopted was 5% ($p \leq 0.05$).

Results

Table 1 displays the characteristics of the participants in the general sample and in the groups of adolescent and adult mothers. Among individual factors, the babies' ages were similar in the groups of adolescent mothers (M ± SD 6.45 ± 3.03) and adult mothers (M ± SD 6.5 ± 2.97). Still on individual factors, the only variable that showed significant difference between groups was type of delivery ($p=0.027$); in the group of adolescent mothers normal delivery was more frequent (70%) and in the group of adult mothers Cesarean delivery was more frequent (65%). Regarding environmental factors, significant differences were found between groups as to family income ($p=0.011$), exclusive breastfeeding time ($p=0.017$), caregiver's/mother's with paid job away from home ($p<0.001$), mother's education ($p = 0.003$), father's education ($p = 0.013$) and daycare attendance ($p <0.001$).

The adolescent mothers' families had lower income than the adult mothers' families did, as well as shorter exclusive breastfeeding time. In the group of adult mothers, they worked away from home more frequently. Regarding parents' education, the group of adolescent mothers showed lower levels for mothers and fathers compared to the group of adult mothers.

The vast majority of the adolescent mothers had studied from the 5th to the 8th grade (40%) and high school (50%), while adult mothers had mostly completed high school (35%) and higher education (40%). About daycare attendance, in the group of adolescent mothers, 16 infants (80%) had never attended it, while 10 (50%) attended from3 to 6 months. The other characteristics were similar between groups (Table 1).

Table 1. Sample characterization in total and by groups and individual/environment factors

Factors	Total sample	Adolescent mothers	Adult mothers	
Individual's factors	**M±SD**	**M±SD**	**M±SD**	***p***
Baby's age	6.48±2.96	6.45±3.03	6.5±2.97	0.958
Gestational age (weeks)	37.98±2.64	37.3±2.7	38.7±2.4	0.083
Birth weight	3054.25±651.87	2914±734	3194±539	0.179
Birth length	47.7±3.3	47.1±3.8	48.3±2.7	0.257
Birth cephalic perimeter	33.33±1.987	33±2.4	33.9±1.2	0.163
1st minute APGAR	8.66±0.9	8.42±1.07	8.89±0.66	0.111
5th minute APGAR	9.32±0.7	9.26±0.65	9.37±0.76	0.650
Neonatal ICU (days)	2.98±10.10	4.95±13.97	1±2.492	0.227
Baby's sex	**N (%)**	**N (%)**	**N (%)**	
Female	19 (47.5%)	9 (45%)	9 (45%)	0.752
Male	21 (52.5%)	11 (55%)	11 (55%)	
Type of delivery	**N (%)**	**N (%)**	**N (%)**	
Normal	21 (52.5%)	14 (70%)	7 (35%)	0.027**
Caesarean	19 (47.5%)	6 (30%)	13 (65%)	
Prematurity	**N (%)**	**N (%)**	**N (%)**	
Preterm (GA<37weeks)	10 (25%)	5 (25%)	7 (35%)	1.000
Term	30 (75%)	15 (75%)	13 (65%)	
Environment factors	**M±SD**	**M±SD**	**M±SD**	
Monthly family income	2319.75±2064.14	1463±1351.96	3176.50±2318.41	0.008*
Mother's age	24.62±8.07	17.5±1.4	32.1±4.5	<0.001*
Father's age	27.69±8.68	20.8±4.1	35±5.6	<0,001*
Mother's education	**N (%)**	**N (%)**	**N (%)**	
1st – 4th grade	4 (10%)	2 (10%)	2 (10%)	
5th – 8th grade	9 (22.5%)	8 (40%)	1 (5%)*	
High school	17 (42.5%)	10 (50%)	7 (35%)*	0.003**
Higher education	8 (20%)	0 (0%)	8 (40%)*	
Postgrad	2 (5%)	0 (0%)	2 (10%)*	
Father's education	**N (%)**	**N (%)**	**N (%)**	
1st – 4th grade	7 (17.5%)	5 (26.3%)	2 (10%)	
5th – 8th grade	8 (20%)	7 (36.8%)	1 (5%)*	
High school	14 (35%)	6 (31.6%)	8 (40%)	0.013**
Higher education	6 (15%)	1 (5.3%)	5 (25%)*	
Postgrad	4 (10%)	0 (0%)	4 (20%)*	
Caregiver works away	**N (%)**	**N (%)**	**N (%)**	
Yes	25 (62.5%)	6 (30%)	19 (95%)*	<0.001*
No	15 (37.5%)	14 (70%)	1 (5%)	*
Parents living together	**N (%)**	**N (%)**	**N (%)**	
Yes	29 (72.5%)	12 (60%)	17 (85%)	0.077
No	11 (27.5%)	8 (40%)	3 (15%)	
Breastfeeding (months)	**M±SD**	**M±SD**	**M±SD**	
	3,49±2.56	2.44±2.64	4.47±2.11	0.015*
Daycare attendance	**N (%)**	**N (%)**	**N (%)**	<0.001*
Never	16 (40%)	16 (80%)	0 (0%)	*
< 3 months	9 (22.5%)	2 (15%)	9 (45%)	
3-6 months	13 (32.5%)	1 (5%)	10 (50%)	
7-12 months	2 (5%)	0 (0%)	1 (5%)	
>12 months	0 (0%)	0 (0%)	0 (0%)	

Note: *p≤0.05 with Student's t test and ** p≤0.05 with Chi-square test
Source: The authors.

Regarding motor and cognitive performance, there was no significant difference between babies of adolescent and adult mothers, and the raw scores, percentile and categorization of development proved similar between groups (Table 2). About criteria for categorization of motor and cognitive development, the studied babies stood within the normal limits expected for their age.

Table 2. Motor and cognitive performance scores of the total sample and by groups

Individual's factors	Total sample	Adolescent mothers	Adult mothers	
Raw scores & percentile	M±SD	M±SD	M±SD	*p*
AIMS total score	26.95±12.85	26.20±13.43	27.7±12.55	0.717
AIMS Percentile	35.08±28.93	31.4±26.83	38.75±31.13	0.429
Prone	9.73±6.18	9.40±6.1	10.05±6.41	0.745
Supine	6.80±2.19	6.60±2.18	7±2.24	0.572
Sitting	7.08±4.27	7.15±4.6	7±4.03	0.913
Standing	3.35±1.71	3.05±1.95	3.65±1.42	0.275
BAYLEY total score	57.88±18.40	56.8±19.08	58.95±18.13	0.717
BAYLEY MDI	89.53±9.59	88.95±10.05	90.1±9.33	0.710
AIMS categorization	**N(%)**	**N(%)**	**N(%)**	***p***
Delay	6 (15%)	3 (15%)	3 (15%)	
Suspect	14 (35%)	7 (35%)	7 (35%)	1.000
Normal	20 (50%)	10 (50%)	10 (50%)	
BAYLEY categorization	**N (%)**	**N (%)**	**N (%)**	
Significant delay	1 (2.5%)	1 (5%)	0 (0%)	
Light delay	10 (25%)	5 (25%)	5 (25%)	0.596
Normal	29 (72.5%)	14 (70%)	15 (75%)	

Legend: MDI = mental development index. Note: *p≤0.05 with Student's t test and ** p≤0.05 with Chi-Square test
Source: The authors.

Regarding home characteristics, availability of materials and practices performed by caregivers, it was observed that babies born to adolescent mothers experience situations of greater stimulus deprivation (Table 3). They had fewer toys and their caregivers showed less knowledge about child development. Despite the non-significance in the DAIS scale total score, the sub-scale referring to the sleeping position presented a significant difference between groups (p=0.001); in the group of children of adolescent mothers, most babies sleep in the prone position (n=6) or on their sides (n=12), while the infants of adult mothers sleep in the supine position (n=12) or on their sides (n=6).

Table 3. Household characteristics, availability of materials and practices performed by caregivers in the total sample and by groups

Environment & Task factors	Total sample	Adolescent mothers	Adult mothers	*p*
Environment factors	N (%)	N (%)	N (%)	
Type of residence				
Apartment	8 (20%)	1 (5%)	7 (35%)	0.018**
House	32 (80%)	19 (95%)	13 (65%)	
	M±SD	M±SD	M±SD	
Number of bedrooms	2.35±0.94	2.45±1.19	2.25±0.63	0.513
External space	3.45±1.28	3.15±1.34	3.3±1.72	0.761
Internal space	3.23±1.52	3.5±1.05	3.4±1.5	0.809
FMS toys	5.53±3.71	5.1±3.05	8.7±3.14	0.001*
GMS toys	6.9±3.56	3.5±1.93	7.55±3.99	<0.001*
Task factors	M±SD	M±SD	M±SD	
AHEMD I practices	4.05±0.98	4.05±1.05	4.05±0.94	1.000
AHEMD II practices	14.38±3.57	14.65±3.63	14.10±3.59	0.633
DAIS total score	15.08±4.04	16.25±3.99	13.9±3.82	0.065
KIDI total score	0.56±0.18	0.47±0.14	0.64±0.17	0.002*

Legend: FMS toys=toys for fine motor skills. GMS toys=toys for gross motor skills. Note: *p≤0.05 with Student's t test and ** p≤0.05 with Chi-Square test.

Regression analyses (Tables 4 and 5) show that different factors remained in the models of each group. In the block referring to individual factors, in both groups, motor and cognitive development scores were the main predictors of the outcome. In the block referring to environment and task factors, the final models of the group of adolescent mothers remained with a larger number of factors and showed greater capacity to predict the score in the outcome, for presenting strong correlations (r^2 values above 0.60) with the dependent variable.

Group of adolescent mothers' babies

In the regression analysis with motor development as outcome (table 4), with respect to individual variables, the cognitive development variable remained in the final model, with a very strong correlation value (r^2=0.753). This result indicates that the higher the motor scores, the higher the cognitive scores. Among environment factors, variables referring to father's age, external and internal home space, mother working away from home – in inverse relation – parents' education and amount of toys and adults in the residence remained in the final regression model, with all variables having strong correlations (r^2 = 0.802) with the dependent one. Finally, on task factors, parenting practices and parents' knowledge about child development remained in the model, with very strong correlation (r^2 = 0.926).

With cognitive development as outcome (Table 5), the regression analysis revealed, in the individual's factors block, an association with the motor development variable, showing a strong and positive correlation (r^2=0.753) with the outcome variable. Among environmental factors, parents living together and number of bedrooms in the residence contributed significantly to the model, with moderate correlation (r^2=0.4) with the dependent variable. Among task factors, parenting practices remained in the regression model, presenting strong and positive correlation (r^2 = 0.8) with the outcome variable.

Group of adult mothers' babies

In the regression analysis displayed in Table 4, with motor development as outcome, in relation to individual's variables, those referring to cognitive development and cesarean delivery type remained in the final model, with very strong correlation value (r^2 = 0, 86). Cognitive development as predictor indicates that the higher the motor scores, the higher the cognitive scores. Among environment factors, parents living together and number of bedrooms in the residence remained in the final regression model, with weak correlation (r^2 = 0.23) with the dependent variable. Finally, on task factors, parenting practices remained in the model, with strong correlation (r^2 = 0.60).

In the regression analysis with cognitive development as outcome (Table 5), the regression analysis revealed for the infants of adult mothers, in the individual's factor block, that motor development and number of days in the ICU remained in the model, with the last one having an inverse relationship and showing a strong correlation (r^2 = 0.90) with the outcome variable. Among environmental factors, the number of bedrooms in the residence contributed significantly to the model, with a weak correlation (r^2 = 0.11) with the dependent variable. Among task factors, parenting practices remained in the regression model, presenting moderate and positive correlation (r^2 = 0.31) with the outcome variable.

Table 4. Backward multivariate linear regression: association between motor development and individual's, environment and task factors

Predictors	Beta	T	P	Adjusted R^2
Individual's factor				
Adolescent mothers				0.753
Bayley total score	0.876	7.265	<0.001	
Adult mothers				0.861
Type of delivery	0.371	3.455	0.005	
Bayley total score	0.769	9.050	<0.001	
Environment factors				
Adolescent mothers				0.802
Father's age	0.478	3.179	0.011	
Mother's education	0.459	3.268	0.010	
Father's education	0.737	5.716	<0.001	
Parents living together	0.362	2.883	0.018	
Caregiver works away	-0.438	-3.067	0.013	
External space	-0.667	-3.889	0.004	
Internal space	0.414	2.598	0.029	
Toys	-0.265	-2.138	0.046	
Number of adults	0.351	2.132	0.062	
Adult mothers				0.237
Parents living together	0.365	1.747	0.028	
Number of bedrooms	0.505	2.413	0.100	
Task factors				
Adolescent mothers				0.926
AHEMD I practices	0.177	2.658	0.019	
DAIS total score	0.935	14.071	<0.001	
KIDI total score	0.255	3.839	0.002	
Adult mothers				0.601
DAIS total score	0.790	5.304	<0.001	

Source: The authors.

Table 5. Backward multivariate linear regression: association between cognitive development and individual's, environment and task factors

Predictors	Beta	T	P	Adjusted R^2
Individual's factors				
Adolescent mothers				0.753
AIMS total score	0.876	7.265	<0.001	
Adult mothers				0.874
Neonatal ICU (days)	-0.351	-3.558	0.004	
AIMS total score	0.769	9.050	<0.001	
Environment factors				
Adolescent mothers				0.387
Parents living together	0.626	3.307	0.004	
Number of bedrooms	-0.426	-2.253	0.039	
Adult mothers				0.110
Number of bedrooms	0.399	1.793	0.031	
Task factors				
Adolescent mothers				0.777
DAIS total score	0.889	7.772	<0.001	
Adult mothers				0.317
DAIS total score	0.596	3.060	0.007	

Source: The authors.

Discussion

Comparison between groups

In general, regarding the characterization of the sample, the groups were homogeneous in most aspects, with the exception of family income, parents' education and caregiver/mother working away from home. This result was already expected since most adolescent mothers are inserted in a context of poverty and social vulnerability[9,10]. Taking human development as a complex and multifactorial phenomenon, these factors can be determinant in the outcome of a child's development. In view of this, the design adopted in the present research can be presented as a limitation of the study.

Motor and cognitive performance proved to be similar between groups. The literature is not consistent about this comparison; some studies suggest similarity[27] and others inferiority in the development of infants born to adolescent mothers[28-31]. The fact that there are differences between the development of babies of adolescent mothers when compared to those of adult mothers may occur not because the mothers are adolescents, but because they are more exposed to conditions of vulnerability, as the present study has confirmed.

The regression analysis showed that different factors remained in the models in each group. Considering environment and task factors, the final models of the group of adolescent mothers remained with a greater number of factors, and the latter had greater capacity to predict the outcome variable, for presenting stronger correlations.

Group of adolescent mothers' babies

Infants of adolescent mothers showed adequate motor and cognitive performance, which was similar to the performance of adult mothers' babies. Besides, younger mothers had lower family income, lower level of education and worked away from home less frequently. Bearing in mind that the babies of adolescent mothers assessed in the present study experience a situation of vulnerability, with accumulation of risk factors for their development[12,31,32], it is suggested that the similarity observed is positive for these infants.

The resilience capacity presented by these babies can be partly explained by the fact that adolescent mothers, though with greater financial limitations, stay longer at home for being out of the labor market and school[12,33], being responsible for the care of their children. Despite the young age and the vulnerable context of adolescent mothers, it is noteworthy that the greater contact of the mother-baby dyad can benefit the child's performance and be considered as a factor that promotes child development[27,32]. Adult mothers, in turn, showed a greater tendency to work away from home, suggesting less interaction between them and the baby throughout the day, which may be a factor that influences child performance.

With respect to the organization of the environment and availability of materials, adolescent mothers give fewer toys to their children, most likely because of the poorer knowledge about child development presented by them. The literature suggests that mothers with lower income and educational level, data observed in the present study, have fewer conditions to stimulate their children, compromising childcare practices[32] and restricting exploration opportunities for the child[34]. Studies also associate teenage motherhood with inadequate stimuli[7,35] and lack of care with the baby[28]. However, it is worth mentioning that the majority of adolescent mothers receive family support in the care of the baby, a fact that may have influenced positively the research participants.

The literature reports that delays in child development have been associated with factors such as environmental, individual and demographic characteristics of families[36]. In the present study, in the regression models of the group of adolescent mothers, external and internal spaces showed to be predictive factors of a baby's motor development. An environment rich in experiences is considered a protective factor for child development[37], being able to influence positively the child's motor and cognitive skills, if possibilities for exploration are guaranteed[21,38]. The majority of the assessed children in the group of adolescent mothers live at home and, due to lower family income, it is probable that the residences are very restricted as to external space and possibility of stimulation.

Still on environment factors, parents' education, number of adults in the residence, parents living together and mother not working away from home are variables that also proved to be predictors of motor and cognitive development. The variable related to the situation of mothers working away from home showed an inverse relationship with motor development, that is, the fact that the adolescent mother did not work away from home had a positive impact on the child's motor development. It is known that the quality of the interaction between children and their main caregivers boosts development[32]. Younger parents, in addition to not having great professional demand, which favors longer interaction with their children, often receive family support in the care of the child[39-41]. In view of this, it is suggested that future studies assess not only parents as the child's main caregivers, but also other family members, as well as daycare educators, who may be interacting directly with the child, thus influencing his or her developmental process.

The father's age remained in the regression models for motor development, suggesting superiority in the motor scores of infants born to fathers aged over 19 years, with strong correlation values. Maternal age was not a prediction factor for child development. Most previous studies report delays in the development of babies born to younger mothers[29-31]. Perhaps, a possible explanation to this result and limitation of the present study lies in the fact that this research counted with adolescent mothers and fathers aged between 15 to 19 years. The literature reports that the greatest risks for babies of adolescent parents occur at an earlier age, especially from 13 to 17 years[42,43], age group represented in this study by 9 mothers and 4 fathers. Maybe most parents between the ages of 18 and 19 have more characteristics that bring them closer to more parents that are adult.

The regression analysis also showed association of child development with parenting practices and parents' knowledge about the development of their children. Results revealed that infants who stayed in positions that allowed their active movement and interaction with the environment and other individuals could create more opportunities for motor and cognitive development. Moreover, parents who allow their children to be in more active positions and with less assistance in different tasks, as well as changes of position (sitting to standing, standing to sitting), boost their development. Likewise, parents' knowledge has an impact on child development, especially motor, according to results of the regression analysis in the present research. A recent study observed associations between parenting practices, parental knowledge and motor and cognitive development over time[36], corroborating with results found in the study. Babies who sleep in positions that offer more opportunities for development (on their side or prone) tend to present higher motor scores[44-46]. A previous study suggests that Brazilian children generally stay longer in one's arms and are rarely put on the floor to play in the first six months of life[47], which has been an indication of a protection that generates developmental delays[32].

Moreover, the regression analyses showed significant associations and strong correlations between the motor and cognitive development of adolescent mothers' babies. The literature reports that the acquisition of motor skills is critically associated with the individual's cognitive skills[38,48,49], and both are synchronously related, especially as of six months of life[51]. Several studies have observed correlations between motor skills and cognition in infants[36,38,51-53]. This strong association between different domains of development can be explained by the coactivation of certain brain areas during motor and cognitive tasks[54].

Group of adult mothers' babies

The babies of adult mothers showed adequate motor and cognitive development, which was similar to the performance of adolescent mothers' infants. Besides, the babies of adult mothers had higher family income, higher parents' education level, higher frequency of mothers working away from home, longer breastfeeding time and higher daycare attendance. For adult mothers' babies, the fact that their mothers worked away from home may have negatively impacted the children's development, since greater contact between mother and baby brings benefits to the latter's development and can be considered as a factor that promotes child development[27,32]. However, the higher daycare attendance of these infants may have acted as a factor that promotes child development, since the daycare environment, when it provides diversified tasks, constant and adequate stimuli for each age group, generates positive impacts on the developmental process[32], when it places the focus away from food assistance and hygiene care[55].

Regarding organization of the environment and availability of materials, adult mothers offer more toys to their children for both gross and fine motor skills, and have greater knowledge about child development. The environment, when rich in experiences and opportunities for exploration, can be considered a protective factor for child development and positively impact motor and cognitive performance[21,37,38]. The result of the present study corroborates with the literature that reports associations of parental practices and knowledge with motor and cognitive development in children over time[36].

In the regression analyses, about individual's factors, type of delivery and number of days in Intensive Care Units (ICU) were predictors of motor and cognitive development, with strong correlations. The hospital environment, as well as the duration of the hospitalization especially in the ICU, can be detrimental to the child's development. Once the routine established in this context is rigorous, requiring continuous monitoring due to the gravity of

the situation, which oftentimes makes the presence of parents impossible, prevent children from living in their family environment, in addition to subjecting them to painful, invasive and unpleasant procedures. The hospital environment, besides causing excessive manipulation for clinical procedures and long periods of restriction in the bed and in the same position, gives little room for movement[56,57], which may contribute negatively to the development of the baby inserted in this context. As for type of delivery, the literature does not provide direct correlation information on type of childbirth with child development. Cesarean delivery was more frequent among adult mothers in the present study, being especially associated with motor performance. In Brazil, cesarean delivery rates are very high and continue to increase; according to UNICEF data in 2007, the rate was 46.5%. Cesarean delivery represents a higher risk for mothers and greater risks of complications than normal deliveries do[59], data that opposes to results found in the present study.

Also with respect to individual's factors, the regression analyses showed significant associations and strong correlations between the motor and cognitive performance of adult mothers' babies, just as the group of adolescent mothers. The literature is already quite consistent about this result, showing relations between the motor and cognitive development of infants[36,38,51-53].

On environmental factors, only the number of bedrooms in the residence and parents living together were predictors of motor and cognitive development, showing weak correlation. A previous study reports that child development can be influenced by physical home space, parents' education, family socioeconomic level, family relationship and dynamics[60]. As for task factors, parenting practices remained in the regression models for both motor and cognitive development, with strong correlation (r^2=0.60) with motor development, and weak correlation (r^2=0.31) with cognitive development. This result is supported by the current literature that reports associations between parenting practices and motor and cognitive development over time[36].

Conclusions

The correlation between motor and cognitive development is evident in all regression analyses in both groups. In the group of adolescent mothers, the regression models showed larger number of factors related to the prediction of child development, and these factors had a greater capacity to predict the score of the outcome variable. For the babies of adolescent mothers, the main predictors of motor and cognitive child development: father's age, parents' education, parents living together, mother not working away from home, household characteristics in terms of space and toys, parenting practices and parental knowledge about child development. For the group of adult mothers' babies, the main predictors were number of days in the ICU, type of delivery, household characteristics in terms of number of bedrooms, parents living together and parenting practices.

Moreover, it is possible to observe a preponderance of environmental factors over biological ones, which has already been reported in the literature. This fact reinforces the importance of the context in which children are inserted from the first years of life, being able to interfere with their developmental trajectory soon from early childhood.

Many are the factors involved in the situation of teenage motherhood and great is their impact on child development. Younger parents, in addition to not having great professional demand, often receive family support in the caring of their child. Future studies are suggested to investigate the support network provided to young people in situations of teenage parenthood, and the influence of this factor on the child's developmental process.

The groups of babies of adolescent and adult mothers presented both risk and protection factors for motor and cognitive development. The higher daycare attendance of adult mothers' babies stood as a protection factor, which may have optimized the development of those babies. Likewise, the fact that adolescent mothers are more present in the home environment, interacting more with their children, may also have boosted the development of the latter. In view of this, we can conclude that the presence of these protection factors in both groups may justify the fact that there are similarities in the motor and cognitive development of babies of adolescent and adult mothers.

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