IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 4 Ver.1 April. (2018), PP 47-51
www.iosrjournals.org

Child Cognition, Preschool Attendance and Socioeconomic Status in Katanga/Democratic Republic Of Congo

Béatrice Koba-Bora[1], Boivin Michael[2], Didier Malamba-Lez[3], Abdon Mukalay Wa Mukalay[4], Daniel Okitundu-Luwa[5], Désiré Tshala-Katumbay[5,6,7]

[1] *Department of Neurology, School of Medicine, University of Lubumbashi, Lubumbashi, Democratic Republic of Congo.*
[2] *Department of Psychiatry and Neurology/Ophthalmology, Michigan State University, East Lansing MI, USA.*
[3] *Department of Internal Medicine, School of Medicine, University of Lubumbashi, Lubumbashi, Democratic Republic of Congo.*
[4] *Faculty of Medicine, School of Public Health, Clinical Epidemiology and Tropical Pathologies Unit/University of Lubumbashi, Lubumbashi, Democratic Republic of Congo.*
[5] *Department of Neurology, University of Kinshasa, Kinshasa, Democratic Republic of Congo.*
[6] *National Institute of Biomedical Research (INRB), Kinshasa, Democratic Republic of Congo.*
[7] *Department of Neurology and School of Public Health, Oregon Health & Science University, Portland OR, USA.*
**Corresponding author: Béatrice Koba-Bora*

Abstract : *There is a link between unfavorable living conditions and child cognition. However, no such study has been conducted in our community.*
The objective of this study was to determine the influence of socioeconomic status and preschool attendance on children's cognition profile in Lubumbashi, Katanga/ DRC. We enrolled 95 school-aged children (46 boys and 49 girls), 6 to 11 years living in the vicinity of a mining industry in Lubumbashi. The SES was assessed by the adapted Kuppuswamy's status scale constructed by parent's educational level, occupation of the main breadwinner and family incomes. We asked about being at preschool or not. Children cognition was assessed using Kauffman Assessment Battery for Children second edition (KABC-II). The association of KABC–II subtests with explanatory variables was assessed by generalized linear models. Pre-school attendance was positively associated with simultaneous memory (p=0.024) and overall performance scores namely: Mental Processing Index (MPI) (p=0.024) and Non-Verbal Index (NVI) (p=0.007). Mother's tertiary level was positively associated with planning (p=0.037) and MPI (p=0.02). Finally, father's tertiary level and children preschool attendance were the independent positive predictors for simultaneous processing (p=0.015), learning (p=0.047) and overall performances MPI (0.006) and NVI (0.024). Neuropsychological assessment of child cognition should control for SES including preschool attendance and parent's education.

Key Words: *Socioeconomic status, children school age, KABC-II, Lubumbashi/ Katanga/ DRC.*

Date of Submission: 23-03-2018 Date of acceptance: 07-04-2018

I. Background

It is estimated that over 249 million children in developing countries are not reaching their full developmental potential because of poverty [1].

In a big survey conducted in 35 low and middle income countries, [2] reported that 80.8 million children aged 3 and 4 years, especially in sub Saharan Africa experienced low cognitive development associated to poverty, to the fact of living in a rural residence and lack of cognitive stimulation.

The neurodevelopment is affected by the combination of genetic predispositions and social and physical environment. There is a continuous interaction between biological and environmental factors [3, 4].

The environment stimulation, the family, the early parental stimulation, the child's nutritional status and its quality have been suggested as key factors that influence early child development [5-8]. Children at high risk due to poverty and restriction to learning opportunities will present developmental impairment and cognitive deficits [9]. The maternal intelligence has been a lot associated with child cognitive development [10] and this biologic influence is similar in low and high socioeconomic families and, in lower SES, the greater cognitive functions can also be the result of children shared experiences [11]. Some interventional studies on early childhood have facilitated learning and enhanced others cognitive functions [12, 13]. In DRC, poverty affects 71% of the population [14] and, at our knowledge, there is no study about relation between socioeconomic status and children's cognition in our area.

The aim of this study was to determine the influence of parent's socioeconomic status and preschool attendance on children cognition assessed by KABC-II.

II. Subjects And Method:

Study design

The study was conducted in Lubumbashi (South-East of the DRC) from June 19 th to September 30th, 2014, in Kampemba commune, in Kabestha neighborhood, located in the vicinity of a mining industry. It is born of a principal carried out study in the same context which assessed the association between cognitive performances and exposure to metallic trace element mixture. We conveniently recruited school aged children by door to door operation. Only children with parent's written consent were part of the study. Children with medical history of hospitalization for illness possibly affecting the Central Nervous System (e.g. cerebral malaria, epilepsy, meningitis, trauma and visual or hearing troubles) were not included.

Anthropometric measurements were made by a training nurse following the protocol of WHO [15]. The weight was recorded to the nearest 0.1 kg using the UNICEF SECA weight. For accuracy, the scale was testes daily before weighing, using a standard object. Before weighing each child, the reading indicator was checked. The children were weighed without shoes and wearing light clothes (underwear) only. The size was measured to the nearest 1 cm using a measuring board fixed against the wall (SECA scale). We computed the weight for age and height for age by using HAZ-score with ENA (National administration school) software. Normal nutritional status was defined when Z-score value was between -2 and +2 and stunting, under -2.

Socioeconomic status

Socioeconomic status (SES) was assessed by adapted Kuppuswamy's Socio-Economic Status Scale [14, 16]. We finally considered a composite score of education (tertiary level =2, non-tertiary level =1) and occupation of the main breadwinner (profession or semi-profession=2, unskilled worker or unemployed=1) along with monthly income of the family (sufficient =2, insufficient=1), which yields a score of 3- 6. After, two levels of SES: high (score = 4-6) and low (score <4) were taken. These elements affected cognitive functions and learning opportunities offered to the children [11, 17, 18]. We asked about being or not at preschool for children.

Neurocognitive assessment

The Kaufman Assessment Battery for Children, 2nd Edition (KABC-II), previously used in the DRC [19, 20] and validated in Uganda [21] was used to assess the children cognitive functions. It is an assessment of processing information and cognitive abilities in children aged 3 to 18 years, providing a comprehensive evaluation of core neurocognitive performance domains. Subscales used in our work are listed in our previous study. Neuropsychological evaluation took place in a quiet room that afforded privacy to minimize distractions. Children were tested after translation of cognitive subtests from English to Swahili or French. Each tested child performance was scored under each subtest and overall performance composite scores computed, *i.e*., MPI (mental processing index) and NVI (nonverbal index).

The study protocol was approved by the institutional review board of the University of Lubumbashi (UNILU/CEM/036/2014) in Haut-Katanga, DRC.

III. Statistical Analysis

Continuous data were expressed as mean and standard deviation, categorical data as absolute frequencies and percentages. Comparison between groups was performed by Student test. The association of KABC-II tests with explanatory variables was assessed with generalized linear models with age and sex as potential explanatory variables. A generalized linear model was built for each KABC –II sub-domain and overall composite scores for the identification of independent predictors of cognition. Data were presented as coefficients and p value. Statistical analyses were done at the 0,05 significance level using Stata 12 software ((Stata Corp, College Station, TX, USA).

IV. Results

Children's characteristics

We enrolled 95 children (46 males vs 49 females), aged from 6 to 11. Almost all of them, 91 (96%) were in normal range of nutritional status and 74 (78%) did not attend pre-school level. Only 6% of mothers (vs 28% of fathers) have rechead a tertiary level. The majority of these children (87%) came from low socioeconomic families. No significant difference was found between boys and girls regarding general characteristics as it is reported in table 2.

Cognitive performances

Mean and standard deviation of cognitive performances are reported in table 3.

Cognition and socioeconomic status

Children whose fathers had tertiary level performed significantly better in all KABC-II subtests except in sequential memory: simultaneous ($p<0,01$); learning($p<0,01$); planning ($p=0,02$); MPI ($p<0,01$) and NVI ($p<0,01$). All scores were significantly higher among children of tertiary-level mothers compared to other children: sequential ($p=0,01$); simultaneous ($p<0,01$); learning ($p<0,01$); planning ($p<0,01$), MPI ($p<0,01$) and NVI ($p=0,01$). Children who had been at pre- school had better cognitive performances compared to those who have not been except for sequential memory: simultaneous ($p<0,01$), learning ($p=0,01$); planning ($p<0,01$), MPI ($p<0,01$) and NVI ($p<0,01$) (table 4).

In a generalized linear model adjusted for age and gender, The tertiary level for the mother remained significant for planning and MPI subtests while the tertiary level for the father remained significant for all KABC-II subtests except sequential and planning. Preschool attendance explained all MPI and NVI composite scores. Boys perfomed better than children in simultaneous and MPI and being younger was a good predictor of learning and NVI. Details are given in table 5.

V. Discussion

The present study provides, for the first time in our area, data on the influence of SES on school aged children cognition. The main findings are that tertiary level for the mothers is a predictor of MPI while tertiary level for the fathers and preschool attendance are predictors of all MPI and NVI. The fact of having been to elementary school was a good factor enhancing cognitive performances in children. Preschool education has a strong effect on the brain development as it was been reported in previous studies. The early parental stimulation and children's own and shared experiences through preschool also explain this finding [8, 10, 11]. Giving learning opportunities to the child during the first years of life, through intervention programs, will improve his cognitive functions [7, 12, 22]. We found that education level of parents, especially when they went to the university, was associated with better cognitive scores on KABC-II. When mothers had tertiary level, the MPI score enhanced by 7 points and the father's education level positively influenced NVI children scores by 4 points. These coefficients were more strong than those found in one previous study and can't be taken as statistic artifacts [23]. Even after children gender and age, these predictors remained strong. The genetic and biologic predisposition which underlies maternal intelligence has been a lot associated with child neurocognitive development [3, 4]. After controlling for age and gender, father's and mother's education level and children preschool attendance were predictors of cognitive performance. In simultaneous and MPI subtests, boys were more performant than girls and to be younger facilitates learning. Many studies focus on gender difference among children cognitive skills found that boys are more performed [24, 25]. We think, in our conditions that, cultural influence (type of game, tendency to favor boys in certain activities including school) could be the main point of this difference. Finally, socioeconomic status defined by parent's educational level and occupation, household income could be the major predictor of children cognitive functions in our area. We used a Kuppuswamy's scale adapted because in our area, we don't find a standardized scale for SES evaluation and we adapted it to our context.

Some studies in low and middle income countries have reported association between poverty and low cognitive performances [2, 6, 13, 18, 20, 26-30]. Parents who have low SES will not get their children to school, will not give them conducive environment and children could not have learning opportunities. It exists here a colinearity relation between these variables. The low families SES in our area could have a negative influence on school-aged children.

The limit of this study was the fact of having taken the parent's SES at the moment of the examination and not during children development and small size of the sample study. A more appropriate and improved indicator of socio-economic scale should be designed for our conditions. In future studies, we would include children of the other geographical areas of DRC.

VI. Competing Financial Interests Declaration

No conflict.

Acknowledgment

To authors who contribute to the study and to National Institutes of Health grant who supported in part, this study.

Author's contribution

BKB and DTK designed the study. DML, DOL, BKB and DTK analyzed the data and all authors discussed the results and commented on the manuscript. All the authors approved the final version of the manuscript.

Tableau 1: Children Characteristics

	All n(%)	Males n(%)	Females n(%)	Stats
	95(100)	46(48)	49(52)	P*
Age, year (mean ± sd)	8,07±1,61	8,3 ± 1,68	7,83 ± 1,51	0.0708
Nutritional status				
Normal n (%)	91(96)	44 (96)	47 (96)	0.949
Abnormal n(%)	4(4)	2 (2)	2 (2)	
Pre-school education				
Yes, n(%)	21 (22)	11 (24)	10 (20)	0,681
No, n(%)	74 (78)	35 (76)	39 (80)	
Socio-economic status				
Low	83 (87)	40 (87)	43 (88)	0,907
High	12 (13)	6 (13)	6 (12)	
Mother education				
university	6 (6)	3 (6)	3 (6)	0,936
under university	89 (94)	43 (94)	46 (94)	
Father education				
university	27 (28)	11 (24)	16 (33)	0,345
under university	68 (72)	35 (76)	33 (67)	

n : effectif de sujets par groupe ; sd : standard deviation ; * Student test and Khi square of pearson

Table 2. Cognitive performances by KABC-II

	All (95)	Male (46)	Female (49)	p*
Sequential (Mean±sd)	81,36±9,80	82±9	80±10	0.16
Simultaneous (Mean±sd)	64,22±9,80	66±10	62±9	**0.015***
Planning (Mean±sd)	74,91±8,33	76±8	73±8	0.056
Learning (Mean±sd)	73,31±9,11	74±10	73±8	0.23
MPI (Mean±sd)	66,95±7,22	68,39±7	66±7	**0.029***
NVI (Mean±sd)	66,55±9,31	67,47±10	66±9	0.174

MPI : mental processus index; NVI : Non verbal index; sd : standard deviation
p :statistically significant value at Student test

Table 3: Parent’s education level, elementary school attendance and KABC-II

	Father's university level			Mother's university level			Pre-school attendance		
	Yes	No	P*	Yes	No	P*	Yes	No	P*
Sequential	83±12	80±9	0,096	90±8	81±10	**0,011**	84±11	80±9	0,0607
Simultaneous	69±12	62±8	**0,0005**	74±18	63±9	**0,0042**	71±13	62±8	**0,0001**
Learning	78±11	71±7	**0,0014**	84±9	72±9	**0,0011**	78±10	72±8	**0,011**
Planning	78±11	73±7	**0,0177**	88±14	74±7	**0,0023**	79±10	73±7	**0,0067**
MPI	71±9	65±5	**0,0001**	78±12	66±6	**0,000**	72±9	65±6	**0,000**
NVI	72±11	64±7	**0,0003**	78±18	66±8	**0,011**	74±11	64±7	**0,000**

MPI: mental processus index; NVI: non verbal index ;p*: statistically significant value at Student test

Table 4 : Generalized linear model : Predictors of cognitive functions

	Constante	Father's level	Mother’s level	Preschool attendanc	Gender	Age
		Coeff(p)	Coeff(p)	Coeff(p)	Coeff (p)	Coeff(p)
Sequential	79	1(0.568)	8(0,077)	1(0,613)	-2 (0,365	0 (0,502)
Simultaneous	66	**5(0,015)**	4(0,3)	**5(0,024)**	**-4(0,015)**	0 (0,686)
Learning	86	**4(0,047)**	5(0,148)	4(0,078)	-2 (0,174)	**-1(0,005)**
Planning	74	3(0,285)	**11(0,037)**	2(0,334)	-3 (0,081)	0 (0,565)
MPI	70	**4(0,006)**	7**(0,02)**	**4(0,024)**	**-3 (0,016)**	0 (0,363)
NVI	57	**5 (0,024)**	6(0,102)	**6(0,007)**	-1 0,370)	**1 (0,043)**

MPI: mental processus index; NVI: non verbal index, p : statistically significanr value

[1]. Walker, S.P., et al., Inequality in early childhood: risk and protective factors for early child development. Lancet, 2011. **378**(9799): p. 1325-38.
[2]. McCoy, D.C., et al., Early Childhood Developmental Status in Low- and Middle-Income Countries: National, Regional, and Global Prevalence Estimates Using Predictive Modeling. PLoS Med, 2016. **13**(6): p. e1002034.
[3]. Stiles, J., et al., Cognitive development following early brain injury: evidence for neural adaptation. Trends Cogn Sci, 2005. **9**(3): p. 136-43.
[4]. Tong, S., et al., Socioeconomic position, maternal IQ, home environment, and cognitive development. J Pediatr, 2007. **151**(3): p. 284-8, 288.e1.
[5]. Black, M.M., et al., Early childhood development coming of age: science through the life course. Lancet, 2017. **389**(10064): p. 77-90.
[6]. ritto, P.R., et al., Nurturing care: promoting early childhood development. Lancet, 2017. **389**(10064): p. 91-102.
[7]. Grantham-McGregor, S., et al., Developmental potential in the first 5 years for children in developing countries. Lancet, 2007. **369**(9555): p. 60-70.
[8]. Nguyen, P.H., et al., Influences of early child nutritional status and home learning environment on child development in Vietnam. Matern Child Nutr, 2017.
[9]. Engle, P.L., et al., Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. Lancet, 2011. **378**(9799): p. 1339-53.
[10]. Bacharach, V.R. and A.A. Baumeister, Effects of maternal intelligence, marital status, income, and home environment on cognitive development of low birthweight infants. J Pediatr Psychol, 1998. **23**(3): p. 197-205.
[11]. Hanscombe, K.B., et al., Socioeconomic status (SES) and children's intelligence (IQ): in a UK-representative sample SES moderates the environmental, not genetic, effect on IQ. PLoS One, 2012. **7**(2): p. e30320.
[12]. Attanasio, O.P., et al., Using the infrastructure of a conditional cash transfer program to deliver a scalable integrated early child development program in Colombia: cluster randomized controlled trial. Bmj, 2014. **349**: p. g5785.
[13]. Walker, S.P., et al., Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-stunted Jamaican children: prospective cohort study. Lancet, 2005. **366**(9499): p. 1804-7.
[14]. plan, M.d., Document de la stratégie de croissance et de réduction de la pauvreté. 2011. p. 126.
[15]. WHO, Training Course on Child Growth Assessment. 2008. p. 116.
[16]. Khairnar, M.R., U. Wadgave, and P.V. Shimpi, Kuppuswamy's Socio-Economic Status Scale: A Revision of Occupation and Income Criteria for 2016. Indian J Pediatr, 2017. **84**(1): p. 3-6.
[17]. Bradley, R.H. and R.F. Corwyn, Socioeconomic status and child development. Annu Rev Psychol, 2002. **53**: p. 371-99.
[18]. Eilertsen, T., et al., Parental socioeconomic status and child intellectual functioning in a Norwegian sample. Scand J Psychol, 2016. **57**(5): p. 399-405.
[19]. Boivin, M.J. and B. Giordani, Improvements in cognitive performance for schoolchildren in Zaire, Africa, following an iron supplement and treatment for intestinal parasites. J Pediatr Psychol, 1993. **18**(2): p. 249-64.
[20]. Boivin, M.J., et al., Economic advantage and the cognitive ability of rural children in Zaire. J Psychol, 1996. **130**(1): p. 95-107.
[21]. Bangirana, P., et al., A preliminary examination of the construct validity of the KABC-II in Ugandan children with a history of cerebral malaria. Afr Health Sci, 2009. **9**(3): p. 186-92.
[22]. Ajayi, O.R., et al., Factors associated with the health and cognition of 6-year-old to 8-year-old children in KwaZulu-Natal, South Africa. Trop Med Int Health, 2017. **22**(5): p. 631-637.
[23]. Alves, A.F., A. Martins, and L.S. Almeida, Interactions between Sex, Socioeconomic Level, and Children's Cognitive Performance. Psychol Rep, 2016. **118**(2): p. 471-86.
[24]. Cvencek, D., A.N. Meltzoff, and M. Kapur, Cognitive consistency and math-gender stereotypes in Singaporean children. J Exp Child Psychol, 2014. **117**: p. 73-91.
[25]. Mano, Q.R., et al., Gender Moderates Association Between Emotional-Behavioral Problems and Text Comprehension in Children with Both Reading Difficulties and Adhd. Psychol Sch, 2017. **54**(5): p. 504-518.
[26]. Brooks-Gunn, J. and G.J. Duncan, The effects of poverty on children. Future Child, 1997. **7**(2): p. 55-71.
[27]. Brumberg, H.L. and S.I. Shah, Born early and born poor: An eco-bio-developmental model for poverty and preterm birth. J Neonatal Perinatal Med, 2015. **8**(3): p. 179-87.
[28]. Drazen, C.H., et al., Prevalence of Developmental Delay and Contributing Factors Among Children With Sickle Cell Disease. Pediatr Blood Cancer, 2016. **63**(3): p. 504-10.
[29]. Luby, J., et al., The effects of poverty on childhood brain development: the mediating effect of caregiving and stressful life events. JAMA Pediatr, 2013. **167**(12): p. 1135-42.
[30]. Ronfani, L., et al., The Complex Interaction between Home Environment, Socioeconomic Status, Maternal IQ and Early Child Neurocognitive Development: A Multivariate Analysis of Data Collected in a Newborn Cohort Study. PLoS One, 2015. **10**(5): p. e0127052.

Béatrice Koba-Bora." Child Cognition, Preschool Attendance and Socioeconomic Status in Katanga/Democratic Republic Of Congo."IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 4, 2018, pp 46-51.