Research Article

iMedPub Journals
www.imedpub.com

Journal of Translational Neurosciences
ISSN 2573-5349

2021
Vol.6 No.6:7247

Borderline Intellectual Functioning, Salivary Cortisol and Associated Factors: ASchool-Based Study in Southern Brazil

Stefânia Martins Teixeira[1] , Vera L.M. de Figueiredo[1] ,Igor Soares Vieira[1] ,Amanda Neumann Reyes[1] ,Fernanda Pedrotti Moreira[1*] ,Carolina David Wiener[1] ,Marcela Renata. G. Z. Janke[1] ,Jerônimo Costa Branco[1] ,Jean Piere Oses[2] ,Ricardo Azevedo da Silva[1] ,Luciano Dias de Mattos Souza[1] ,Karen Jansen[1]

[1] Translational Science on Brain Disorders, Postgraduate Program in Health and Behavior, Catholic University of Pelotas, RS, Brazil.

[2] Visiting Researcher at Federal University of Mato Grosso do Sul, MS, Brazil

***Corresponding author:** Fernanda Pedrotti Moreira, Translational Sci ence on Bra in Disorders, Postgraduate Program in Hea lth and Beh avior, Catholic University of Pelotas, RS, Brazil ,Tel: 5553981087468 E-mail: fepedrotti@gmail.com

Received date: November 09, 2021;**Accepted date:** November 23,2021;**Published date:** November 30, 2021

Citation: MoreiraF.P (2021) Borderline intellectual functioning, salivary cortisol and associated factors: a school-based study in southern Brazil. J Transl Neurosc.Vol.6,No.6:7247

ABSTRACT

Objective: This study aimed to evaluate the associated factors to the BIF among students from public schools in southern Brazil.

Method: A cross-sectional study was conducted with a school-based sample at 20 schools selected by systematic random sampling. Participants consisted of children aged 7-8 year old and their parents or primary caregivers. The Wechsler Abbreviated Scale of Intelligence (WASI) was used to evaluate the BIF. The salivary cortisol level was measured by electrochemiluminescence.

Result: The prevalence of BIF was 50.9% and was associated with non-white children, lower educated caregivers and families with lower economic status. Children with BIF showed higher stress and higher cortisol levels when compared to children with no BIF.

Conclusion: Half of the children exhibit BIF, being associated with higher social vulnerability and higher levels of stress.

Keywords: Intellectual Disability; stress; salivary cortisol; schoolchildren

INTRODUCTION

Children with borderline intellectual functioning (BIF) have an intelligence quotient (IQ) in the range of 71 to 84, where difficulties in academic, social, or vocational are manifested1. The child's intellectual level should be assessed to diagnose BIF, since the can be considered a risk factor for psychiatric morbidity and poor mental health in childhood and adulthood1,2. This limited body of research is particularly impressive, considering that estimates of the prevalence of BIF are about 7.0% of the school-age population1.

Previous research has focused mostly on intellectual disability with a known an etiology, such as Down syndrome and children with a more profound intellectual disability, but not on children with a BIF. There are many factors linked to the intellectual disability, with particular emphasis to socioeconomic status (e.g., race/ethnicity, child gender, age, family structure, and economic status). The family socioeconomic status is a complex variable that is composed of the relationship of different factors such as maternal education, caregiver occupation, and family income3.

In addition, there is evidence supporting the role of childhood stress as a risk factor in the pathway leading to mental disorder, including brain structures, cognition, and expression of symptoms4, which can also be an important factor related to impaired learning, worst social interaction ability, and impaired development in children with borderline intellectual disability. The hypothalamic pituitary adrenal (HPA) axis, which has as primary hormonal end product, the hormone cortisol, is a well-known physiological response system that is activated in acutely stressful situations5. Thus, the focus of this study was to examine the prevalence, associated factors and cortisol levels in children with BIF from elementary public schools.

METHOD

We used a cross-sectional design nested in a larger study entitled "Healthy Childhood in Context: A Multidisciplinary Research", which was approved by the Research Ethics Committee under protocol number 843.526. A probabilistic sampling method was used to select the municipal elementary schools (primary sampling units) for the present study. To that end, 20 public elementary schools were randomly selected out of 40 in the urban area of the city of Pelotas. Schoolchildren aged 7-8 years and one of their respective parents or primary caregivers were included in the study. Details of design and sample of the study are available elsewhere6.

Data collection began after the parents or caregivers provided written informed consent. It was divided into two steps: (1) the assessment of children during classes in their school, and (2) the interview with parents or caregivers at their homes. The economic assessment was performed using the National

Economic Indicator (IEN), which is based on the accumulation of material goods and the education of household head 7. This assessment was divided into terciles. To assess intellectual functioning, the Wechsler Abbreviated Scale Intelligence (WASI) was used. It was considered BIF when the Total IQ was below 80 points8. The Child Stress Scale (ESI) was used to assess the student's stress levels9. On this scale, higher scores represented higher stress levels.

Salivary cortisol levels were collected in the morning and measured using the Roche commercial kit according to the manufacturer's instructions (Roche Diagnostics, Mannheim, Germany) using the electrochemiluminescence technique with the COBAS® 6000 analyzer. Salivary cortisol was expressed as ng/mL. Details of these dosages are available elsewhere10.

The data were analyzed using the Statistical Package for the Social Sciences program, version 22.0, and were described by absolute and relative frequencies, mean and standard deviation, or median and interquartile ranges. The crude analysis was performed by Chi-square test, Student's t-test, and Mann-Whitney test to assess factors associated with borderline intellectual performance. Variables with p <0.20 in the crude analysis were included in a model adjusted by Poisson regression. Finally, we considered statistically significant associations when p-value <0.05.

RESULTS

In total, 723 children met the inclusion criteria in the study. However, 34 (5.0%) were not located in schools on the assessment days, and 80 (11.0%) did not have the consent of the caregiver. Thus, 609 children were included in the larger study, but 13 caregivers were not located or refused to participate in the study. There was still a loss of 11 cognitive assessments of children who did not complete the assessment. Thus, the sample size of the present study consisted of 585 children and their respective caregivers. The prevalence of BIF was 50.9%

The sociodemographic characteristics of the sample are shown in Table 1. Most children with BIF were non-white (67.9%; p < 0.001). In addition, children from economically underprivileged families (p < 0.001), where caregivers had a lower educational level (p = 0.003) had a higher proportion of BIF (Table 1).

Variables	Sample distribution †	Borderline intelligence †	p-value
	n= 585	n= 298	
Sex			0.35
Female	281 (48.0)	137 (48.8)	
Male	304 (52.0)	161 (53.0)	
Age			0.16
7 years	259 (44.3)	123 (47.5)	
8 years	326 (55.7)	175 (53.7)	
Skin color			<0.001
White	373 (63.8)	154 (41.3)	
Non-white	212 (36.2)	144 (67.9)	
Caregiver education			0.003
Up to 11 years	494 (84.4)	264 (53.4)	
12 years or more	91 (15.6)	29 (34.9)	
IEN (tercile) ‡			<0.001
3 (richest)	196 (33.5)	64 (32.7)	
2	195 (33.3)	106 (54.4)	
1 (poorest)	194 (33.2)	128 (66.0)	

Table 1 Demographic characteristics and factors associated with the borderline intellectual functioning of public elementary school students

The borderline QI children had higher stress scores (mean= 48.9 ± 21.4) when compared to children with the expected Total IQ score for age (mean= 40.2 ± 16.8; p < 0.001). In addition, salivary cortisol levels were higher in children with BIF (median: 0.10, interquartile range: 0.07; 0.14) compared to children with expected intellectual functioning for age (median: 0.08, interquartile range: 0.06; 0.12, p < 0.001) (Figure 1).

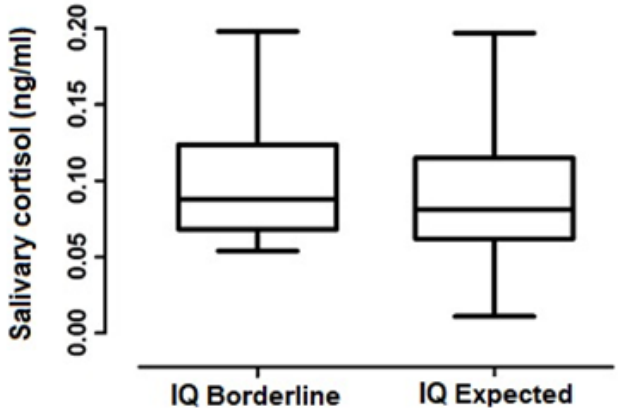

Figure 1 Cortisol levels presented by median and interquartile ranges. Significant difference of p <0.001 using the Mann-Whitney test.

The relationship between childhood stress and BIF remained significant (p =0.014) when adjusted by Poisson regression for the age, child's skin color and family economic indicator. Moreover, the cortisol level also remained significant (p < 0.001) when adjusted by Poisson regression for the family economic indicator and caregivers educational level (data not shown).

DISCUSSION

Our findings showed that half of the children in the public schools included in our study were classified as BIF, and this outcome was associated with the economic disadvantage of the family. In addition, children with BIF had higher levels of stress and salivary cortisol.

BIF was more prevalent among children with non-white skin color, who had a caregiver with lower education and lower economic classification. In this sense, a meta-analysis study findings that maternal employment was associated with children's lower cognitive performance, and this result was attenuated by the inclusion of a number of variables that controlled for sample characteristics such as education, income, and race/ethnicity3. According to Fryer et al.11, the differences in children's environments between racial and/or vulnerable groups can explain gaps in intelligence. Also, it has been previously demonstrated that maternal education has positive impacts both on cognitive skills and behavioral problems of children6. This is perhaps because the caregiver's education can contribute to the quality of interaction, emotional and verbal involvement, and cognitive stimulation of the child6,12.

Our study also demonstrates that children with BIF had higher stress and cortisol levels than children with intellectual functioning expected for their age. This might be explained by the stress develops when the demands are higher than the individual's ability to overcome them, making it impossible to resist and create strategies to deal with the dysfunctional externalizing behavior13. In this sense, authors emphasize that with time, the strength of the relationship between cortisol reactivity and externalizing behavior should increase, as with repeated activation of the neuroendocrine system, a hypercortisolism response could become stronger14. Thus, a child with BIF who can flexibly respond physiologically to stress may be better regulated and socially competent. For instance, a study that examined the main effects of early adversity and cortisol reactivity on risk and adaptive outcomes in preschoolers shown the ability to manifest a moderate cortisol response to mild stress was associated with better self-regulation and executive functioning, ability to maintain positive, and supportive relationships with adults, including teachers14. These results are also found in a study using an animal model, which concluded that the group exposed to individual or combined environmental stressors may trigger endophenotypes related to higher cognitive impairment, as well as induces long-term complex behaviors that result in mixed phenotypes of mood disorders15.

The results of this study should be considered from some limitations. Only public schools were included, which may overestimate the prevalence of the outcome. Therefore, we suggest studies that allow the comparison between the intellectual functioning of children from public and private schools. Another limitation that should be considered when interpreting the results is its cross-sectional design, which makes it impossible to evaluate any causal relationship between the variables studied.

However, it was observed the BIF in a significant portion of the children of this study and the high predictive power in the social, behavioral, and cognitive future in the individual's life. The need to develop pedagogical programs in early grades with individual interventions is indicated, as education is an essential factor for development. In addition, it is understood that the family is a privileged place to engage in such programs, as it is a determining factor in human development. It is noteworthy that the findings presented here gain scientific credibility because they come from a representative sample of children and identify the high level of stress, both reported and biological.

Considering the high prevalence of BIF among students, it is relevant to point out that this study was conducted with a probabilistic sampling of children regularly enrolled in public schools in Brazil. The literature reveals that, despite the obvious daily problems, BIF is almost invisible in the field of research, so further studies are needed.

INDIVIDUAL CONTRIBUTIONS

S.M.T., V.L.M. design of the study, data interpretation, writing of article and approved the version to be published; F.P.M., J.P.O.; C.DW.; R.A.S.; L.D.M.S.; K.J. conception and design of the study, drafting the article and approval of the version to be published; A.N.R.; I.S.V.; J.C.B; M.R.G.Z.J. analysis and interpretation of data and drafting the article.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

REFERENCES

1. Ninivaggi F. Borderline intellectual functioning in children and adolescents: reexamining an underrecognized yet prevalent clinical comorbidity. Conn Med. 2001;65(1):7-11.
2. Emerson E, Einfeld S, Stancliffe RJ. The mental health of young children with intellectual disabilities or borderline intellectual functioning. Soc Psychiatry Psychiatr Epidemiol. 2010;45(5): 579-587.
3. Goldberg WA, Prause J, Lucas-Thompson R, Himsel A. Maternal employment and children's achievement in context: a meta-analysis of four decades of research. Psychol Bull. 2008;134(1): 77-108.
4. Brietzke E, Kauer-Sant'anna M, Jackowski A, et al. Impact of childhood stress on psychopathology. Braz J Psychiatry. 2012;34:480-488.
5. Ponzi D, Zilioli S, Mehta PH, Maslov A, Watson NV. Social network centrality and hormones: The interaction of testosterone and cortisol. Psychoneuroendocrinology. 2016;68:6-13.
6. Bach SdL, Molina ML, Amaral PLd, et al. Emotional and behavioral problems: a school-based study in southern Brazil. Trends Psychiatry Psychother. 2019;41:211-217.
7. Barros AJ, Victora CG. Indicador econômico para o Brasil baseado no censo demográfico de 2000. Rev de Saúde Pública. 2005;39:523-529.