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EDITORIAL

Social and biological determinants of growth and development in underprivileged societies☆,☆☆

Determinantes sociais e biológicos do crescimento e desenvolvimento em sociedades menos favorecidas

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The stimulating study by da Rocha Neves et al. (in this issue)[1] addresses the role of social and biological factors in growth and development of young children in a disadvantaged society. The authors assessed a group of 92 children, aged 24–36 months, who in 2011 attended the municipal early childhood education network in a town in the Vale do Jequitinhonha region. This region in the southeast of Brazil is considered economically underprivileged. The study was restricted to children with typical development, which meant that the children did not suffer from an evident congenital or acquired disability. Growth was assessed by means of standard anthropometrics, with a focus on height-for-age, a valid tool to assess childhood malnutrition.[2] Development was measured with the Bayley Scales of Infant and Toddler Development (BSITD-III),[3] the gold standard to measure developmental outcome at early age. The cognitive score and the expressive language scores were used as outcome parameters. Biological risk was assessed by a few perinatal factors, such as gestational age at birth, birth weight, pregnancy complications, and the number of prenatal consultations, and a few childhood parameters, including breastfeeding, the presence of chronic diseases, infectious diseases, and hospital admissions. The social environment was documented extensively, not only by means of parental level of education, the number of siblings, and the number of people in the household, but also with standardized questionnaires to assess (a) the economic situation (with the questionnaire of the Brazilian Association of Research Companies [Associação Brasileira de Empresas de Pesquisa]); (b) the quality of early childhood education (with the Infant/Toddler Environment Rating Scale – Revised); (c) the quality of the home environment (with the Home Observation for Measurement of the Environment (HOME) Inventory); and (d) the quality of the neighborhood (with a self-developed questionnaire including questions on accessibility and quality of services).

The results confirmed that the children had a socially disadvantaged background. This was reflected by the finding that about 90% of the fathers had not completed high school, and that approximately half of the children did not live with both parents. The large majority of children were born at term (94%), without signs of severe intrauterine growth restriction. Almost half of the children had had chronic and/or infectious diseases in the three months preceding the study.

Impaired growth, defined as height-for-age falling below two standard deviations of the norm, occurred in 15% of children. Multivariable analysis indicated that stunted growth was associated with birth weight and the number of prenatal consultations. None of the many social factors contributed to impaired growth. This suggests that early childhood growth is largely determined by the quality of prenatal life.

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The child's prenatal condition, in turn, is based on a complex interaction of biological and social factors, in which psychological and physiological stress during pregnancy, including infections and inadequate nutrition, play a role.[4] High levels of psychosocial stress are not only associated with a lower birthweight, but also with a lower number of antenatal consultations.[5]

Interestingly, the study by da Rocha Neves et al.[1] reported that none of the children were thin, whereas overweight occurred in 4.4% of children. Nowadays, not only is impaired growth related to disadvantaged social conditions; overweight is also associated with low parental education, large household size, and lower socioeconomic status.[6] In addition, increasing evidence suggests that both impaired growth in early life and childhood overweight put the child at increased risk for cardiovascular disease in adulthood.[7]

Almost 30% of the children had a cognitive impairment or language impairment – impairments defined as scores falling one standard deviation below the mean. In contrast to stunted growth, cognitive and language development were not associated with biological risk factors, but only with social ones. Cognitive development was associated with the HOME score; language development was associated with the HOME score and the quality of the neighborhood in terms of infrastructure, and interaction and trust. The data suggest that childhood cognitive and language development in disadvantaged communities are strongly dependent on environmental conditions, implying that improvement of these environmental conditions may promote child development. Indeed, the review of Komro et al.[8] indicated that strategies that aim at the enhancement of social cohesion and improvement of the physical environment are associated with better cognitive development and child health. However, whether specific early intervention programs that aim to teach parents how they best can stimulate their child's development – programs that are effective in infants at biological risk for cognitive impairment[9] – are also effective in promoting cognitive development in children from socially disadvantaged families is not clear.[10]

Does the absence of a contribution of biological factors to impaired cognitive outcome imply that biological factors do not play a role in developmental outcome of children in underprivileged societies? Presumably, that is not the correct conclusion. In the first place, da Rocha Neves et al. assessed only a few prenatal, perinatal, and neonatal factors. For instance, no data were available on maternal prepregnancy weight, maternal diseases, and maternal smoking during pregnancy, as well as perinatal asphyxia. These factors are known to have an adverse effect on long-term developmental outcome.[11,12] For example, term born infants prenatally exposed to maternal smoking on average have a 10-point reduction of their intelligence quotient (IQ) compared to peers who have not be exposed to maternal smoking prenatally.[13] Secondly, developmental outcome focused on cognitive and language development, and the outcome of the psychomotor developmental index of the BSITD-III was not reported. It is conceivable that motor development at 2–3 years of age did depend on early biological factors, such as birth weight and gestational age. Animal experiments[14] and early intervention studies[9] both indicate that motor development is more hardwired in the brain than cognitive development, implying that the former is more strongly determined by biology than the latter. Thirdly, da Rocha Neves et al. assessed developmental outcome at 2–3 years. At that age, only a part of cognitive functions have been developed. With increasing age and with increasing complexity of the nervous system, new cognitive functions develop. It is first with the appearance of a function that the impairment of that function can be diagnosed. This is the reason that most cognitive impairments and cognitive and behavioral disorders first emerge at school age.[15] It is conceivable that with increasing age, the contribution of early biological and social factors on cognitive outcome changes. At early age – as da Rocha Neves et al. reported – the influence of social factors may dominate. But it may be surmised that at school age the impact of early biological factors increases, in line with the developmental origin of health and disease hypothesis.[16,17] Increasing evidence suggests that prenatal and perinatal adversities may have a long lasting effect on development and heath.[16,18]

The study by da Rocha Neves et al. draws the attention to the need for improved antenatal and early childhood care in order to facilitate child health and development. The first step to be taken is to improve prenatal care, in which an adequate number of antenatal consultations plays a pivotal role. Not only is a low number of antenatal visits associated with stunted growth – as the study by da Rocha Neves et al. demonstrated – it is also a well-known risk factor of neonatal mortality and morbidity.[19] The World Health Organization (WHO) recommends at least four antenatal care visits, with the initial visit occurring during the first trimester, the second between 24 and 28 weeks of gestation, and the third and fourth at 32 and 36 weeks of gestation, respectively.[19] Factors that prevent women from receiving an adequate number of pregnancy consultations include poverty, lack of information, the distance to the antenatal care service, inadequate services, and cultural practices.[20] This means that the biology of early life is largely determined by socio-economic conditions. Not only prenatal care should be targeted to improve child growth and development; postnatal rearing conditions also have a strong impact on child development. As the study by da Rocha Neves et al. demonstrated, the child's cognitive development is largely dependent on the home environment, including the quality of caregiving, parental responsivity, and the presence of learning material.

The outcome of the study by da Rocha Neves et al. stresses the need for long-term follow-up of infants who grow up in economically disadvantaged situations. Only in this way will we understand how the complex interaction of biological and social adversities during early life impacts growth, health – including cardiovascular disease and obesity – and developmental outcome, including cognitive impairments and psychiatric morbidity. Only in this way will we know which type of social and health services during pregnancy and during childhood are needed to achieve optimal child health and development.

Conflicts of interest

The author declares no conflicts of interest.

References

1. da Rocha Neves K, de Souza Morais RL, Teixeira RA, Pinto PA. Growth and development and their environmental and biological determinants. J Pediatr (Rio J). 2016;92:241–50.
2. Restrepo-Méndez MC, Barros AJ, Black RE, Victora CG. Time trends in socio-economic inequalities in stunting prevalence: analyses of repeated national surveys. Public Health Nutr. 2015;18:2097–104.
3. Bayley N. Bayley Scales of Infant and Toddler Development: technical manual. 3rd ed. San Antonio: Harcourt Assessment; 2006.
4. Hodnett ED, Fredericks S, Weston J. Support during pregnancy for women at increased risk of low birthweight babies. Cochrane Database Syst Rev. 2010:CD000198.
5. Brown SJ, Yelland JS, Sutherland GA, Baghurst PA, Robinson JS. Stressful life events, social health issues and low birthweight in an Australian population-based birth cohort: challenges and opportunities in antenatal care. BMC Public Health. 2011;11:196.
6. Keino S, Plasqui G, Ettyang G, van den Borne B. Determinants of stunting and overweight among young children and adolescents in sub-Saharan Africa. Food Nutr Bull. 2014;35:167–78.
7. Robinson SM, Barker DJ. Coronary heart disease: a disorder of growth. Proc Nutr Soc. 2002;61:537–42.
8. Komro KA, Tobler AL, Delisle AL, O'Mara RJ, Wagenaar AC. Beyond the clinic: improving child health through evidence-based community development. BMC Pediatr. 2013;13:172.
9. Spittle A, Orton J, Anderson PJ, Boyd R, Doyle LW. Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants. Cochrane Database Syst Rev. 2015;11:CD005495.
10. Miller S, Maguire LK, Macdonald G. Home-based child development interventions for preschool children from socially disadvantaged families. Cochrane Database Syst Rev. 2011:CD008131.
11. Ergaz Z, Ornoy A. Perinatal and early postnatal factors underlying developmental delay and disabilities. Dev Disabil Res Rev. 2011;17:59–70.
12. Kerac M, Postels DG, Mallewa M, Alusine Jalloh A, Voskuijl WP, Groce N, et al. The interaction of malnutrition and neurologic disability in Africa. Semin Pediatr Neurol. 2014;21:42–9.
13. de Jong C, Kikkert HK, Fidler V, Hadders-Algra M. Effects of long-chain polyunsaturated fatty acid supplementation of infant formula on cognition and behaviour at 9 years of age. Dev Med Child Neurol. 2012;54:1102–8.
14. Kolb B, Mychasiuk R, Williams P, Gibb R. Brain plasticity and recovery from early cortical injury. Dev Med Child Neurol. 2011;53:4–8.
15. Hadders-Algra M. General movements: a window for early identification of children at high risk for developmental disorders. J Pediatr. 2004;145:S12–8.
16. Räikkönen K, Pesonen AK. Early life origins of psychological development and mental health. Scand J Psychol. 2009;50:583–91.
17. Hadders-Algra M. Two distinct forms of minor neurological dysfunction: perspectives emerging from a review of data of the Groningen Perinatal Project. Dev Med Child Neurol. 2002;44:561–71.
18. Whitaker AH, Feldman JF, Lorenz JM, Shen S, McNicholas F, Nieto M, et al. Motor and cognitive outcomes in nondisabled low-birthweight adolescents: early determinants. Arch Pediatr Adolesc Med. 2006;160:1040–6.
19. Mbuagbaw L, Medley N, Darzi AJ, Richardson M, Habiba Garga K, Ongolo-Zogo P. Health system and community level interventions for improving antenatal care coverage and health outcomes. Cochrane Database Syst Rev. 2015;12:CD010994.
20. World Health Organization (WHO). Maternal mortality. Factsheet 348. Available from: http://www.who.int/mediacentre/factsheets/fs348/en/ [accessed 13.12.15].