Journal of Physical Education and Sport ® (JPES), 18(3), Art 218, pp. 1478 - 1487, 2018
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Motor and school performance, self-perception of competence and nutritional status of children across ages: the role of social vulnerability on child development

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Published online: September 30, 2018
(Accepted for publication July 19, 2018)
DOI:10.7752/jpes.2018.03218

Abstract:
Introduction: children in situations of risk or social vulnerability several times fail to meet the expected developmental milestone. Objective: To investigate fundamental motor skills and school performance, the self-perceptions of competence, and the nutritional status of children at different ages living in social vulnerability in Brazil. Method: 211 children, both gender (87 girls, 41%), 7 to 10-years-old living in social vulnerability in Ceará, Brazil, participated in this crosss-sectional study. Children were assessed using the Test of Gross Motor Development-2 for the fundamental motor skills; Test of School Performance for reading, writing, and arithmetics; Self Perception Profile for Children for the self perceptions of competence; and, the Body Mass Index, subscapular and triciptal skinfold for the nutritional status. Results: The MANOVA showed: (1) an age-effect for jump (9 and 10 year-old), slide (7 years-old in relation to all other ages), catch (7 and 10 year-old), and roll a ball (7 years in relation to 8 and 10-year-old); (2) age-effect for School Performance, 7 year-old-children demonstrated lower performance in writing compared to 9 and 10 year-old-children, and arithmetics, reading, and overall school performance compared to all other ages; (3) no age-effect for self-perception of compentece and Body Mass Index. Conclusion: the results suggest stabilization and delays in the motor and school performance; stabilization at moderatelevels in perceived competence and higher prevalence of low weight for the young children. Childrens development seems to be negative affected by socialeconomic restrictions and public services such as compensatory interventions should be implemented for children in vulnerability.
Keywords*:* self-concept, motor performance, vulnerability, children.

Introduction

The difficulty of access to basic services such as education programs, health care, leisure spaces, socialization in diferent cultural context and the lack of opportunities of diversified practices are some of the factors that characterize a situation of risk or social vulnerability (Abramovay, Castro, Lima and Martinelli, 2002). Vulnerability negatively affects quality of life and exposes children to risks of delays in many aspects of development, such as in the physical growth and nutritional status (Niehues et al. 2014). Furthermore the vulnerability lead to delays in motor skills (Goodway, Robinson and Crowe 2010; Valentini et al. 2016; Valentini, Clark and Whitall 2015), deficits in psychosocial development (Nobre et al. 2015; Yeung, Craven and Kaur, 2014), and fragile academic achivements (Brancalhone, Fogo and Williams 2004).

Vulnerable children are often living in contexts with limited physical space to explore, limited equipament for play, and lack opportunities for adequate motor instruction motor and sports practice (Valentini, Clark and Whitall 2015). These inadequate environments for the practice of motor skills, with few opportunities for appropriate learning experiences and efficient instruction, in general fail to foster gains in motor proficiency, consequently causing motor delays (Logan et al. 2012;; Valentini et al. 2016) or plateau in motor development (Spessato et al. 2013). In addition, considering that lower competence in fundamental motor skills is associated with decreased physical fitness, increased sedentary lifestyle, and less involvement of children in sports (Barnett et al. 2008) concerns in respect to the global development of children in situations of vulnerability must be raised in order toprovided better care.

Other important repercussion resulting from the situation of vulnerability is the negative influence on children's academic achivements (Alves and Soares 2009). Vulnerable children often show inferior performance in school tasks, with high grades' failure rates and consequent stay back their age groups and sometimes schools' interruptions (Alves and Soares 2013; Osti and Brenelli 2013; Osti and Martinelli 2013; Tavares Jr, Valle, and Maciel 2015). This is a multifactorial effect, due in part to the lack of family support, limited access to socio-cultural resources and oportutinites in different contexts, lack of extra-curricular programs, as well as inadequate

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functioning and infrastructure of the schools (Tavares Jr et al. 2015). Although, the negative possible impact has been addressed, in fact the mensure of children schools' outcomes is yet very limited in the literature. Monitoring of children achievement at schools, the extended contribution of the present research, is critical to prevent or minimize the damages of constant failure and school drop out of these children.

Psychosocial aspects of development should also be monitored since the condition of vulnerability can also affect the self-concept and the perceptions of competences of these children (Nobre et al. 2015). Across childhood, children use diversified parameters and sources of information (parents, peers, teachers) for the foundation of self-concept; by reinforcing positive perceptions of children competences children overall self-worth and self-concept is strengthening (Harter, 1988, 1990, 2012b). However, childrens' perceptions need to be increases as consequence of became more competent, the misalignement of children actual competence and the perceptions prevent children to implement strategis to improve (Valentini, 2002). Furthermore, if inadequate parameters are provided, children can internalize negative attributes about themselves and thus develop restrictive beliefs about their own achievements generating feelings of disability and inferiority that may increase as the age advances.

Vulnerability may also expose children to inadequate nutrition (Chung et al. 2016), and in the last decate studies in several countries have reported significant percentages of overweight and obesity in children of various age groups situated in low socioeconomic status (Niehues et al., 2014; Ogden et al., 2016). In Brazil, the prevalence of overweight and high obesity has also been observed in all regions of the country for children in general (Aiello et al. 2015; Bloch et al. 2016; Flores et al. 2013; Niehues et al. 2014). However, little is known until now about the nutritional status of children in situations of vulnerability. Constant monitoring of nutritional status, through indicators such as body mass, height, and body mass index by age, is an important strategy to avoid the health implications for those children. Deficits in cognitive and neuromotor development, delay in physical growth and biological maturation, and the occurrence of chronic degenerative diseases (Chung et al. 2016) are some of these implications, which could be controlled by monitoring these indicators.

Understanding that the situation of social vulnerability exposes children to factors that negatively affect their development, it is important to identify who these children are and how this process impact children across infancy. The results on these investigations may subsidize public policies for the implementation of assistance programs for these children. Thsus, the aim of this study is to investigate fundamental motor skills, school performance, the self-perceptions of competence, and the nutritional status of children at different ages living in social vulnerability in Brazil.

Material & methods

Participants

Participated in this crosss-sectional study, 211 children, both gender (124 boys and 87 girls), 7 to 10-year-old (7-year-old: n = 44; 8-year-old: n = 66; 9-year-old: n = 79; 10-year-old: n = 22) randomly selected from public schools in Ceará, Brazil. The study included only children who: (1) were regularly enrolled and attending public schools (75% of school attendance); (2) were from families in situation of social vulnerability, living in cities with low levels of municipal level of development, in neighborhoods with high levels of violence, with limited access to public institutions and services, little availability of leisure spaces according to the Ceará Institute of Economic Research and Strategy (IPECE) (2012); (3) living in poverty (per capita household income of households of less than one minimum wage); (4) being attended by government social economic-aid programs; (5) having parents or legal guardians with low schooling.

Context

The municipalities involved presented low human development indexes (montain: 0.648, coast: 0.620, semiarid: 0.659) and were among the lowest in the country. This index considers agricultural production, energy consumption, gross domestic product, average formal employment income, public services, paving, schooling, infant mortality and medical care (Institute of Research and Economic Strategy of Ceará, 2012). Two municipalities are located geographically in the northwest mesoregion, mountain and coast, and one in the semiarid mesoregion of the state of Ceará, in northeastern Brazil. The populations of these municipalities are 31.787 (mountain), 60.158 (coast) and 80.604 (semiarid) inhabitants. The municipalities show a high incidence of poverty, percentages of % 16.6 (mountain), 28.5% (coast) and 20.8% (semiarid) among the respective populations of the municipalities. The development index of basic education (IDEB) showed values of 3.9, 4 and 4.9; values considered low. This scale ranges from 0 to 10 points and considers students' achievement and approval rate (Ministry of Education, 2015). The level of education, observed by the declared schooling of people over 15 years (Ministry of Education, 2010), showed high percentages of the population of the three municipalities. Percentages between 39.4% (montaian), 43.7% (coast) and 49.8% (semiarid) of the population of these municipalities showed education with incomplete elementary school.

In general, the three municipalities presented lack of public spaces for leisure activities. In the neighborhoods where the children participating in the study resided, the few sports courts available were in poorly conserved and therefore unsuitable for practice. The physical structure of schools offered few

opportunities for motor practices as well. The few spaces available had low usage conditions, in general small physical spaces ground-dirty floor. In all the schools, classroom teachers administered physical education lessons; state law did not require physical education professionals for elementary grades. Motor practices were held once a week in 50-minute sessions. The activities developed were free games, predominantly soccer for boys and adapted handball for girls.

Instruments

The *Test of Gross Motor Development, second edition* - TGMD-2 (Urich, 2000) validated for the Brazilian children (Valentini, 2012) was used to evaluate performance in locomotor skills (run, jump, gallop, hop, slide, leap) and object control (strike, bounce, throw, roll a ball, kick and catch). The TGMD-2 for Brazilian children showed high evidences of construct validity (clarity: $\alpha = 0.93$ and pertinence: $\alpha = 0.91$); moderate to strong, positive and significant correlations for the motor skills and criterias ($r = 0.51$ to 92, $p < 0.001$); appropriate confirmatory factorial indexes (Root Mean Square Error of Approximation = 0.06; Comparative Fit Index = 0.88; Tucker-Lewis Index =0.83; Normed Fit Index = 0.09; Goodness-of-Fit Index = 0.98; Adjusted Goodness-of-Fit Index = 0.95).

The School Performance Test (SPT) was used to asssess school performance (Stein, 1994). The SPT was desing to assesss children, from second to seven grades from elementary school, performance in writing, reading and aritmetics. The instrument presents an organization of items considering a progressive order of difficulty, regardless of the school year of the child. Performance is calculated by the sum of the raw score of each dimension and for the SPT total raw score (Knijnik, Giacomoni, & Stein, 2013, Stein, 1994). This SPT is adequate for the conditions and characteristics of the Brazilian school system and it is widely used in research in the country (Cia and Barham 2008; Knijnik et al. 2013).

The Self-Perception Profile for Children - SPPC (Harter, 1982, 2012) validated for Brazilian population (Valentini et al. 2010) was used to assess children children self-percepctions of competence (SPC) in for school, athletics, physical appearance, social acceptance, behavioral conduct, and global selfworth. The instrument is composed of 36 questions (6 for each dimension), with alternative Likert responses of 1 to 4 points. The Brazilian version presented coefficients of content validity within acceptable values: clarity, $k = 0.68$ to 0.91 and pertinence, $k = 0.86$ to 0.89 for the six dimensions and for the total scale score, satisfactory indexes in confirmatory factor analysis ($x^2/gl = 4.33$; Non-Normed Fit Index = 0.96; Comparative Fit Index = 0.97 e Tucker e Lewi's Index of Fit = 0.96).

A digital scale and a portable stadiometer were used to measure the body mass and height of the children. Body Mass Index (BMI) was calculated. The skin folds of the triceps and subpecapular were measured with a Sanny® brand adipometer.

Procedures

The ethics committee of the university of origin approved the present research (protocol number: 19861). For the implementation of the study, contacts were conducted with the education' boards in the three municipalities. The board of education of each city provided a list of schools located in extremely poor neighborhoods, considering precarious basic sanitation, areas of risk and precarious public safety with low-income families. Ten schools were randomly selected and agree to participate in the study. One of the researchers vitsited all the schools to explain the project for shill administrators, to verify the physical conditions of the schools considering the minimum physical space required to conduct the assessment, management support, and acceptance of the school and community in general to participate. School administrators and the parents of the children were informed about the procedures to be adopted in the assessment as well as the benefits for the children involved in the study. Only the children whose families signed the free and informed consent form participated in the study.

The motor performance was evaluated in spaces of motor practices provided by the schools. The evaluations of the TGDM-2 were conducted with two children alternately. The duration of the test was, on average, 20 minutes for each child. Trained assessors with at three one year of experience administered the test. The raw scores of each motor skill and the categorization of performance were used.

The SPT was administered by the researchers and by three pedagogy trainees. Following the recommendation of the author of the test, the writing subtest was the first administered and was conducted collectively. The approximate duration was 10 minutes. The reading and arithmetic sub tests were applied individually, and the approximate application time was 20 to 25 minutes. The raw scores of each subtest and the classification of school performance were obtained (Stein, 1994). The self-perceptions of competence of the children were assessed individually with an average time of 20 minutes and counducted in quiet rooms. The sum of the scores of the questions in each dimension of the scale comprised the total score, which was transformed into a standardized "z score" for the perceived competence' categorization. "Z" scores ranging from -1 to +1 were establish as "moderate" perceived competence. Values smaller than -1 and greater than +1 were considered with "low" and "high" perceived competence respectively. Trained assessors with more than three years of experience applied the two instruments.

Anthropometric variables (body mass, stature and skinfolds) were measured in closed spaces. A professional with more than 15 years of experience performed the antrometric evaluations of all children. Each anthropometric test and measurement was performed on different days and times which were scheduled according to the availability of the children and the school. The recommendations for anthropometric measurements suggested by Gordon, Chumlea and Roche (1991) were adopted. Body mass index (BMI) was calculated and the results were analyzed using the gross score (kg/m²) and Center Disease Control standards (Kuczmarski et al. 2010).

Statistical Analysis

The mean, standard deviation, confidence interval (CI95%), frequency and relative percentage were used in the description of the results. *One-way* multivariate analise of variance (MANOVA) was used to verify possible effects of age on the locomotor and object control motor skills; school performance (writing, reading and arithmetic); the dimensions of self-perception of competence (school competence, motor skills, social competence, physical appearance, behavioral conduct and global selfworht), and on nutritional status indicators (body mass, height, BMI, skinfolds). The multivariate normality was evaluated by the asymmetry (sk) and kurtosis (ku) uni and multivariate coefficients considering values greater than 3 for sk and greater than 7 for ku as a severe violation to the normal distribution (Maroco, 2014a). The assumption of variance-covariance homogeneity was evaluated by the Box M test. The Wilks' Lambda criterion was used as the test statistic. The *Bonferroni* multiple-comparison test was used to verify possible differences when main or interaction effects were identified. The effect size was evaluated by the partial square test (η^2_ρ) adopting values smaller than 0.05 as small effect, between 0.06 and 0.25 as a moderate effect, between 0.26 and 0.50 as high and greater than 0.50 as a very high effect (Cohen, 1988; Maroco, 2014b). The probability of error type I (a) of 0.05 was considered in all analysis.

Results

Fundamental motor skills

Table 1 shows the means and confidence interval of the motor parameters of children according to age. The MANOVA showed a significant effect of age on children's locomotor performance ($\Lambda = 0.81$, $F(18, 572) = 2.50$, $p = 0.001$, $\eta^2_\rho = 0.07$). There were significant differences between the ages for jump ($F(3, 211) = 3.31$, $p = .021$, $\eta^2_\rho = 0.05$) and slide ($F(3, 211) = 8.93$, $p < 0.001$, $\eta^2_\rho = 0.11$). The *Bonferroni* test showed that 10-year-old children performed lower than 9-year-old children ($p = .016$) in the jump. On the slide, 7-year-old children showed lower performance when compared to 8-year-old ($p = .004$), 9-year-old ($p < .001$), and 10-year-old ($p < .001$) children.

Regarding object control skills, the MANOVA showed significant effect of age on children's performance ($\Lambda=0.86$, $F(18, 572) = 1.69$, $p = 0.036$ $\eta^2_\rho = 0.05$). Significant differences between ages were observed for catch ($F(3, 211) = 2.80$, $p = 0.041$, $\eta^2_\rho= 0.04$) and roll a ball ($F (3, 211) = 3.85$, $p = 0.010$, $\eta^2_\rho = 0.053$). The *Bonferroni* test showed superior performance of 10-year-old children compared to 7-year-old children ($p = 0.033$) in catch. In roll a ball, 7-year-old children performed significantly lower than those at 8-year-old ($p = 0.023$) and 10-year-old ($p = 0.028$).

Table 1. Mean, standard deviation and confidence interval of motor skills of children by age.

Dimensions	Age M(SD), [CI95%]			
	7-year-old	8-year-old	9-year-old	10-year-old
Locomotor				
Run	5.6(1.1), [5.2; 5.9]	5.3(1.2), [5.0; 5.6]	5.6(1.2), [5.3; 5.9]	5.4(0.9), [5.0; 5.8]
Gallop	3.4(2.0), [2.8; 4.0]	3.9(1.9), [3.4; 4.4]	4.1(1.8), [3.7; 4.5]	3.4(1.4), [2.5; 4.3]
Hop	3.8(1.3), [3.4; 4.2]	4.0(1.8), [3.5; 4.6]	4.3(1.6), [3.9; 4.6]	4.0(1.8), [3.2; 4.8]
Leap	3.6(1.1), [3.2; 3.9]	3.3(1.0), [3.0; 3.6]	3.4(1.1), [3.1; 3.6]	3.1(1.2), [2.6; 3.7]
Jump	3.0(1.4), [2.6; 3.4]	3.2(1.1), [2.8; 3.7]	3.5(1.3), [3.1; 3.9]	2.3(1.4), [1.4; 3.0]
Slide	3.0(2.0), [2.4; 3.5]	4.1(1.2), [3.6; 4.6]	4.5(1.2), [4.1; 4.8]	4.8(1.4), [4.2; 5.5]
Object Control				
Strike	5.1(1.8), [4.6; 5.7]	4.8(1.2), [4.5; 5.2]	5.0(1.6), [4.7; 5.5]	5.2(1.7), [4.5; 6.0]
Bounce	2.8(1.2), [2.0; 3.5]	3.5(2.1), [2.9; 4.1]	3.6(1.5), [3.2; 4.1]	3.5(1.5), [3.4; 4.3]
Catch	3.8(1.2), [3.4; 4.3]	4.2(1.2), [3.9; 4.5]	4.3(1.2), [4.0; 4.6]	4.8(2.0), [4.3; 5.4]
Kick	5.5(1.6), [5.0; 6.0]	5.3(1.5), [4.9; 5.7]	5.0(1.7), [4.6; 5.4]	5.3(1.2), [4.5; 6.0]
Throw	3.9(1.8), [3.3; 4.5]	3.6(1.2), [3.2; 4.1]	3.8(1.6), [3.4; 4.3]	3.7(1.3), [2.7; 4.6]
Roll a ball	2.9(1.1), [2.4; 3.4]	3.9(1.3)[3.4; 4.2]	3.5(1.2), [3.2; 3.9]	4.1(1.7), [3.2; 5.1]

Note: [1,2,3,4] – Statistically significant differences in motor ability between ages.

School Performance

Table 2 shows the means and confidence interval of school performance according to the age of the children. MANOVA showed significant effect of age ($\Lambda = 0.76$, $F(12, 211) = 4.99$, $p < 0.001$, $\eta^2_\rho = 0.09$) in children's school performance. There were significant differences between the ages in writing ($F(3, 211) = 8.92$ $p < .001$, $\eta^2_\rho = 0.11$), arithmetic ($F(3, 211) = 11.148$, $p < 0.001$, $\eta^2 = .14$), reading ($F(3,211) = 8.96$, $p < 0.001$, $\eta^2 = .11$) performances, and in overall school performance ($F(3, 211) = 11.17$, $p < 0.001$, $\eta^2_\rho = 0.14$). *Bonferroni's* multiple comparisons did not show differences between 8, 9 and 10-year-old in reading, arithmetic, writing, and overall school performance (p-values between 0.321 and 0.881). The *Bonferroni* test showed that in writing the 7-year-old children presented inferior performance compared to 9-year-old ($p < 0.001$), and 10-year-old ($p = 0.001$). In arithmetic, 7-year-old performed significantly lower than 8-year-old children ($p = 0.005$), 9-year-old ($p < 0.001$), and 10-year-old ($p < 0.001$) children. Similar trend was observed in reading ($p < 0.001$, $p < 0.001$, $p = 0.008$, respectively) and in overall school performance ($p < 0.001$, $p < 0.001$, $p = 0.002$, respectively) where the 7-year-old children showed inferior performance in relation to the other ages.

Table 2. Mean, standard deviation and confidence interval in school performance of children by age.

School Performance	Age M(SD), [CI95%]			
	7-year-old	8-year-old	9-year-old	10-year-old
Writing	7.8(3.2), [5.8; 9.9]	12.9(3.4), [10.4; 15.3]	16.8(3.5), [14.4; 19.2]	17.6(8.0), [12.3; 23.0]
Arithmetic	3.9(1.1), [3.0; 4.8]	7.7(3.1), [6.7; 8.7]	9.8(4.1), [8.0; 11.5]	10.3(5.1), [7.9; 12.6]
Reading	26.4(6.3), [19.3; 33.5]	45.3(5.3), [39.9; 50.6]	48.6(5.2), [43.1; 54.0]	46.5(12.8), [34.4; 58.6]
Overall SP	38.2(10.1), [28.6; 47.8]	66.7(8.1), [58.6; 74.8]	74.3(8.5), [66.3; 82.3]	74.1(15.4), [55.6; 92.6]

Note: SP – School Performance

Self-perception of Competence

The MANOVA did not show significant effect of age on children's self-perception of competence ($\Lambda = 0.899$, $F(12, 211) = 1.27$, $p = .26$, $\eta^2_\rho = .03$). Table 3 shows the means, standard deviations and confidence intervals of the dimensions of self-perception of competence assessed according to the children's age.

Table 3. Mean, standard deviation and confidence interval of the psychosocial parameters (self-perception of competence) of children by age.

Self-perception	Age M(SD), [CI95%]			
	7-year-old	8-year-old	9-year-old	10-year-old
School	16.1(3.1), [15.1; 17.0]	15.9(4.1), [15.0; 17.0]	16.0(2.9), [15.3; 16.6]	15.6(3.0), [14.2; 16.9]
Athletic	14.4(3.0), [13.3; 15.3]	14.7(3.2), [13.9; 15.5]	14.6(2.7), [13.9; 15.2]	14.9(0.7), [14.5; 15.2]
Social	16.4(3.3), [15.5; 17.3]	15.2(3.4), [14.3; 16.0]	15.8(3.0), [15.1; 16.5]	16.1(3,1), [14.7; 17.4]
Behavioral	15.7(2.4), [14.9; 16.4]	15.9(2.6), [15.3; 16.6]	15.9(2.2), [15.4; 16.4]	15.6(2.1), [14.7; 16.6]
Physical	17.0(3.1), [16.0; 17.9]	14.9(3.4), [14.1; 15.7]	16.6(3.4), [15.7; 17.3]	16.0(2.9), [14.7; 17.3]
Selfworth	17.4(2.5), [16.6; 18.1]	17.0(3.6), [16.1; 17.4]	17.6(2.4), [17; 18.1]	17.6(2.8), [16.3; 18.8]

Nutritional Status

The MANOVA showed a significant effect of age on the anthropometric indicators (body mass, stature, BMI, subscapular and tricipital folds) of the nutritional status ($\Lambda = 0.06$, $F(15, 561) = 65.65$, $p < 0.001$, $\eta^2 = 0.61$). There were significant differences between the ages in all indicators investigated: height ($F(3, 211) = 281.91$, $p < 0.001$, $\eta^2 = 0.80$); body mass ($F(3, 211) = 201.23$, $p < 0.001$, $\eta^2_\rho = 0.74$); BMI ($F(3, 211) = 49.497$, $p < 0.001$, $\eta^2_\rho = 0.42$); Subscapular skinfold ($F(3, 211) = 7.25$, $p < 0.001$, $\eta^2_\rho = 0.09$); Tricipital skinfold ($F(3,211) = 23.31$, $p < 0.001$ $\eta^2_\rho = 0.25$). The *Bonferroni* test showed a significant increase in height (p values between 0.001 and < 0.001) and in body mass (p values between 0.035 and < 0.001) over the ages. Except for children aged 8 and 10-year-old ($p = 1.00$), there were significant differences in BMI between the ages ($p < 0.001$). Compared to older children, 7-year-old had significantly lower mean triceps skinfold ($p < 0.001$) and

subscapular (p values between 0.002 and 0.001). Table 4 shows the means and confidence interval of motor parameters of children according to age.

Linear by linear association test showed a significant association ($X^2(1) = 9.41$, $p = 0.002$) between the nutritional status and the age of the children. A high percentage (25%) of 7-year-old children with low weight were observed. However, most showed that BMI was considered healthy.

Table 4. Mean, standard deviation and description of physical parameters and nutritional status of children according to age.

Anthropometric variables	Age M(SD), [CI95%]			
	7-year-old	8-year-old	9-year-old	10-year-old
Height (m)	122.0(2.3), [121.3; 122.7]	126.9(1.3), [126.3; 127.3]	133.4(3.1), [132.7; 143.1]	136.6(2.8) [135.3; 137.9]
Body mass (kg)	21.6(1.5), [21.1; 22.1]	27.1(1.3), [26.7; 27.4]	27.8(1.8), [27.4; 28.3]	31.1(2.1), [30.2; 32.0]
BMI (kg/m²)	14.5(1.2), [14.1; 14.9]	16.8(0.8), [16.6; 17.0]	15.6(0.9), [15.4; 15.8]	16.7(1.0), [16.2; 17.1]
Subscapular (mm)	5.3(1.1), [4.7; 5.8]	9.0(3.4), [7.4; 10.5]	8.6(3.3), [7.8; 9.5]	10.3(4.3), [7.4; 13.1]
Triceps (mm)	5.4(1.8), [5.2; 5.8]	10.0(3.3), [9.0; 11.0]	10.0(3.1), [9.2; 10.6]	11.2(4.3), [8.8; 13.5]
Nutritional Categorization	25.0% low weight 75.0% healthy weight	92.4% healthy weight 7.6% overweight	2.5% low weight 97.5% healthy weight	100% healthy weight

Note: BMI - body mass index

Discussion

The objective of the present study was to investigate the fundamental motor skills, school performances, self-perceptions of competence, and the nutritional status of children in social vulnerability according to age.

Fundamental motor skills

The analysis showed a plateau in the performance of most locomotor and object control skills between 7 and 10 years of age. Differences were restricted to jump and slide skills with a small superiority of the older children (9 and10 year-old). In the control of objects similar tendency was observed with differences in catch and roll a ball. These results are in line with previous studies in Brazil, which have reported a tendency to stabilization of performance in fundamental motor skills between six and eight years of age (Nobre et al. 2016; Nobre, Coutinho and Valentini 2014; Valentini et al. 2016). As exemple, a recent study involving 2,377 low-socioeconomic status' children, ages 3 to 10, from different Brazilian states and with significant increase in most skills up to 6 years of age, with a performance plateau starting at 7-year-old for locomotor skills (hop, slide, leap for 6-year-old children and gallop for 6-year-old children) (Valentini et al. 2016). In the jump, the plateau was observed at 7 years of age and again an increase among the older children (9 and 10 years). Furthermore, in all object-control skills, the authors reported stabilization at 7 to 8 years of age (Valentini et al. 2016). In the present study, this plateau occurs for most motor skills from 7 to 10 years of age.

Furthermore, regardless of age, most of the children in this study showed poor proficiency in motor skills. These results may be related to the socioeconomic disadvantages observed and the vulnerability situation in which these children live. Poor educational background and social and family frailty resulting in lack of opportunities for motor skills learning and development for children living in poverty (Valentini et al. 2015). This tendency of low performance and delays in socioeconomically disadvantaged children (Booth et al. 1999; Cohen et al. 2014; Goodway et al., 2010; Valentini et al. 2012) has been reported previously. The children participating in the present study, as well as the characteristic of most Brazilian children with low socioeconomic status, attend schools with crowded classrooms, with poor physical structures and limited or nonexistent equipaments for motor and sports practice, with little or no efficient guidance, and reside in homes and neighborhoods also with limited physical and internal spaces, with few conditions to practice motor activities. These combined factors ultimately lead to other tasks within their homes and the few motor experiences in which they are involved are not sufficient to increase children's motor skills.

School Performance

Most children investigated presented inferior performance in reading, writing, arithmetic and overall test of school performance. The results evidenced a plateau in the school performance of children from 8 years of age. Aligned with these results, studies have shown that Brazilian children at risk or social vulnerability show poor performance at schools in all age groups (Alves and Soares 2013; Silva and Santos 2015). The Brazilian index evaluating the development of basic education is lower in schools with students with low socioeconomic levels and in situations of social vulnerability (Alves and Soares 2013), a reality observed in the present study.

The situation of vulnerability reflects an inadequate economic, cultural and social condition that has shown a negative influence on the development and schooling of children who are in this situation. The organization and structure of the family, such as the parents' low level of schooling, also observed in the present study, the attitudes regarding children's schooling and the child's need to contribute to the family's income, combined with the few resources and opportunities, added to the lack of governmental institutions in these neighborhoods, help explain this picture of low school performance (Alves and Soares 2013).

Still, the deficiency of the school structure also explains the low performance and the failure in the school trajectory observed in these children. Little physical infrastructure and irregular functioning of schools; lack of basic sanitation, didactic material, electronic equipment, physical spaces and ressources such as libraries, laboratories, appropriate structures for the practice of sports and leisure, violence inside and outside the school, are factors indicative of the vulnerability of these schools. In addition to this, the teacher career gap, the academic climate, and the lack of educational projects in the after-school hours are some of the aspects that also contribute to the low performance of Brazilian children in public schools (Alves and Franco 2008; Alves and Soares 2013), which was observed in the present study.

Self-perception of Competence

In this study, the analysis did not show a significant effect of age on the dimensions of the self-perception of competence and the overall self-value of the children. Yet regardless of age, most children reported moderate perceived competence. According to previous studies (Nobre et al. 2015; Valentini 2002), the observed results suggest that the children of the present study overestimate their competences. While poor motor and school performance is observed in most of these children, moderate perceptions of competence imply lack of evaluation parameters. Although it is expected that as children progress in their cognitive, social, and motor development, they tend to be more aware of their abilities, especially in the school period, and tend to present more realistic perceptions, and therefore lower perceptions compared to the previous evaluations (Harter, 1988, 1990, 2012b), this trend was not observed in the present study.

It is worth noting that between 8 and 10 years of age children describe their competences by comparing them with the characteristics of others (Harter 2012b), and the opinion and values of external agents (parents, peers, neighbors, teachers) are internalized and play a role in guiding children to construct a positive self-concept (Harter 1988, 2012b; Renick and Harter 1989). Considering that the children of the present study use their peers as their parameters for self-evaluation and the judgment of their parents and teachers in the face of an environment in which everyone has difficulties, it seems logical to be self-perceived as moderately competent. However, without adequate parameters, these children may believe that they do not have the potential to be more competent and feel inferior and incapable and/or they do not realize the need to become more motor and school competent. Intervention programs should be implemented to reinforce the motor and school competence of these children by assisting them in the realistic and positive construction of self-perception for the simple strategy of helping these children to become more competent.

Nutritional Status

The results, as expected, showed a significant effect of age on anthropometric indicators of nutritional status (Kuczmarski et al. 2010). There was a tendency for linear increase in height as a function of age. These results initially suggest a harmonious growth, since gain in height was accompanied by gains in body mass (Malina, Bouchard and Bar-Or 2004) and evidenced that children in vulnerability showed BMI considered healthy at most ages. Research on the dynamics of growth and nutritional status of children has shown divergent results to those of the present study (Javed et al. 2015; Ng et al. 2014; Ogden et al. 2016; Ogden et al. 2012; Rivera et al. 2014; Savva et al. 2013), evidencing a high prevalence of risk of obesity and obesity in children, regardless of age. Researches involving Brazilian children also confirmed this trend (Aiello et al. 2015; Bloch et al. 2016; Flores et al. 2013; Niehues et al. 2014). However, in the present study, only 7% of the children were overweight, while a high percentage of seven-year-old children presented low weight for age.

Inadequate food intake may explain the high percentage of children with less than seven years of age who are underweight. Low weight has been recognized as an important parameter to detect deficiency or imbalance of energy intake, which alters metabolism and negatively interferes with body functioning (Norman et al. 2008). In children, the low weight is related to recurrence of infectious diseases, delays in neurodevelopment, decreased school performance (United Nations Administrative Committee on Coordination, 2000) and affect bone growth and sexual maturation of children (Malina et al. 2004). Therefore, constant evaluation of nutritional status may be a necessary strategy to avoid or minimize the health losses due to overweight and low body weight observed and to prevent undesirable conditions, considering the vulnerability of these children (Abramovay et al. 2002; Fonseca et al. 2013)

Conclusion

The results of the present study suggest low levels of motor and school performance with a plateau in the performance of basic motor skills of locomotion and control of objects and in the reading, arithmetic and writing performance of children in situations of social vulnerability between 8 and 10 years old. Moreover,

unrealistic expressions of their competencies were detected. A high percentage of 7-year-old children showed low weight for their respective age, which is worrying since it adds up to the other vulnerabilities detected.

These children, their families, and schools are in unfavorable situations that affect overall development. Inadequate housing conditions, structural and functional limitations to motor and school practices, low socioeconomic status, and difficulties in the functioning of schools can explain these results. The implementation of intervention strategies is vital to assist children in situations of vulnerability or, at least, to minimize the developmental losses observed in this public.

Limitations

Monitoring of in-school and out-of-school activities, routines of daily living and evaluation of children's and families' eating habits have not been performed and are assumed as limitations in the present research.

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