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Influence of school ambience on the nutritional status of preschoolers of Macaé, Rio de Janeiro, Brazil

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Abstract *This study evaluated school ambience and the nutritional status of preschoolers in the Macaé city public system. This is a cross-sectional study with secondary anthropometric data collected between 2012 and 2014. In all, 962 children, aged 2.1 to 6.6 years from four schools were analyzed as per the World Health Organization recommendation. Ambience was assessed qualitatively by direct observation. Logistic regression verified the probability of different nutritional deviations among schools. The prevalence of nutritional excess was alarming, especially for children under five (13.7%). In children aged five years and over, the two schools with large social support network in their surroundings had a lower probability of nutritional excess (OR = 0.40 and OR = 0.33; p < 0.05). The school with more cafeterias and food advertisements in the territory had higher proportion of obesity. Positive factors of ambience within schools, such as the lack of commercial canteen, could not avoid nutritional excess. This paper warns about the importance of surroundings, especially social support. This is poorly addressed in nutrition literature, but may be a differential in the nutritional profile, mainly when key aspects of protection within school are adequate.*

Key words *Nutritional status, School health, Child, Preschool, Environment and public health, Social support*

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Introduction

Assessing the nutritional profile of children is an essential tool to verify the health conditions of communities[1,2]. The identification of children with nutritional disorders helps to direct health promotion and intervention actions, favoring declining diseases, not only in childhood, but also in youth and adulthood[3,4].

School is a unique space for the development of these actions, since it is a privileged field for the construction of values and ways of knowing the world, interfering in the social production of health[5,6]. In Brazil, school has been a setting for narrowing political and practical relationship between the Health and Education sectors, in the context of the intersectoriality provided for in the Unified Health System[7]. The school nutritional diagnosis is planned in government programs, such as the National School Feeding Program (PNAE) and the School Health Program (PSE), which seek to promote healthy eating, health and nutrition in the public school system[5,8].

This governmental attention to the nutritional situation in Brazilian schools is due in particular to the growing prevalence of overweight and obesity found in children in the country[9,10]. Unlike developed countries, where high prevalence of childhood obesity have been found for decades[11], Brazil is a relatively recent epidemiological panorama, which is accompanied by a significant decline in weight and growth deficits[9,12].

It should be noted that there is a set of non-biological factors determining the nutritional situation in childhood. Housing conditions and mother's schooling are examples of these factors historically evaluated in relation to childhood malnutrition[2,12]. In turn, exposure to food advertising and trade has appeared as an important extrinsic aspect related to nutritional excess[13]. Not specifically in childhood, but in order to understand determinants of nutritional excess in any age group, the number of studies that relate characteristics of the environment, food availability and food consumption is growing[14-17]. The idea of an obesogenic environment has been highlighted for the purpose of intervention programs[18]. A recent report by the World Health Organization (WHO) indicates that many children are living in environments that promote excessive weight gain[1]. This report recommends the promotion of healthy school environments as one of the main actions to reduce childhood obesity and the health problems associated with this disease. In line with WHO's goals, international and national action plans have been created to favor environments that allow healthy eating and physical activity, especially in the school environment. For example, in Brazil, the National Strategic Action Plan for Coping with Chronic Noncommunicable Diseases 2011-2022 directly or indirectly mentions schools in most of its proposals[19].

In order to understand the interaction between nutritional profile and a set of factors of the school routine and of the physical space in the internal environment and in the school surroundings, this study aimed to evaluate the school ambience and the nutritional status of children of the municipal early childhood education system of Macaé.

Methods

This is a cross-sectional, descriptive and quantitative study with secondary anthropometric data collected at the Coordination Office of School Nutrition of the Macaé Municipal Education Department (SEMED). Information was collected by SEMED nutritionists and by nutrition undergraduates who were trained and supervised, participating in an extension project of the Federal University of Rio de Janeiro (UFRJ).

The database provided by SEMED included the date of birth, gender, height (in centimeters) and weight (in kilograms) of the universe of children enrolled in four municipal schools of early childhood education (EMEI). The information was related to the period 2012-2014 and there was only one record per child. The height variable was in duplicate, with an accuracy of 1 mm, and the mean of the two measures was calculated for analysis purposes. The weight record had an accuracy of 100 g. Children's age was calculated according to the birth and evaluation dates recorded in the database. In all, 1,161 children were enrolled and aged between 2.1 and 6.6 years. Due to incomplete records, 188 children were excluded from the analysis, and so were 11 children with values of weight or height that were clearly wrong. In all, 962 records were analyzed, representing 82.9 % of eligible children.

The anthropometric profile was described separately for children under five years of age (UNDER5) and for children five years of age or older (ABOVE5). The indicators used were: Height-for-age (H/A), Weight-for-age (W/A), Body Mass Index-for-age (BMI/A) and, exclusively for UNDER5, Weight-for-height (W/H).

These were expressed as z-scores, calculated according to WHO reference curves[2,20], using WHO Anthro (v3.2.2) and WHO Anthro Plus (v1.0.4) programs. For all indicators, z-scores lower than two negative standard deviations (SD) were considered nutritional deficits. UNDER5 children with W/H or BMI/A equal to or greater than two SD were classified as nutritional excess (overweight or obese); and equal to or greater than three SD, with obesity. In ABOVE5, BMI/A equal to or greater than one SD was considered nutritional excess; and equal to or greater than two SD, obesity.

Ambience analysis was observational and qualitative from the perspective of one of the authors on internal, external and routine schools' aspects, which may be related to the nutritional status of children. To assess the school environment, a radius of three blocks was stipulated. By contact via SEMED, in July 2014, three visits were made to each school registered in the database, when a direct observation was made, following a specific roadmap of this study. The concept of ambience adopted by the Brazilian Ministry of Health was applied, which covers the physical, social, professional and interpersonal relationships space[21].

Roadmap observations were organized into a list of 20 positive factors, according to the three health promotion strands: incentive, support and protection (Chart 1)[22]. Incentive measures are those of an educational nature, which aim to inform people on health issues and motivate the adoption of healthy practices. Support measures aim to facilitate informed and motivated individuals to adhere to healthy practices more easily. Protective measures are generally of a regulatory nature and aim to avoid exposing individuals to situations that favor unhealthy practices. School ambience was evaluated not only in an objective way, according to evidence or lack of positive factors, but mainly in a subjective way, considering that these factors fit into different strands and have different temporalities and weights in the determination of nutritional deviations.

Descriptive statistics were made in R package, version 3.1.3, by gender, age group and school. Multivariate logistic regression analysis was performed, with binomial adjustment. Independent variables were "Gender", "Age group" (UNDER5 or ABOVE5) and "School" (A, B, C or D). The prevalence of "Nutritional Excess by W/H" and "Nutritional Excess by BMI/A" were the dependent variables used dichotomously, for each of which a regression model was tested. Odds Ratio

Chart 1. Nutritional ambience of four municipal schools of early childhood education, Macaé, 2012-2014.

Ambience Positive Factors	School			
	A	B	C	D
Incentive Strand				
1. Educational healthy eating activities were addressed with school children regularly			P	
Support Strand				
Healthy eating				
2. There are proper water fountains and cups	P	P	P	P
3. Municipality regularly provides public school feeding	P	P	P	P
4. Municipality offers differentiated preparations for children with food special needs	P	P	P	P
Physical Activity Practice				
5. Inside school there is an indoor area for recreation/physical activity	P	P	P	P
6. A minimum of 40 minutes of weekly physical education classes	P	P	P	
Social equipment in the surroundings				
7. Presence of Family Health Strategy	P	P	P	P
8. Diversified social support network, including churches and other philanthropic/public institutions		P		P
Access and permanence in school				
9. Children study full-time		P	P	
10. Absence of constant flooding in the school's access streets		P	P	
11. Paving school's access streets			P	P
12. Availability of public transportation through school's access streets	P	P	P	P
13. School rooms have proper size, windows and fans	P		P	P
Protection Strand				
Healthy eating				
14. Absence of commercial canteens inside school	P	P	P	P
15. Students cannot bring food to school	P	P	P	P
16. Absence of snack bars and/or street vendors of unhealthy food in the surroundings		P		
17. Absence of unhealthy food advertising in the surroundings		P		
Hygiene and sanitation				
18. Treated sewage		P	P	P
19. Treated tap water	P		P	P
20. Proper garbage collection inside school and in the surroundings	P	P	P	P

P = Presence of the positive factor.

(OR) and 95 % confidence intervals (CI) were calculated, considering a significance level of 5 %.

Results

Of the 962 children evaluated, 60.6 % were UNDER5, and 50.8 % were girls. Respectively for UNDER5 and ABOVE5, the mean age was 46.3 and 68.4 months and was similar between boys and girls (Table 1).

Regardless of age, gender, and school, H/A averages were close to zero. The prevalence of H/A deficit was 2.4 % and 1.1 %, respectively, for UNDER5 and ABOVE5; and less than 3 % in all schools (Table 2). Distributions of W/H, W/A and BMI/A showed positive deviations, therefore, there was a low prevalence of deficit for these indicators (less than 1.0 %) in all analyzed categories.

Among the UNDER5, the distribution curves of W/H, W/A and BMI/A were similar to each other and considerably higher than those of the WHO. The z-scores' means for these indicators ranged from 0.43 to 0.85 SD, depending on gender and school (Table 1). In Figure 1, using the W/H distribution as an example, the magnitude of the deviation to the right can be visualized.

The prevalence of nutritional excess among UNDER5 was 12.9 % and 13.7 %, respectively, according to W/H and BMI/A, with a similar proportion between genders. By W/H and BMI/A, the prevalence of obesity in boys was 5.9 % and 6.3 %, and was 4.1 % and 3.7 % among girls. Comparing schools, School-B evidenced a higher proportion of UNDER5 with nutritional excess (Table 2), as well as higher mean of W/H and BMI/A (Table 1).

For the ABOVE5, there was a deviation to the right in the BMI/A distribution, but more subtle than in the UNDER5. The BMI/A's means ranged from 0.20 to 0.60 SD. The prevalence of obesity and nutritional excess were respectively 8.4 % and 24.8 %, and were similar between genders. The prevalence of nutritional excess among the ABOVE5 was higher in School-A and School-C (Table 2), where the highest BMI/A means were also observed (Table 1).

In logistic regression, no significant effect was observed for "Gender", regardless of age group (Table 3). Using "Nutritional Excess by BMI/A" as dependent variable, and all children grouped together, "Age group" was significantly associated with the outcome. Being part of the ABOVE5 group implied a greater probability of nutritional excess, both in the bivariate analysis and the gender-adjusted model (OR = 2.09, CI = 1.49-2.43). Schools B, C and D OR values indicated a lower probability of the outcome occurring than in School-A, with significance only for School-D (OR = 0.52; CI = 0.27-0.99). When analyzing ABOVE5 separately, the direction of association remained, with significance for School-D (OR = 0.33, CI = 0.14-0.76) and School-B (OR = 0.40, CI = 0.20-0.81). No significant effect was found in the analyses only with UNDER5.

Among the 20 ambience factors, 9 (45.0 %) were found in all schools (Chart 1). Among these, it is worth noting that the municipality regularly provided public school feeding, including family farming produce foods, and differentiated preparations for children with special needs, such as lactose intolerance and gluten allergy. As a measure of support in the surroundings, Family Health Strategies (ESF) close to the four EMEI stands out. Regarding protection, it is worth mentioning the lack of commercial canteens inside the EMEIs, and that none of them allowed students to bring food to school.

The EMEIs are located in municipal regions with different socioeconomic conditions. School-A is located in one of the poorest regions of the municipality, within a community with a disorderly urban growth and social risk due to drug trafficking-related violence. Churches are the only available social facilities. There are diversified shops, snack bars and unhealthy food advertising, especially near the busy highway adjacent to the school. A set of aspects that hinder children's access and stay in School-A were identified, such as constant flooding, lack of access streets paving and, mainly, the fact that students study in partial shifts. The most serious aspect is the lack of sanitation added to flooding, which caused the open sewage ditch on the street in front of School-A to overflow.

School-B is also located in a region of the socioeconomically deprived municipal suburbs, but not characterized by obvious social risk. This EMEI is located in a residential area, with little trade and food advertising, without snack bars or street vendors. There are several social facilities nearby, including a social center for the elderly and a UFRJ complex. Students in School-B study full time. The EMEI is not supplied with treated tap water, and this is a serious flaw.

The School-C is located in a rich neighborhood, in the municipal coastal area, characterized by diversified commerce, tourism and residential area. It is a region with obvious social inequality,

Table 1. Descriptive anthropometric data by sex and school of 962 children of municipal schools of early childhood education, Macaé, 2012-2014.

		Mean (± 1 standard deviation)						
Age Range	**Variables**	**Boys n = 287**	**Girls n = 296**	**Total n = 583**	**School A n = 41**	**School B n = 199**	**School C n = 213**	**School D n = 130**
Menores de 5 anos	Idade (meses)	46.20 (± 9.34)	46.40 (± 8.53)	46.30 (± 8.92)	52.38 (± 5.91)	47.66 (± 8.13)	43.95 (± 9.71)	46.17 (± 8.26)
	Peso (kg)	17.50 (± 3.39)	17.05 (± 3.47)	17.27 (± 3.43)	18.38 (± 2.56)	17.58 (± 3.66)	16.89 (± 3.50)	17.07 (± 3.11)
	Estatura (cm)	102.46 (± 7.13)	101.49 (± 6.96)	101.97 (± 7.06)	105.52 (± 4.54)	102.24 (± 6.82)	101.14 (± 7.76)	101.79 (± 6.55)
	P/E	0.75 (± 1.24)	0.64 (± 1.19)	0.69 (± 1,22)	0.75 (± 0.94)	0.81 (± 1.33)	0.61 (± 1.21)	0.63 (± 1.10)
	E/I	0.10 (± 1.15)	0.00 (1.02)	0.05 (± 1,08)	0.02 (± 0.69)	−0.09 (± 1.02)	0.21 (± 1.21)	0.01 (± 0.91)
	P/I	0.58 (± 1.24)	0.43 (± 1,12)	0.52 (± 1,18)	0.53 (± 0.81)	0.50 (± 1.27)	0.55 (± 1.23)	0.44 (± 1.05)
	IMC/I	0.78 (± 1,26)	0.65 (± 1,18)	0.71 (± 1,22)	0.75 (± 0.93)	0.85 (± 1.34)	0.63 (± 1.22)	0.64 (± 1.11)
		Boys n = 185	**Girls n = 194**	**Total n = 379**	**School A n = 48**	**School B n = 166**	**School C n = 88**	**School D n = 77**
Idade igual ou superior a 5 anos	Idade (meses)	68.46 (± 5.01)	68.28 (± 5.06)	68.37 (± 5.03)	68.04 (± 4.91)	69.65 (± 5.53)	67.40 (± 4.26)	66.93 (± 4.12)
	Peso (kg)	20.89 (± 3.41)	20.98 (± 3.92)	20.94 (± 3.67)	21.36 (± 3,16)	20.65 (± 3.54)	21.55 (± 4.18)	20.59 (± 3,58)
	Estatura (cm)	114.46 (± 5.82)	113.80 (± 5.15)	114.12 (± 5.49)	114.77 (± 5.23)	114.22 (± 5.23)	114.08 (± 5.80)	113.56 (± 5.83)
	E/I	0.06 (± 1.03)	0.10 (± 0.90)	0.10 (± 0.90)	0.26 (± 0,95)	−0.02 (± 0.88)	0.17 (± 1.05)	0.10 (± 1.03)
	P/I	0.27 (± 1.07)	0.34 (± 1.11)	0.30 (± 1.09)	0.51 (± 0,99)	0.14 (± 1.03)	0.53 (± 1.23)	0.26 (± 1.05)
	IMC/I	0.32 (± 1.07)	0.38 (± 1.16)	0.35 (± 1.12)	0.50 (± 1.05)	0.20 (± 1.07)	0.60 (± 1.29)	0.28 (± 1.00)

W/H = z-score of weight-for-height; H/A = z-score of height-for-age; W/A = z-score of weight-for-age; BMI/A = z-score of body mass index-for-age.

Table 2. Frequency of nutritional deviations by sex and school of 962 children of municipal schools of early childhood education, Macaé, 2012-2014.

Age Range		%						
	Variables	**Boys n = 287**	**Girls n = 296**	**Total n = 583**	**School A n = 41**	**School B n = 199**	**School C n = 213**	**School D n = 130**
Under 5 years	Deficit of H/A (H/A < -2)	2.4	2.4	2.4	0.0	2.5	2.8	2.3
	Nutritional Excess (W/H ≥ 2)	13.6	12.2	12.9	7.3	19.1	11.3	7.7
	Obesity (W/H ≥ 3)	5.9	4.1	5.0	0.0	7.0	4.7	3.8
	Nutritional Excess (BMI/A ≥ 2)	13.9	13.5	13.7	7.3	18.6	12.7	10.0
	Obesity (BMI/A ≥ 3)	6.3	3.7	5.0	0.0	7.0	4.7	3.8
		Boys n = 185	**Girls n = 194**	**Total n = 379**	**School A n = 48**	**School B n = 166**	**School C n = 88**	**School D n = 77**
Age equal or over 5 years	Deficit of H/A (H/A < -2)	1.6	0.5	1.1	2.1	0.0	1.1	2.6
	Nutritional Excess (BMI/A ≥ 1)	25.4	24.2	24.8	37.5	1.3	35.2	16.9
	Obesity (BMI/A ≥ 2)	7.6	9.3	8.4	8.3	6.6	14.8	5.2

W/H = z-score of weight-for-height; H/A = z-score of height-for-age; W/A = z-score of weight-for-age; BMI/A = z-score of body mass index-for-age.

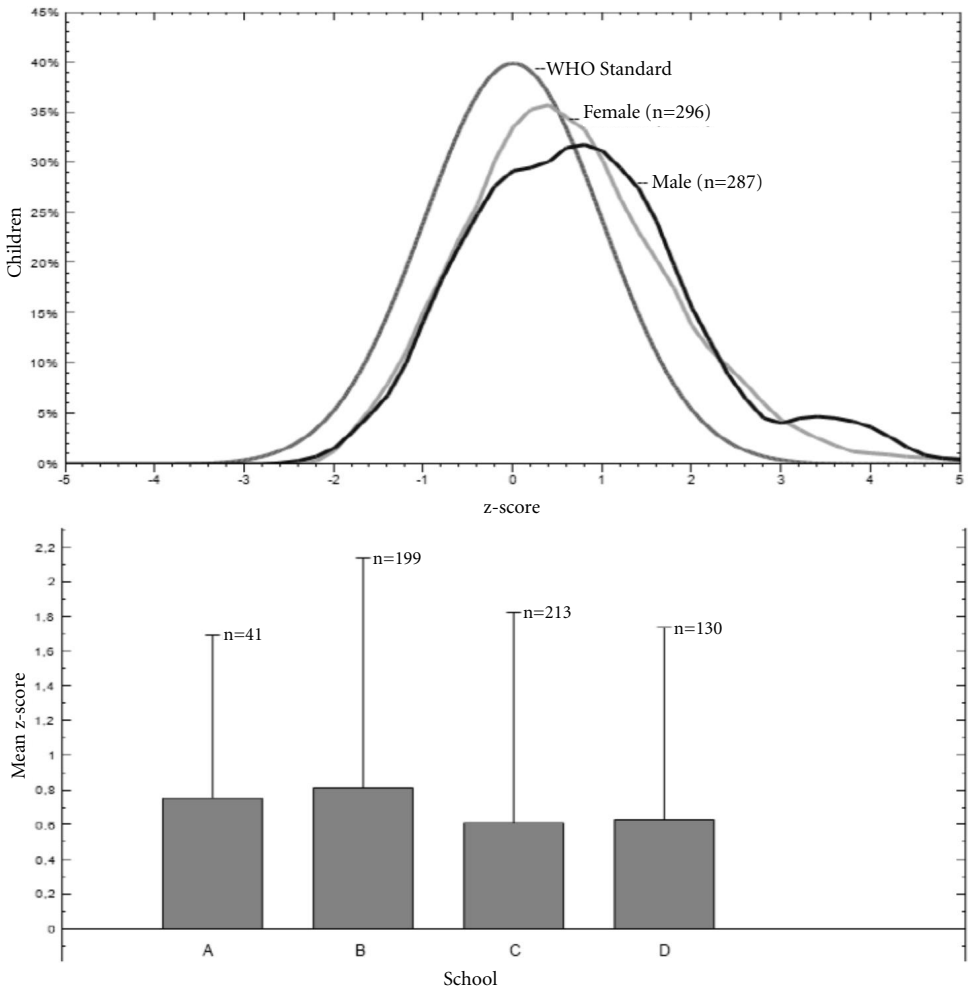

Figure 1. Distribution of z-scores of Weight-for-height by sex and school of 583 children under five years of age of municipal schools of early childhood education, Macaé, 2012-2014.

with high-standard residential buildings permeated by substandard housing. The territory has few social facilities and a massive presence of snack bars and food advertising, including a store with respective advertisement of a global chain of sandwiches. This EMEI was the only one to carry out activities to encourage healthy eating. Unlike other schools, where this theme was only addressed once or twice a year, School-C had a suspended garden, where food and environmental education was addressed with children weekly.

School-D is located in a region of intermediate socioeconomic condition, which gives access to the downtown area and to farther districts. In the vicinity, trade is intense, with a marked presence of social facilities, including a Social Welfare Reference Center (CRAS). This EMEI was flooded regularly through the access street, but not inside the school. The lack of a physical education teacher (and classes) for several months stands out as unfavorable factor.

Discussion

Prevalence of nutritional deficits lower than 3 %, as observed in this study, are not considered expressive in collective terms, since they are within the normal rates of expected deviation in a healthy population. The frequency of H/A

Table 3. Odds Ratio (OR) and respective 95 % confidence intervals (CI) identified by multivariate logistic regression analysis of nutritional excess among children of municipal schools of early childhood education, Macaé, 2012-2014.

Age Range	Independent Variable (category of reference)		Response-Variable: Nutritional Excess BMI/A (BMI/A ≥ 1 for ABOVE5 and ≥ 2 for UNDER5)		Response-Variable: Nutritional Excess W/H (W/H ≥ 2)	
			OR	CI	OR	CI
Total of children (n = 962)	School (A)	B	0.85	0.46-1.42	-	-
		C	0.93	0.52-1.68		
		D	0.52*	0.27-0.995		
	Sex (Male)		0.94	0.67-1.31	-	-
	Age range		2.09*	1.49-2.43	-	-
UNDER5 (n = 583)	School (A)	B	2.89	0.98-12.41	2.97	1.00-12.75
		C	1.84	0.61-7.96	1.59	0.52-6.95
		D	1.41	0.43-6.37	1.05	0.30-4.88
	Sex (Male)		0.98	0.61-1.58	0.90	0.55-1.47
ABOVE5 (n = 379)	School (A)	B	0.40*	0.20-0.81	-	-
		C	0.91	0.44-1.91		
		D	0.33*	0.14-0.76		
	Sex (Male)		0.88	0.54-1.42	-	-

* Significant association; W/H = z-score of weight-for-height; BMI/A = z-score of body mass index-for-age; ABOVE5 = age equal or over 5 years; UNDER5 = under 5 years.

deficits was lower than the estimates for children in the Southeast of the country (5.6 % for UNDER5, and 6.2 % and 5.3 %, respectively, for boys and girls ABOVE5). In terms of W/H and W/A deficits in UNDER5, the prevalence in this study were lower than the already small estimates made in 2006 for the Southeast region (1.5 % and 1.4 % respectively for W/H and W/A deficits)[9,10].

It was expected to find few cases of nutritional deficits in the EMEI's of Macaé, since the occurrence of child malnutrition in all Brazilian regions has been reduced[9,10,12]. This decrease includes acute cases, expressed by deficits of W/H, W/A and BMI/A, as well as long-term deficits, expressed primarily by H/A deficit. Improvements in different aspects that make up the multi-causality of malnutrition have contributed to this decline. Among these, it should be highlighted the increase of purchasing power of Brazilian families and access to health care[12]. It is also worth mentioning the advances of public policies and governmental food and nutrition programs in Brazil, regarding coping with hunger and food insecurity, promotion of healthy food and realization of the Human Right to Adequate Food[8].

In the school context, the PNAE and the PSE are programs carried out to satisfaction in the public schools of Macaé. The regularity and quality of public school feeding in the four EMEIs evaluated are one of the most important ambience factors against malnutrition. In addition, the presence of ESF in the EMEI surroundings favors access to primary health care services and the development of actions provided for in the PSE, in conformity with the prevention or reversal of nutritional deviations[7]. It should be noted that Macaé also manages municipal programs for dispensing supplies, such as infant formulas and food supplements; in addition to executing actions planned at the state and federal levels, such as the operationalization of the Food and Nutrition Surveillance System and the Bolsa Família Program, which corroborate with the nutritional adequacy.

It should be noted that important sanitation items were lacking in one or more schools, which is a very serious failure due to the possibility of contact of the open sewage with the schools and homes, which favors the emergence of infectious-parasitic diseases[12]. However, this severity was not expressed in the nutritional results, possibly due to the long-term presence of important protective factors.

Anthropometric nutritional status takes time to change, especially in relation to height deficits in children[2,20]. Thus, continuous municipal actions are paramount because they allow ambience aspects some time to interfere in the de-

termination of nutritional deviations. It is worth mentioning that this causal temporality attenuates the possible limitation of this study about the difference in the collection period of anthropometric and ambience data.

Regarding nutritional excess, whether by W/H or BMI/A, prevalence among UNDER5 in this study indicates a high exposure of this population. For example, the prevalence of obesity by W/H for boys (5.9 %) and girls (4.1 %) considerably exceeded the expected percentage of individuals above the third SD in a healthy population (about 0.3 %). The prevalence of nutritional excess by W/H for boys (13.6 %) and girls (12.2 %) exceeded that observed in 2006 for Brazilian children (6.9 % and 7.7 %, respectively, for males and females) in all income strata[9].

Among studies at the local level, comparable to this analysis in terms of age, cutoff points and reference curve, it is important to highlight those performed in public day care centers in Taubaté, SP[23] and Rio de Janeiro[24], which observed an nutritional excess by BMI/A, respectively, in 8.9 % and 7.9 % of UNDER5 children. This prevalence is clearly lower than that of this study.

In world terms, Brazil is among the countries with a moderate prevalence of nutritional excess in UNDER5, from 5 to 10 %. However, the prevalence found in this study is close to 15 %. Frequencies of this magnitude are found in countries of North Africa and West Asia, such as Egypt and Syria, where the largest proportions of infant nutritional excess in the world are currently estimated[1,11].

It should be remembered that W/H and BMI/A distributions express the balance between body mass and linear growth, with positive deviations indicative of excess adiposity. Thus, the proportion of nutritional excess in the UNDER5 of Macaé is surprising, since the adiposity rebound, critical physiological period for the development of obesity, does not normally occur in this age group[4]. It is worth mentioning that infant nutritional deviations, especially in UNDER5, are influenced by extrinsic factors, implying, therefore, a collective risk[2]. Since they share the same obesogenic environment[18], a large number of children with nutritional excess entails a greater probability that others will also have the same problem.

Among the ABOVE5, the prevalence of nutritional excess in EMEIs ranged from 16.9 to 37.5 %. These are high frequencies, but consistent with the national estimates of 2008/2009[9]. The prevalence of nutritional excess in males (25.4 %) and females (24.2 %) in this study was lower than that found in the Southeast region of the country (39.7 % and 37.9 % respectively for boys and girls); and similar to that observed among Brazilian families with income of up to half a minimum wage (between 20.8 and 29.7 %, depending on gender and the specific income range). The proportion of obesity in boys (7.6 %) and girls (9.3 %) in EMEIs was also lower than the estimate for the Southeast (20.6 % and 13.6 %, respectively), and similar to that found in the lower strata income (between 7.4 and 12.9 %).

Few local studies independently evaluate the nutritional status of preschoolers older than five and younger than seven years of age. Information about the ABOVE5 is often shown in aggregate with that of UNDER5, which hinders comparisons. For example, a study in the metropolitan region of São Paulo found 9.5 % of preschoolers with BMI/A of more than two SD in philanthropic daycare centers[25]. However, interpreting these frequencies is intricate, since the recommended cutoff points for classifying nutritional excess in UNDER5 differ from those for ABOVE5[2,20]. Depending on the number of ABOVE5 children in the sample of preschoolers studied, when using "above two SD" as the single cut-off point, the prevalence of nutritional excess may be underestimated, since it does not include overweight ABOVE5 (BMI/A between one and two SD).

The variation of nutritional excess frequencies according to the four schools triggers a reflection on the aspects of the school environment that would be contributing to the occurrence of this positive deviation. This is especially so because school plays a prominent role in the mosaic of causality of childhood obesity[6]. Following aspects at the individual and family level, the school environment is the most proximal sphere in terms of nutritional impact.

Among the UNDER5, there was no significant difference between the EMEIs regarding the probability of nutritional excess. This result suggests that ambience factors investigated do not explain the nutritional excess in UNDER5; and that this deviation is more likely to be associated with aspects beyond the school context, such as birth conditions, breastfeeding or family coexistence, not analyzed in this study. It should be noted once again that fundamental ambience factors related to nutritional excess in young children, especially those in support of healthy eating within the school, have been in place for years in the municipal school system, which could justify the lack of nutritional difference among the EMEIs evaluated.

Of the ambience factors that varied among the EMEIs are educational healthy eating activities, carried out only in one school. Such children-targeting activities are undoubtedly relevant, since childhood is a peculiar phase of setting preferences and habits[5]; and the knowledge built up in childhood can last for a lifetime. In addition, children often share with their families what they learn in school, favoring socialization of knowledge and the school's health promoting role[5,6]. However, incentive actions may not imply a notorious anthropometric impact in the short term, especially in younger children, whose food choices are heavily influenced by the environment and people they interact with in daily life. Thus, incentive actions aimed at educators and other adults in the school community, such as those mentioned in the Brazilian Ten Steps for the Promotion of Healthy Eating at School[26] could have a greater impact on children's nutritional status. However, none of the EMEIs reported doing healthy eating activities aimed at this audience.

Protective and supportive factors related to the food trade and advertising within schools and in the surroundings are central to coping with obesity, as children are vulnerable to media persuasion strategies because they are still immature in terms of critical ability to do conscientious choices[5,13]. The food industry invests in studies on food preferences, signs, colors and forms that most attract the child, which imposes strong consumer pressure, in an unfair setting in terms of suitable choices.

Cafeterias and advertisements tend to have a greater influence on UNDER5 habits when in place inside schools, because in this age group, the child's contact with the external environment is restricted. As the four EMEIs did not have commercial canteens, nor did they allow food in schools other than those provided by public school feeding, these factors did not imply a nutritional difference. It is noteworthy that food sale in Macaé schools abides by State of Rio de Janeiro Law Nº 4580 of January 11, 2005, which does not forbid trade canteens, but prohibits, in schools, the sale of products that contribute to child obesity[8]. As a result, such legislation would preclude the presence of canteens in EMEIs, thus contributing to the lack of competitive food, that is, food that competes with public school feeding, and ends up reducing or devaluing their consumption by children[17].

If in Macaé the public school feeding failed in quality, it would be worth conjecturing whether it could not be contributing to the excessive weight gain of children. However, it is important to emphasize that public school feeding in the municipality follows current recommendations of the Food Guide for the Brazilian Population, including reducing sugary drinks and sweet foods in menus and providing a greater supply of food *in natura* or with minimum industrial process[27].

Among the ABOVE5, the likelihood of nutritional excess was significantly lower in School-B and School-D, which indicates that such excess in this age group is associated with aspects of EMEIs. Since most of the supportive and protective factors against excessive weight gain are found within EMEIs, the characteristics of the surroundings explaining the nutritional differences in ABOVE5 of this study stand out. Above all, the existence of a wide network of social facilities in the territory seems to play a relevant protective role, overcoming adverse aspects.

School-B and School-D, which were less likely of showing nutritional excess, are the same with a strengthened social equipment network. This network favors access to information, public services and better social and emotional life conditions. For example, the university center adjacent to School-B may, through extension actions, bring school community, the academy and municipal services closer together, contributing to the implementation of actions planned in the policies and food and nutrition programs[28]. In relation to the positive health impact of the support of neighborhood, churches, associations, among others, the intellectual legacy of Victor Valla is highlighted, especially the discussion about religiosity as a form of implementing the human right to food and strengthening food and nutritional security[29].

A Social Welfare Reference Center (CRAS) near School-D consists of other outstanding social equipment. Besides not working full-time, the school has basic problems, such as frequent flooding and lack of physical education class. However, the CRAS of School-D's territory, as well as others of Macaé, provides sports in the school's before/after period, supervised by a physical educator. Thus, CRAS covers part of School-D flaws and favors the adequate nutritional status of children.

School-B was the only one that did not have snack bars and advertisements of unhealthy foods, which may have made a difference in nutritional results among the ABOVE5. It is pertinent to mention that greater consumption of unhealthy foods tends to occur in places with more establishments that offer such products[14].

In addition, we emphasize that students in School-B study full-time, which increases the hours during which they fall under the school's support and protection factors, and reduces the period of exposure to possible nutritional risk factors found in other environments. Comprehensive education, not only in relation to time in school, but also with regard to the integrality of teaching and social participation, has been a way of bringing social acceptance and favoring implementation of public education and health policies[30].

School-A resembles School-B in terms of serving a region with poor socioeconomic conditions, but differs in that it does not have a strong network of social facilities or protection factors in the surroundings against food trade and advertising. Such characteristics may have contributed to the high prevalence of nutritional excess in ABOVE5 in this school. We also identified a set of aspects that reduce the possibility of children staying in the protection space of School-A, mainly the fact that students studying in partial shifts.

It is noteworthy that School-C showed the highest frequency of obesity in ABOVE5, despite the evaluation of 17 of their 20 ambience factors. This result ratifies the importance of the surroundings, primarily of social facilities in the prevention of nutritional problems, since these were precisely the aspects lacking in School-C. The set of positive ambience factors in this school was not able to promote nutritional adequacy in face of the notorious social inequality of the territory, with few social equipment and massive presence of trade and advertisement of unhealthy foods.

The fact that School-C is in a noble area of the municipality is another aggravating nutritional excess factor, since places with higher purchasing power may have more establishments selling food and beverages, as observed in Belo Horizonte, MG[15]. Moreover, as perceived in Santos, SP[16], the supply of ultra-processed foods is higher in establishments geographically closer to schools.

When considering the socioeconomic aspect at the family level, national data show a higher occurrence of childhood weight excess in the upper income strata, both for UNDER5 and for the elderly[9,10] It is important to note that the wealthy area where School-C is located does not reflect the high socioeconomic status of students. Children from families with high socioeconomic status attend private schools in the territory. The socioeconomic level of children in School-C is low, as in other EMEIs of this study, in which location of children's homes may not coincide with the school territory. The exposure of children of low socioeconomic status to the rich school environment may be an aggravating factor to the occurrence of nutritional excess.

Conclusion

The frequency of nutritional deficits in the EMEIs of Macaé was low. However, the magnitude of nutritional excess prevalence was alarming, especially among UNDER5. In this age group, the prevalence of nutritional excess extrapolated all the estimates, especially since they are low socioeconomic level children.

EMEIs with a large network of social facilities in the surroundings were significantly less likely of showing nutritional excess. The school with the greatest exposure in the territory of snack bars and advertisements of unhealthy foods had a higher prevalence of obesity among ABOVE5.

This study emphasizes that the assessment of EMEIs' surroundings is paramount, especially as regards the availability and quality of social facilities, since these can have a direct influence on the nutritional profile, especially when key factors of the ambience within schools are adequate.

Collaborations

AEP Lourenço designed and outlined the study. JL Vieira and CMM Rocha analyzed the study's database. AEP Lourenço, JL Vieira, CMM Rocha and FF Lima participated in the writing and reviewed the manuscript.

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