




# Association Between Early Admission at School and Oral Health and Nutritional Status of Children in the City of São Paulo, Brazil

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## ABSTRACT

**Objective:** To investigate the possible relationship between early admission to the school of children in early childhood and oral health conditions (OH) and nutritional status (NS). **Material and Methods:** Cross-sectional study conducted with 140 children aged 3-4 years, selected for convenience, in 4 public schools in the city of São Paulo, Brazil, during 2016, divided into children with early (IE) and late (IL) admission at school. Comparisons between groups were performed for the presence of overweight / obesity (OW / OB), caries lesions (CL), malocclusion (MO) and dental biofilm (DB), in addition to socioeconomic and dietary data. Multiple regression analysis was applied to determine the association between age of admission at school and OH and NS. **Results:** Children with IE had CL = 28.1%; DB = 46.9%; MO = 54.7% and OW / OB = 25.9%. Children with IE had IL = 29.8%; DB = 35.1%; MO = 61.4% and OW / OB = 30.8%. No significant association was found between age of admission at school and CL: 1.40 (0.53-3.73) 0.490; DB: 0.51 (0.22-1.16) 0.112; MO: 1.77 (0.77-4.05) 0.173 and OW / OB: 1.27 (0.55-2.92) 0.568, [OR (95% CI) p]. **Conclusion:** The age of admission at school of children in early childhood did not show a significant association with OH and NS.

**Keywords:** Oral Health; Nutritional Status; Preschool; Eating Habits.

## Introduction

Food care and education during early childhood used to be entirely carried out by the family nucleus in the past, which responsibility was largely attributed to the mother. In the last decades, with the greater insertion of women in the labor market, the family routine dynamics has changed. One of the first achievements in Brazil was the expansion of social assistance for infants aged 0-3 years through daycare centers. Subsequently, from the growing recognition of the State's duty to early childhood education, public policies began to establish better designs for children's insertion in early childhood education [1].

Early Childhood Education is currently recognized in the Brazilian constitution as a human and social right of all children aged 0-5 years and a State's duty [2]. These institutions include Early Childhood Education Centers (CEI) for children up to 3 years old and the Pre-School (Municipal Schools for Early Childhood Education - EMEI) for children aged 4-5 years. CEIs and EMEIs differ by length of stay, full time at CEI and part-time at EMEI [3]. Enrollment in early childhood education becomes mandatory when the child turns 4 or 5 years of age, [4] being optional until 3 years of age.

In the context of expanding the State's commitment to child development, school feeding programs have played a positive and important role in nutrition and healthy food promotion for children [5], as it is the case in Brazil of the National School Feeding Program (PNAE). PNAE is the second-largest school feeding program in the world and the only one recognized by the United Nations Food and Agriculture Organization (FAO) as a world reference [6]. From the year 2009, through a new federal law, PNAE strengthened Food and Nutrition Education (EAN) for students from all basic public schools, establishing goals for the supply of fresh food acquired from family farming, low in sugar and fat [7]. This law was implemented in the city of São Paulo from the year 2013.

According to their age group, children attending CEIs remain full time at school, receiving five balanced daily meals based on Food Guides. In addition, educational activities on healthy eating are carried out to promote and establish good eating habits since early years, reducing the risks of chronic diseases and protecting them for future stages of development [3]. A national study carried out in Brazil showed that 57% of children aged 0-3 years do not attend CEI and are cared for at home and 12% are under the care of someone other than their parents [8].

When parents choose to take care of their children at home, it is important to ensure a warm and stimulating physical and family environment, as well as healthy eating habits, from the transition from breastfeeding to family feeding. Children exposed to early stimulating environments are more likely to develop physically, cognitively, emotionally and socially than children in adverse and vulnerable conditions [9]. Food safety and the establishment of healthy eating habits during the first years of life are essential for the child's growth and development [10]. A systematic review of child health shows that deficiency in micronutrient consumption and excess energy consumption are probably associated with replacing fresh or minimally processed foods with ultra-processed foods [11].

Oral health can also be strongly influenced by dietary patterns [10]. Among chronic noncommunicable diseases in childhood, which has a high consumption of added sugar as a common risk factor, dental caries and obesity stand out, which, in addition to compromising the child's general health, have high treatment costs [12].

In this context, early childhood education is of strategic importance for health promotion, especially in families in a situation of social and economic vulnerability and parents with low schooling [2]. The aim of this study was to analyze the possible association between the early admission of children in early childhood

education with oral health conditions and nutritional status. The hypothesis is that early admission at school may have a protective effect on these children's oral health and nutritional status.

## Material and Methods

### Study Scenario

The municipality of São Paulo (MSP) has thirteen Regional Education Directorships (DRE) distributed in five macro-regions (northern, southern, southeastern, western, eastern regions) [13]. Two DREs were chosen (western and southern regions) that had considerable number of children, both with early and late admission, and within these DREs, two CEIs were chosen, which also had a large number of children with early and late admission, according to the enrollment data provided by the respective DRE.

### Sample Population

A convenience sample involving 140 children aged 42-55 months was divided into two groups, according to the median age of admission of children to the CEI (months): early admission (IE) ( $\leq 23$  months,  $n = 71$ ) and late entry (IL) ( $> 23$  months,  $n = 69$ ). The age of admission was calculated by the difference between the date of initial enrollment in the CEI and the child's date of birth, data provided by each CEI.

### Data Collection

The criteria for diagnosis and determination of dental caries lesions' presence were those recommended by the World Health Organization [14]. For active white spot (WS) lesions, white, opaque and porous WS was considered [15].

To assess the presence of malocclusion, the Foster and Hamilton criteria [16] were adopted, being considered present if it had at least one type of occlusal alteration. To assess the presence of dental biofilm, a 52,51,62,61, dull-tipped WHO probe was used, according to the modified visible plaque index [17] criterion, considered positive, only when dental biofilm was observed on the buccal surfaces of the four examined teeth.

To determine the child's nutritional status, according to age, children were weighed and measured, and the Anthro software from the World Health Organization [18] was used, taking as reference the Body Mass Index (BMI) [ $BMI = \text{weight} / (\text{height})^2$ ]. A questionnaire was also applied to parents / guardians via telephone about socioeconomic conditions [19], eating habits at home and the child's oral hygiene.

Fieldwork and data collection were carried out between September 2016 and August 2017. The data collection team was composed of 5 researchers: a dentist, two nutritionists and two collaborators (undergraduate students). The dentist was previously trained and calibrated for the diagnosis of dental caries lesions (DCL, Kappa: 0.84), including initial white spot lesions (WS, Kappa: 0.83); malocclusion (MO, Kappa: 0.92); dental biofilm (DB, Kappa: 0.85). The two nutritionists received training and calibration at the Laboratory of Nutritional Assessment of Populations of the School of Public Health at USP (Kappa<sup>1</sup> = 0.91; Kappa<sup>2</sup> = 0.087).

Prior to fieldwork, a pilot study was carried out to test the questionnaire methodology and clinical evaluation in 28 children enrolled in CEI with the same characteristics as the sample. Children who participated in the pilot study were excluded from the main survey.

Due to the age of children, an initial approach was performed one day before the clinical examination, involving playful activities with the use of a dummy simulating the clinical evaluation so that children were familiarized with the examiner and with data collection procedures. Oral clinical examination was carried out

in an environment prepared at CEI during the day with natural light, using sterilized material and properly dressed staff. Oral clinical examination was visual-tactile, in the following order: occlusion (child standing in front of the examiner with the Frankfurt Plan parallel to the ground at maximum intercuspation), evaluation of the presence of dental biofilm and caries lesions (previous cleaning and drying of teeth with gauze) using a dull-tipped WHO probe, the latter with the child lying in the knee-knee position.

Weight and height were measured with the child barefoot and with light clothes, collecting and recording weight and height using previously calibrated measuring instruments (electronic scale and stadiometer).

### Data Analysis

The association between qualitative variables and outcomes was assessed using the Pearson's chi-square test. In the analysis of factors associated with the main outcomes (oral health and nutritional status), univariate and multiple logistic regression was used, calculating the odds ratio (OR) value and its respective 95% confidence interval (95% CI).

The stepwise forward method allowed the construction of the final model of factors associated with the outcomes. Initially, variables in the univariate regression had  $p < 0.20$  were considered for the construction of the multiple model. Variables that were independently associated with the outcome were included in the final model, adjusted for the main study variable. The significance level adopted was 5% for all hypothesis tests. Analyses were performed using the SPSS statistical software for Windows v.25 and Stata / MP 14.0 for Windows.

### Ethical Considerations

This study was approved by the Research Ethics Committee of the Faculty of Dentistry - University of São Paulo (CAAE: 55796616.4.0000.0075). All procedures were conducted in accordance with the Declaration of Helsinki.

### Results

There was no significant difference between groups of children (IE and IL) concerning socioeconomic variables and household eating habits. The sample consisted mostly of female children and mothers with schooling up to high school. Regarding eating habits, undesirable eating practices were observed, especially regarding the early introduction of beverages with added sugar ( $\leq 12$  months of age) and bottle use (Table 1).

**Table 1. Sample composition in relation to outcome variables and age of admission of children at CEI.**

Variables	Age of Admission at CEI		Total N	Missing N	p-value <sup>1</sup>
	Early Admission N (%)	Late Admission N (%)			
Number of Students	71 (100.0)	69 (100.0)	140		
Sex	71	69	140	0	0.836
Male	29 (40.9)	27 (39.1)	56		
Female	42 (59.1)	42 (60.9)	84		
Maternal Schooling	54	53	107	33	0.668
Up to High School	42 (77.8)	43 (81.1)	85		
Higher Education	12 (22.2)	10 (18.9)	22		
Monthly Per Capita Income	54	53	107	33	0.066
Equal to or Below R\$ 551,00*	32 (59.3)	22 (41.5)	54		

Higher Than R\$ 551,00*	22 (40.7)	31 (58.5)	53		
Introduction of Sweets	54	53	107	33	0.747
Before 12 Months	9 (16.6)	7 (13.2)	16		
Between 12 and 24 Months	30 (55.6)	28 (52.8)	58		
After 24 Months	15 (27.8)	18 (34.0)	33		
Introduction of Sweetened Drinks	54	53	107	33	0.454
Before 12 Months	37 (68.5)	33 (62.3)	70		
Between 12 and 24 Months	12 (22.2)	17 (32.0)	29		
After 24 Months	5 (9.3)	3 (5.7)	8		
Frequency of Sweets / Week	54	53	107	33	0.781
Never	18 (33.3)	16 (30.2)	34		
Weekly	26 (48.2)	29 (54.7)	55		
Daily	10 (18.5)	8 (15.1)	18		
Frequency of Soft Drinks / Week	54	53	107	33	0.069
Never	22 (40.7)	13 (24.5)	35		
Weekly	20 (37.1)	18 (34.0)	38		
Daily	12 (22.2)	22 (41.5)	34		
Breastfeeding	54	53	107	33	0.595
Up to 12 Months	29 (53.7)	31 (58.5)	60		
Up to 24 Months	15 (27.8)	11 (20.8)	26		
More Than 24 Months	6 (11.1)	4 (7.5)	10		
Never	4 (7.4)	7 (13.2)	11		
Use of Pacifier	54	53	107	33	0.477
Never	26 (48.1)	21 (39.6)	47		
Before	17 (31.5)	16 (30.2)	33		
Still Uses	11 (20.4)	16 (30.2)	27		
Use of Bottle	54	53	107	33	0.504
Never	13 (24.1)	8 (15.1)	21		
Before	18 (33.3)	20 (37.7)	38		
Still Uses	23 (42.6)	25 (47.2)	48		

\*Chi-squared test; \*551 R\$ Reais = 98 US dollars.

The general and comparative percentages referring to children's oral health and nutritional status with early and late admission in early childhood education are shown in Figure 1.

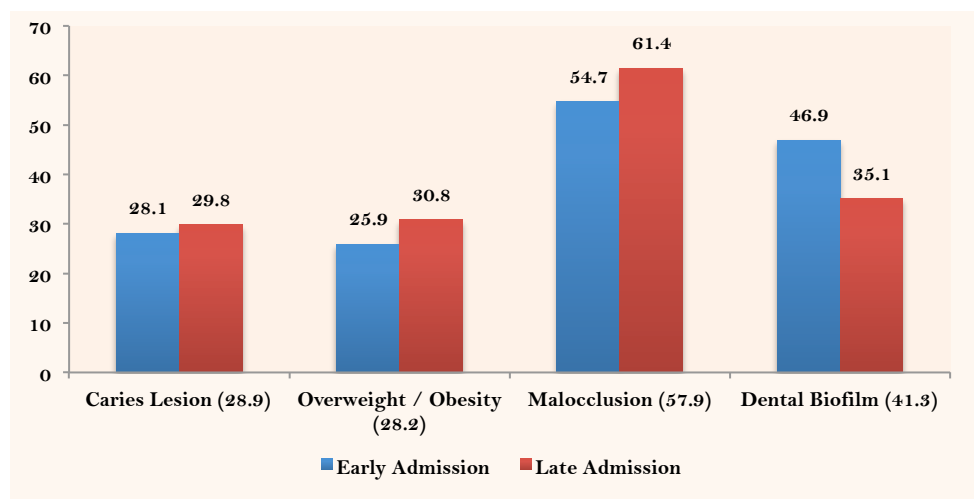


Figure 1. Oral health conditions and nutritional status according to the age of admission at CEI.

No variable was found independently associated with nutritional status. The age of admission at CEI was not associated with the analyzed outcomes, but it was included as an adjustment variable in the multiple regression model. Visit to the dentist was associated with the presence of caries lesions (OR: 4.56; 95% CI:

1.69-12.32; p=0.003). Pacifier user was independently associated with the presence of malocclusion (OR: 2.75; 95% CI: 1.20-6.28; p=0.016). Children with DLC and WS were almost three times more likely to have dental biofilm than children who did not have DCL and WS (OR: 2.92; 95% CI: 1.21-7.05; p=0.017). (Table 2).

**Table 2. Multiple regression analysis of factors associated with oral health and nutritional status**

Variables	Caries Lesions	Dental Biofilm	Malocclusion	Nutritional Status
	OR (95%CI) p-value <sup>1</sup>	OR (95%CI) p-value <sup>1</sup>	OR (95%CI) p-value <sup>1</sup>	OR (95%CI) p-value <sup>1</sup>
Age of Admission at CEI				
Early	1	1	1	1
Late	1.15 (0.45-2.91); 0.768	0.58 (0.27-1.23); 0.156	1.77 (0.77-4.05); 0.173	1.27 (0.55-2.92); 0.568
Use of Pacifier				
Never			1	
Before /Still Uses	---	---	2.75 (1.20-6.28); 0.016*	---
Visit to the Dentist				
No	1			
Yes	4.56 (1.69-12.32); 0.003*	---	---	---
DCL and WS				
No		1		
Yes	---	2.92 (1.21-7.05); 0.017*	---	---

DCL and WS: Presence of initial dental caries lesions (white spot) and dental caries lesions (cavitations); <sup>1</sup>Multiple Regression Analysis; \*p<0.05.

## Discussion

In Brazil, access to health and education are established as constitutional rights. The school offers an environment conducive to educational activities in relation to healthy habits. PNAE promotes food and nutritional safety by offering balanced food according to age groups. The quality indicators for early childhood education in the city of São Paulo, developed and implemented since 2013, include a specific topic in the health promotion indicator, called “responsibility for the healthy feeding of infants and children” [20]. The implementation of school feeding programs in vulnerable populations shows positive effects on the improvement of nutritional status and school performance of students [5]. The school feeding program also shows positive effects on students' oral health compared to schools without a program [21].

Despite the fact that gender inequalities still playing a relevant role, the growing female insertion in the labor market stands out [22], which can lead to a decrease in the time dedicated to activities of preparing family meals, stress or tiredness in child care at home. While not enrolled in CEI, children can also have their daycare transferred to other people (older siblings, grandparents, hired caregivers), influencing the acquisition of eating habits [8].

Diet patterns have undergone change in contemporary society [23]. There was a time when the consumption of fresh foods prepared just before meals predominated, that has been gradually replaced by an increase in the consumption of processed and ultra-processed foods, which do not depend on prior preparation, motivated, among other factors, by urban lifestyle, socioeconomic, cultural factors and advertising strategies target at children [24-27]. These changes resulted in children's eating patterns alterations, with the early introduction of ultra-processed foods soon after the transition phase from breastfeeding to complementary feeding [28].

Inadequate eating patterns affect oral health, while frequent and early consumption of cariogenic food and / or liquids (rich in sucrose) in addition to the presence of dental biofilm (oral hygiene deficiency) increases the risk of developing dental caries disease [10].

Even knowing that schools promote healthy eating habits, the results of this study did not show any significant difference between groups of children (early and late admission at CEI), in relation to eating habits, oral health and nutritional status. In general, both groups showed undesirable practices (early introduction of sweets and soft drinks, prolonged use of pacifiers and babybottles). These aspects demand orientation guidance to both parents and teachers so that they can act proactively towards health promotion and prevention of the main oral health problems. These results may have been influenced by the study design and sample composition. It is worth mentioning that, given the lack of previous studies on the association between outcomes and age of admission at school, this study can be considered an exploratory study for future research, in which a probabilistic sample with population representation can be established.

In addition, it should be highlighted that the use of babybottle is associated with the consumption of sweetened liquids at high frequency and during sleeping periods, predisposing the infant to the appearance of caries lesions, a situation that must be taken into account for the adoption of preventive measures against dental caries disease. The use of pacifier involves emotional and psychological aspects, also complementing the need for suction from the interruption of breastfeeding, which can contribute to the persistence of the non-nutritive sucking habit [29]. The results of this study show a high prevalence of babybottle (45%) and pacifier use (25%), and as a result, a high prevalence of malocclusions - 57.9%. The most prevalent occlusal changes were overjet and anterior open bite, which is generally related to prolonged use of pacifiers and bottles.

Dental caries is a disease that affects general health, manifesting in its most advanced stages through signs and symptoms such as infection, swelling, pain, among others, thus influencing life quality [30]. One of these symptoms resulting from severe caries injuries is pain of dental origin, being in most cases the main reason for dental visits. This study showed an association between visits to the dentist in the last 12 months and the presence of caries lesions in children. It is possible that the association of visits to the dentist in the last 12 months is motivated by some consequence or effect of early child caries. Another result was that the presence of dental biofilm was associated with the presence of initial caries lesions (WS). Studies have verified this association by showing that the presence of dental biofilm is an indicator of caries risk [17]. Caries disease is a process of demineralization of the affected teeth, determined by the influence of etiological factors acting over a certain period of time, which in its initial stages is clinically visible through WS. The early diagnosis of carious lesions in young children is important to reverse or inactivate these lesions.







Regarding nutritional status, there was no significant difference between children with early and late admission at CEI. It is suggested that factors such as gestational period, family influence, physical inactivity, economic status, sleep duration, family structure, may also have influenced on that [31]. In both groups, prevalence of normal nutritional status according to age and BMI was observed, evidencing the association between access to food and the offer of healthy food promoted by PNAE. It was observed that 28% of children were overweight / obese. Weight gain in early childhood is a predictor of obesity in adolescence and adulthood [32]. Therefore, education concerning healthy nutritional habits in partnership with the family nucleus must be reinforced, considering that children in this age group is not autonomous their food choice, and that CEI can play an important role in the acquisition of good eating habits. Upon completing the 1st cycle of early childhood education at CEI and moving to EMEI, the child stops remaining at school full time, which results in greater influence of family eating habits. In this sense, the CEI period (0 to 3 years of age) represents a very important window of opportunity for promoting good eating habits for the role families, which may have repercussions in the medium and long term on the oral and general health of children and their families.

In general, this work showed that, in addition to the educational issues, there are other factors that can influence the acquisition of children eating habits and health promotion, which are reflected in their nutritional status and health oral. Public policy must be continued to ensure healthy nutrition and oral health for children, especially during the first years of life. On the other hand, this work also showed the need to focus on oral hygiene habits and behavioral habits in relation to the use of pacifiers and babybottles, habits that influence children's oral health. Despite limitations in relation to sample size and selection, part of the obtained results related to oral health and nutritional status are compatible with similar studies, as well as the use of measurement instruments tested in other studies that reinforce the validity of our results. As this study has a cross-sectional design, causality could not be established since effect and exposure are being simultaneously evaluated. However, further longitudinal studies with representative population-based samples should be carried out.

## Conclusion

Visiting the dentist, the presence of dental caries and white spot lesions, and the use of pacifiers were associated with the prevalence of oral health conditions. However, the age at which the child was admitted at CEI was not associated with oral health conditions and nutritional status in this group of children.

## Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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