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Prolonged Pacifier Use during Infancy and Smoking Initiation in Adolescence: Evidence from a Historical Cohort Study

Helenice R. Ferreira^a Ecinele F. Rosa^b José Leopoldo F. Antunes^d
Danilo A. Duarte^a José Carlos P. Imparato^c Claudio M. Pannuti^b
Fausto M. Mendes^c

^aDivision of Pediatric Dentistry, Cruzeiro do Sul University, ^bDivision of Periodontics, Department of Stomatology, and ^cDepartment of Pediatric Dentistry, School of Dentistry, and ^dSchool of Public Health, University of São Paulo, São Paulo, Brazil

Key Words

Pacifiers · Smoking · Breastfeeding · Historical cohort studies

Abstract

Aim: To investigate the association between prolonged pacifier use during childhood and smoking in adolescence and early adulthood. **Methods:** A historical cohort study including patients from a dental private office was designed. Dental records were used, which contained complete data about sucking habits from 314 children (2–10 years of age) who had attended a private dental office from 1988 to 1994 in Ibiá, Brazil. Then, we collected data about the smoking habits from 261 subjects who were successfully contacted again from 2004 to 2006. Our outcome variable was smoking, and subjects who had smoked more than 100 cigarettes during their lifetime were classified as smokers. Poisson regression analysis matched the association between oral habits and smoking. Incidence rate ratios (IRR) and 95% confidence intervals (95% CI) were calculated. The level of significance was

set at 5%. **Results:** We observed a statistically significant association between prolonged pacifier use (more than 24 months) and smoking (IRR = 4.48; 95% CI 2.32–8.65). Breastfeeding, in contrast, was a protective factor (IRR = 0.64; 95% CI 0.42–0.96). **Conclusions:** Prolonged pacifier use during childhood is positively associated with smoking initiation in adolescence and early adulthood. © 2014 S. Karger AG, Basel

Introduction

Since 1990, the World Health Organization has considered smoking to be an epidemic. Currently, more deaths are attributed to smoking than to tuberculosis, HIV/AIDS and malaria combined. It is estimated that 1 person dies every 6 s as a result of this habit and 1 in 3 young smokers dies prematurely [1]. Over 80% of tobacco users started smoking before 18 years of age [2], and the rate of smoking cessation is inversely proportional to the age of initiation of the habit [3].

However, the mechanisms that make adolescents start smoking are still unclear. The literature has identified several predictors of smoking initiation during adolescence, such as sex, parents' education, poor academic performance, specific neurobehavioral factors (impulsivity and risk-taking propensity), hyperactivity and other conduct disorders [4–9]. Having friends, siblings or parents who smoke has also been described as an important risk factor for the acquisition of the habit [9, 10]. Another possible reason why adolescents smoke is the perception that cigarettes have a calming effect when they are nervous or angry [11–14]. Interestingly, the same reason is alleged when a mother introduces a pacifier to her child during infancy [15, 16].

Therefore, parents' practices and possible external mechanisms which have a calming effect might be explanations for a possible relationship between sucking a pacifier during childhood and cigarette smoking during adolescence. This was our working hypothesis. The major problems associated with the use of pacifiers for more than 2 years include a higher occurrence of malocclusion and otitis media [15, 16]. To the best of our knowledge, no previous study has investigated the possible impacts of prolonged nonnutritive sucking habits on the behavioral and psychological development of the individual. Thus, we aimed to evaluate the association between prolonged pacifier use during childhood and smoking in adolescents and young adults through a historical cohort study.

Materials and Methods

Ethics Approval

The present investigation followed international standards of ethics in research involving human beings, and the study protocol was approved by the Local Ethics Committee in 2004. Written informed consent was obtained from all participants. For subjects younger than 18 years, their parents or guardians signed the form.

Design and Subjects

A historical cohort study was conducted involving patients who had attended a private dental office from 1988 to 1994 in a city on the Brazilian countryside (Ibiá, Minas Gerais, Brazil). At that time, the subjects were between 2 and 10 years old, and the sample was comprised of both sexes. The dentist (H.R.F.) had a total of 314 dental records complete with all the information required for the study.

The dental records contained data on age, sex and previous medical and dental history. Data on the occurrence and duration of oral habits (breastfeeding, bottle feeding, pacifier use, thumb sucking, biting objects and nail biting) were also recorded in the clinical registers. These data were collected by the dentist in the private dental office during the anamnesis with the patients' mothers.

In a second time period, from 2004 to 2006, the researchers tried to contact the patients again. At this second occasion, subjects were aged 15–26 years. First, the contacted patients were asked to participate in the research. Then, an interview was performed to gather information regarding socioeconomic and demographic characteristics (educational level, family income and marital status) and variables related to smoking (parental smoking, present or past smoking habit, age of smoking initiation and cigarettes per day). The interviewer was unaware of the previously gathered dental records.

Explanatory Variables and Outcome

The outcome variable of this study was the smoking habit, and the participants were dichotomized into smokers and nonsmokers. Participants who had smoked over 100 cigarettes during their lifetime were considered to be smokers [17].

The following explanatory variables were collected when the participants were adolescents or young adults: sex (female or male); marital status (single or married); age (parametrically assessed); level of education (up to 8 years of formal education, which in Brazil corresponds to the basic level of school education, or more than 8 years); family income (dichotomously classified in 4 Brazilian minimum wages, with the Brazilian minimum wage used as a reference for measuring income, which increased from 90 to 160 USD during the period of data gathering, 2004–2006) and parental smoking (having or not having a parent who had smoked more than 100 cigarettes during their lifetime).

Variables related to oral habits were collected during childhood (when the child had attended the private dental office): prolonged pacifier use (less than 24 vs. 24 months or longer); prolonged bottle feeding (up to 36 or longer than 36 months); thumb sucking (no or yes); exclusive breastfeeding (0–5 vs. 6 months or longer); biting objects (no or yes), or nail biting (no or yes).

Statistical Analysis

First, unadjusted Poisson regression analysis with robust variance was performed to test the association between the outcome and explanatory variables [18]. This analytical scheme allowed estimating the incidence rate ratios (IRR) and their respective 95% confidence intervals (95% CI) for each covariate.

Subsequently, an adjusted Poisson regression model was fitted. Explanatory variables presenting $p \leq 0.20$ in the unadjusted analysis were included in the multiple model. The final multiple model was built including explanatory variables that permitted a better adjusted model. Adjusted IRR values and 95% CI were reported. For statistical analysis, the software Stata 12.0 (Stata Corporation, College Station, Tex., USA) was used and the level of significance was adjusted as $p < 0.05$.

Results

Of the 314 children who had complete records between 1988 and 1994, 261 were found between 2004 and 2006 and agreed to participate in the research (follow-up rate of 83.8%). The descriptive characteristics of this sample are presented in table 1. The prevalence of smokers was 27.6% (72 individuals) with a mean of 9.4 cigarettes per day.

Table 1. Unadjusted Poisson regression analysis with robust variance of association between sociodemographic variables and smoking during adolescence and early adulthood

Variables	Nonsmokers	Smokers	IRR (95% CI)	p ¹
Sex				0.261
Female	104 (75.4)	34 (24.6)	1.00	
Male	85 (69.1)	38 (30.9)	1.25 (0.85–1.86)	
Marital status				0.074
Single	177 (73.7)	63 (23.3)	1.00	
Married	12 (57.1)	9 (42.9)	1.63 (0.95–2.80)	
Age (continuous variable), years				0.001
Mean (SD)	19.6 (3.1)	20.9 (2.7)	1.11 (1.05–1.18)	
Level of education				0.352
Up to 8 years	57 (68.7)	26 (31.3)	1.00	
More than 8 years	132 (74.2)	46 (25.8)	0.82 (0.55–1.24)	
Family income				0.599
Less than 4 BMW	75 (74.3)	26 (25.7)	1.00	
4 BMW or more	114 (71.2)	46 (28.8)	1.12 (0.74–1.69)	
Parental smoking				0.063
No	57 (81.4)	13 (18.6)	1.00	
Yes	132 (69.1)	59 (30.9)	1.66 (0.97–2.84)	

Values represent n (%) unless otherwise indicated. SD = Standard deviation; BMW = Brazilian minimum wage (about USD 305.00/month during the period of data gathering). ¹ Significance obtained by Wald test.

Table 2. Unadjusted Poisson regression analysis with robust variance of association between oral habits during childhood and smoking during adolescence and early adulthood

Oral habits during childhood	Nonsmokers	Smokers	IRR (95% CI)	p ¹
Prolonged pacifier use				<0.001
Less than 24 months	104 (92.0)	9 (8.0)	1.00	
24 months or longer	85 (57.4)	63 (42.6)	5.34 (2.78–10.29)	
Prolonged bottle feeding				0.090
Up to 36 months	96 (77.4)	28 (22.6)	1.00	
Longer than 36 months	93 (67.9)	44 (32.1)	1.42 (0.95–2.14)	
Thumb sucking				0.840
No	180 (72.3)	69 (27.7)	1.00	
Yes	9 (75.0)	3 (25.0)	0.90 (0.33–2.46)	
Breastfeeding				<0.001
0–5 months	67 (58.3)	48 (41.7)	1.00	
6 months or longer	122 (83.6)	24 (16.4)	0.39 (0.26–0.60)	
Biting objects				0.810
No	147 (72.1)	57 (27.9)	1.00	
Yes	42 (73.7)	15 (26.3)	0.94 (0.58–1.53)	
Nail biting				0.309
No	100 (75.2)	33 (24.8)	1.00	
Yes	89 (69.5)	39 (30.5)	1.23 (0.83–1.82)	

Values represent n (%). ¹ Significance obtained by Wald test.

Table 3. Multiple Poisson regression model of smoking during adolescence and early adulthood and covariates on sociodemographic status and variables related to oral habits during childhood

Variables	IRR	95% CI	p ¹
Pacifier use			<0.001
Less than 24 months	1.00		
24 months or more	4.48	2.32–8.65	
Breastfeeding			0.030
0–5 months	1.00		
6 months or more	0.64	0.42–0.96	
Age (continuous variable)	1.09	1.02–1.15	0.008
Parental smoking			0.052
No	1.00		
Yes	1.62	1.00–2.65	

Pseudo $R^2 = 0.135$; pseudo $-2 \log$ -likelihood = 285.098; $p < 0.001$ for the entire model. ¹ Significance of each variable calculated by Wald test.

We did not observe significant associations of sex, marital status or socioeconomic variables in connection with a smoking habit ($p > 0.05$). Having a parent who smokes yielded an IRR of 1.66; however, this association was not significant (95% CI 0.97–2.84; $p = 0.063$). Age was significantly associated with a smoking habit (table 1).

Regarding oral habits, a prolonged use of pacifiers was significantly associated with smoking in the unadjusted analysis. Persons who had used pacifiers for a period longer than 24 months during childhood had a five-fold greater risk of becoming a smoker in adolescence or early adulthood. From 148 children with prolonged pacifier habits, 63 (42%) became smokers in adulthood. On the other hand, of the 113 children who had used pacifiers for less than 2 years, only 9 (8%) became smokers. Moreover, children who had been breastfed for 6 months or more presented a reduced incidence of smoking in adulthood. Other oral habits were not significantly associated with the outcome (table 2).

In the multiple analysis, older persons had a higher incidence of smoking than younger ones. Moreover, children who had used pacifiers for more than 24 months were more likely to smoke in adulthood. On the other hand, children who had been breastfed for a longer period (more than 5 months) had an almost 40% lower incidence of smoking in adulthood (table 3). We also performed an analysis considering time of pacifier use as a continuous variable, and the association remained statistically significant (IRR = 1.03; 95% CI 1.02–1.04; $p < 0.001$, adjusted by age, parental smoking and breastfeeding), indicating a possible dose-response relationship.

Discussion

In the same manner that a pacifier sucking habit has been reported to provide calming effects in young children [15, 16], cigarette smoking has been reported to be associated with relaxation and stress relief in adolescents and adults [11–14]. Additionally, parenting factors and practices have been observed to be related to prolonged pacifier use in childhood [19] and smoking initiation during adolescence [7, 9]. Consequently, we conjectured that related mechanisms could be involved in both habits in different ages; thus, our working hypothesis was that prolonged sucking habits during childhood might be associated with smoking in adolescence and early adulthood. We found a significantly higher incidence of smoking in participants who had a prolonged habit (longer than 24 months) of pacifier sucking when they were children.

The interplay between habits or trauma during childhood and their repercussions in adulthood is complex and has not been fully explained. We contend that the prospective association between prolonged pacifier use and smoking is plausible due to the analogous motivation for both habits. Research conducted in the 1960s supplied a psychological background to explain this association, arguing that frustrations during the early developmental phase could lead to a dependence on substances that individuals themselves can control or manipulate [20, 21].

More recently, reports have focused on the role of early life events that can lead to an increased risk for several diseases which occur during adolescence and adulthood [22, 23]. Considering this perspective, many conceptual pathways could relate early events to subsequent behaviors, and the occurrence of chronic diseases would reflect the gradual accumulation of risk factors over the course of life, including psychosocial and physical exposures during gestation and childhood [23]. Considering the smoking habit, a longitudinal study with a nationally representative sample of young adults reported that traumatic events that occurred during childhood were risk factors for smoking, and this relationship appeared to be unique to this habit [24]. The main finding of the current study was that a higher incidence of smoking was found in persons who had used pacifiers for a long time, and this finding is consistent with the life course theory. Other possible modulating mechanisms could be related to impulsivity-related behavior of children and/or their parents. Some authors observed that some personality factors, such as impulsivity, have been associated with different types of addictive behaviors [5].

We also observed an association between the duration of breastfeeding during infancy and smoking in adolescence and early adulthood. Being breastfed for 6 months or longer was significantly associated with a smaller incidence of subsequent smoking. Previous studies reported that children who had been breastfed for a shorter period had a higher risk of using pacifiers for prolonged periods of time [25, 26]. Therefore, the protective effect of breastfeeding against the incidence of smoking might be related to the association between breastfeeding and the use of pacifiers. In fact, when assessing the IRR of this association, we observed that children who had been breastfed for 6 months or more were less likely to use pacifiers for more than 24 months (IRR = 0.58; 95% CI 0.47–0.72; $p < 0.001$). Furthermore, a birth cohort study showed that children of mothers who smoked during pregnancy were less likely to breastfeed their babies who were then also more likely to start smoking during adolescence [27]. However, other authors have not found a significant association between breastfeeding duration and smoking, and this subject remains controversial [28].

Regarding socioeconomic variables, we did not observe a significant association with smoking, which is in accordance with some reports in the literature [8, 29]. In contrast, other authors have reported a significant positive association [30]. The absent association between socioeconomic characteristics and smoking could be related to the fact that we assessed a convenience sample from a private dental office; consequently, few differences in socioeconomic and cultural background among the subjects would be expected. This fact could threaten the external validity of our study. However, a recent discussion raised some interesting points about the real necessity of a representative sample for etiological studies [31]; hence, our choice seems to be acceptable. Also, this is a study that was designed to preliminarily explore the possible association between prolonged pacifier use and smoking.

There were other limitations of a historical cohort, and our findings may not represent a direct causality. In addition to having used a nonrepresentative sample, the data on oral habits during childhood were not collected for research purposes, and the gathering of data was constrained to information already available. Therefore, we were not able to collect other factors that were eventually associated with smoking. The association between pacifier use and smoking might reflect other life course exposures. Risk factors around the time when smoking begins are important predictors for the initiation of the habit [7–10]. Nevertheless, some authors have asserted that the

identification of a connection between early-life risk factors and smoking in adolescence could reduce the incidence of this harmful habit [6]. Thus, despite the limitations of our study, this appears to be the first report to demonstrate an association between pacifier use in childhood and smoking in adulthood. This novelty reflects the importance of our study. However, further prospective cohort studies should be conducted to better comprehend the nature of this association.

The potential harmful effects of a prolonged use of pacifiers, which can be observed in adulthood, are not entirely acknowledged. Several reports recommend that parents should offer pacifiers to their children during the first year to reduce the risk of sudden infant death syndrome [15, 16, 32]. Conversely, adverse factors of pacifier use in children are an increased risk of acute otitis media, a negative impact on breastfeeding [15, 16, 26, 32] and the occurrence of dental malocclusion [15, 16]; however, these harmful effects have mainly been associated with prolonged use [15, 16]. Therefore, based on our findings, an additional benefit of discouraging the prolonged use of pacifiers would be to reduce the incidence of smoking in adolescents and young adults. The identification of factors that lead a person to initiate smoking is extremely important, especially for the implementation of preventive health strategies that attempt to contain the dissemination of the tobacco epidemic.

In conclusion, prolonged pacifier use during childhood presents a positive association with smoking initiation in adolescence or early adulthood.

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