Child Temperament and Risk Factors for Early Childhood Caries

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ABSTRACT

Purpose: The purpose of this study was to determine if a relationship existed between a mother's perception of her child's temperament and the child's risk factors for early childhood caries (ECC).

Methods: Data was collected from 629 records of children ages 0 to 4 who were patients of the University of Iowa's Infant Oral Health Program. Data included: (1) maternal report of child's temperament; (2) knowledge of ECC; (3) dietary and oral hygiene habits; and (4) clinical evidence of cavitated and noncavitated lesions and visible plaque on maxillary incisors. Chi-square tests and logistic regression models were used to analyze the data.

Results: Bivariate analyses showed that children reported as "easy" were more likely to: (1) be younger (*P*=.001); (2) be breast-fed to sleep (*P*=.046); (3) be breast-fed throughout the night (*P*=.012); and (4) have their teeth brushed twice daily (*P*=.006). Children reported as "difficult" were more likely to: (1) be bottle-fed to sleep (*P*=.002); and (2) have noncavitated lesions (*P*=.044). Final logistic regression analysis indicated that children perceived as "easy" were more likely to breast-fed throughout the night (odds ratio [OR]=1.77; *P*=.016), while those perceived as "difficult" were more likely to be bottle-fed to sleep (OR=1.74; *P*=.016).

Conclusions: Maternal reported child temperament may be related to important early childhood caries risk factors. (J Dent Child 2006;73:98-104)

KEYWORDS: TEMPERAMENT, RISK FACTORS, EARLY CHILDHOOD CARIES, FEEDING

Early childhood caries (ECC) is a significant pediatric and public health problem. Despite declines in tooth decay over recent decades, it remains the single most common chronic disease of childhood.[1] Caries rates for children younger than 3 and enrolled in Women, Infants, and Children (WIC) programs have been reported to be 35% to 56%.[2,3]

Multiple authors have demonstrated the biological risk factors for ECC.[4-13] The tremendous prevalence, high cost, and negative outcomes associated with ECC, however, have led some researchers to look beyond biological factors and explore behavioral factors in an effort to better understand ECC's development and prevention. It has been suggested that child temperament may be a determinant of ECC. Children described as "strong tempered"[14] or having a "difficult temperament"[15] have been shown to be at increased risk for ECC.

There is a sizable body of literature on childhood behavior and temperament.[14,16-21] Multiple studies have demonstrated, suggested, or explored the possibility that children with a difficult temperament have more problems with issues such as: (1) a predisposition to crying[19]; (2) greater frequency of colic and injuries requiring sutures[16]; (3) increased night waking,[17] feeding,[21] and sleep difficulties[14]; (4) increased weight gain[20]; and (5) early school adjustment.[18]

In the medical literature, it has been suggested that a child's temperament may be a risk factor for him or her directly and/or indirectly because of the changes induced in their caretakers.[22] Some literature suggests that a mother's

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reaction to a child's behavior is influenced by the child's temperament.[23] In addition, observational findings have shown that mothers behave differently with children of different temperaments.[23] Gordon looked at mothers' perceptions of their 3-year-old's temperament and found that children behaved similarly with their mothers regardless of whether the mother classified her child as "difficult" or "easy."[24] It was the mother who showed a behavioral difference as a function of how she classified her child.[24]

There are multiple approaches to measuring childhood temperament including: (1) temperament scales; (2) maternal report; (3) naturalistic measures; and (4) laboratory observations.[23,25-28] All these methods have advantages and limitations. There is a growing consensus, however, that parent-report measures provide a useful perspective on child personality on a wide range of behaviors as well as a strong degree of objective validity.[28] It has been shown that a mother's perception of her child's temperament is reasonably valid and can be utilized in clinical settings.[23,25,29] Mother's ratings of her child's temperament have been shown to be highly correlated with the toddler temperament scale,[25] the infant temperament questionnaire,[29] and with observer's rating of child temperament.[23] From a clinical viewpoint, parental perceptions may be just as important as the child's actual temperament.[27]

There have only been a few studies in the dental literature exploring child's temperament and its association with dental decay. In a study researching the "strong tempered" profile and parental feeding practices, Quinonez et al found that shyness and duration of feeding habit were risk factors for ECC.[28] Marino and Moy, however, found an association with a difficult temperament and ECC.[14,15] A higher prevalence of a "strong temper" was reported in children with ECC.[14] As temperament became more difficult, children were more likely to have maxillary incisors with decay.[15] While very insightful in their ideas and suggestions, these studies consisted of small sample sizes. Therefore, additional scientific research is needed in this area.

The purpose of this study was to determine if a relationship exists between a mother's perception of her child's temperament and the child's risk factors for ECC.

METHODS

Dental records from the University of Iowa's Infant Oral Health Program (IOHP) at the Johnson County Department of Public Health WIC Clinic, Iowa City, Iowa, were reviewed. The information consisted of maternal-reported information and clinical examination of children 0 to 4 years old enrolled in the IOHP. The information was obtained during the child's first visit. The IOHP dental record contains:

1. patient demographic data;
2. health and dental histories;
3. dietary, oral hygiene, sleeping, and oral habits;
4. information on the presence of cavitated and noncavitated (white spot) lesions and visible plaque on the child's maxillary incisors.

Mother's background knowledge of ECC and the perception of her child's temperament are also documented in the child's first IOHP dental visit record. The presence of dental plaque was inspected visually by the naked eye or with the aid of a dental explorer and without disclosing solution on each facial surface of the child's 4 maxillary incisors. Dental cleanliness was assessed using the following dichotomized categorization:

0= no visible plaque on the facial surfaces of the maxillary incisors;
1= visible plaque on at least 1 facial surface of 1 maxillary incisor.

The clinical criteria used for scoring dental caries in this study utilized the d_1d_{2-3} caries criteria developed by members of the Iowa Fluoride Study team, which distinguish between cavitated and noncavitated carious lesions in the primary dentition.[30] All dental exams were performed by staff members from the Department of Pediatric Dentistry, College of Dentistry, the University of Iowa, Iowa City, Iowa, who were trained and familiar with both plaque and dental caries scoring criteria. Ninety percent of the exams were conducted by a faculty member, and the remaining 10% were conducted by 5 graduate students.

In this cross-sectional study, children were grouped into age categories:

0= 0 to 11 months;
1= 12 to 23 months;
2= 24 to 35 months;
3= 36 to 47 months; and
4= 48 to 59 months.

For the purposes of this study, children were classified as "easy" or "difficult" according to the mother's perceptions. Mothers were given 6 choices of temperament and were asked to mark all that applied to her child. Choices included: (1) "calm"; (2) "fussy"; (3) "crying"; (4) "demanding"; (5) "stubborn"; and (6) "other." Responses were dichotomized into either "easy" or "difficult" for the purpose of statistical analysis. A child was classified as difficult if his/her temperament was marked as: (1) "fussy"; (2) "crying"; (3) "demanding"; or (4) "stubborn." Any child whose temperament was marked as "calm" was classified as "easy." Those who wrote in the "other" category were classified by the researchers' judgment. For example, if a mother wrote "easygoing" or "happy," these would be classified as "easy." If a mother wrote "grumpy" or "tantrums," these would be classified as "difficult." If both an "easy" and a "difficult" temperament were marked, the child was classified as "difficult." Mantel-Haenszel chi-square tests, nonparametric Kruskal-Wallis and Wilcoxon rank sum tests, and logistic regression models were used to analyze data using SAS software (version 9.1; SAS Institute Inc, Cary NC). All tests had a 0.05 level of statistical significance. This study was approved by the Institutional Review Board of the University of Iowa.

RESULTS

Data was collected from 629 records of children ages 0 to 4 who were patients of the University of Iowa's Infant Oral

Table 1. Demographic/Temperament Findings (n=629)

Variable	Frequency	Valid %
Child's gender		
Male	304	48
Female	325	52
Child's age category (ys)		
0 (0-11 mos)	139	22
1 (12-23 mos)	207	33
2 (24-35 mos)	138	22
3 (36-47 mos)	90	14
4 (48-59 mos)	55	9
Maternal reported temperament		
Easy	273	43
Difficult	356	57

Table 2. Relationship Between Perceived Temperament and Demographic/Knowledge Information (n=629)

Variable	Easy (%) (n=273)	Difficult (%) (n=356)	P value
Child's gender			
Female	52	46	.015*
Male	48	54	
Who child lives with			
Both parents	72	66	.121
Other	28	34	
Daytime caretaker			
Mother/grandmother	64	59	.173
Other	36	41	
Maternal knowledge of early childhood caries			
Yes	74	72	.592
No	26	28	

Chi-square test statistic; significance=P<.05.

Table 3. Relationship Between Perceived Temperament and Feeding Habits (n=629)

Variable	Easy (%) (n=273)	Difficult (%) (n=356)	P value
Breast-fed			
Yes	72	71	.771
No	28	29	
Breast-fed to sleep			
Yes	63	54	.046*
No	37	46	
Breast-fed throughout night			
Yes	70	59	.012*
No	30	41	
Bottle-fed			
Yes	84	86	.539
No	16	14	
Bottle-fed to sleep			
Yes	35	48	.002*
No	65	52	
Bottle-fed throughout night			
Yes	37	37	.879
No	63	63	
Snacks			
Sugary	15	20	.159
Nonsugary	85	80	
Frequency of snacks/day			
1-2	60	60	
3-4	36	32	.084
>4	4	8	

Chi-square test statistic; significance=P<.05.

Health Program. Three-hundred and twenty-five of the subjects were males (52%), while 304 (48%) were females. Most children (33%) fell in the age 1 category (12 to 23 months). Overall, 356 (57%) of the subjects were reported by their mothers as "difficult" and 273 (43%) were reported as "easy" (Table 1). Results from bivariate analyses showed no significant differences between perceived temperament and the following variables:

1. "who the child lives with" (*P*=.121);
2. "who takes care of the child during the day" (*P*=.173); and
3. "maternal background knowledge regarding ECC" (*P*=.592; Table 2).

A significant relationship was found, however, between perceived temperament and the child's gender (*P*=.015), where males were more likely to be perceived as "difficult" than females (Table 2). A significant relationship was also found between perceived temperament and the child's age (*P*<.001). Results showed that children perceived as "easy" were significantly younger (median age category=1) than those perceived as "difficult" (median age category=2).

Regarding a possible relationship between perceived temperament and the child's feeding habits, results showed that children perceived as "easy" were more likely to be breast-fed to sleep (*P*=.046) and throughout the night (*P*=.012) than those perceived as "difficult." On the other hand, the latter were more likely to be bottle-fed to sleep (*P*=.002) than children perceived as "easy" (Table 3).

As for brushing habits, "difficult" children were more likely to have their teeth brushed daily (*P*=.002), while "easy" children were more likely to have their teeth brushed twice daily (*P*=.006; Table 4).

Lastly, "difficult" children were found to have non-cavitated (white spot) lesions significantly more often than "easy" children (*P*=.044; Table 5). Moreover, the data also

Table 4. Relationship Between Perceived Temperament and Brushing Habits (N=629)

Variable	Easy (%) (N=273)	Difficult (%) (N=356)	P value
Tooth-brushing			
Daily	65	73	.002*
Once in a while	19	19	
None	16	8	
Who brushes child's teeth			
Parent	64	60	.571
Parent and child	27	30	
Other	9	10	
When child's teeth brushed			
AM	19	26	.006*
PM	37	42	
AM and PM	44	32	

*Chi-square test statistic; significance=P<.05.

Table 5. Relationship Between Perceived Temperament and Caries/Plaque Rates (n=629)

Variable	Easy (%) (n=273)	Difficult (%) (n=356)	P value
Cavitated lesions			
Yes	12	15	.269
No	88	85	
Noncavitated (white spot) lesions			
Yes	12	18	.044*
No	88	82	
Visible plaque on maxillary incisors			
Yes	17	22	.173
No	83	78	

*Chi-square test statistic; significance=P<.05.

indicated that children perceived as difficult were more likely to experience noncavitated (white spot) lesions at an earlier age (48% at age 2) compared to children perceived as calm (41% at age 3; $P<.001$).

Variables showing significant results in bivariate analyses ($P \leq 0.05$) were used to develop a final model using forward and backward stepwise logistic regression analysis. The final logistic regression model indicated that children perceived as "easy" were 1.77 times more likely to breastfeed throughout the night ($P=.016$), while those perceived as "difficult" were 1.74 times more likely to be bottle-fed to sleep ($P=.016$). It was also found that children from age groups 2 (24 to 25 months) and 3 (36 to 47 months) were significantly more likely to be perceived by their mothers as "difficult" ($P<.05$; Table 6).

Table 6. Multivariate Logistic Regression Analysis for Maternal Reported Child Temperament

Variable	Easy (%)	Difficult (%)	Odds ratio 95% CI	P value
Breast-fed throughout the night				
Yes	46	54	1.77 (1.11-2.82)	.016
No	35	65	1.00	
Bottle-fed to bed				
No	48	52	1.74 (1.11-2.73)	.016
Yes	35	65	1.00	
Age group (ys)				
0	61	39	1.08 (0.48-2.66)	(.025)
1	44	56	0.75 (0.36-1.57)	.086
2	29	71	0.43 (0.19-0.94)	.506
3	32	68	0.38 (0.16-0.94)	.039
4	49	51	1.00	.046

DISCUSSION

This study found that children perceived as "easy" were more likely to be breast-fed throughout the night. The scientific literature available on breast-feeding and its relationship to dental caries is not as plentiful as that describing dental caries related to bottle-feeding practices. In a systematic review of the literature, Valaitis et al was unable to draw conclusions regarding the relationship between ECC and breast-feeding. This is partly because of inconsistencies in the methodology and differences in definitions of ECC and breast-feeding among reviewed studies.[31] Although in vitro studies[32,33] have shown that human milk is more cariogenic than cow milk, the majority of studies regarding breast-feeding have indicated a lower dental caries incidence in breast-fed children, especially if oral hygiene is good and diet is low in sugar.[34-40] The existing dental literature that addresses temperament does not look into breast-feeding or oral hygiene habits, as was the case in this study. Therefore, no comparisons can be made.

The other 2 results of this study were that children perceived as "difficult" were more likely to be bottle-fed to sleep and were more likely to have noncavitated (white spot) lesions than children perceived as "easy." Similarly, Marino et al found a higher incidence of a "strong temper" with "nursing bottle caries," and those with "nursing bottle

caries" were more likely to take a bottle to bed.[14] Moy also found similar clinical results. In her study, children with a "difficult" temperament tended to have more maxillary incisors with decay.[15] Similarly, the current study suggests that children referred to as "difficult" may be at a higher risk for taking a bottle to bed and for caries development. It is important to note, however, that the association described in the literature between feeding method and temperament is extremely inconsistent. Some investigators have found breast-fed infants to be more irritable than bottle-fed infants.[41] Others showed that bottle-fed infants cry more than breast-fed infants,[42] and some reported no differences based on the feeding method.[43]

When looking at this study's results regarding daily tooth-brushing frequency, it was found that, if the choice of "no daily brushing" was eliminated from the statistical analyses, there would be no significant difference between perceived "easy" and "difficult" temperaments. It can be speculated that children perceived as "easy" had their teeth brushed twice daily because they possibly did not protest as much as "difficult" children.

Using the toddler temperament scale, Fullard et al looked at mothers' ratings of their infants first at 4 to 8 months and then again at 1 to 3 years of age.[25] More children were judged by their mothers as "more difficult than average" in the 1- to 3-year-old age group than in the 4- to 8-month-old age group. Similarly, the current study found that ages 2 to 3 (24 to 47 months) were significantly more difficult compared to the other age groups. These findings could be explained by the fact that toddlers are becoming more independent and strong-willed and go through what is commonly known as the "terrible twos."

This study also found that males were more likely to be perceived by their mothers as "difficult" than females. During the first few years, a greater proportion of boys are reported to: (1) have a difficult temperament; (2) be harder for their mothers to manage; and (3) show more behavior problems.[44,45] Although boys are commonly believed to have a more active temperament, however, it is believed that systematic differences between boys and girls do not appear prior to age 4, which is the age group of this study's sample (0 to 4 years of age).[27,46] Oberklaid et al assessed the temperament among a large sample (N=2,528) of Australian toddlers.[27] The toddler temperament scale[25] was used, and the subjects were divided into 2 groups: (1) younger toddler group (<35 months); and (2) older toddler group (>36 months). Results showed no significant sex differences in temperament for the younger toddler group. Among older toddlers, boys were significantly more likely ($P<.05$) to be clinically categorized as having a "difficult" temperament compared to their female counterparts.

The subject of temperament in infants and young children has received great clinical and research attention, with an increasing number of studies attempting to better define and quantify temperament.[16-27,29,41-47] The concern regarding the ability to generalize temperament scores used in different studies, however, should be considered when comparing data obtained from different socioeconomic and cultural settings. In addition, some studies either based their results on small, selected samples or applied lengthy and complex parental interviews that are impractical for routine clinical use.[25,47] This study was not originally designed to apply psychological temperament scores. By applying a very simple method of child temperament assessment, however, study results showed significant relationships between a mother's perception of her child's temperament and the child's risk factors for ECC. It is hoped that this study's results will encourage future researchers to conduct further studies to assess and validate temperament scores in clinical settings in a more practical fashion by utilizing less complex and time-consuming parental interviews.

Despite this study's limitations and the ones described in the temperament literature regarding the variation in operationalizing temperament, there is evidence that maternal reports provide accurate descriptions of temperament. Furthermore, there are many implications for the use of temperament in a pediatric practice.[16,26,48] Carey recommends the use of temperament data in pediatric practice for the following reasons:

1. A general discussion about temperament between the clinician and parent will increase parental awareness and understanding of individual differences.
2. If the child's temperament is identified, the parents obtain a more organized picture of the child's behavior.
3. The clinician may suggest alternative methods of parental management when the child, the environment and the parent are not interacting in an effective way.[26]

Cameron and Rice looked at developing anticipatory guidance programs for behavioral problems based on early assessment of infant temperament.[49] They found that parents felt better just by bringing up the topic of their child's temperament. Therefore, this literature suggests that positive changes are more likely to be implemented by:

1. simply bringing up the topic of temperament;
2. acknowledging that a child and parent may be having a difficult time with an issue; and
3. educating the parent on what attempts can be made to change behavior.[49]

A mother's perception of her child's temperament would by no means conclusively explain why a child may experience ECC. Based on scientific literature, however,[23,25,27-29,50] it should be considered:

1. while assessing a child's overall caries risk;
2. to understand what type of child the parents are dealing with; and
3. while attempting to effectively educate the parents about preventive measures.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. Children reported as "easy" were more likely to:
   a. be younger;
   b. have their teeth brushed twice per day; and
   c. be breast-fed to sleep and throughout the night.
2. Children reported as "difficult" were more likely to:
   a. be bottle-fed to sleep; and
   b. have noncavitated (white spot) lesions.
3. Maternal reported child temperament may be related to important Early Childhood Caries risk factors.

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