ORIGINAL SCIENTIFIC ARTICLE

Associations between oral habits, dental anxiety, dental service utilization, and maternal mental health status among 6- to 12-year-old children in Ile-Ife, Nigeria

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Abstract

Purpose The current study sought to determine the associations between maternal mental health and oral habits, dental anxiety, and dental service utilization of 6- to 12-year-old children in Ile-Ife, Nigeria.

Methods Data were obtained from a household survey involving 1411 mothers and their 6- to 12-year-old children. Data collected were the confounding (maternal age, child's age at last birthday, sex at birth and socioeconomic status), independent (maternal psychological distress, and depression status) and dependent (child's non-nutritive oral habits, dental anxiety level, and most recent dental visit) variables. Bivariate analyses were conducted to test the associations between the dependent and independent variables. After controlling for confounding variables, the associations between the dependent and independent variables were determined using multivariable linear and logistic regression analyses.

Results Overall, 479 (33.9%) reported one oral habit, 189 (13.4%) reported two and 99 (7.0%) children reported three or more oral habits. Only 25 (1.7%) children reported a dental visit in the year preceding the study. Higher maternal psychological distress was associated with higher dental anxiety in children (AOR: 0.094; 95% CI − 0.080 to − 0.293; $p < 0.001$). There was no significant association between maternal psychological distress, child's non-nutritive oral habits, and the child's most recent dental visit. There was also no association between maternal depression and the child's non-nutritive oral habits, dental anxiety level, and most recent dental visit.

Conclusion Maternal psychological distress was a significant risk indicator for dental anxiety, but not for dental service utilization or non-nutritive oral habits among children in Ile-Ife, Nigeria. Maternal educational status was also associated with dental anxiety. Further research is needed to elucidate the study's findings.

Keywords Mental health disorders · Anxiety · Depression · School-aged children · Nigeria

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Introduction

Oral health-related behaviors, dental anxiety, and regular dental service utilization are important indicators of the oral health of children (Buldur and Guvendi 2020). Family-level intergenerational socialization influences the development of behavior, dental anxiety, and dental service utilization patterns (Buldur and Guvendi 2020; Shearer and Thomson 2010). Within the family, maternal factors, such as the mental health status, are strong determinants of the children's future oral health (Andreola Beber Gomes et al. 2021; Costa et al. 2017a; Esa et al. 2020; Finlayson et al. 2019; Gomes et al. 2020; Saied-Moallemi et al. 2008; Shearer et al. 2011).

Parenting stress is an important maternal mental health factor that affects the oral health of the child. Mothers may experience greater parental stress when their children have behavioral difficulties (Biswas et al. 2014). Older mothers and those with a higher level of education are more likely to work outside the home, to have a child with behavioral difficulties (Pooja et al. 2019), and to experience parental stress (Rajgariah et al. 2021). Children with behavioral problems are also more likely to have a history of a non-nutritive oral habit (Richards and Els 1994). Non-nutritive habits such as finger or digit sucking, tongue sucking, tongue thrusting, lip sucking, lip biting, nail biting, object biting, and bruxism are calming to children but offer no nutritional benefit (Silva and Manton 2014). While some studies (Coric et al. 2014) have found a direct correlation between maternal anxiety and children's dental anxiety, others have not (Wu and Gao 2018; Folayan et al. 2002).

The association between parental stress and children's dental anxiety is poorly understood. Moreover, little is known about the effect of parental stress on children's access to dental treatment, although multiple studies have indicated that parental stress increases the risk of children's poor oral health (Chouchene et al. 2021; Gavic et al. 2018; LaValle et al. 2000). A possible pathway may be that factors that increase parental stress may also be factors that reduce the children's access to health-care services, including dental care.

Maternal depression also increases parenting stress (National Research Council (US) and Institute of Medicine (US) Committee on Depression 2009). Also, mothers who have depression are more likely to have children who have dental anxiety (Costa et al. 2017b) and poor oral health behaviors (Gomes et al. 2020). Dental anxiety also increases the risk for poor oral health (Merdad and El-Housseiny 2017) due to fears of dental procedures and avoidance of dental services (Kida Minja and Kokulengya Kahabuka 2019). Although there are no studies directly associating maternal depression with poor dental service utilization, maternal depression is associated with poor health-care service utilization (Minkovitz et al. 2005).

Dental anxiety, non-nutritive oral habits, and dental service utilization are oral health risk behaviors that are associated with higher risk of caries (Folayan et al. 2018; Oba et al. 2009; Torriani et al. 2014). When maintained for at least 36 months, non-nutritive sucking habits are associated with occlusal and physiological changes that increase caries risk. Non-nutritive habits are emotional compensatory behaviors for the sensations of insecurity resulting from this distancing between mother and children (Silva and Manton 2014). The child then retains infantile oral habits beyond 3 years of age which is reinforced by the low utilization of health-care services (Folayan et al. 2018; Oba et al. 2009; Torriani et al. 2014).

Though maternal mental health problems can lead to distancing from the child (Leis et al. 2014), there is paucity of information on the impact of specific maternal mental health problems on children's non-nutritive oral habits. There is also a dearth of information on the impact of specific maternal mental health problems on children's oral health risk indicators like dental anxiety and dental service utilization. To address these knowledge gaps, the current study sought to answer the question: are there associations between maternal psychological distress, depressive symptoms and children's non-nutritive oral habits, dental anxiety, and dental service utilization of school-aged children in Ile-Ife, Nigeria? Our hypothesis was that children of mothers with mental health challenges and depressive symptoms have higher odds of indulging in non-nutritive oral habits, greater dental anxiety, and using dental services less frequently.

Materials and methods

Ethical considerations

Ethical approval for the conduct of this study was obtained from the Ethics and Research Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Nigeria (IPH/OAU/12/1887). Written consent was obtained from the parents of the children that participated in the study in line with international and national ethics guidelines. In addition, children who were 12 years old also provided written assent based on national ethical guidelines (Federal Ministry of Health, 2014).

Study design and study participants

This is a secondary analysis of the data of a cross-sectional study conducted in Ife Central Local Government Area of Osun State, a semi-urban community in Southwestern Nigeria to determine the prevalence of caries and gingivitis

in school children. Study participants were 6- to 12-year-old children and their mothers who gave written consent for study participation. Mothers provided information on their mental health, while both mothers and children provided information on the child's dental anxiety. Children aged 6–7 years had their mothers respond to the questions, whereas children aged 8–12 years answered the questions independently. Maternal response on the level of children's anxiety has been shown to highly correlate with the dentist's evaluation of the child's dental anxiety in the study environment (Folayan et al. 2004). Critically ill children were excluded from study participation. The data was collected through a household survey conducted between December 2018 and January 2019.

Sample size and sampling technique

The minimum sample size for the primary study was calculated with the formula proposed by Araoye (2003), using a caries prevalence of 13.9% (Adekoya-Sofowora et al. 2006), a 5% margin of error, and a confidence level of 95%. The minimum sample size was 1233 children. The children were recruited using a multi-stage random sampling technique. For the first stage, 70 of the 700 enumeration areas in Ife Central Local Government Area were selected using the simple random sampling method. For the second stage, every other household in the selected enumeration areas was identified as eligible for participation. For the final stage, one child who met the inclusion criteria was recruited per household. Households that declined participation were replaced by the next eligible household. In households where there was more than one eligible study participant, the children balloted to identify who will be included in the study. The other children were also examined and referred for treatment, but their data were not collected for the study. Participants' recruitment continued until the minimum study sample size was attained.

Data collection

The primary study collected data from mothers of participating children using an interviewer-administered questionnaire. The survey instrument was administered by field workers trained on the study protocol, the use of the data collection tools, sample selection (including household listing and selection), and the ethical conduct of research (Folayan et al. 2019). Data collected included covariates for the mother (age at last birthday and educational level) and child (age at last birthday, sex at birth, and socioeconomic status), the independent variables (maternal mental health risk, maternal depression status), and the dependent variables (child's non-nutritive oral habits, dental anxiety level, and date of the most recent dental visit).

Study variables

Covariates: The primary study obtained information on each participant's maternal age, child's age, sex, and socioeconomic status. Age for mothers and their children was computed in years as age at last birthday, while the child's sex was determined as assigned sex at birth (male or female). Data on the child's socioeconomic status was determined using an adapted version of the index developed by Olusanya (1985) ,which is a multiple-item index combining the mother's level of education with the father's occupation and has been used in multiple studies in the study environment (Folayan et al. 2014b; Folayan et al. 2017; Ola et al. 2013). When a child had lost a parent, their socioeconomic status was determined using the status of the living parent. For this study, the children were grouped into three socioeconomic classes: high (upper and upper-middle status), middle (middle status) and low (lower-middle and lower status). The regrouping was done in line with a prior index regrouping of children in Nigeria (Folayan et al. 2003).

Independent variables

Maternal psychological distress: The mothers' level of psychological distress was assessed using the Global Health Questionnaire. The Global Health Questionnaire (GHQ-12) is one of the most widely used mental health screening tools to assess the risk of psychological distress and it has been validated for use in Nigeria (Fatoye and Morakinyo 2003; Gureje 1991). Each one of the 12 items of the GHQ-12 had four possible responses, namely: 'not at all', 'no more than usual', 'rather more than usual', and 'much more than usual'. Responses were scored using the bimodal method of 0–0–1–1, respectively, with a total possible score of 12. The Cronbach alpha score for the GHQ-12 for this study was 0.828.

Maternal depressive symptoms: The Patient Health Questionnaire (PHQ-9) a nine-item questionnaire with scores for each of the nine DSM-IV criteria was also used to assess the level of maternal depressive symptoms. Each criterion was scored from "0" (not at all) to "3" (nearly every day) with possible total score ranging from 0 to 27. The Cronbach alpha score for the PHQ-9 in this study was 0.958.

Dependent variables

Non-nutritive oral habits: Mothers were asked if their child practiced any non-nutritive oral habit including 'digit or finger sucking', 'tongue sucking', 'tongue thrusting', 'lip sucking', 'lip biting', 'nail biting', 'object biting', and 'bruxism'. This was dichotomized for bivariate analysis as zero = non-nutritive oral habits absent, if the

mother indicated that her child had none of these habits, and '1' = non-nutritive oral habits present if she indicated that her child had any of the habits.

Dental anxiety: Mothers also provided responses to five questions in the Corah dental anxiety scale used in assessing the child's dental anxiety. This scale, which had been validated for use in Nigeria (Folayan et al. 2002), is a brief, four-item Likert scale. Responses to items are scored as: 'not anxious' = 1, 'slightly anxious' = 2, 'fairly anxious' = 3, 'very anxious' = 4 and 'extremely anxious' = 5. Responses were summed to produce a total score ranging from 5 to 20. Scores 13 and above indicate high dental anxiety and 9–12 moderate anxiety, while scores lower than 9 indicate low dental anxiety (Corah et al. 1978). The Cronbach alpha score for the Corah dental anxiety scale for this study was 0.831.

Last dental visit: Mothers were asked to indicate the time of the child's last dental visit using these alternatives: within the last 6 months, more than 6 months to 1 year ago, between 1 and 2 years ago, between 2 and 5 years ago, more than 5 years ago, never, and do not remember (Folayan et al. 2014a). The timing of the most recent dental visit was dichotomized into a year ago or less (1) and more than a year ago (0).

Data analysis

Data analysis was conducted using IBM-SPSS statistical software version 28. Frequencies and percentages were generated for all the variables, while measures of central tendency and variation were computed for numerical variables. Chi-squared test, student T test, ANOVA test, and correlation statistics were used to test the associations between the dependent and independent variables.

Multivariable regression models were developed for inferential analysis. Binary logistic regression analysis was used to determine the strength of association between the dependent (reporting non-nutritive oral habits and visiting the dentist last year) and independent variables after adjusting for the confounding variables. The strength of the association between the independent variables and the child's dental anxiety score as the dependent variable was determined using linear regression analysis. Only variables that showed no collinearity were included in the model. The estimated coefficients were expressed as adjusted odds ratios (AOR), regression coefficients, and their 95% confidence intervals, and p values were reported. The goodness of fit of models was assessed using Nagelkerke R^2, and -2 log likelihood ($-2LL$) for logistic regression models and adjusted R^2 for linear regression. Significance was set at 5%.

Results

The complete data of 1411 mothers and their children were extracted for this study. The mother's mean age (standard deviation—SD) was 36.4 (8.85) years, while the mean age (SD) of the children was 8.7 (1.94) years. The mean (SD) maternal psychological distress score was 0.9 (1.85), mean (SD) maternal depressive symptoms score was 10.47 (2.90), and the mean (SD) child dental anxiety score was 10.4 (3.67). The most reported oral habit was nail biting (41.7%), followed by object biting (15.7%) and lip sucking (7.2%). Overall, 644 (45.6%) children reported no oral habit, 479 (33.9) reported at least one oral habit, 189 (13.4%) reported two oral habits, and 99 (7.0%) children reported three or more oral habits. Only 25 (1.7%) children reported a dental visit in the year preceding the study.

As shown in Table 1, significantly more mothers who were 30 years or below had children with a high level of dental anxiety ($p = 0.007$) and significantly higher mean anxiety scores ($p < 0.001$). Also, significantly more mothers with college/university level of education had children with high dental anxiety ($p = 0.028$). Maternal psychological distress was significantly associated with the child's dental anxiety level ($p < 0.001$). There was a positive and significant correlation between maternal psychological distress and the child's dental anxiety score ($p < 0.001$). Furthermore, a significantly higher percentage of children with no oral habits had high dental anxiety ($p < 0.001$) and a significantly higher mean dental anxiety score ($p < 0.001$).

Table 2 shows that more children of mothers aged 41 years or older reported a non-nutritive oral health habit ($p = 0.005$). Also, significantly more children reporting a dental clinic visit within the last 12 months had mothers who were 30 years and below ($p = 0.012$).

Table 3 shows that the multivariable logistic regression model determining factors associated with the child's oral habits explained only a small (1.2%), but not statistically significant ($p = 0.164$) proportion of the variance observed in reporting the presence of the habit. Children of older mothers had higher odds of reporting oral habits (AOR: 1.018; 95% CI 1.005–1.032; $p = 0.008$). For every additional year of maternal age, there was 1.8% higher odds of the child reporting oral habits.

The multivariable logistic regression model determining factors associated with the child's dental service utilization explained only a small (3.9%), but not statistically significant ($p = 0.439$) proportion of the variance observed in reporting dental visits in the population. Children of older mothers had lower odds of reporting a recent dental visit (AOR: 0.907; 95% CI 0.835–0.986; $p = 0.022$. For every additional year of maternal age, there was 9.3% lower odds of the child reporting a recent dental visit.

Table 1 Bivariate association between maternal factors, and dental anxiety of 6- to 12-year-old children in South-West Nigeria ($N = 1411$)

Variables	Child's dental anxiety						
	Low	Moderate	High	All/whole sample	p value	Mean score	p value
	$N = 666$	$N = 353$	$N = 392$	$N = 1411$		(SD)*	
	n (%)	n (%)	n (%)				
Maternal age category							
30 years and below	122 (42.2)	62 (21.5)	105 (36.3)	289 (20.5)	**0.007**	11.34 (4.19)	
31–40 years	422 (49.1)	218 (25.4)	219 (25.5)	859 (60.9)		10.24 (3.49)	**< 0.001**
41 years and above	122 (46.4)	73 (27.8)	68 (25.9)	263 (18.6)		10.00 (3.45)	
Maternal education							
None/Quranic school/primary school	166 (50.0)	83 (25.0)	83 (25.0)	332 (23.5)	**0.028**	10.26 (3.30)	
Secondary school only	400 (48.6)	204 (24.8)	219 (26.6)	823 (58.4)		10.36 (3.77)	0.122
College/university	100 (39.1)	66 (25.8)	90 (35.2)	256 (18.1)		10.84 (3.77)	
Maternal psychological distress							
Mean score (SD)	0.72 (1.66)	0.85 (1.77)	1.23 (2.14)	0.89 (1.85)	**< 0.001**	0.090*	**< 0.001**
Maternal depressive symptoms							
Mean score (SD)	10.44 (2.84)	10.42 (2.71)	10.55 (3.16)	10.47 (2.90)	0.776	− 0.050*	0.061
Child oral habits							
Absent	269 (41.8)	159 (24.7)	216 (33.5)	644 (45.6)		11.00 (3.76)	**< 0.001**
Present	397 (51.8)	194 (25.3)	176 (22.9)	767 (54.4)	**< 0.001**	9.94 (3.51)	

P values in bold letters indicate statistically significant associations at $p < 0.05$

*Spearman's correlation Rho computed

Table 2 Bivariate association between maternal factors, child's oral health habits, and dental service utilization among 6- to 12-year-old children in South-West Nigeria ($N = 1411$)

Variables	Oral health habits			Recent dental service utilization		
	Absent	Present	p value	A year ago, or less	Over a year ago	p value
	$N = 644$	$N = 767$		$N = 25$	$N = 1386$	
	n (%)	n (%)		n (%)	n (%)	
Maternal age category						
30 years and below	132 (45.7)	157 (54.3)	**0.005**	11 (3.8)	278 (96.2)	**0.012**
31–40 years	415 (48.3)	444 (51.7)		10 (1.2)	849 (98.8)	
41 years and above	97 (36.9)	166 (63.1)		4 (1.5)	259 (98.5)	
Maternal education						0.66
None/Quranic school/primary school	167 (50.3)	165 (49.7)	0.138	6 (1.8)	326 (98.2)	
Secondary school only	361 (43.9)	462 (56.1)		13 (1.6)	810 (98.4)	
College/university	116 (45.3)	140 (54.7)		6 (2.3)	250 (97.7)	
Maternal psychological distress*						
Mean score (SD)	0.93 (1.88)	0.87 (1.82)	0.543	0.90 (1.85)	0.60 (1.35)	0.421
Maternal depressive symptoms						
Mean score (SD)	10.43 (2.92)	10.49 (2.88)	0.694	10.47 (2.91)	10.52 (2.43)	0.926

P values in bold letters indicate statistically significant associations at $p < 0.05$

The linear regression model determining factors associated with the child's dental anxiety explained only a small (1.2%) and statistically significant proportion of the variance observed in dental anxiety in the population ($p = 0.002$). Children of mothers who had secondary education (B: − 0.076; 95% CI − 1.083 to − 0.052; $p = 0.031$) and none/primary education (B: − 0.070; 95% CI − 1.205 to − 0.006; $p = 0.048$) had significantly less dental anxiety than children

Table 3 Multivariable regression of factors associated with the presence of dental anxiety, oral habits, and dental service use among 6- to 12-year-old children in South-West Nigeria ($N=1411$)

Variables	Oral habits		Dental service use		Child's dental anxiety	
	AOR (95% CI)	p value	AOR (95% CI)	p value	B (95% CI)	p value
Child's age	0.986 (0.932–1.042)	0.909	1.026 (0.828–1.272)	0.812	− 0.025 (− 0.148 to − 0.054)	0.361
Child's sex		0.618		0.343		0.491
Male	1.00		1.00		1.00	
Female	1.012 (0.819–1.251)		0.670 (0.293–1.533)		− 0.018 (− 0.517 to − 0.248)	
Child's social status						
High	1.00	0.705	1.00	0.943	1.00	–
Medium	1.064 (0.751–1.509)	0.725	1.047 (0.256–4.282)	0.949	0.010 (− 0.542 to –0.720)	0.782
Low	1.132 (0.830–1.545)	0.434	1.191 (0.337–4.205)	0.786	− 0.032 (− 0.805 to 0.320)	0.399
Maternal education						
College/university	1.00	0.116	1.00	0.543	1.00	–
Secondary school only	1.104 (0.830–1.469)	0.496	0.571 (0.210–1.554)	0.439	− 0.076 (− 1.083 (− 0.052)	**0.031**
None/Quranic school/primary school	0.841 (0.604–1.170)	0.304	0.628 (0.193–2.039)	0.273	− 0.070 (− 1.205 to (− 0.006)	**0.048**
Maternal age	1.018 (1.005–1.032)	**0.008**	0.907 (0.835–0.986)	**0.022**	− 0.068 (− 0.050 to (− 0.006)	**0.012**
Maternal psychological distress	0.974 (0.919–1.033)	0.387	0.892 (0.664–1.199)	0.45	0.094 (0.080–0.293)	**< 0.001**
Maternal depression	1.013 (0.976–1.052)	0.497	0.995 (0.856–1.155)	0.943	− 0.037 (− 0.115 to − 0.021)	0.178
Naglkerke R^2	0.12	0.164	0.039	0.439		
− 2 log likelihood	1932.35		242.23			
Adjusted R square	–	–	–	–	0.012	**0.002**

AOR adjusted odds ratio, *CI* confidence interval, *B* regression coefficient

P values in bold letters indicate statistically significant associations at $p<0.05$

whose mothers were college/university educated. Maternal age (B: − 0.068; 95% CI − 0.050 to − 0.006; $p=0.016$) was inversely and significantly associated with child's dental anxiety: the higher the maternal age, the lower was the child's dental anxiety level. On the contrary, maternal psychological distress (B: 0.094; 95% CI − 0.080 to − 0.293; $p < 0.001$) was directly and significantly associated with child dental anxiety: the higher the maternal psychological distress, the higher was the child's dental anxiety level.

Discussion

Maternal and child health are inextricably linked, and when information regarding effective methods and interventions affecting both mother and child's health is available, a continuum of care strategy can be designed to meet their health-care needs (Lassi et al. 2013). Results from this study showed that maternal psychological distress and depressive symptoms were not associated with children's non-nutritive oral habits and dental service utilization. However, maternal psychological distress was significantly associated with the child's dental anxiety: the higher the maternal psychological distress, the higher was the level of dental anxiety in school-age children. There was no significant association between maternal depressive symptoms and the child's

dental anxiety level. The study results thus partially support the study hypothesis.

The present study has several strengths. It is the first to explore the association between maternal mental health status and school-aged children's oral health risk indicators in sub-Saharan Africa. The study also provides the first evidence of a possible link between maternal mental health and the oral health of school-aged children in Nigeria. In addition, this study used a household survey for data collection thus increasing the generalizability of the study results to mothers and their children in the study environment.

This study, however, had limitations. The cross-sectional design makes it challenging to infer a causal connection between the independent and dependent variables. There is also the possibility for social desirability responses though the use of validated tools to measure most of the constructs mitigates this risk. Furthermore, the data focused largely on maternal factors, whereas oral diseases are multifactorial. The low Nagelkerke R^2 scores indicates that the data-driven regression models explained only a small portion of the observed differences. According to a conceptual model of children's oral health (Fisher-Owens et al. 2007), many factors affect a child's oral health, including culture and other community-level factors that were not investigated in this study. The small effect of maternal mental health on a Nigerian child's oral health suggests that other factors are

more influential in determining children's oral health habits, dental service utilization, and dental anxiety in Nigeria. Despite these limitations, the study findings may be helpful in designing interventions that can improve the oral health of school-aged children in Nigeria.

A major finding was that maternal psychological distress was an important risk indicator of dental anxiety in school-aged children. Prior studies identified an association between maternal mental health and child's dental anxiety (Costa et al. 2017a; Esa et al. 2020; Fatoye and Morakinyo 2003). Although a prior hospital-based study conducted in the same study environment did not find a significant association between parental anxiety and child's dental anxiety, the correlation between maternal and child dental anxiety was stronger than that between child and paternal dental anxiety (Folayan et al. 2002). Prior studies had indicated that maternal stress was associated with adolescent neural stress system function, causing adolescents' higher responses in the medial prefrontal cortex to stressful negative emotional stimuli, thereby predisposing them to higher risk for psychopathology (Niehaus et al. 2019). The heightened activation in the medial prefrontal cortex during an emotionally evocative task may indicate heightened processing of and reactivity to stressful negative emotional stimuli (Etkin et al. 2011) like dental care. This study provides the first suggestive evidence that a possible psychopathology associated with school-aged children's chronic exposure to highly stressed mothers may be dental anxiety.

Furthermore, familial transmission of anxiety disorders may explain the correlation between maternal psychological distress and child dental anxiety reported in this study (Beidel and Turner 1997; Turner et al. 1987). Individuals with psychological distress are more likely to develop general anxiety disorders and are more likely to exert excessive control over children (Becker et al. 2010; Moore et al. 2004). Parental over-controlling behaviors signal to a child that there is an excessive amount of threat that the child will be unable to cope with or manage. Over-controlling parental behavior reduces the opportunity for the child to develop competence, or mastery over things in their environment, including novel situations (Affrunti and Ginsburg 2012) like dental visits. Future studies to identify how maternal psychological distress may affect dental anxiety in children, and the associations between parental controlling behavior, maternal psychological distress, and children's dental anxiety are recommended.

Second, we found an association between maternal age and children's non-nutritive oral habits in the study environment, with the risk increasing with increasing maternal age. Children of older mothers may turn to oral habits for comfort because their mothers may be too preoccupied with work to provide the necessary attention. It is also possible that older mothers are more permissive and, as a result, less strict when it comes to breaking oral habits in young children (Onyejaka et al. 2018). We also found an association between maternal age and dental service utilization with younger mothers more likely to have taken their children to the dentists in the preceding year. (Denloye et al. 2010; Folayan et al. 2013; Ola et al. 2013; Olatosi et al. 2020). The study results suggest that curative dental care needs may be higher for children with younger mothers than for those with older mothers. The inverse association between age and dental anxiety also suggests a likelihood that the risk of poor oral health from dental anxiety is less likely for children with older mothers. Studies are needed to understand how and why children of older mother are less likely to have dental anxiety and less likely to visit dental clinics. These lessons can be used to reinforce the training of younger mothers on oral health care of their children to change the current observed paradigm positively. The paradigm change needed includes increasing the number of children who make preventive care visits to the dental hospital.

Finally, the study findings suggests that maternal age and educational status may moderate or mediate the association between maternal psychological distress and the child's dental anxiety. Further analysis of the current study's data to determine the relationship between the child's dental service utilization, non-nutritive habits, and dental anxiety level may be useful for elucidating the causal pathways underlying the observed associations.

Conclusion

Within the limitations of the present study undertaken in Ile-Ife, Nigeria, it has been shown that:

– Maternal psychological distress was a significant risk indicator for dental anxiety, but not for dental service utilization or non-nutritive oral habits among children.
– Maternal depression was not associated with the child's dental anxiety level, dental service utilization nor non-nutritive oral habits.
– Maternal educational status was associated with dental anxiety in children.
– Further research is needed to elucidate the study's findings.

Declarations

Conflict of interest The authors declare no competing interest.

References

Adekoya-Sofowora CA, Nasir WO, Oginni AO, Taiwo M. Dental caries in 12-year-old suburban Nigerian school children. Afr Health Sci. 2006;6(3):145–50. https://doi.org/10.5555/afhs.2006.6.3.145.

Affrunti NW, Ginsburg GS. Maternal overcontrol and child anxiety: the mediating role of perceived competence. Child Psychiatry Hum Dev. 2012;43(1):102–12. https://doi.org/10.1007/s10578-011-0248-z.

Andreola BGM, da Polina PCV, Leao GM, Sousa AM. Maternal common mental disorders symptoms influence associated with early childhood dental caries: a cross-sectional study in a southern Brazilian city. Int J Paediatr Dent. 2021;31(3):344–50. https://doi.org/10.1111/ipd.12685.

Araoye M. Research methodology with statistics for social sciences. Ilorin: Nathadex Publisher; 2003.

Becker KD, Ginsburg GS, Domingues J, Tein JY. Maternal control behavior and locus of control: examining mechanisms in the relation between maternal anxiety disorders and anxiety symptomatology in children. J Abnorm Child Psychol. 2010;38(4):533–43. https://doi.org/10.1007/s10802-010-9388-z.

Beidel DC, Turner SM. At risk for anxiety: I. Psychopathology in the offspring of anxious parents. J Am Acad Child Adolesc Psychiatry. 1997;36(7):918–24. https://doi.org/10.1097/00004583-199707000-00013.

Biswas S, Moghaddam N, Tickle A. What are the factors that influence parental stress when caring for a child with an intellectual disability? A critical literature review. Int J Dev Dis. 2014;61(3):127–46.

Buldur B, Guvendi ON. Conceptual modelling of the factors affecting oral health-related quality of life in children: a path analysis. Int J Paediatr Dent. 2020;30(2):181–92. https://doi.org/10.1111/ipd.12583.

Chouchene F, Masmoudi F, Baaziz A, Maatouk F, Ghedira H. Parental stress as a predictor of early childhood caries: a systematic review. Eur Arch Paediatr Dent. 2021;22(2):111–9. https://doi.org/10.1007/s40368-020-00580-4.

Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. J Am Dent Assoc. 1978;97(5):816–9. https://doi.org/10.14219/jada.archive.1978.0394.

Coric A, Banozic A, Klaric M, Vukojevic K, Puljak L. Dental fear and anxiety in older children: an association with parental dental anxiety and effective pain coping strategies. J Pain Res. 2014;7:515–21. https://doi.org/10.2147/JPR.S67692.

Costa FDS, Azevedo MS, Ardenghi TM, Pinheiro RT, Demarco FF, Goettems ML. Do maternal depression and anxiety influence children's oral health-related quality of life? Commun Dent Oral Epidemiol. 2017a;45(5):398–406. https://doi.org/10.1111/cdoe.12303.

Costa VPP, Correa MB, Goettems ML, Pinheiro RT, Demarco FF. Maternal depression and anxiety associated with dental fear in children: a cohort of adolescent mothers in Southern Brazil. Braz Oral Res. 2017b;3:e85. https://doi.org/10.1590/1807-3107BOR-2017.vol31.0085.

Denloye O, Ajayi D, Bankole O, Bamidele P. Dental service utilization among junior secondary school students in Ibadan, Nigeria. Pediatric Dental J. 2010;20(2):177–218. https://doi.org/10.1016/S0917-2394(10)70210-X.

Esa R, Jamaludin M, Yusof ZYM. Impact of maternal and child dental anxiety on oral health-related quality of life of 5–6-year-old preschool children. Health Qual Life Outcomes. 2020;18(1):319. https://doi.org/10.1186/s12955-020-01565-z.

Etkin A, Egner T, Kalisch R. Emotional processing in anterior cingulate and medial prefrontal cortex. Trends Cogn Sci. 2011;15(2):85–93. https://doi.org/10.1016/j.tics.2010.11.004.

Fatoye F, Morakinyo O. Psychopathology among senior secondary school students in Ilesa, south western Nigeria. Niger Postgrad Med J. 2003;10(3):182–7.

Federal Ministry of Health, 2014. Guidelines for Young Persons' Participation in Research and Access to Sexual and Reproductive Health Services in Nigeria

Finlayson TL, Beltran NY, Becerra K. Psychosocial factors and oral health practices of preschool-aged children: a qualitative study with Hispanic mothers. Ethn Health. 2019;24(1):94–112. https://doi.org/10.1080/13557858.2017.1315366.

Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader MJ, Bramlett MD, Newacheck PW. Influences on children's oral health: a conceptual model. Pediatrics. 2007;120(3):e510–20. https://doi.org/10.1542/peds.2006-3084.

Folayan MO, Adekoya-Sofowora CA, Otuyemi O, Ufomata D. Parental anxiety as a possible predisposing factor to child dental anxiety in patients seen in a suburban dental hospital in Nigeria. Int J Paediatr Dent. 2002;12(4):255–9. https://doi.org/10.1046/j.1365-263x.2002.00367.x.

Folayan M, Idehen E, Ufomata D. The effect of sociodemographic factors on dental anxiety in children seen in a suburban Nigerian hospital. Int J Paediatr Dent. 2003;13(1):20–6. https://doi.org/10.1046/j.1365-263x.2003.00411.x.

Folayan MO, Idehen EE, Ojo OO. Dental anxiety in a subpopulation of African children: parents ability to predict and its relation to general anxiety and behaviour in the dental chair. Eur J Paediatr Dent. 2004;5(1):19–23.

Folayan M, Ozeigbe E, Oyedele T, Ola D. Factors limiting dental service utilization by pupils in Ile-Ife, Nigeria. Niger J Health Sci. 2013;2:18–23.

Folayan MO, Khami MR, Onyejaka N, Popoola BO, Adeyemo YI. Preventive oral health practices of school pupils in Southern Nigeria. BMC Oral Health. 2014a. https://doi.org/10.1186/1472-6831-14-83.

Folayan MO, Kolawole KA, Oyedele T, Chukumah NM, Onyejaka N, Agbaje H, Oziegbe EO, Osho OV. Association between knowledge of caries preventive practices, preventive oral health habits of parents and children and caries experience in children resident in sub-urban Nigeria. BMC Oral Health. 2014b;14(1):1–10. https://doi.org/10.1186/1472-6831-14-156.

Folayan MO, Kolawole KA, Oziegbe EO, Oyedele TA, Agbaje HO, Onjejaka NK, Oshomoji VO. Association between family structure and oral health of children with mixed dentition in suburban Nigeria. J Indian Soc Pedod Prev Dent. 2017;35(2):134. https://doi.org/10.4103/0970-4388.206034.

Folayan MO, Kolawole KA, Onyejaka NK, Agbaje HO, Chukwumah NM, Oyedele TA. General anxiety, dental anxiety, digit sucking, caries and oral hygiene status of children resident in a semi-urban population in Nigeria. BMC Oral Health. 2018;18(1):66. https://doi.org/10.1186/s12903-018-0529-z.

Folayan MO, Alade MO, Oziegbe EO. Challenges with study procedure fidelity when conducting household survey: reports from the field. BMC Res Notes. 2019;12(1):493. https://doi.org/10.1186/s13104-019-4500-0.

Gavic L, Tadin A, Mihanovic I, Gorseta K, Cigic L. The role of parental anxiety, depression, and psychological stress level on the development of early-childhood caries in children. Int J Paediatr Dent. 2018;28(6):616–23. https://doi.org/10.1111/ipd.12419.

Gomes MAB, Cademartori MG, Goettems ML, Azevedo MS. Are maternal mental disorders associated with children's oral health? A systematic review. Int J Paediatr Dent. 2020;30(3):252–64. https://doi.org/10.1111/ipd.12608.

Gureje O. Reliability and the factor structure of the yoruba version of the 12-item general health questionnaire. Acta Psychiatr Scand. 1991;84(2):125–9. https://doi.org/10.1111/j.1600-0447.1991.tb03115.x.

Lassi ZS, Majeed A, Rashid S, Yakoob MY, Bhutta ZA. The interconnections between maternal and newborn health–evidence and implications for policy. J Matern Fetal Neonatal Med. 2013. https://doi.org/10.3109/14767058.2013.784737.

LaValle PS, Glaros A, Bohaty B, McCunniff M. The effect of parental stress on the oral health of children. J Clin Psychol Med Settings. 2000;7(4):197–201. https://doi.org/10.1023/A:1009576213027.

Leis JA, Heron J, Stuart EA, Mendelson T. Associations between maternal mental health and child emotional and behavioral problems: does prenatal mental health matter? J Abnorm Child Psychol. 2014;42(1):161–71. https://doi.org/10.1007/s10802-013-9766-4.

Merdad L, El-Housseiny AA. Do children's previous dental experience and fear affect their perceived oral health-related quality of life (OHRQoL)? BMC Oral Health. 2017;17(1):47. https://doi.org/10.1186/s12903-017-0338-9.

Minja IK, Kahabuka FK. Dental anxiety and its consequences to oral health care attendance and delivery. In: Neşe K, Çağlayan RHB, editors. Anxiety disorders–from childhood to adulthood. London: Rijeka IntechOpen; 2019.

Minkovitz CS, Strobino D, Scharfstein D, Hou W, Miller T, Mistry KB, Swartz K. Maternal depressive symptoms and children's receipt of health care in the first 3 years of life. Pediatrics. 2005;115(2):306–14. https://doi.org/10.1542/peds.2004-0341.

Moore PS, Whaley SE, Sigman M. Interactions between, mothers and children: Impacts of maternal and child anxiety. J Abnorm Psychol. 2004;113(3):471–6. https://doi.org/10.1037/0021-843X.113.3.471.

National Research Council (US) and Institute of Medicine (US) Committee on Depression PP, and the Healthy Development of Children, 2009. Depression in Parents, Parenting, and Children: Opportunities to Improve Identification, Treatment, and Prevention. In: England MJSL (Ed). National Academies Press (US), Washington (DC)

Niehaus CE, Chaplin TM, Goncalves SF, Semelsberger R, Thompson JC. Maternal stress and adolescent brain structure and function. Brain Behav. 2019;9(6): e01311. https://doi.org/10.1002/brb3.1311.

Oba AA, Dulgergil CT, Sonmez IS. Prevalence of dental anxiety in 7-to 11-year-old children and its relationship to dental caries. Med Princ Pract. 2009;18(6):453–7. https://doi.org/10.1159/000235894.

Ola D, Gamboa ABO, Folayan MO, Marcenes W. Family structure, socioeconomic position and utilization of oral health services among Nigerian senior secondary school pupils. J Public Health Dent. 2013;73(2):158–65. https://doi.org/10.1111/j.1752-7325.2012.00362.x.

Olatosi OO, Oyapero A, Onyejaka NK, Boyede GO. Maternal knowledge, dental service utilization and self-reported oral hygiene practices in relation to oral health of preschool children in Lagos, Nigeria. PAMJ-One Health. 2020. https://doi.org/10.11604/pamj-oh.2020.2.10.22850.

Olusanya O. The importance of social class in voluntary fertility control in a developing country. WAJM. 1985;4:205–12.

Onyejaka NK, Kolawole KA, Folayan MO, Oziegbe EO, Chukwumah NM, Oyedele TA, Agbaje HO, Oshomoji OV. Habit-breaking methods employed by mothers of children with nonnutritive sucking habits resident in suburban Nigeria. Indian J Dent Res. 2018;29(5):545–50. https://doi.org/10.4103/ijdr.IJDR_404_16.

Pooja D, Vandna MS, Maheshwari SK. Behavioural problems between working and non working mother's children: A comparative cross sectional survey. Int J Curr Res. 2019;11(11):8046–54. https://doi.org/10.24941/ijcr.37092.11.2019.

Rajgariah R, Chandrashekarappa SM, Babu KV, Gopi A, Ramaiha NMM, Kumar J. Parenting stress and coping strategies adopted among working and non-working mothers and its association with socio-demographic variables: a cross-sectional study. Clin Epidemiol Glob. Health. 2021;9:191–5. https://doi.org/10.1016/j.cegh.2020.08.013.

Richards PD, Els WJ. Cytochemical localization of adenylate cyclase in the sodium-transporting epithelium isolated from frog skin. Histochem J. 1994;26(6):495–503. https://doi.org/10.1007/BF00157895.

Saied-Moallemi Z, Virtanen JI, Ghofranipour F, Murtomaa H. Influence of mothers' oral health knowledge and attitudes on their children's dental health. Eur Arch Paediatr Dent. 2008;9(2):79–83. https://doi.org/10.1007/BF03262614.

Shearer DM, Thomson WM. Intergenerational continuity in oral health: a review. Commun Dent Oral Epidemiol. 2010;38(6):479–86. https://doi.org/10.1111/j.1600-0528.2010.00560.x.

Shearer DM, Thomson WM, Broadbent JM, Poulton R. Maternal oral health predicts their children's caries experience in adulthood. J Dent Res. 2011;90(5):672–7. https://doi.org/10.1177/0022034510393349.

Silva M, Manton D. Oral habits–part 1: the dental effects and management of nutritive and non-nutritive sucking. J Dent Child (chic). 2014;81(3):133–9.

Torriani DD, Ferro RL, Bonow MLM, Santos IS, Matijasevich A, Barros AJ, Demarco FF, Peres KG. Dental caries is associated with dental fear in childhood: findings from a birth cohort study. Caries Res. 2014;48(4):263–70. https://doi.org/10.1159/000356306.

Turner SM, Beidel DC, Costello A. Psychopathology in the offspring of anxiety disorders patients. J Consult Clin Psychol. 1987;55(2):229–35. https://doi.org/10.1037//0022-006x.55.2.229.

Wu L, Gao X. Children's dental fear and anxiety: exploring family related factors. BMC Oral Health. 2018;18(1):100. https://doi.org/10.1186/s12903-018-0553-z.