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RESEARCH ARTICLE

Birth Order and its Effect on Children's Dental Anxiety and Behavior during Dental Treatment

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Abstract:

Objectives:

To investigate the association between dental anxiety and birth order among children seeking dental treatment at King Abdulaziz University Dental Hospital, Jeddah, Saudi Arabia.

Methods:

A total sample of 306 children aged 6-12 years were enrolled in a cross-sectional descriptive study. Demographic background data on the family and childbirth order were collected using a validated questionnaire. The Abeer dental anxiety scale (ADAS) was used to assess the dental anxiety level, while the Frankl scale was used to assess behavior during dental treatment. Binary Regression analysis was carried out to evaluate the effect of sociodemographic factors on the child's anxiety and behavior according to the ADAS and Frankl scale, respectively.

Results:

The childbirth order had a significant effect on the anxiety score ($p < 0.0001$). The ADAS score in middle-born children was statistically significantly lower than that of only children, first-borns and last-borns ($p = 0.018$). Further, there was a statistically significant effect of childbirth order on behavior according to the Frankl scale ($p < 0.0001$).

Conclusion:

The presence of siblings and childbirth order are significant indicators of children's behavior and anxiety during dental treatment. This study provides valuable information that can help pediatric dentists plan behavior management for children.

Keywords: Birth order, Dental anxiety, Behavior, Abeer dental anxiety scale, Frankl scale, Anxiety score.

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1. INTRODUCTION

The intensely unpleasant sensations associated with dental treatment elicit dental anxiety [1]. Dental anxiety in children is a significant and challenging problem in the dental office and has several implications for children, parents, dentists, and dental teams [2 - 5]. Anxiety triggers physical, emotional, and behavioral responses in an individual. Dental anxiety is observed across all age groups and usually is exhibited during childhood or adolescence [5, 6]. Studies in different populations and countries have shown that the prevalence of anxiety ranges from 3 to 43% in children of different ages [7 - 9].

Children with a high level of dental anxiety have poor oral hygiene, oral health, and general health, and increased parents' anxiety [10]. Anxious children will most likely avoid or delay dental treatment [11 - 13]. High levels of anxiety in children usually lead to larger numbers of decayed teeth and fewer numbers of restored teeth [9]. Children with previous experience of dental pain attributable to caries are more likely to experience dental anxiety [10]. Treating children with dental anxiety requires more effort and time on the part of dentists and the dental team [14]. Therefore, understanding and assessing dental anxiety in children is a crucial strategy to improve children's oral health and dental experiences [15]. The evaluation of dental anxiety is important to overcome these issues and facilitate diagnosis and dental treatment [2].

The first social structure encountered, the individual's birth order within the family, has been suggested to be a contributing

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factor in shaping human personalities and responses to psychological stress [16, 17]. Firstborn children are usually privileged but also exhausted by feelings of excessive responsibility and are usually more prone to score high on neuroticism. On the other hand, later-born children are overindulged by their parents, but lack social empathy [18]. Middle children show fewer uniform birth-order results, as their place within the family varies over time. Only children sometimes have a particular personality of their own; however, they usually reflect some of the characteristics of the firstborn child [16]. According to reports, a child's birth order influences his/her ability to cope with difficult situations and stress in medical conditions [1].

Only two studies have been conducted to assess the association between dental anxiety and childbirth order [16, 17]. Aminabadi *et al.* [16] found that only children and firstborns have higher clinical and situational anxiety and are less cooperative in dental treatment, and Ghaderi *et al.* [17] obtained the same results. However, both studies used anxiety scales without cognitive assessment [16, 17]. Therefore, this study aimed to investigate the association between dental anxiety and birth order among children seeking dental treatment at a university dental hospital using a validated anxiety scale with cognitive assessment.

2. METHODS

2.1. Study Design and Sampling

This cross-sectional descriptive study was conducted between March and October 2021 in the city of Jeddah, Saudi Arabia. Non-probability quota sampling was used to select the participants. The samples enrolled in this study were gathered from children referred to the pediatric department at King Abdulaziz University dental hospital. Ethical approval was obtained from the Research Ethical Committee of King Abdulaziz University, Faculty of Dentistry (Approval Number 228-02-21; March 30, 2021). All participants participated with the consent of their parents/guardians after they understood the purpose of the study fully. Parents/guardians were informed that they had the right to withdraw from the study at any time. The sample size was calculated using G*Power 3.1.9.6, G*Power (RRID: SCR_013726). A logistic regression model with odd ratio of 1.43, α error probability of 0.05, and a power of 0.80 were used based on a previous study [1]. The sample size required was 217.

2.2. Study Eligibility Criteria

Healthy children from 6 years to less than 12 years old who can read Arabic were included in the study, while children with a learning disability or mental or physical illness were excluded.

2.3. Questionnaire

A questionnaire consisting of three sections was used. The first section collected data on the child's sociodemographic factors (10 questions), which included parents' marital status, parents and child's education, income, the number of children within the family, and the child's age and birth order. The

section also enquired about the history of previous dental treatment.

The second section assessed the child's anxiety using the Abeer Dental Anxiety Scale (ADAS). The scale includes three components. The first is the child's anxiety assessment, which includes 13 questions used to evaluate dental anxiety. Each question has a response set of three faces from which the child is required to choose one: 1 = Happy, 2 = Ok, and 3 = Scared. The total answers to all questions were summed, and the value ranged between 13 to 39. The child was considered anxious if his overall score was ≥ 26 [19]. The second component included three questions that measured the child's cognitive assessment of his/her feelings. Each question used two answers, 1= no and 2= yes. The total of the answers to all cognitive assessment questions was summed, and the value ranged from 3 to 6. The child was considered to have negative cognitive thoughts if his/her score overall was >3 . The third component consisted of two questions that assessed the child, the parent's evaluation of the child's expected behavior during treatment, and the dentist's evaluation of the child's behavior at the end of the visit according to the ADAS.

The third section assessed the child's behavior using the Frankl classification. Upon conclusion of dental treatment, the dentist's evaluation of the child's behavior was recorded *via* two questions that included the history of previous dental treatment and behavior evaluation according to the Frankl classification.

The Frankl behavior scale categorizes the behavior observed into four groups, ranging from definitely negative (--), negative (-), positive (+) to definitely positive (++). Then, the Frankl behavior assessment was then divided into two groups for a binary regression analysis: non-cooperative (definitely negative or negative) and cooperative (positive or definitely positive).

2.4. Questionnaire's Validity

The questionnaire was validated based on the content validity index (CVI) and face validity. The content validity index (CVI) score was 0.98 and was calculated by five experts. Face validity was assessed with ten participants who were not included in the main study and the questionnaire was modified according to their comments to ensure clarity.

The second section was the ADAS, which Al-Namankany, *et al.* [19, 20] tested for validity and reliability in Arabic and English. The ADAS's internal consistency was calculated in this study using Cronbach's alpha and demonstrated excellent consistency (0.93).

2.5. Data Collection

Each participant received the questionnaire in the waiting area before entering the dental office and completed the first section (demographic questions) and the first and second sections of the ADAS questionnaire. Then, the child was called in for the dental examination using a dental mirror and explorer, followed by oral prophylaxis using prophylaxis paste and a brush attached to a low-speed handpiece. Thereafter, all children received a 5% fluoride varnish followed by oral

hygiene instructions given to the child and parents. Finally, after the child was dismissed from the dental office, the dentist completed the behavior assessment according to the ADAS and Frankl scales.

2.6. Statistical Analysis

All data were analyzed using SPSS v. 20.0 (IBM Corp., Armonk, NY). Frequencies and percentages were calculated for categorical variables and groups were compared using the Chi-square test. Means and standard deviations (SD) were calculated for continuous variables. Binary regression analysis was carried out to evaluate the effect of childbirth order, number of siblings, sociodemographic characteristics, and whether the child was treated previously (independent factors) on the child's anxiety, behavior, and cognitive assessment (dependent factors). The significance level was set at 0.05.

3. RESULTS

A total of 306 children were enrolled in the study, 164 (53.6%) males and 142 (46.4%) females. The participants' childbirth order was 75 (24.5%), 98 (32%), 78 (25.5%), and 55 (18%), for first-born, middle-born, last-born, and only child, respectively (Table 1). The mean number of siblings within the family was 3.37 ±1.817.

Table 2 shows the relation between the child's anxiety using the ADAS and childbirth order. The children's anxiety

assessment according to the ADAS revealed that 26 (47.3) of only children, 25 (32.1) of last-born, 22 (29.3), of first-born, and 17 (17.3) of middle-born have anxiety with a statistically significant difference between the childbirth order groups ($p < 0.0001$).

Table 3 shows the relation between the total cognitive score using the ADAS and childbirth order. There was a statistically significant effect of childbirth order on their shyness about their dental appearance. More only and first-born children feel shy (40%) about their appearance compared to middle- (24.5%) and last-born children (20.5%). This difference was statistically significant ($p = 0.012$). Further, the child behavior assessment according to the ADAS revealed a statistically significant difference between the childbirth order groups when assisted by the dentist ($p = 0.011$). Middle children reported that they were happy more frequently and fewer reported that they were scared in the dental clinic compared to children with other childbirth orders. However, there was no statistically significant difference in the child behavior assessment when assisted by the parents ($p = 0.119$).

Table 4 shows the relation between the child's behavior using the Frankl scale and childbirth order. There was a statistically significant difference between the childbirth order groups. First-born (32, 42.7%) and middle-born children (32, 42.7%) were reported to have positive behavior more frequently than only children (13, 23.6%) and last-born children (21, 26.9%) at $p = 0.001$.

Table 1. Characteristics of the study sample (N=306).

Variables		N (%)
Number of siblings within a family	Mean ± SD	3.37 ± 1.817
Age (Years)	10-12	76 (24.8)
	8-9	97 (31.7)
	6-7	133 (43.5)
Gender	Male	164 (53.6)
	Female	142 (46.4)
Birth order	First-born	75 (24.5)
	Middle-born	98 (32)
	Last-born	78 (25.5)
	Only child	55 (18)
Parents' marital status	Married	260 (85)
	Single	46 (15)
Father's Education	≤ High school	133 (43.5)
	> High school	173 (56.5)
Mother's Education	≤ High school	139 (45.4)
	> High school	167 (54.6)
Income (SR)	≤ 5000	68 (22.2)
	5000 to 10000	129 (42.2)
	> 10000	109 (35.6)
Previous dental visits	Yes	171 (55.9)
	No	135 (44.1)

Table 2. Relation between child anxiety using the ADAS and childbirth order (N=306).

ADAS Variables		Only Child	First-born	Middle-born	Last-born	p-value
How do you feel		n (%)	n (%)	n (%)	n (%)	
In the waiting area?	Happy	31(56.4)	46 (61.3)	67 (68.4)	50 (64.1)	0.516
	Ok	20 (36.4)	21 (28)	24 (24.5)	18 (23.1)	
	Scared	4 (7.3)	8 (10.7)	7 (7.1)	10 (12.8)	
When a doctor is wearing a mask?	Happy	32 (58.2)	57 (76)	83 (84.7)	55 (70.5)	0.008*
	Ok	16 (29.1)	15 (20)	14 (14.3)	18 (23.1)	
	Scared	7 (12.7)	3 (4)	1 (1)	5 (6.4)	
When are you lying down on a dental chair?	Happy	33 (60)	50 (66.7)	69 (70.4)	48 (61.5)	0.313
	Ok	16 (29.1)	20 (26.7)	26 (26.5)	20 (25.6)	
	Scared	6 (10.9)	5 (6.7)	3 (3.1)	10 (12.8)	
When does doctor examine you with a mirror?	Happy	33 (60)	54 (72)	77 (78.6)	56 (71.8)	0.100
	Ok	14 (25.5)	15 (20)	18 (18.4)	12 (15.4)	
	Scared	8 (14.5)	6 (8)	3 (3.1)	10 (12.8)	
When do you feel a strange taste in your mouth?	Happy	24 (43.6)	39 (52)	63 (64.3)	33 (42.3)	0.002*
	Ok	15 (27.3)	30 (40)	23 (23.5)	26 (33.3)	
	Scared	16 (29.1)	6 (8)	12 (12.2)	19 (24.4)	
Having a pinch feeling in your gum?	Happy	15 (27.3)	35 (46.7)	60 (61.2)	30 (38.5)	0.002*
	Ok	22 (40)	25 (33.3)	19 (19.4)	24 (30.8)	
	Scared	18 (32.7)	15 (20)	19 (19.4)	24 (30.8)	
When you get anesthesia (numbness in lips or tongue)?	Happy	17 (30.9)	31 (41.3)	60 (61.2)	31 (39.7)	0.006*
	Ok	24 (43.6)	28 (37.3)	28 (28.6)	27 (34.6)	
	Scared	14 (25.5)	16 (21.3)	10 (10.2)	20 (25.6)	
When the dentist cleans your teeth with the buzzy electric brush?	Happy	22 (40)	42 (56)	73 (74.5)	40 (51.3)	0.001*
	Ok	21 (38.2)	24 (32)	22 (22.4)	28 (35.9)	
	Scared	12 (21.8)	9 (12)	3 (3.1)	10 (12.8)	
When you hear the sound of the instrument?	Happy	17 (30.9)	37 (49.3)	58 (59.2)	37 (47.4)	0.003*
	Ok	26 (47.3)	26 (34.7)	35 (35.7)	23 (29.5)	
	Scared	12 (21.8)	12 (16)	5 (5.1)	18 (23.1)	
When you smell the material and the dentist's instrument?	Happy	22 (40)	41 (54.7)	76 (77.6)	42 (53.8)	<0.0001*
	Ok	21 (38.2)	27 (36)	14 (14.8)	23 (29.5)	
	Scared	12 (21.8)	7 (9.3)	4 (4.1)	13 (16.7)	
About your tooth being extracted?	Happy	15 (27.3)	21 (28)	48 (49)	22 (28.2)	0.020*
	Ok	18 (32.7)	23 (30.7)	30 (30.6)	23 (29.5)	
	Scared	22 (40)	31 (41.3)	20 (20.4)	32 (41)	
When the doctor applied a rubber mask to your face?	Happy	15 (27.3)	27 (36)	53 (54.1)	32 (41)	0.007*
	Ok	27 (49.1)	36 (48)	40 (40.8)	33 (42.3)	
	Scared	13 (23.6)	12 (16)	5 (5.1)	13 (16.7)	
Having a pinch feeling in your hand?	Happy	14 (25.5)	30 (40)	51 (52)	33 (42.3)	0.012*
	Ok	31 (56.4)	32 (42.7)	43 (43.9)	34 (43.6)	
	Scared	10 (18.2)	13 (17.3)	4 (4.1)	11 (14.1)	
Child's dental anxiety	Yes	26 (47.3)	22 (29.3)	17 (17.3)	25 (32.1)	<0.0001*
	No	29 (52.7)	53 (70.7)	81 (82.7)	53 (67.9)	

Note: ADAS: Abeer dental anxiety scale

*The difference is significant at the 0.05 level.

‡ ≥26 according to the ADAS

‡ <26 according to the ADAS

Table 3. Relation between total cognitive score using the ADAS and childbirth order (N=306).

ADAS Cognitive Variables		Only Child	First-born	Middle-born	Last-born	p-value
Child's Cognitive Assessment		n (%)	n (%)	n (%)	n (%)	
Do you feel shy in the clinic?	Yes	19 (34.5)	21 (28)	25 (25.5)	18 (23.1)	0.505
	No	36 (65.5)	54 (72)	73 (74.5)	60 (76.9)	
Do you feel shy about the way your teeth look?	Yes	22 (40)	30 (40)	24 (24.5)	16 (20.5)	0.012*
	No	33 (60)	45 (60)	74 (75.5)	62 (79.5)	
Are you worried about losing control with the dentist?	Yes	31 (56.4)	40 (53.3)	40 (40.8)	39 (50)	0.220
	No	24 (43.6)	35 (46.7)	58 (59.2)	39 (50)	
Total cognitive score	Yes	43 (20.5)	58 (27.6)	61 (29)	48 (22.9)	0.034*
	No	12 (12.5)	17 (17.7)	37 (38.5)	30 (31.2)	

(Table 3) contd.....

ADAS Cognitive Variables		Only Child n (%)	First-born n (%)	Middle-born n (%)	Last-born n (%)	p-value
Parent's Behavior Assessment						
How do you expect your child will behave today?	Happy	26 (47.3)	44 (58.7)	58 (59.2)	37 (47.4)	0.119
	Ok	23 (41.8)	20 (26.7)	35 (35.7)	28 (35.9)	
	Scared	6 (10.9)	11 (14.7)	5 (5.1)	13 (16.7)	
Dentist's Behavior Assessment						
Dentist, how do you rate the child's behavior in today's dental visit?	Happy	30 (54.5)	48 (64)	67 (68.4)	38 (48.7)	0.011*
	Ok	11 (20)	16 (21.3)	25 (25.5)	21 (26.9)	
	Scared	14 (25.5)	11 (14.7)	6 (6.1)	19 (24.4)	

Note: ADAS: Abeer dental anxiety scale

*The difference is significant at the 0.05 level.

‡ > 3 according to the total ADAS cognitive score.

‡ ≤ 3 according to the total ADAS cognitive score.

Table 4. Relation between child's behavior using the Frankl scale and childbirth order (N=306).

Variables		Only Child n (%)	First-born n (%)	Middle-born n (%)	Last-born n (%)	p-value
Child behavior according to the Frankl scale	Definitely negative	7 (12.7)	3 (4)	3 (3.1)	9 (11.5)	0.001*
	Negative	21 (38.2)	15 (20)	13 (13.3)	16 (20.5)	
	Positive	14 (25.5)	25 (33.3)	44 (44.9)	32 (41)	
	Definitely Positive	13 (23.6)	32 (42.7)	38 (38.8)	21 (26.9)	
Grouped Frankl scale	Corporative	27 (49.1)	57 (76)	82 (83.7)	53 (67.9)	<0.0001*
	Non-cooperative	28 (50.9)	18 (24)	16 (16.3)	25 (32.1)	
Total		55 (100)	75 (100)	98(100)	78 (100)	

Note: *The difference is significant at the 0.05 level.

Table 5. Binary logistic regression for dental anxiety, behavior and cognitive according to sociodemographic characteristics and previous dental visits.

Variables		Dental Anxiety ‡ / Behavior* / Cognitive*		p-value, AOR, [95% CI]
		Yes	No	
Dental Anxiety				
Parents' marital status	Single parent family	15 (32.6)	31 (67.4)	0.494, 1.300, [0.613, 2.755]
	Married	75 (28.8)	185 (71.2)	1
Father's Education	≤ High school	39 (29.3)	94 (70.7)	0.505, 1.251, [0.648, 2.415]
	> High school	51 (29.5)	122 (70.5)	1
Mother's Education	≤ High school	42 (30.2)	97 (69.8)	0.789, 1.098, [0.554, 2.175]
	> High school	48 (28.7)	119 (71.3)	1
Income ≤ 5000 (SR)	≤ 5000	23 (33.8)	45 (66.2)	0.064, 2.289, [0.953, 5.496]
	5000 to 10000	41 (31.8)	88 (68.2)	0.077, 1.731, [0.943, 3.177]
	> 10000	23 (33.8)	45 (66.2)	1
Age (years)	10-12	14 (18.4)	62 (81.6)	0.023*, 0.431, [0.209, 0.890]
	8-9	26 (26.8)	71 (73.2)	0.268, 0.713, [0.392, 1.297]
	6-7	50 (37.6)	83 (62.4)	1
Gender	Male	45 (27.4)	119 (72.6)	0.797, 0.930, [0.535, 1.617]
	Female	45 (31.7)	97 (68.3)	1
Only child	First-born	22 (29.3)	53 (70.7)	0.163, 0.522, [0.210, 1.300]
	Middle-born	17 (17.3)	81 (82.7)	0.018*, 0.240, [0.074, 0.780]
	Last-born	25 (32.1)	53 (67.9)	0.252, 0.555, [0.202, 1.521]
	Only child	26 (47.3)	29 (52.7)	1
Previous Treatment	No	50 (37)	85 (63)	0.129, 0.651, [0.374, 1.133]
	Yes	40 (23.4)	131 (76.6)	1
Number of Siblings				0.898, 1.015, [0.812, 1.268]
Child's Behavior				
Parents' marital status	Single parent family	14 (30.4)	23 (69.6)	0.238, 1.606, [0.731, 3.528]
	Married	73 (28.1)	187 (71.9)	1

(Table 5) contd.....

Variables		Dental Anxiety ⁺ / Behavior [*] / Cognitive [*]		p-value, AOR, [95% CI]
		Yes	No	
Dental Anxiety				
Father's Education	≤ High school	37 (27.8)	96 (72.2)	0.167, 1.589, [0.824, 3.064]
	> High school	50 (28.9)	123 (71.1)	1
Mother's Education	≤ High school	43 (30.9)	96 (69.1)	0.365, 0.738, [0.383, 1.424]
	> High school	44 (26.3)	123 (73.7)	1
Income ≤ 5000 (SR)	≤ 5000	21 (30.9)	47 (69.1)	0.152, 1.952, [0.781, 4.879]
	5000 to 10000	42 (32.6)	87 (67.4)	0.062, 1.864, [0.970, 3.584]
	> 10000	24 (22)	85 (78)	1
Age (years)	10-12	14 (18.4)	62 (81.6)	0.016*, 0.406, [0.195, 0.845]
	8-9	21 (21.6)	76 (78.4)	0.026*, 0.486, [0.258, 0.917]
	6-7	52 (39.1)	81 (60.9)	1
Gender	Male	36 (22)	128 (78)	0.027*, 0.539, [0.311, 0.934]
	Female	51 (35.9)	91 (64.1)	1
Only child	First-born	18 (24)	57 (76)	0.051, 0.407, [0.165, 1.005]
	Middle-born	16 (16.3)	82 (83.7)	0.023*, 0.273, [0.089, 0.834]
	Last-born	25 (32.1)	53 (67.9)	0.439, 0.669, [0.242, 1.1852]
	Only child	28 (50.9)	27 (49.1)	1
Previous Treatment	No	49 (36.3)	86 (63.7)	0.235, 0.705, [0.395, 1.256]
	Yes	38 (22.2)	133 (77.8)	1
Number of Siblings				0.461, 0.919, [0.733, 1.151]
Child's Cognitive Assessment				
Parents' marital status	Single parent family	173 (66.5)	87 (33.5)	0.119, 1.965, [0.840, 4.598]
	Married	37 (80.4)	9 (19.6)	1
Father's Education	≤ High school	97 (72.9)	36 (27.1)	0.241, 1.452, [0.779, 2.707]
	> High school	113 (65.3)	60 (34.7)	1
Mother's Education	≤ High school	100 (71.9)	39 (28.1)	0.641, 1.168, [0.609, 2.239]
	> High school	110 (65.9)	57 (34.1)	1
Income ≤ 5000 (SR)	≤ 5000	47 (69.1)	21 (30.9)	0.361, 1.473, [0.642, 3.383]
	5000 to 10000	88 (68.2)	41 (31.8)	0.527, 1.214, [0.666, 2.214]
	> 10000	75 (68.8)	34 (31.2)	1
Age (years)	10-12	54 (71.1)	22 (28.9)	0.848, 0.938, [0.486, 1.810]
	8-9	65 (67)	32 (33)	0.985, 1.006, [0.547, 1.850]
	6-7	91 (68.4)	42 (31.6)	1
Gender	Male	112 (68.3)	52 (31.7)	0.912, 0.972, [0.585, 1.614]
	Female	98 (69)	44 (31)	1
Only child	First-born	58 (77.3)	17 (22.7)	0.021*, 0.314, [0.117, 0.840]
	Middle-born	61 (62.2)	37 (37.8)	0.012*, 0.385, [0.182, 0.812]
	Last-born	48 (61.5)	30 (38.5)	0.957, 0.982, [0.510, 1.892]
	Only child	43 (78.2)	12 (21.8)	1
Previous Treatment	No	95 (70.4)	40 (29.6)	0.818, 1.067, [0.615, 1.850]
	Yes	115 (67.3)	56 (32.7)	1
Number of Siblings				0.173, 0.857, [0.686, 1.070]

Note: * The difference is significant at the 0.05 level.

AOR: adjusted odds ratio

⁺ Yes ≥26, No <26 according to the ADAS

^{*} Yes= non-cooperative, No= cooperative

^{*}> Yes 3, No ≤ 3 according to the total ADAS cognitive score

Table 5 shows the binary logistic regression analysis that was conducted to assess dental anxiety, behavior, and cognitive assessment according to childbirth order, number of siblings, sociodemographic characteristics, and whether the child was treated previously. Middle-born and older age groups (10 to 12 years old) demonstrated less anxiety ($p=0.018$, $AOR=0.240$, and $95\% CI=[0.074$ to $0.780]$, ($p=0.023$, $AOR=0.431$, and

$95\% CI= [0.209$ to $0.890]$, respectively. Further, middle-born, older age groups (8 to 9 and 10 to 12 years), and male children were correlated significantly with cooperative dental behavior ($p=0.023$, $AOR=0.273$, and $95\% CI=[0.089$ to $0.834]$, ($p=0.016$, $AOR=0.406$, and $95\% CI=[0.195$ to $0.845]$, ($p=0.026$, $AOR=0.486$, and $95\% CI=[0.258$ to $0.917]$, ($p=0.027$, $AOR=0.539$, and $95\% CI=[0.311$ to $0.934]$, respectively. On the other hand,

parents' marital status, father's and mother's education, family income, the presence of previous treatment and the number of siblings were not correlated statistically significantly with either child anxiety or behavior. The cognitive assessment showed that first-born ($p=0.021$, AOR 0.314, and 95% CI= [0.117 to 0.840]), and middle-born ($p=0.012$, AOR= 0.385, and 95% CI= [0.182 to 0.812]) children were correlated significantly with fewer negative thoughts compared to only children.

4. DISCUSSION

This study investigated the association between dental anxiety and birth order among children seeking dental treatment. In this study, we used ADAS to assess anxiety. The ADAS is the first children's dental anxiety scale that contains a cognitive component that can enhance the ability to identify anxious children. The ADAS is designed for children aged 6 years and above, as it requires the ability to read and understand written questions [19]. The ADAS was originally constructed in English and then translated and validated in the Arabic language with good sensitivity (86.8%) and specificity (86.2%). Therefore, the ADAS is considered a valid and generalizable cognitive dental anxiety scale for children and adolescents [20].

According to our findings, only children were found to be at increased risk of developing dental anxiety and negative behavior compared to middle-born children. This result is consistent with that of two previous studies by Aminabadi, *et al.* [16] and Ghaderi, *et al.* [17] Nevertheless, there are several differences between our study and their research. First, the assessment scales used in this study were the ADAS for dental anxiety (with a cognitive component) and the Frankl scale for dental behavior. In contrast, Aminabadi, *et al.* [16] used the facial image scale (FIS) to measure situational anxiety, the clinical anxiety rating scale to assess clinical anxiety, and the Frankl scale to assess behavior, while Ghaderi, *et al.* [17] used the "Dental Subscale of the Children's Fear Survey Schedule" (CFSS-DS) to assess anxiety and behavior. Second, we used four childbirth order groups, as we compare only children to first-, middle- and last-born children. However, Aminabadi *et al.* and Ghaderi *et al.* compared only children with children who have siblings [16, 17]. Accordingly, the findings of this study are expected to be more specific in identifying the relationship between childbirth order and anxiety.

Given the importance of children's negative cognition in anxiety development, which can make the child cautious and difficult to treat, these results were consistent with those in Al-Namankany *et al.*'s original ADAS study. There was a clear link between negative cognition and the level of dental anxiety [20]. The results of our cognitive assessment, which evaluates the perception of losing control, embarrassment, and lack of self-confidence, showed that these feelings were stronger in only children and last-born children.

The binary regression analysis in our study revealed that birth order and age are the only factors that affect dental anxiety level, while birth order, age, and gender affect the child's cooperation. After controlling the confounding variables, other factors were associated neither with dental

anxiety nor behavior. The results for age and gender are consistent with those in previous studies that showed a relationship between age, gender, and anxiety [21, 22]. However, we found no relation between socioeconomic status and dental anxiety in our study, which could be attributable to medical healthcare being free in Saudi Arabia. Therefore, socioeconomic status did not influence dental treatment. Two other studies were conducted in Jeddah, Saudi Arabia. Alshoraim, *et al.* [23] investigated the effects of children's characteristics and dental history on dental fear, while Felemban, *et al.* [24] studied the effects of familial characteristics on dental fear. Similar to our results, Alshoraim, *et al.* [23] found that age and gender influence dental anxiety, while Felemban *et al.* [24] also found that socioeconomic variables were not associated with dental anxiety.

Our study had some limitations. The research was cross-sectional in nature and therefore, no causal relations can be determined. The results of this survey were obtained only from children in Jeddah, Saudi Arabia, and cannot be generalized to other populations. In addition, there were confounding factors that could affect children's anxiety, such as previous dental treatment. However, we tried to overcome this by conducting a regression analysis. Further, we made efforts to overcome the limitations and strengthen the study, as we included a main referral hospital with free healthcare that enrolls heterogeneous populations from all around the city. Thus, our findings may be generalized with caution, at least to other countries with free healthcare.

CONCLUSION

The presence of siblings and childbirth order were found to be significant indicators of children's behavior and anxiety during dental treatment. This study provides valuable information that can help pediatric dentists manage their young patients' behavior.

AUTHORS' CONTRIBUTIONS

NF, HS Conceptualization; MA, FA Data curation; HS, MA Formal analysis; MA, NF, HS Investigation; Methodology; MA, FA Project administration; MA, HS Validation; MA: Writing - original draft; MA, NF, HS Writing - review & editing.

LIST OF ABBREVIATIONS

ADAS	= Abeer Dental Anxiety Scale
CVI	= Content Validity Index
SD	= Standard Deviations
FIS	= Facial Image Scale
CFSS-DS	= Dental Subscale of the Children's Fear Survey Schedule

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Research Ethics Committee of King Abdulaziz University, Faculty of Dentistry (Approval Number 228-02-21; March 30, 2021).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research

procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

All participants participated with the consent of their parents/guardians after they understood the purpose of the study fully. Parents/guardians were informed that they had the right to withdraw from the study at any time.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the following URL <https://drive.google.com/drive/folders/1JgC3WBS2x1N4Fteh3Xj3jtKbIKGuTXCp>

STANDARDS OF REPORTING

STROBE guidelines were followed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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