

Oral Health Related Knowledge, Attitude And Behavior Among Group of Mothers In Relation To Their Primary School Children's Oral Health, Jeddah, Saudi Arabia: A Cross-Sectional Study

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Abstract

Aim: To assess the knowledge, attitudes, and behavior of a group of mothers with their children aged 6-12 years regarding their own and their children's oral health and to evaluate its impact on their children oral health status in Jeddah, Saudi Arabia.

Methods: A validated, and reliable Arabic questionnaire comprised four sections (demographic characteristics and socioeconomic status, Hiroshima University– Dental Behavioral Inventory; HU-DBI; for mother' attitudes and behavior pertaining their own oral health, mothers' knowledge, and mothers' attitudes regarding oral health of their children) was used for this study. The questionnaire was completed by the mothers. A clinical oral examination was performed for the children, attending primary schools in Jeddah city, to detect the caries experience and Simplified Oral Hygiene Index (OHI-S).

Results: A total of 1496 mother-child pairs completed the study. The mean values of dmft were 4.08 ± 3.47 ; DMFT was 1.82 ± 2.07 ; total dmft and DMFT was 5.65 ± 4.05 ; and the OHI-S was 1.17 ± 0.94 . According to the questionnaire results, mothers in private schools had a more favorable attitude and behavior toward their own oral health, as well as a more favorable knowledge and attitude toward their children's oral health. The multiple linear regression model revealed that the children's dmft/DMFT scores were significantly related to mother education, mother questionnaire scores, and the OHI-S.

Conclusion: Mother education, knowledge, and attitude all play a role in the development of dental caries. Overall, mothers need to improve their oral health attitudes and behaviors, as well as increase their level of oral health knowledge.

Introduction

Although caries is considered a preventable disease, however, its worldwide prevalence remains high. In Saudi Arabia, prevalence of dental caries remained high reaching 97% as recently reported by the Ministry of health (1). Factors associated with the increased prevalence of childhood dental caries were investigated comprehensively in the literature. Some of the most important studied factors were those related to children's parents/caregiver. Parents play an important role in maintaining children's good oral health and establishing better oral health related habits. Parents' socioeconomic status, habits, knowledge, and attitude towards their children's oral health were reported to have a major impact on children's oral health (2).

The association between dental caries and socioeconomic status is well established (3–5). Children of fathers with higher socioeconomic status and non-working mothers were found to have lower caries prevalence compared to those with lower socioeconomic status (6, 7). Previous studies reported higher prevalence of poor oral health in children of mothers with low educational level (8–10). Additionally, it was reported that mothers with lower educational levels had poorer knowledge regarding their children oral health leading to increased incidence of early childhood caries (11).

Parents tend to be their children's role model especially when it comes to the oral hygiene practice (12). An epidemiological study conducted in Belarus reported high prevalence of dental caries. The lack of parental knowledge and inconsistency between the parent's dental knowledge and their actual practice were one of their major findings and the focus for their recommendations (13). A systematic review was conducted to assess the effect of the parents' dental health habits on their children's oral health. They concluded that parent's dental habit can have an impact on their children's oral health (14). In Saudi Arabia, Alhabdan conducted a study in Riyadh to evaluate the association between parent behavior and attitudes toward their children's oral health and to relate it with the oral hygiene statuses for their children. They found higher dental caries prevalence among children aged 6-8 years resulting from inadequate oral health attitude and behaviors of their parents (15).

The association between parent and their children's oral health has been investigated since 1946 (16) with stronger association among mothers than fathers (17). Hence, mothers' knowledge, attitude and behavior toward oral health need to be optimum to maintain their own and their children's oral health. Therefore, the aim of the study is to evaluate the level of oral health-related knowledge, attitudes, and behavior among a group of mothers with children aged 6-12 years toward their own and their children (oral health), and to assess its influence on the oral health status of their children in terms of dental caries experience.

Methods

Subjects: The sample was a multistage stratified random one consisting of children attending primary schools. A group of mothers with their children aged 6 - 12 years participated in the study. The children are healthy ASA I and their native language is Arabic. They are joining primary schools either private or public in Jeddah city, Saudi Arabia.

According to Ministry of Education files, the number of registered children in the primary schools in the academic year 2017-2018 was 293,373 children (147,525 boys and 145,848 girls) in 737 schools in Jeddah districts. Based on the gender, schools were divided into boys' schools (344) and girls' schools (393) following the country's regulations. Sample size was calculated based on previous research (18). A two-sided 95% confidence interval for a single proportion using the large sample normal approximation modified for a finite population of size 300,000 will stretch 0.025 from the observed percentage for an expected proportion of 35% when the sample size is 1392. The schools were stratified on three levels:

- Four strata, by district (west, east, north, south).
- Then by type each strata was stratified into public or private producing 8 strata.
- Finally, by gender each of the 8 strata was stratified into boys or girls resulting in 16 strata.

Random number generator (19) was used to select one schools from each of the 16 strata resulted into 16 primary schools with approximately 7,181 children from different regions in Jeddah. To compensate for the drop out of participated mother-child pairs due to incomplete questionnaire response or the child

resistance to oral examination, 1728 questionnaires were distributed. From each grade, one class was randomly chosen to join the study by the bowl method. In cases of a small number of children in any class (less than 18), another class was randomly selected, and in cases of a small number of children in the school (less than 108), the whole school children were included in the sample.

Questionnaire

The questionnaire had a cover letter describing the aim of the study and stressing confidentiality of the responses. An Arabic questionnaire comprised of four sections was used for this study. The questionnaire was completed by mothers. Section I, to record the demographic characteristics like child gender; and mothers' age (40 years or less, 41 years or more), educational level (High school or less, Diploma/University or higher) and monthly family income; (low, medium, or high). The informed consent was attached to this section. Section II, Hiroshima University– Dental Behavioral Inventory (HU-DBI)-questionnaire, to evaluate attitudes and behaviors of mothers pertaining their own oral health based on the sum of agree/disagree responses by giving one point to each favorable response of good oral health (20). This section contains 20 items asking about the protection of her teeth, regular visits to the dentist, ideal toothbrush, and toothpaste. To clarify item 5 (I use child-sized toothbrush), it was modified; into (I use recommended-sized toothbrush). High scores indicate good oral health attitudes and behaviors (21–29). **Section III** of the questionnaire was to recognize mothers' knowledge about their children oral health (30). The present study used the last 2 sections (12 questions) concerning dental health and dental care for children. Mothers selected the correct response from multiple choices. One point was given for each correct answer. Section IV for identifying the mothers' attitudes towards their children's oral health, (31). It was composed of 13 agree/disagree questions. One point was given for each correct answer.

Arabic Translation of the questionnaire was carried out by two Saudi linguists. Forward and back-translation was used. The first linguist, who is fluent in both the Arabic and English languages, translated the questionnaire from English to Arabic, forward translation. The other linguist translated back the Arabic version into English language, backward translation. Then, a dental public health professor compared the two English questionnaires (the original one and translated one) and made modifications until the final Arabic translated version was formulated which was considered the final Arabic questionnaire (32).

Test-retest Reliability of the Arabic questionnaire was done. The final Arabic version of the questionnaire was completed twice with two weeks' interval by a group of mothers (30 mothers), not included in the study. The results were compared using Pearson's correlation coefficient (Pearson's r) as a reliability test. Pearson's r between the two questionnaires' responses was referred to as the coefficient of stability and were found to equal 0.90 which is considered excellent. Moreover, **internal consistency** was done to reflect the inter-correlation between items in the questionnaire and was quantified using the Cronbach's alpha to be 0.86 (33, 34).

Content validity of the Arabic translated version of the questionnaire was performed to recognize if the questionnaire items were representative of the entire theoretical construct that the questionnaire was proposed to measure. A panel of experts in pediatric dentistry were asked to rate each item in the questionnaire concerning relevance, clarity, simplicity, and ambiguity on a four-point Likert scale. The Content Validity Index (CVI) was calculated according to the methodology of Lynn MR and Polit et al and was found to be 0.84 (33, 34).

Three school visits were performed. The first visit for distribution of the questionnaire for the selected children in the class to submit to their mothers with the help of the class teacher. Each questionnaire was assigned a serial number which was matched with an examination sheet for confidentiality purposes. The second visit was carried out after one week, for collection of the questionnaires and clinical oral examination for the children who had a permission from their mothers to assess dental caries experience using two indices (dmft) and (DMFT) (35), and oral hygiene status of the children by Simplified Oral Hygiene Index (OHI-S); Debris Index component (DI); (Greene and Vermillion, 1964). A brief report was sent to the mothers describing the oral health status of their children and instructions for improvement and/or maintaining the oral health condition. Two groups of examiners, one for girls' schools (two examiners) and one for boys' schools (two examiners) shared in this study. Inter and intra-rater reliability test was done for Calibration and training of the examiners. Kappa statistic was calculated and found excellent (0.93 for female and 0.95 for male examiners). The inter-rater reliability between the examiners was evaluated using the Intra-class Correlation (ICC) and was found to be 0.96. On the third school visit, mother-child pairs were gathered for presenting an oral health education lecture and distribution of oral health instruction pamphlets to increase their awareness of the proper oral health knowledge, attitude and behavior regarding themselves and their children.

The research protocol was approved by The Research Ethics Committee at the Faculty of Dentistry, King Abdulaziz University with proposal number (008-16). In addition, approval was obtained from the local School Health and Education Directorate Authority; Ministry of Education; to provide the primary schools' lists in Jeddah city districts and to implement the research among the schools.

Statistical Analysis

Data was entered, coded, and analyzed using the Statistical Package for Social Science SPSS (IBM Statistics for Windows, Version 23.0 Armonk NY: IBM Corp). Univariate analysis of data was carried out and presented as frequencies, percentages or means and standard deviations. The responses of the three questionnaires from public schools were compared to private schools using chi-square test. The association between the demographic variables and questionnaire score, DMFT, and OHI-S was evaluated using independent t-test or ANOVA test which was followed by post hoc analysis. A multiple linear regression was modelled to assess the effects of all the significant independent variables on the DMFT (dependent variable). The significance level was set as $p < 0.05$.

Results

The research comprised a total of 1496 mother-child pair out of the 1728 distributed questionnaires (a response rate of 86.57%). A little over half were from private schools (50.2%). About half (53.8%) of the children were aged 6-9 years and 46.2% were aged 10-12 years. Male children accounted for 47.1% and female children for 52.9%. Mothers' age has been distributed according to the following figures: 56.2% were aged 40 years or less and 43.8% were aged 41 years or older. Only 44.3% of mothers had high school education or less whilst 55.7% had diploma, university, or higher education. Less than quarter of mothers had low monthly income (22.4%), less than half had a medium income (46.7%), and less than one third had a high income (30.9). Table 1 shows the demographic characteristics of children and mothers.

With respect to the children oral health, the average dmft was 4.08 ± 3.47 ; DMFT was 1.82 ± 2.07 ; total dmft and DMFT was 5.65 ± 4.05 ; and the Debris index was 1.17 ± 0.94 .

Table 1
Demographic features of the research sample children and their mothers

| Variable | Category | Frequency (%) |
|---------------------------|-------------------------------------|----------------------|
| School type | Public | 745 (49.8) |
| | Private | 751 (50.2) |
| Child age | 6 - 9 years | 805 (53.8) |
| | 10 - 12 years | 691 (46.2) |
| Child gender | Male | 704 (47.1) |
| | Female | 792 (52.9) |
| Mother's age | 40 or less | 841 (56.2) |
| | 41 or more | 655 (43.8) |
| Mother's education | High school or less | 663 (44.3) |
| | Diploma/University or higher | 833 (55.7) |
| Monthly Income | Low | 335 (22.4) |
| | Medium | 698 (46.7) |
| | High | 463 (30.9) |

The replies of the mothers to the HU-DBI questionnaire are shown in Table 2. When comparing moms of children in public vs private schools, there was a statistically significant difference in 16 out of the 20 questions. Regarding replies to questions 6, 8, 9, and 16, the differences were not statistically significant between mothers who are enrolled their children in public school's vs those in private schools. Mothers in public schools had much higher favorable replies to questions 3, 4, and 13 compared to mothers in

private schools. Mothers at private schools tended to provide more favorable replies to questions 1, 2, 5, 7, 10, 11, 12, 14, 15, 17, 18, 19, and 20.

Table 2

Comparison between public and private schools of mothers' answers to the HUDBI questionnaire

| Items | The correct answer | Total n=1496 | Public n=745 | Private n=751 | P-value |
|--|--------------------|-----------------|-----------------|------------------|---------|
| 1 I don't worry much about visiting the dentist | Agree | 631 (42.2) | 246 (33.0) | 385 (51.3) | <0.001 |
| 2 My gums tend to bleed when I brush my teeth | Disagree | 1096 (73.3) | 495 (66.4) | 601 (80.0) | <0.001 |
| 3 I worry about color of my teeth | Agree | 933 (62.4) | 554 (74.4) | 379 (50.5) | <0.001 |
| 4 I have noticed some white sticky deposits on my teeth | Agree | 113 (7.6) | 82 (11.0) | 31 (4.1) | <0.001 |
| 5 I use a recommended -sized toothbrush | Agree | 1435 (95.9) | 690 (92.6) | 745 (99.2) | <0.001 |
| 6 I think that I cannot help having false teeth when I am old | Disagree | 80 (5.3) | 48 (6.4) | 32 (4.3) | 0.061 |
| 7 I am bothered by the color of my gums | Disagree | 1275 (85.2) | 602 (80.8) | 673 (89.6) | <0.001 |
| 8 I think my teeth are getting worse despite my daily brushing | Disagree | 867 (58.0) | 441 (59.2) | 426 (56.7) | 0.333 |
| 9 I brush each of my teeth carefully | Agree | 1283 (85.8) | 630 (84.6) | 653 (87.0) | 0.186 |
| 10 I have never been professionally taught how to brush | Disagree | 466 (31.1) | 169 (22.7) | 297 (39.5) | <0.001 |
| 11 I think I can clean my teeth without using toothpaste | Agree | 348 (23.3) | 125 (16.8) | 223 (29.7) | <0.001 |
| 12 I often check my teeth in a mirror after brushing | Agree | 1092 (73.0) | 494 (66.3) | 598 (79.6) | <0.001 |
| 13 I worry about having bad breath | Agree | 250 (16.7) | 166 (22.3) | 84 (11.2) | <0.001 |
| 14 It is impossible to prevent gum disease without toothbrushing alone | Disagree | 523 (35.0) | 214 (28.7) | 309 (41.1) | <0.001 |
| 15 I put off going to the dentist until I have a toothache | Disagree | 211 (14.1) | 63 (8.5) | 148 (19.7) | <0.001 |
| 16 I have used a dye to see how clean my teeth are | Agree | 40 (2.7) | 22 (3.0) | 18 (2.4) | 0.505 |

P-value<0.05 significant difference

| Items | The correct answer | Total n=1496 | Public n=745 | Private n=751 | P-value |
|--|--------------------|-----------------|-----------------|------------------|---------|
| 17 I use a toothbrush which has hard bristles | Disagree | 1243 (83.1) | 573 (76.9) | 670 (89.2) | <0.001 |
| 18 I don't feel I've brushed well unless I brush with strong strokes | Disagree | 833 (55.7) | 370 (49.7) | 463 (61.7) | <0.001 |
| 19 I feel I sometimes take too much time to brush my teeth | Agree | 903 (60.4) | 358 (48.1) | 545 (72.6) | <0.001 |
| 20 I have had my dentist tell me that I brush very well | Agree | 403 (26.9) | 127 (17.0) | 276 (36.8) | <0.001 |
| P-value<0.05 significant difference | | | | | |

In Table 3, public and private school mothers held different views on oral health and good oral hygiene. When it comes to mother's awareness about oral health and oral hygiene habits, mothers of children in private schools had better results compared to mothers of children in public schools. However, when questioned about the optimum quantity of toothpaste to be used and about their position when brushing their children's teeth, the replies of mother in public schools were superior to mothers in private schools.

Table 3

The comparison between public and private school mothers' answers to the knowledge questionnaire

| Items | The correct answer | Total n=1496 | Public n=745 | Private n=751 | P-value | |
|-------------------------------------|---|-----------------------------|-----------------|------------------|---------------|--------|
| 1 | How often should you brush your child teeth | Twice daily | 784 (52.4) | 350 (47.0) | 434 (57.8) | <0.001 |
| 2 | Size of brush best for your child | Small | 828 (55.3) | 398 (53.4) | 430 (57.3) | 0.136 |
| 3 | Quantity of paste to be used | pea size | 587 (39.2) | 362 (48.6) | 225 (30.0) | <0.001 |
| 4 | Your position to brush your child's teeth | By side of the child | 717 (47.9) | 418 (56.1) | 299 (39.8) | <0.001 |
| 5 | Does your child toothpaste have fluoride | Yes | 1099 (73.5) | 460 (61.7) | 639 (85.1) | <0.001 |
| 6 | Fluoride content of child paste | 1000 to 1450 ppm | 210 (14.0) | 59 (7.9) | 151 (20.1) | <0.001 |
| 7 | Four of the following cause tooth decay. ○ Chocolate (C) ○ Cheese ○ Biscuits (C) ○ Sweets (C) ○ Soft drink (C) | Correct | 1337 (89.4) | 651 (87.4) | 686 (91.3) | 0.013 |
| 8 | Best time to give sugary snacks | Mealtime | 185 (12.4) | 64 (8.6) | 121 (16.1) | <0.001 |
| 9 | Has child used sweetened baby bottle or honey dipped pacifier | No | 1149 (76.8) | 540 (72.5) | 609 (81.1) | <0.001 |
| 10 | Importance of decay in baby teeth | Very important | 1405 (93.9) | 667 (89.5) | 738 (98.3) | <0.001 |
| 11 | child's first dental visit | On getting first baby tooth | 130 (1496) | 50 (6.7) | 80 (10.7) | 0.007 |
| 12 | If baby teeth decayed, what treatment would you prefer | Fill it | 1227 (82.0) | 545 (73.2) | 682 (90.8) | <0.001 |
| P-value<0.05 significant difference | | | | | | |

Table 4 shows disparities in the replies between public and private school mothers on the mother's attitude questionnaire. Of the 13 assertions, replies to 4 statements (3, 5, 11, and 12) out of the 13 statements showed no statistically significant difference between mothers in public and in private

schools. In their replies to the 9 reminiscent statements (1, 2, 4, 6, 7, 8, 9, 10, and 13), the attitude of mothers at private schools was significantly higher than that of mothers at public school.

Table 4

Comparison between public and private schools of the answers from the mother's attitude questionnaire

| Items | The correct answer | Total n=1496 | Public n=745 | Private n=751 | P-value |
|---|--------------------|-----------------|-----------------|------------------|---------|
| 1 We feel it is important that we check our child's teeth for decay | Agree | 1482 (99.1) | 732 (98.3) | 750 (99.9) | 0.001 |
| 2 I don't know how to brush my child's teeth properly | Disagree | 857 (57.3) | 358 (48.1) | 499 (66.4) | <0.001 |
| 3 We feel it is important to check if our child has brushed his/her teeth | Agree | 144 (96.5) | 717 (96.2) | 727 (96.8) | 0.552 |
| 4 we don't have time to help brush our child's teeth daily | Disagree | 1009 (67.4) | 247 (63.4) | 537 (71.5) | 0.001 |
| 5 It is the responsibility of the dentist to prevent our child getting tooth decay | Disagree | 472 (31.6) | 220 (29.5) | 252 (33.6) | 0.094 |
| 6 If our child gets tooth decay, it is by chance | Disagree | 996 (66.6) | 412 (55.3) | 584 (77.8) | <0.001 |
| 7 It would not make any difference to our child getting tooth decay, if we helped him/her brush every day | Disagree | 434 (29.0) | 169 (22.7) | 265 (35.3) | <0.001 |
| 8 It is worthwhile to give our child sweets/biscuits to behave well | Disagree | 775 (51.8) | 312 (41.9) | 463 (61.7) | <0.001 |
| 9 Tooth decay is a serious problem in baby teeth | Agree | 946 (63.2) | 406 (54.5) | 540 (71.9) | <0.001 |
| 10 As parents, it is our responsibility to prevent our child getting tooth decay | Agree | 1348 (90.1) | 648 (87.0) | 700 (93.2) | <0.001 |
| 11 We can prevent tooth decay in our child by reducing sugary foods and drinks between meals | Agree | 1464 (97.9) | 732 (98.3) | 732 (97.6) | 0.374 |
| 12 If we brush our child's teeth daily, we can prevent our child getting tooth decay in the future | Agree | 1107 (74.0) | 537 (72.1) | 570 (75.9) | 0.092 |
| 13 If our child uses a fluoride toothpaste, it will prevent tooth decay | Agree | 1324 (88.5) | 623 (83.6) | 701 (93.5) | <0.001 |
| P-value<0.05 significant difference | | | | | |

The results in Table 5 demonstrate the associations between demographics of children and mothers and the questionnaires and dmft+DMFT. An effect was established between mothers in public schools and

lower mean scores on the three questionnaires, but the results were different for their children, who had higher dmft+DMFT and DI scores. Slight differences were seen in questionnaire scores and dmft+DMFT and DI scores when compared by children age and gender. However, as the age of the mothers increased, the questionnaire scores declined while mean dmft+DMFT and DI increased. Children whose mothers with at least diploma/university degree had greater questionnaire scores and lower dmft+DMFT and DI while the children of mothers with lesser levels of education had higher mean dmft+DMFT and DI. As the income level improved, the questionnaire scores rose while the mean dmft+DMFT and DI descended.

Table 5
Associations between demographic factors and the scores on the HUDBI questionnaire

| Variable | Category | HU-DBI | Mother Knowledge | Mother attitude | dmft+DMFT | DI |
|-------------------------------------|-------------------------------|----------------|------------------|-----------------|---------------|---------------|
| School type | Public | 10.39 ± 2.75 | 6.13 ± 1.73 | 8.51 ± 1.98 | 6.70 ± 4.08 | 1.36 ± 0.96 |
| | Private | 12.71 ± 2.56 | 6.78 ± 1.45 | 9.75 ± 1.58 | 4.61 ± 3.76 | 0.98 ± 0.88 |
| | p-value | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Child age | 6 - 9 years | 11.41 ± 2.94 | 6.56 ± 1.67 | 9.03 ± 1.94 | 6.18 ± 4.44 | 1.18 ± 0.96 |
| | 10 - 12 years | 11.72 ± 2.85 | 6.33 ± 1.57 | 9.25 ± 1.84 | 5.04 ± 3.46 | 1.15 ± 0.93 |
| | p-value | 0.038 | 0.009 | 0.024 | <0.001 | 0.453 |
| Child gender | Male | 11.11 ± 2.85 | 6.37 ± 1.73 | 8.87 ± 2.01 | 5.81 ± 3.97 | 1.43 ± 0.95 |
| | Female | 11.95 ± 2.89 | 6.53 ± 1.52 | 9.36 ± 1.76 | 5.51 ± 4.13 | 0.93 ± 0.87 |
| | p-value | <0.001 | 0.049 | <0.001 | 0.158 | <0.001 |
| Mother's age | 40 or less | 12.38 ± 2.74 | 6.88 ± 1.51 | 9.59 ± 1.72 | 4.80 ± 3.85 | 0.97 ± 0.89 |
| | 41 or more | 10.50 ± 2.75 | 5.91 ± 1.61 | 8.54 ± 1.95 | 6.75 ± 4.05 | 1.42 ± 0.95 |
| | p-value | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Mother's education | High school or less | 9.66 ± 2.34 | 5.74 ± 1.63 | 8.14 ± 1.83 | 7.77 ± 3.69 | 1.66 ± 0.92 |
| | Diploma/ University or higher | 13.07 ± 2.36 | 7.03 ± 1.38 | 9.92 ± 1.54 | 3.96 ± 3.51 | 0.77 ± 0.76 |
| | p-value | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Monthly Income | Low | 8.77 ± 2.33 a | 5.37 ± 1.72 a | 7.62 ± 1.99 a | 8.76 ± 3.55 a | 1.83 ± 0.90 a |
| | Medium | 11.36 ± 2.07 b | 6.54 ± 1.46 b | 9.05 ± 1.50 b | 5.76 ± 3.68 b | 1.17 ± 0.86 b |
| P-value<0.05 significant difference | | | | | | |

| Variable | Category | HU-DBI | Mother Knowledge | Mother attitude | dmft+DMFT | DI |
|-------------------------------------|----------|----------------|------------------|-----------------|---------------|---------------|
| | High | 13.87 ± 2.39 c | 7.12 ± 1.38 c | 10.35 ± 1.49 c | 3.23 ± 3.28 c | 0.68 ± 0.78 c |
| | p-value | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| P-value<0.05 significant difference | | | | | | |

A multiple linear regression model (adjusted) was used to quantify the impact of school type, mother's age, mother's education, the questionnaire scores, and Debris Index score on the dmft+DMFT index (Table 6). Overall, 48.6% of the data variability was accounted for by the model. The dmft+DMFT scores of children whose mothers had lower educational levels were higher by 0.71 (95% CI 0.31 – 1.11) than those of children whose mothers had higher educational levels. It was predicted that children's dmft+DMFT decreased by -0.33, -0.16, and -0.17 for every increase in the questionnaire scores by one. When the Debris Index went up by one, the dmft+DMFT index climbed by 1.43 on average (95% CI 1.22 – 1.64, p<0.001).

Table 6
Model of the impacts of different variables (multiple linear regression, R2=0.495)

| Independent variables | | $\beta \pm SE$ | 95% CI | | p-value |
|-------------------------------------|------------------------------|----------------|-------------|-------------|---------|
| | | | Lower bound | Upper bound | |
| School type | Public | 0.013 ± 0.17 | -0.33 | 0.35 | 0.940 |
| | Private | Reference | | | |
| Mother's age | 40 or less | -0.04 ± 0.17 | -0.237 | 0.28 | 0.793 |
| | 41 or more | Reference | | | |
| Mother's education | High school or less | 0.71 ± 0.20 | 0.31 | 1.11 | <0.001 |
| | Diploma/University or higher | Reference | | | |
| HUDBI | | -0.33 ± 0.05 | -0.42 | -0.24 | <0.001 |
| Mother knowledge | | -0.16 ± 0.06 | -0.27 | -0.06 | 0.003 |
| Mother attitude | | -0.18 ± 0.06 | -0.30 | -0.06 | 0.003 |
| Debris index | | 1.43 ± 0.11 | 1.22 | 1.64 | <0.001 |
| P-value<0.05 significant difference | | | | | |

Discussion

Parents' oral health knowledge, attitude, and behavior have an impact on their children's dental health (36), especially the mother, who mostly is the person who attend to her children's oral hygiene needs. As a result, the purpose of this study was to determine the level of oral health-related knowledge, attitudes, and behavior among a group of mothers with children aged 6 to 12 years, as well as to investigate the relationship between mothers' socioeconomic status and their knowledge, attitudes, and behavior regarding their own and their children's dental health. The impact of mothers' oral health knowledge and attitudes on their children's dental caries status (dmft/DMFT) and oral hygiene condition (DI) were also investigated in this study.

In comparison to mothers of public primary school children, mothers whose children attend private primary schools have higher questionnaire scores on average (HU-DBI, knowledge, and attitude). The study's findings can be explained by the fact that most private schools provide oral health education to children and their parents, but most public schools do not. These arguments are supported by a 2017 study conducted in Riyadh, which indicated that oral health educational sessions in private schools improved schoolchildren's oral health awareness (37). Schools are accountable for more than simply providing education; they are also responsible for informing parents and students about other aspects such as oral health. According to the Haloi et al study, the type of school has a substantial impact on oral health promotion, with schoolteachers in private schools having relatively high oral health knowledge and attitudes (38). In contrast to our findings, an Indian study found that the majority of moms of children in private schools had a mediocre understanding of oral health (38). In addition, an Iranian study indicated that mothers of children in public schools had a good understanding and attitude toward dental health (39). However, neither study revealed the participants' socioeconomic background, which could have a substantial confounding effect on the relationship between school type (private vs. public) and oral health-related knowledge, attitudes, and behavior.

Children in private primary schools have lower dmft/DMFT and DI mean scores on average than children in public primary schools, according to our research. These findings are similar to those of a 2016 study in Nigeria, which found that children in private schools scored lower on the DMFT than children in public schools (40). In India, it was discovered in 2016 that children in private schools (12-13 years old) had a lower DMFT mean score than kids in public schools (41). In Brazil in 2004, children in public schools had higher dmft/DMFT than children in private schools, with a statistically significant difference (42). On the contrast, there was no statistically significant difference in dmft/DMFT scores between public and private school students in Port Harcourt, Nigeria, despite private school students having lower dmft/DMFT scores (43).

In comparison to moms with lesser education and/or income, mothers with higher education and/or income had better oral health related knowledge, attitudes and behavior, and their children had fewer cavities and lower DI. These results could be explained by the fact that women have a significant role in their children's dental health, and that their high levels of education enable them to seek out the best oral

hygiene practices. Mothers with a higher level of education are likely to be more aware of the risks of neglecting oral health and the oral disorders that may harm their children. In terms of oral health, educated mothers can use the internet, social media, and electronic periodicals to find reliable oral health information. Higher-educated mothers recognize the necessity of teaching their children how to brush their teeth and to examine them thereafter. This may motivate children to brush their teeth thoroughly and maintain good oral hygiene. Another possibility is that children of mothers with higher levels of education and income have more frequent dental checkups. Most highly educated mothers took their infants to the dentist when they were six to twelve months old, whereas the majority of illiterate parents took their children to the dentist only when they were in pain (44). According to other studies (45), children's oral health is directly related to their monthly family income, and children of low-income mothers use fewer dental services than children of high-income mothers. Our findings are in line with two Saudi Arabian studies that found a link between educational and financial levels, as well as oral hygiene knowledge and attitudes (18, 46). A higher prevalence of caries was connected to a lower parental educational level and a lower family income (47). As a result, it's vital to inform low-income mothers about their children's dental care options.

Conclusion

The study results revealed that the level of oral health-related knowledge, attitudes, and behavior of the mothers toward their own and their children (6-12 years), with high educational level a were higher and consequently their children had better oral health status. Overall, participated mothers need to increase the level of oral health knowledge and improve their oral health attitudes and behavior. Therefore, there is a need for increase comprehensive oral health education and oral health promotion programs among mothers in Jeddah, Saudi Arabia. Moreover, implementation of awareness campaign of oral health education programs targeted at pre-school and primary school children to encourage them for good oral health attitude and behaviors, through schools' extra-curricular activities and electronic social media. Additional studies are required to evaluate mothers' awareness regarding oral health in different cities in Saudi Arabia which would help in planning and designing public health campaign.

Abbreviations

HU-DBI - Hiroshima University– Dental Behavioral Inventory questionnaire

CVI - The Content Validity Index

dmft – Decayed, Missed, Filled teeth for the primary dentition

DMFT - Decayed, Missed, Filled teeth for the permanent dentition

DI – Debris Index component

OHI-S - Simplified Oral Hygiene Index

ICC - Intra-class Correlation

SPSS - Statistical Package for Social Science

CI – Confidence Intervals

Declarations

Ethical approval

The research protocol was approved by Research Ethics Committee at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia with proposal number (008-16). In addition, approval was obtained from the local School Health and Education Directorate Authority; Ministry of Education; to provide the primary schools' lists in Jeddah city districts and to implement the research among the schools. A written consent form was obtained from all participant before participating in the research.

Consent for Publication

Not applicable

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors did not have any conflict of interest related to this study.

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Author's Contributions

We declare that this work was done by the author(s) named in this article. The study's conception and design were done by NA and EE; acquisition of data by DQ; analysis and/or interpretation of data by OF. Drafting of the manuscript was by DQ and RA while revising the manuscript was by NA, EE and RA. All authors of the manuscript have read and agreed to its content and are accountable for all aspects of the accuracy and integrity of the manuscript.

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