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A Systematic Review of Cross-Sectional Studies Conducted in the Kingdom of Saudi Arabia on Levels of Dental Anxiety Between Genders and Demographic Groups

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Background: Dental anxiety can impact oral health and dental treatment in patients of all age groups, which seems to be an obstacle to quality dental care. This systematic review of the literature aimed to evaluate the findings from cross-sectional studies conducted in the Kingdom of Saudi Arabia (KSA) on levels of dental anxiety (DA) between genders and among various demographic groups.





Material/Methods: An electronic search of PubMed, Embase, and Web of Science databases was carried out in January 2022. Studies that measured dental anxiety in Saudis in all regions of the KSA by direct evaluation and interviews were included. Studies that were not in the English language or used proxy measures were excluded. Quality assessment was carried out using Joanna Briggs Institute's critical appraisal tool for cross-sectional studies.

Results: A total of 19 cross-sectional studies from the KSA were identified that used validated anxiety scales, including the Corah Dental Anxiety Scale (DAS), the Corah Dental Anxiety Scale, Revised (DAS-R), and the Modified Dental Anxiety Scale (MDAS). All studies were rated as having a high risk of bias. A mild level of DA was the most common among participants in the KSA.

Conclusions: The findings from this systematic review showed that in the KSA, although a mild level of dental anxiety was most common in the study participants, women, young adults, and university students showed a higher prevalence of dental anxiety. However, the lack of sufficient literature to support the current findings make an overall conclusion about DA extremely difficult.

Keywords: **Dental Anxiety • Gender Role • Prevalence • Saudi Arabia**

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Background

Dental anxiety refers to an emotional state of apprehension or dread at the prospect of dental treatment [1]. The prevalence of dental anxiety (DA) can vary in populations and according to age [2]. It is believed to be 20% or higher based on the population sampled [3-6]. Dental treatment often involves some form of invasive treatment including injections, cavity preparation using high-speed handpieces, or sharp blades and instruments that may be alarming for patients [7]. Subjects suffering from DA report anxiety accompanied by negative thoughts, and fears, coupled with a sense of losing control, linked to a feeling that something dreadful is going to happen in relation to dental treatment [5]. DA may be related to anticipatory anxiety and previous dental experiences of pain and trauma [8].

Dental anxiety can be a significant hindrance to dental care and oral health. Aversion to the dental office and treatment leads to avoidance behavior where the patient does not seek dental care, infrequent attendance, and self-medication in case of pain [9]. Pronounced evasive behavior can lead to missing teeth, decayed teeth, poorer periodontal status, and overall poorer oral health [10-12]. These can undermine growth and development in children and adolescents, predisposing them to systemic disease [13,14]. During treatment, DA can affect compliance and increase the perception of pain, requiring longer treatment times. Delivering resource-intensive care increases the burden of stress on the clinician and staff [15,16].

Studies in population and clinical samples have shown that severe dental anxiety is related to poor mental health [17-19]. Negative consequences in social relationships may include embarrassment regarding poor oral health and decreased self-confidence, as well as increased frequency of absence from work and less social involvement [7,18,20]. Berggren has presented a bio-psychosocial vicious-circle model of dental avoidance, with dentally anxious individuals having poorer dental attendance and more appointment cancellations, leading to poorer oral health [21].

Dental anxiety can vary with age, gender, and ethnicity. DA appears more apparent in females and younger individuals [4,22,23]. Humphris et al, Nascimento et al, Stabholz et al, and Dadalti et al observed that younger and female patients appeared more prone to DA [24-27]. Moore et al dissented from this view, reporting that high dental anxiety was associated with a person's education, gender, and income but not with age [3]. These variances in the findings may be a result of the methods used to assess the prevalence or the different cultural contexts. Anxiety is inversely related to the frequency of dental attendance, implying that desensitization may be effective [28]. Children with previous caries experience who had not visited dentists may have higher dental anxiety [5].

One other recent cause of DA was COVID-19. Many studies discuss the effect of COVID-19 on dental patients, and there was a significant effect on DA [29-31]. One of the reasons is that the long period of stay at home and the distance between the family members to avoid the infection increase their craving for food, especially sweets, and increase their dental problems [29]. On the other hand, they are anxious about getting infected in the dental office [30]. However, The stress and anxiety increased with the dental practitioner during the COVID-19 pandemic [31]. Nikolić et al found that the COVID-19 pandemic has affected the attitudes and behavior of people about visits to dental offices. Therefore, including a pre-treatment protocol might increase the sense of security for the patient [32,33].

Self-reporting scales allow patient responses to be used to evaluate the level of anxiety. Subjective evaluation by questionnaires, interviews, and self-reporting on anxiety scales can significantly improve the diagnosis and help categorization of these individuals as mildly, moderately, or highly anxious or dental phobics [34]. Various scales and indices have been adopted to record and evaluate DA: Corah's Dental Anxiety Scale (DAS), Modified Dental Anxiety Scale (MDAS), Corah's Dental Anxiety Scale-Revised (DAS-R), Dental Fear Survey (DFS), Dental Anxiety Question (DAQ), Depression Anxiety and Stress Scale (DASS); Dental Environment Stress (DES); and Social Anxiety Scale (SAS) [35-43].

Assessment of dental anxiety in a specific population can inform treatment planning and behavior management techniques. A dental team aware of the risk factors for dental anxiety can anticipate a patient's anxiety and modify their treatment approach [44]. Previously identified factors may vary with population and setting. These findings are crucial for evidence-based dental practice and can inform healthcare decisions. Although dental anxiety is a universal phenomenon, few studies have systematically examined the current literature for evidence of the prevalence of dental anxiety in the Middle East and North African (MENA) countries. Therefore, this systematic review of the literature aimed to evaluate the findings from cross-sectional studies conducted in the Kingdom of Saudi Arabia on levels of anxiety between genders and among demographic groups.

Material and Methods

Aims of the study

“What is the prevalence of dental anxiety among Saudis in different regions of the Kingdom of Saudi Arabia (KSA)?” We created the focus question with inclusion and exclusion criteria using the PICO framework recommended by the Joanna Briggs Institute for examining qualitative studies [45].

Inclusion Criteria

The inclusion criteria were: population (P), which included the Saudi population in different regions of the KSA; interest (I), which included experiences in dental anxiety validated using self-examination questionnaires and indices such as Corah's Dental Anxiety Scale (DAS), Modified Dental Anxiety Scale (MDAS), and Corah's Dental Anxiety Scale-Revised (DAS-R); and context (Co) of dental care.

Exclusion Criteria

The exclusion criteria were: use of proxy measures of dental anxiety, and articles in languages other than English.

Search Strategy

The electronic databases PubMed, Science Direct, Scopus, Wiley Library, and Web of Science were searched for relevant articles. The searches were conducted from July 2021 to August 2021. The search terms used were "dental anxiety," "scale," "indices," and "Saudi Population." The keywords were used individually or in combination by using the Boolean operators "AND," "OR," and "NOT" to search for the term "dental anxiety" independently. The gray literature was searched using Google Scholar.

Study Selection

Two reviewers (T.A.A. and M.M.A.) independently assessed articles for eligibility based on the inclusion criteria. After the removal of duplicates, the titles and abstracts of the remaining articles were examined for relevant studies. A third reviewer (P.S.) evaluated the validity and duplications of the studies. Studies that did not assess the level of DA among Saudis, longitudinal studies, case-control studies, systemic reviews, and case reports were excluded. Articles that did not indicate the number of subjects and participants or whose samples had been partly evaluated in other studies were also excluded. A study was deemed relevant when both the researchers agreed that it was related to the study questions.

The full text of potentially relevant articles was obtained and assessed. The references of selected articles were examined for additional studies that fulfilled the inclusion criteria. In case of a disagreement regarding the inclusion of an article, a third reviewer (P.S.) was consulted.

Data Extraction and Analysis

Two authors (T.A.A. and M.M.A.) independently extracted the relevant data from each study using customized tables in Microsoft Excel (Microsoft Corp., Redwood, CA, USA). Any

disagreements were resolved through discussion with a third author (P.S.). Details regarding the year of publication, authors, name of city or region, sample size, gender, index or scale used, level of anxiety, outcomes, and significant clinical findings were extracted.

Quality of the Included Studies

The quality of the included studies was evaluated using the Joanna Briggs Institute's critical appraisal tool for cross-sectional studies [45]. The critical appraisal was performed independently by 2 authors (T.A.A. and M.M.A.). Any disagreements were resolved through discussion until consensus was reached with a third author (P.S.). The external validity of the studies was assessed by reporting of 3 criteria: the characteristics of the study groups, the appropriateness of the outcome measures, and the statistical measures used.

Results

Study Selection

The search strategy yielded 109 results. From these, 50 articles were excluded as they were duplicates or not related to this review. The remaining articles were screened based on title and abstract. Twenty-one studies were excluded because they were case studies [5], reviews [9], or non-valid samples [7]. The full text of 38 articles was extracted for the assessment using predefined eligibility criteria. Nineteen studies were excluded as they did not use questionnaires or indices. A total of 19 papers that met all the inclusion criteria were included in this review. **Figure 1** depicts the flow chart.

Quality of the Evidence

The risk of bias assessment revealed that all the 19 included studies suffered from methodological limitations. This led to an overall rating of high risk of bias. A majority of the studies showed attrition bias with a lack of responses. There was limited information on how the response rate was managed. The studies did not use any objective measures to examine dental anxiety. The summary of the risk of bias ratings is presented in **Figures 2 and 3**.

Study Characteristics

Seven studies were conducted in the central region of the Kingdom of Saudi Arabia (KSA), 4 in the southern and western region, 3 in the northern region, and only 1 in the eastern region. All 7 studies conducted in the central region of the KSA recorded the highest values of all parameters tested, except in "sample size calculation/pilot studies", where it

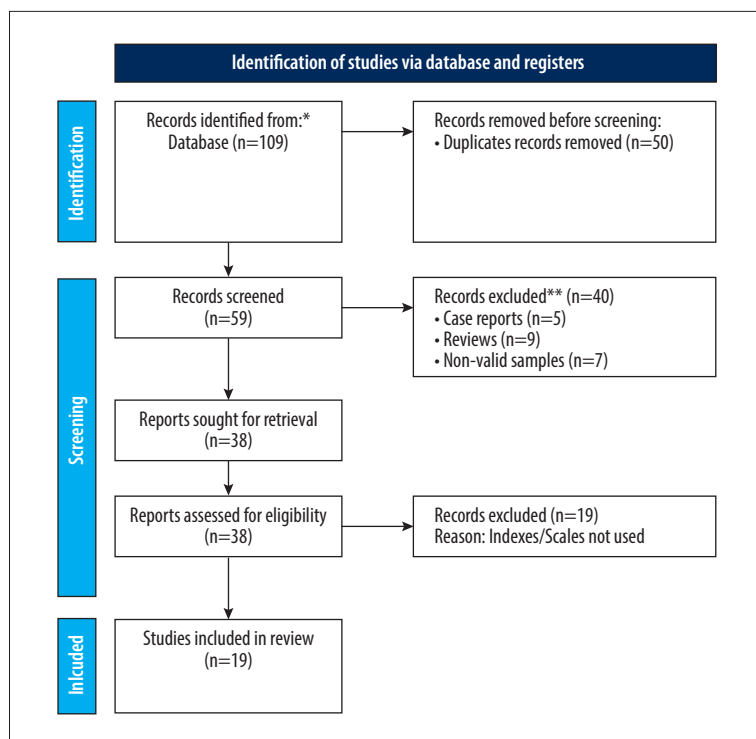


Figure 1. Flow chart depicting the study selection via databases and registries.

was only 53%. The score of the parameter “ethics committee”, which most researchers did not include, was 68%. The parameter “future research” was not indicated in 63% of the studies. “Strengths and limitations” was not included in 37% of the studies. “Reliability” and use of intra/interrater reliability tests was not included in 53% of the studies. Only 1 study assessed the level of DA in the eastern region, as compared to 3 and 4 studies that investigated this in the northern and southern regions of the KSA, respectively. **Table 1** summarizes the characteristics of the selected studies.

Gender

The percentage of male participants (60%) involved in studies on DA in the KSA was higher than that of female participants (40%). **Figure 4** shows the studies that reported the incidence of DA among male and female participants in all regions of the KSA. In the western region, 4 studies reported that females had a high DA level [46-49]. In the northern and eastern regions, only 2 studies assessed DA among females and only 1 study evaluated DA among males [50-52]. In the central and southern regions, 3 and 2 studies, respectively, reported high DA levels among males [53-57]. In all regions of the KSA, 10 out of 19 studies reported high DA levels among females.

Age

The incidence of DA among young patients (18-39 years old) in all regions of the KSA was reported by 85.5% of the studies.

By comparison, 10.5% of the studies reported the incidence of DA among adults (40-59 years old). No study reported the incidence of DA among the elderly (**Figure 5**) [46,50-53,57-64]. The studies included herein also established that the educational level of the participants was another factor related to DA. Ten studies reported that university students had the highest DA level in all regions of the KSA (**Figure 6**) [46,50,52,54,58,62-64].

Response Rate

The total response rate from all regions was 87.47%. The highest response rate was from the southern region (97%), followed by that from the eastern (93%), western (87.70%), and northern and central regions (80%).

Regional Variations

All 5 regions of the KSA had different DA levels (mild, moderate, and severe). The incidence of moderate DA was 40.7% in the western region and 33.6% in the southern region, while the northern region reported the highest incidence of mild DA (79.0%). This, in contrast, was only 31.6% in the central and eastern regions, slightly higher than that of severe DA (29.9%). The incidence of mild (39.7%), moderate (31.1%), and severe (23.4%) DS was substantially different among regions of the KSA (**Figure 7**).

The other contributing factors did not have a generalized effect on DA in the KSA. Nevertheless, some individual studies

| Study | Risk of bias | | | | | | | | Overall |
|----------------------------|--------------|----|----|----|----|----|----|----|---------|
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | |
| Al-Madi & Abdellatif, 2022 | ⊗ | ⊗ | ⊕ | ⊗ | ⊗ | ⊖ | ⊕ | ⊕ | ⊗ |
| Alaki et al, 2012 | ⊕ | ⊗ | ⊕ | ⊗ | ⊕ | ⊕ | ⊖ | ⊗ | ⊗ |
| Al-Sowaygh et al, 2013 | ⊗ | ⊕ | ⊕ | ⊗ | ⊗ | ⊕ | ⊕ | ⊗ | ⊗ |
| Sghaireen et al, 2013 | ⊕ | ⊕ | ⊕ | ⊗ | ⊖ | ⊕ | ⊕ | ⊗ | ⊗ |
| Inamdar et al, 2014 | ⊕ | ⊕ | ⊕ | ⊗ | ⊖ | ⊖ | ⊕ | ⊗ | ⊗ |
| Gaffer et al, 2014 | ⊗ | ⊗ | ⊗ | ⊗ | ⊗ | ⊖ | ⊖ | ⊗ | ⊗ |
| Al-Khalifa, 2015 | ⊕ | ⊗ | ⊕ | ⊗ | ⊗ | ⊕ | ⊕ | ⊗ | ⊗ |
| El-Shayed et al, 2016 | ⊗ | ⊗ | ⊖ | ⊗ | ⊗ | ⊕ | ⊖ | ⊗ | ⊗ |
| Ibrahim et al, 2016 | ⊕ | ⊖ | ⊖ | ⊗ | ⊖ | ⊕ | ⊕ | ⊗ | ⊗ |
| Fayed et al, 2017 | ⊕ | ⊕ | ⊕ | ⊗ | ⊖ | ⊕ | ⊖ | ⊗ | ⊗ |
| Alshammary et al, 2017 | ⊗ | ⊗ | ⊕ | ⊗ | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ |
| Al Bahhawi et al, 2018 | ⊕ | ⊕ | ⊕ | ⊗ | ⊖ | ⊖ | ⊕ | ⊗ | ⊗ |
| Al-Towayan & Osman, 2018 | ⊕ | ⊕ | ⊕ | ⊗ | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ |
| Alafaleg, 2018 | ⊕ | ⊕ | ⊕ | ⊗ | ⊕ | ⊖ | ⊗ | ⊗ | ⊗ |
| Allam et al, 2018 | ⊕ | ⊕ | ⊕ | ⊗ | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ |
| Alalwan et al, 2018 | ⊕ | ⊗ | ⊖ | ⊗ | ⊗ | ⊗ | ⊖ | ⊗ | ⊗ |
| Jesser et al, 2019 | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ | ⊗ | ⊕ | ⊗ | ⊗ |
| Junaymi et al, 2020 | ⊕ | ⊕ | ⊕ | ⊗ | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ |
| AIDhelai et al, 2021 | ⊕ | ⊕ | ⊖ | ⊗ | ⊕ | ⊕ | ⊕ | ⊗ | ⊗ |

D1: Were the criteria for inclusion in the sample clearly defined?
 D2: Were the study subjects and setting described in detail?
 D3: Were valid methods used for the identification of the condition?
 D4: Were objective, standard criteria used for measurement of the condition?
 D5: Were confounding factors identified?
 D6: Were the outcomes measured in a valid and reliable way?
 D7: Was appropriate statistical analysis used?
 D8: Was the response rate adequate and if not was the low response rate managed appropriately?

Judgement
 ⊗ High
 ⊖ Unclear
 ⊕ Low

Figure 2. Risk of bias ratings based on Joanna Briggs Institute Critical Appraisal Tools.

that assessed clinical procedures, such as anesthetic injections, surgical procedures, extractions, and tooth drilling, reported that these procedures were terrifying to the patients. Subjects reported that lack of time, unsatisfactory dental services, and fear were attributed to irregular dental visits [46,61]. Two studies also reported that other factors, such as unequal distribution of dental services and the cost of treatment, were contributing factors [46,50].

Discussion

Dental anxiety (DA) is an obstacle to the provision of quality dental care and places an enormous economic, social, and health burden on patients [65]. From a public health standpoint, it is crucial to assess the prevalence DA in a population and examine the factors that may lead to the avoidance of oral healthcare. This systematic review examined the evidence

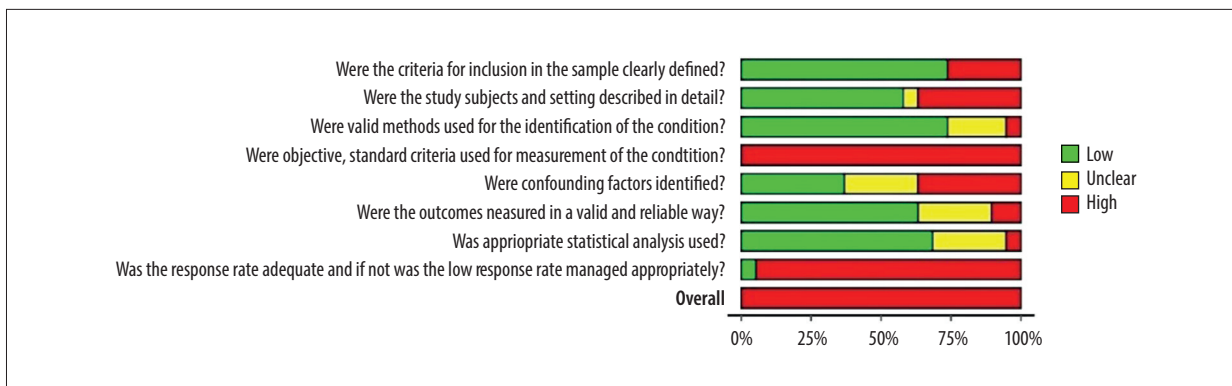


Figure 3. Summary of quality assessment.

in the literature for the prevalence of dental anxiety in the Kingdom of Saudi Arabia (KSA). The overall DA score in the regions of the KSA was similar, with mild DA being widely reported (39.72%). Reports of DA were high in the northern region (79%). These values were consistent with those reported by Madfa et al [66] among university students in Yemen and those reported by Suhani et al [67] in young participants with hearing impairment in Romania. DA is prevalent regardless of age, gender, social status, and place of residence. This is a growing concern for dental professionals, who need to be aware of the extent of this issue to find systems and procedures that will help patients in overcoming it [49].

The gender distribution of males to females was similar (60% and 40%, respectively). However, the incidence of DA was higher among females. Similar findings were obtained in India, Romania, Yemen, Australia, and Portugal [27,66-69]. There was a disparity in the reports of DA related to gender in the studies included in this review. While 10 studies conducted in the western region of the KSA reported a higher DF level in females, other studies in the central and southern regions of the KSA reported that males had a higher DA level than females, but 2 studies reported that DA level is equal between genders. Earlier reports by Goh et al, Shim et al, and Talo et al concur that females tend to show a greater prevalence of dental anxiety [22,23,44]. However, this is in contrast to other studies that report no variation in dental anxiety between the genders [70], or greater dental anxiety in males [71]. This disagreement among studies may be a result of the cultural background or population examined [72].

We found that the DA level was greater in the younger age group (18-39 years old) as compared to the older age group. Similar findings were reported by studies conducted in Yemen, Romania, and Australia. University students had the highest DA level among all educational groups. Children may be particularly susceptible to influence through second-hand information gleaned from media or reported experiences of family and friends that raise the specter of dental treatment as

something “uncomfortable” or “painful” [73]. Past dental experiences may play an outsized role in the development of DA. Feelings of helplessness, duress, and indifference on the part of the dentist may be predictive of future instances of dental anxiety [74]. However, the elderly had the lowest DA level in these studies. This result may be due to sampling bias, as most studies assessed DA levels among college and university students and very few old people participated in these studies.

University students had the highest DA level among all educational groups (10 out of 19 studies). This observation was consistent with that of Calabiano and Madfa et al in Yemen and Australia. However, it was slightly lower than that reported by Suhani et al, possibly because they only included younger university students [67,69].

The response rate from all the regions of the KSA was very high. This high response rate was achieved because the submission of the questionnaire was followed up during the same visit and most of these studies were conducted in person at location (private clinic, dental centers, or teaching hospital). Females and young adults had a higher level of DA, especially related to clinical procedures. The lack of proper dental health education might have resulted in higher DA levels among non-medical undergraduates in the country. DA is prevalent regardless of age, gender, social status, or residence. Educational sessions with dental training can help in reducing DA levels among dental students. DA can be reduced through educational campaigns and dental health education. Social media, academic programs, and school- and community-based dental health programs can help educate the populace to reduce the level of DA.

Regarding the completeness and applicability of this research, our review examined studies that used self-reporting via questionnaires to estimate the prevalence of dental anxiety. Self-reporting may be insufficient in delineating levels of dental anxiety. There is considerable variability in the ratings of different scales. Dental anxiety scores need to have a mid-value

Table 1. Characteristics of selected studies conducted in the Kingdom of Saudi Arabia.

| Researcher(s)/Year | Region/City | Sample size & type | Indexes used | Gender ↑ significant |
|---------------------------------------|----------------------------------|--|---------------|--|
| Dental Anxiety, Central Region | | | | |
| Jasser et al., 2019 [15] | SA Riyadh & Magmmah RR 75% | 224 Dent, Med, Nursing Students Medicine 40.6%, Nursing 31.7% Dentistry 27.7% | (MDAS) | Equal Male 24% Female 76% Non-Significant |
| Alalwan et al., 2018 [16] | SA Riyadh RR 98% | 296/Participants | (MDAS) | ----- Male 42% Female 58% Significant |
| Allam et al., 2018 [19] | SA Riyadh RR 90% | 356/Dental Students | Corah's (DAS) | Male ↑ Male 68% Female 32% Significant |
| Al-Sowygh et al., 2013 [20] | SA Riyadh RR 76% | 425/Dental Students | (MDAS) | Females ↑ Married Male 68.9% Female 31.1% Significant |
| Al-Madi & AbdelLatif, 200221 | SA Riyadh | 1424/High School Female/Adolescent 91% Saudi | (DAS) | ----- |
| Al-Towayan & Osman, 2018 [22] | SA Qassim RR 67% | 512/Dent & Medi Students | (MDAS) | Male ↑ 60% Male 40% Female Non-significant |
| Alafaleg R, 2018 [23] | SA Buraidah RR 80% | 1037/Participants | (DAS-R) | Females ↑ Significant |
| Dental Anxiety, Western Region | | | | |
| El-Sayed et al., 2016 [24] | SA Taibah RR 88% | 143/Dental Students Male 33% Female 67% | (MDAS) | Female ↑ Significant |
| Ibrahim et al., 2016 [25] | SA Jeddah RR 90% | 231/Patients | Corah's (DAS) | Female ↑ Significant |
| Alaki et al., 2012 [26] | SA Jeddah RR 58.5% | 518/School Students | (DAS) | Female ↑ Male 61% Female 39% Significant |
| Al-Khalifa KS, 2018 [27] | SA Jeddah & Dammam RR 92% | 276/Participants Jeddah 48% Dammam 52% Educational level BDS 79% | (MDAS) | Female ↑ Male 49% Female 51% Significant |
| Dental Anxiety, Eastern Region | | | | |
| Gaffer et al., 2014 [28] | SA Dammam RR 94% | 1025/Participants | (DAS) | Female ↑ Male 55% Female 45% Significant |

Table 1 continued. Characteristics of selected studies conducted in the Kingdom of Saudi Arabia.

| Researcher(s)/Year | Region/City | Sample size & type | Indexes used | Gender ↑ significant |
|--|--|---|---|--|
| Dental Anxiety, Northern Region | | | | |
| Fayad et al., 2017 [29] | SA Aljouf RR 74% | 221/Participants | (MDAS) | Female ↑ Male 65% Female 35% Significant |
| Alshammary et al., 2017 [30] | SA Hail Mailed RR 80% | 159/US (Health Care) | Norman Corah's (DAS-R) | Male ↑ Male 44% Female 56% Non-significant |
| Sghaireen et al., 2013 [31] | SA Aljouf RR 86% | 700/USA Medical 13% Dental 10% Arts 58% Computer-Sicn 18% | Corah (MDAS) | Female ↑ Significant |
| Dental Anxiety, Southern Region | | | | |
| AlDhelai et al., 2021 [17] | SA Jazan | 500 Participants | (MDAS) | Male ↑ Male 63% Female 37% Significant |
| Jumaymi et al., 2020 [32] | SA Jazan | 352/Participants Khat chewers 71% | (MDAS) | Equal Male 76% Female 34% Significant |
| Al Bahhawi et al., 2018 [33] | SA Jazan | 642/University Students | DAS | Female ↑ Significant |
| Inamdar et al., 2014 [34] | SA Jazan RR 94% | 233/Dental & Medical Student | Corah's (MDAS) | Male ↑ Male 68% Female 32% Significant |
| Researcher(s)/Year | Level of dental snxiety/ % highest in age-groups | | Other clinical finding | |
| Dental Anxiety, Central Region | | | | |
| Jasser et al., 2019 [15] | Mean MDAS 14 (Nursing 12.6%, Medicine 10.2%, dentist 9.2% 18-22-age-group 55% Low 65.2%; Moderate 18.3%; High 8.5%; Sever 8% | | Dental student's ↓ dental anxiety. SD ↔ DS & NS and SD ↔ MS & NS NSD ↔ MS & DS SD ↔ students good with had a bad dental experience 52% visit the Dentist when having problems, and 51% reported that their last dental visit was six months ago | |
| Alalwan et al., 2018 [16] | 21-30 age-group ↑ 39% Anxiety Low 42%; Moderate 26%; Anxious 20%; Highly Anxious 12% | | SD ↔ anxiety Open mouth, LA injection& Day before a visit NSD ↔ Tooth drilling & Dentist angry with the nurse The highest frequency is 30% During drilling instruments, very anxious high at 35% Dentist is angry with the nurse | |

Table 1 continued. Characteristics of selected studies conducted in the Kingdom of Saudi Arabia.

| Researcher(s)/Year | Level of dental anxiety/ % highest in age-groups | Other clinical finding |
|--|--|---|
| Allam et al, 2018 [19] | 12.1 Male ↑ & 11.1 Female Anxiety Low 48%; Mild 35%; High 10%; Sever 7.0% | Anxiety ↓ as the level of study ↑ Educational sessions & graded exposure therapy during the initial phase of dental training could ↓ DA |
| Al-Sowygh et al., 2013 [20] | 20 years the highest and 3 rd years most Overall high Anxiety received | Stressful ↑ by Workload, Amount of assigned classwork, late ending day followed by lack of time for relaxation, 4 th , 5 th Clinical requirements Patient treatment, Performance pressure, Social stressors are significantly more stressful in married subjects |
| Al-Madi & AbdelLatif, 2002 [21] | Young age Anxiety Low;16%; Medium56%; High29% | Extraction ↑, Then 1 st -time Dentist, ↓ never been to Dentist The lowest fear was for prevention |
| Al-Towayan & Osman, 2018 [22] | Medical Students/Anxiety High or Sever 89%; Medium-Low 5.1% & scored 19 Dental Students/Anxiety High or Sever 60.9%; 39.1% Moderate – Low | SD ↔ Medical & Dental students; Have you gone?; For what?; How often with SD. ↔ Students Tooth drilling and scaling ↔ More anxious |
| Alafaleg R, 2018 [23] | 16-20 years with ↑ Overall-Anxiety 10.2 Male – 9.8 & Female – 10.5 | SD ↔ Age groups, Education Level Education level ↑ Dental Anxiety Anxiety ↑ With Extraction, RCT, LA injection |
| Dental Anxiety, Western Region | | |
| El-Sayed et al., 2016 [24] | 19-22 age-group Anxiety Low 52%; Moderate 39%; High9% | SD ↔ Pre-clinical&clinical students, anxiety parameters The anesthetic injection was the highest cause of DA The muscle becomes tense” highest mean score, then breathing rate increases and “heartbeats faster” |
| Ibrahim et al., 2016 [25] | Overall Anxiety 50.6% Less than 40 years Anxiety Low 49%; Moderate 31%; High 11%; Sever 9% | SD ↔ Age-group, Education, Income, Professional Extraction 46.0%; Sweaty hands 56.1%; fast breathing 21.5% & ↑ heart rates 13.6% during visiting dentists |
| Alaki et al., 2012 [26] | 11-15 years Anxiety Low 33.3%; Moderate 36.5: High 6.1%; Sever 24.2% | SD ↔ Age, Type of school ↑ Anxious during teeth extractions & root canal treatment, LA injection, Sound of drilling |
| Al-Khalifa KS, 2018 [27] | ↑ Less than 20-yers-old 59% Slightly 42%; Moderate 30.4%; Extremely Anxious 27.5% Dammam 22.7% & Jeddah 31.9% ↑ | SD ↔ City, Gender, Education, 1 st appointment NSD ↔ Age-group & Income Most Anxiety; LA Injection & ↓ Next-dental visit RCT is 1 st , then Restoration, Extraction Bad experience with a Dentist |
| Dental Anxiety, Eastern Region | | |
| Gaffer et al., 2014 [28] | 18-20 age-years ↑ Overall Anxiety is 27%. 51.4%; Secondary Diploma, 53.7%; Married 87.2%; Urban areas | SD ↔ Age groups, Previous Trauma, Dental procedures Anesthetic injection 88.2%; Dental surgery 35.7%; Extraction 23% Causes irregular visits Fear; 57%; Lack time 79.5%; Cost 71.5%; Distance 62.2% 31% No specific reason |

Table 1 continued. Characteristics of selected studies conducted in the Kingdom of Saudi Arabia.

| Researcher(s)/Year | Level of dental anxiety/ % highest in age-groups | Other clinical finding |
|--|---|--|
| Dental Anxiety, Northern Region | | |
| Fayad et al., 2017 [29] | Overall Anxiety Score 11.4 21-35-age-year, Younger Patients ↑ Anxiety Low 48%; Moderate 22.1%; High 17.1%; Extremely anxious 12.4% | SD ↔ Age group, Previous dental visits NSD ↔ Level education Previous unpleasant dental experience ↑ MDAS score |
| Alshammary et al., 2017 [30] | Overall Anxiety Score 9.1 ↑ 19-22 age-year Anxiety Low 50%; Moderate 34%; High 11%; Very high 5% (Phobia) | Dental student's ↓ level of DA (High 2.7%) & High and Dental Phobia for Pharmacy, Applied Science, Medicine (13 & 7%; 16 & 5: 10 & 5) Half participant experiences some level of DA. Study field associated significantly with degree DA |
| Sghaireen et al., 2013 [31] | Overall Male 13-Female 14.5 & Dentistry 12.26; Medicine 12.79; Arts 14.02; Computer Sins 14.04 18 years-age ↑ anxiety | Medical S & Dental S ↓ anxious than arts & computer science SD ↔ ↑ level of study → ↓ in the level of Anxiety Local anesthesia most fearful step, than drilling teeth |
| Dental Anxiety, Southern Region | | |
| AlDhelai et al., 2021 [17] | Young adult (18-39) ↑ Anxiety Low 19%; Moderate 36.8%; High 17.4%; Sever 26.6% | SD ↔ Age- groups, Educational level, Educational level, Marital status, Monthly income Severe DA among high school-educated, patients chewed khat had severe DA, patients government hospitals, followed patients' private clinics. |
| Jumaymi et al., 2020 [32] | Overall Anxiety Low-Moderate Low 40%; Moderate 38%; High 18%; Sever 4% Anxiety RCT 33.8% Genders & 34.3% kha-t- chewers. | SD ↔ Gender & Khat-chewers with Anxiety parameters and anesthesia injection, and drilling of teeth in MDAS. LA-injection & tooth drilling of MDAS 36.6% for Gender & Khat-groups → moderately & extremely anxious RCT 1 st treatments, fear of pain cause irregular visits |
| Al Bahhawi et al., 2018 [33] | Anxiety Low 26.5%; Mild 7.8%; Moderate 24.3%; Sever 13.4; Extremely-Sever 28% Stress Low 49.2%; Mild 16.2%; Moderate 19.2%; Sever 16.4; Extremely-Sever 3.9% | A ↑ Divorced & Married, Low income, GPA Khat ↑ rates anxiety symptoms & depression ↑ Non-science colleges ↑ 1 st to 3 rd year |
| Inamdar et al., 2014 [34] | Age less than 21 years Anxiety Low 24.2%; Slightly 24.7%; Fairly 26.5%; Very- Anxious 13.2%; Extremely – Anxious 9.7% (Phobic) | NSD ↔ Age-groups Anxious mostly about tooth drilling & LA injection |

SA – Saudi Arabia; RR – response rate; DA – dental anxiety; SD – significant differences; NSD – non significant differences; US – University Students; DS – Dental Students; MS – Medical Students; NS – Nurses Students; AP – adult patients; AGs – age groups; ↑ – Increase; ↓ – Decrease; % – percentage; ↔ – between; MDAS – Modified Dental Anxiety Stress; DAS-R – Dental Anxiety Scale-Revised; NCDAS – Norman Corah's Dental Anxiety Scale.

threshold to be clinically relevant. However, this does not imply that the patients below the clinical threshold have zero anxiety and are relaxed. Stoic and non-demonstrative presentations of anxiety may be difficult to assess in a clinic. It is important to realize that patients who score below the clinical threshold may also need DA management.

There may be a poor agreement between a patient's anxiety rating and the dentist's perception. Future studies may benefit from using objective measures such as heart rate, blood pressure, or skin temperature to assess anxiety. Physiological responses such as respiration rate may prove a reliable indicator of dental anxiety level.

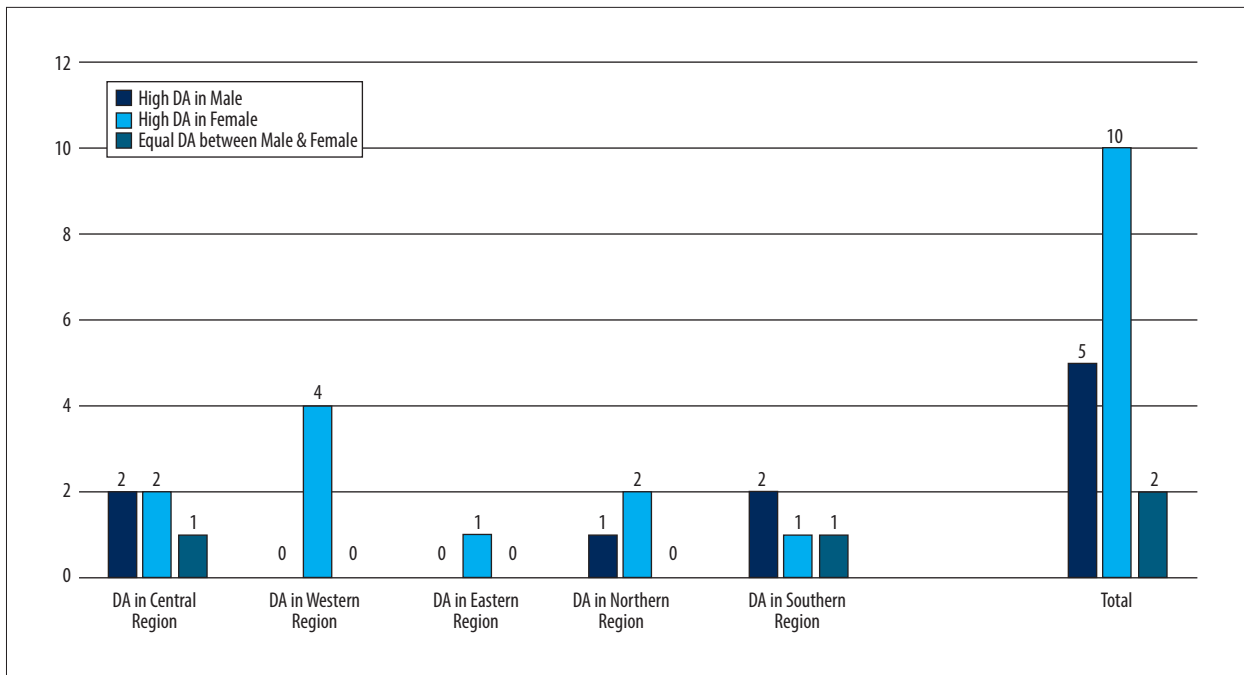


Figure 4. Number of studies that indicated the presence of dental anxiety levels among males and females in all regions of the Kingdom of Saudi Arabia.

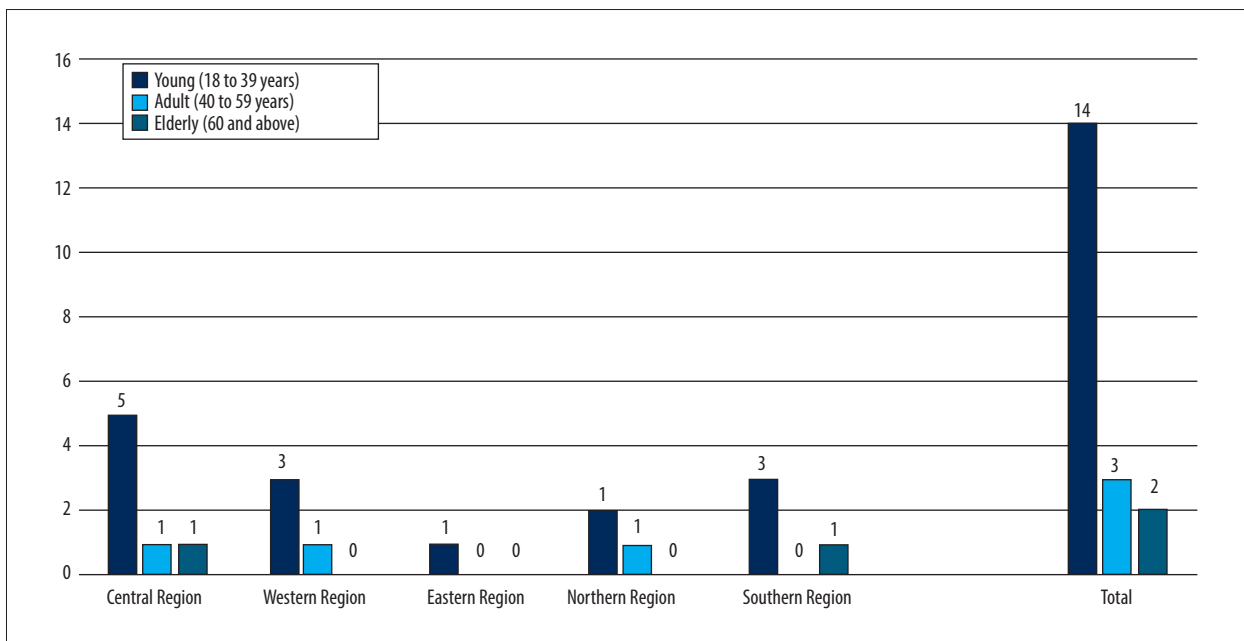


Figure 5. Percentage of dental anxiety among different age groups in all regions of the Kingdom of Saudi Arabia.

There are concerns regarding whether the samples selected can be broadly representative of the general population across all ages. Population-based studies that collect patient-reported outcomes of previous dental experience or caries experience can help in analyzing reasons for ingrained dental anxiety.

The prevalence of dental anxiety is important from both research and clinical standpoints. The findings of this review can help academics focus research on targeted age groups and populations to shift behavior toward a positive attitude to dental care and away from avoidance. Dentistry has evolved technologically through the years, shifting to a digital workflow and newer equipment that may increase patient comfort

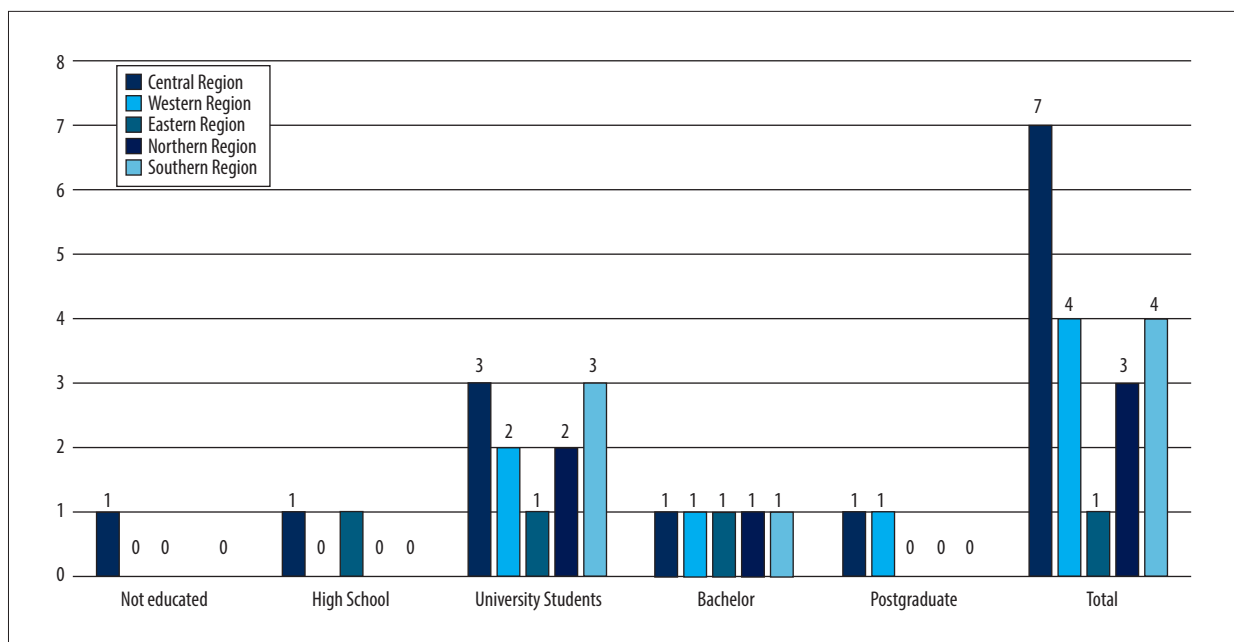


Figure 6. Number of studies that reported high levels of dental anxiety in relation to the level of education among different regions of the Kingdom of Saudi Arabia.

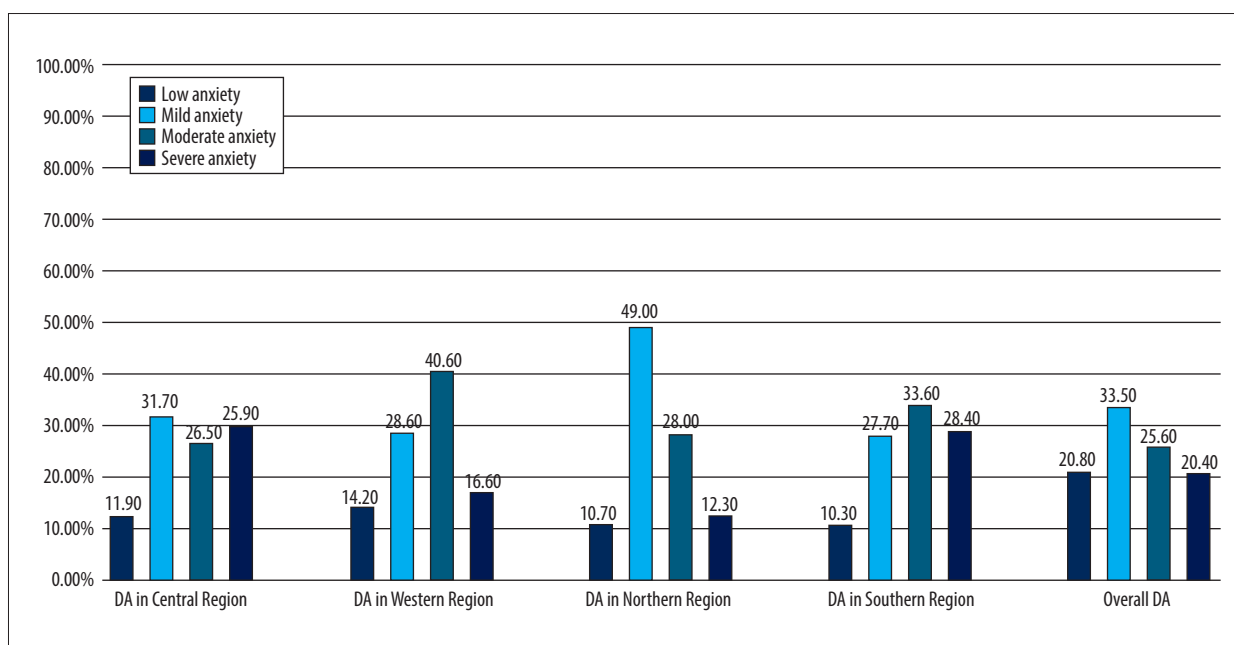


Figure 7. Percentage of dental anxiety levels in all regions of the Kingdom of Saudi Arabia.

and reduce dental anxiety [75]. Clinicians aware of an anxious, fearful patient can prepare to meet the emotional needs of the patient. The findings of this review can assist clinicians in identifying, assessing, and treating patients with dental anxiety using pharmacological or behavior management techniques.

A wide-ranging strategy to identify both published and unpublished studies was a strength of this review. Two authors

independently analyzed the studies to be included in this review along with manual hand-searching of the references of the selected articles to limit the risk of selection bias.

Despite the authors' best efforts, our review is limited by its exclusion of articles in languages other than English. Articles in languages other than English were excluded due to the lack of translational resources and this may have led to publication

bias. Moreover, few studies have examined DA in children and adolescents with learning disabilities. Further studies on this population may help to develop an anxiety-measuring tool that could aid in communication and provide effective care. Future studies should adhere to the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for high-quality reporting. Research aimed at breaking down barriers to adequate dental care should examine dental anxiety trends over time in a population. Finally, the findings of this review must be interpreted with caution owing to the high risk of bias seen in the studies. The reported prevalence may underestimate the real prevalence, as the attrition bias was high for all the included studies. Information regarding the internal validity of the studies was unclear. Most studies did not have details on taking confounding variables into account. Without correcting for potential confounders, the analysis may skew the estimates of the actual effect. The external validity of the study is unclear, reducing the confidence in applying the findings of this review to other populations. The characteristics of the study group were mentioned in most studies. However, reporting on the other criteria for external validity was limited.

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Conclusions

Dental anxiety is a universal phenomenon influenced by various cultural features. Based on limited evidence, mild dental anxiety appears common in the Saudi population, especially in the northern region. Women, young adolescents, and university students reported a higher prevalence of dental anxiety. A clinician needs to be aware of a patient's dental anxiety level and institute anxiety-reducing measures to encourage dental care and compliance. The findings of this systematic review can bridge the gap between anxious patients and clinicians. These results can help guide future researchers in the development and validation of newer anxiety measures to aid in effective communication and delivering quality oral healthcare.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors, who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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