

## Review Article

# Effect of Trait Anxiety on Oral Health Status: A Review Article

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## Abstract

**Introduction:** A bidirectional relationship exists between oral and mental health. Certain personality traits, such as trait anxiety, can modify this relationship. No previous review article has summarized the findings of studies investigating this topic. Accordingly, the aim of this article is to investigate and summarize findings on the effect of trait anxiety on the oral health status of individuals.

**Methods and results of literature review:** PubMed electronic database was searched using a pre-defined search strategy. Snowballing techniques were conducted to review additional studies. Four relevant studies, from Brazil, India, and Turkey, were identified with the purpose of assessing the relationship between trait anxiety and oral health outcomes, such as periodontal disease and dental caries. However, findings of those studies yielded inconsistent results.

**Conclusions:** Evidence on the association between high trait anxiety and worsening of oral health outcomes exists. However, due to the small number of studies, in addition to the inconsistent results, definite conclusions could not be drawn. Based on existing evidence, it is recommended that future studies focus on personality traits, particularly trait anxiety, as a risk factor for worsening of oral health outcomes. More studies on this topic should also be conducted in the Middle Eastern region.

**Keywords:** Trait anxiety; Personality traits; Oral health; Dental caries; Periodontal disease.

## 1- Introduction

Mental health disorders (MHDs) represent a global public health challenge due to their rising prevalence (Jacob *et al.*, 2020) and the significant morbidity and disability associated with them. (Hamdan, 2009) MHDs contribute to the global burden of disease by approximately 7.4%, and this number is expected to continue rising (Dahl, Calogiuri and Jönsson, 2018) especially in low- and middle-income countries. (Ghanem *et al.*, 2009) In Egypt, for

example, an earlier community-based mental health survey (Ghanem *et al.*, 2009) showed that approximately 17% of the Egyptian population suffered from one or more MHDs.

Anxiety disorders, being the most common MHDs (Zender and Olshansky, 2009), usually tend to co-exist with depression. (Delgado-angulo *et al.*, 2015) Some researchers postulate that anxiety and depression have the same causal origin (Zender and Olshansky, 2009) and are both

closely linked to psychosocial stress, and hence affect chronic diseases' outcome and course.(Delgado-angulo *et al.*, 2015)

Although the exact cause of stress and anxiety is not precisely known; stressful events, socioeconomic status, biology, and genetics are all known to affect the mental health and psychological well-being of individuals. This can be further modified by the effect of individuals' personality traits.(Zender and Olshansky, 2009) To a large extent, personality traits define the individual's psychosocial functioning and influence future development of psychological disorders. In addition, literature postulates that psychological disorders and personality traits may even share the same etiological factors and pathways.(Costache *et al.*, 2020)

Neuroticism, one of the big five personality traits, is the major personality factor responsible for the *vulnerability* of individuals to a variety of unpleasant emotions including stress, anger, anxiety and depression.(Weger and Sandi, 2018; Almutairi *et al.*, 2021) Neuroticism, depression and anxiety do not only share the same genetic risk factors(Hettema, 2008; Bishop and Forster, 2013; Weger and Sandi, 2018), but also a common fundamental trait, known as trait anxiety (TA).(Bishop and Forster, 2013) TA is the individual's tendency to overestimate harm as a response to ambiguous and/or threatening situations.(Beckler, 2010) Some authors hypothesize that neuroticism and TA are similar constructs, as both have psychopathological tendencies for perceiving threats and for constant arousal(Wauthia *et al.*, 2019), and both have been linked to psychological vulnerability and stress-

induced psychopathologies.(Min *et al.*, 2012; Mundy *et al.*, 2015; Nordahl *et al.*, 2019)

The relationship between mental health and general health is thought to be bidirectional(Zender and Olshansky, 2009) where depression and anxiety, for example, predispose the individual to a number of noncommunicable diseases (NCDs) such as diabetes mellitus, hypertension and heart disease. Those diseases can, in turn, aggravate MHDs.(Coelho *et al.*, 2020) The same is true regarding the relationship between mental health and oral health(Kisely, 2016; Jacob *et al.*, 2020); where MHDs can adversely impact oral health resulting in dental caries, gingival and periodontal diseases, and partial or complete tooth loss. Oral diseases can, in turn, expose the individual to other mental health problems due to lack of function and/or esthetics.(Kisely *et al.*, 2016; Do and Lee, 2017; Jacob *et al.*, 2020)

Although the relationship between MHDs and oral health has been investigated several times in the literature, factors such as personality traits have been given less attention. Also, no previous review articles summarized findings on this topic. Accordingly, the purpose of this article is to review the existing concepts on the effect of TA on the oral health status of individuals, based on recent evidence.

## **2- Review of Current Literature**

### **2.1 Methods:**

A comprehensive literature review was conducted based on a pre-specified research question “*What is the effect of trait anxiety on the oral health status of individuals?*” using PubMed electronic database. The search strategy used in

this review included “*anxiety and “oral health”*” as Medical Subject Headings (MeSH terms) to ensure coverage of various keywords and synonyms used in different studies. Under each concept, multiple keywords were used; for the first concept (anxiety), keywords included “*trait anxiety*”; “*anxiety disorders*”; “*mental health disorders*”; “*mental health issues*”; “*psychosocial stress*”; “*psychosocial disorders*”; “*stress-related disorders*”; and “*personality traits*”. For the second concept (oral health), keywords included: “*periodontal disease*”; “*gingival disease*”; “*periodontitis*”; “*oral disease*”; “*dental caries*”; “*dental decay*”; “*dental lesions*”; “*tooth decay*” and “*tooth loss*”.

Forward and backward snowballing techniques were also used to identify additional relevant studies by looking on citing and cited papers of the pre-identified studies, respectively. In the end, this review included all available studies conducted on humans, and excluded animal studies. Also, all studies in English language, and conducted between 1960 and 2021 were included.

## **2.2 Results:**

Four relevant studies on the effect of TA on oral health status were found and are included and discussed in the current review. All studies were observational, two of which adopted a case-control study design (Vettore *et al.*, 2003, 2005) while the other two were cross sectional.(Akarslan *et al.*, 2010; Veeraboina *et al.*, 2020) All the identified studies used the gold-standard State-Trait Anxiety Inventory- Trait subscale (STAI-T) to assess TA among participants.

### **2.2.1 Oral health outcomes:**

#### ***Periodontal disease:***

Three studies(Vettore *et al.*, 2003, 2005; Veeraboina *et al.*, 2020) investigated the relationship between TA and periodontal disease. One study (Veeraboina *et al.*, 2020) used Community Periodontal Index (CPI) to assess the periodontal condition using parameters such as gingival bleeding (GB), periodontal pocket depth (PPD) and clinical attachment loss (CAL), recorded to the nearest millimeter (mm) using a threshold of > 4-mm.

The other two case-control studies (Vettore *et al.*, 2003, 2005) classified participants into three groups according to PPD measured at six sites per tooth; where the first group included participants with PPD  $\leq$ 4-mm (control group), and the test groups included participants with PPD from 4-mm to 6-mm assigned to test group (1), and those with > 6-mm assigned to test group (2). The main difference between the two previously mentioned studies was that (Vettore *et al.*, 2005) assessed levels of TA in regard to periodontal health status before and 3-months following non-surgical periodontal therapy. Table (1) provides a summary of the key findings of the three available studies.

#### ***Dental caries:***

Two studies(Akarslan *et al.*, 2010; Veeraboina *et al.*, 2020) investigated the relationship between TA and dental caries using decayed, missed, filled teeth (DMFT) index. Table (2) provides a summary of the key findings of the two identified studies.

**Table 1.** Summary of key findings of studies assessing the relationship between trait anxiety and periodontal health status.

Author(s) and location	Study sample	Main findings
Vettore <i>et al.</i> , 2003 Brazil	79 participants	CAL: 4-6-mm ( $p<0.05$ ), PPD: $>4$ -mm to $\leq 6$ -mm ( $p<0.05$ ) were significantly associated with higher TA scores.  After adjusting for socioeconomic factors, CAL: 4-6-mm ( $p<0.05$ ), PPD 4-6-mm ( $p<0.05$ ) were still significantly associated with higher TA scores.
Vettore <i>et al.</i> , 2005 Brazil	85 participants, only 66 considered for final analysis.	CAL $\geq 4$ -mm to $\leq 6$ -mm ( $p<0.05$ ) were significantly associated with high TA scores before and three months following non-surgical periodontal therapy.  PPD $> 6$ -mm before non-surgical periodontal treatment ( $p<0.05$ ), and CAL $> 6$ -mm three months after non-surgical periodontal treatment therapy ( $p<0.05$ ) were significantly associated with higher TA scores.  TA scores were significantly associated with reduction of CAL $> 6$ -mm ( $p=0.011$ ), reduction of PPD $> 6$ -mm ( $p=0.03$ ), and reduction of PPD $> 4$ -mm ( $p=0.026$ ).  After adjusting for number of cigarettes and for dental plaque, CAL $> 6$ -mm remained significantly associated with TA scores. ( $p=0.011$ ).
Veeraboina <i>et al.</i> , 2020 India	456 participants	No correlation between TA scores and all three clinical parameters (GB, PPD, CAL) among both genders.

TA: Trait Anxiety, CAL: Clinical Attachment Loss, PPD: Periodontal Pocket Depth, GB: Gingival bleeding.  $P<0.05$  indicate a statistically significant difference.

**Table 2.** Summary of key findings of studies assessing the relationship between trait anxiety and dental caries.

Author(s) and location(s)	Study sample	Main findings
Akarslan <i>et al.</i> , 2010 Turkey	600 participants	No correlation was found between DMFT and TA scores among both genders.
Veeraboina <i>et al.</i> , 2020 India	456 participants	A very weak positive correlation was found between DMFT and TA scores among males. ( $r=0.05$ , $p=0.03$ )

TA: Trait Anxiety, DMFT: Decayed, Missed, Filled Teeth index.  $P<0.05$  indicate a statistically significant difference.

### 3- Discussion and conclusion

Oral health problems are among the most prevalent diseases (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2019), affecting around 3.5 billion people worldwide in 2019 (GBD Results Tool / GHDx, 2019) and causing significant disease morbidity, functional and social limitations, and negative consequences on quality of life. (Petersen *et al.*, 2005) It is well-known that oral diseases, particularly dental caries and periodontal diseases have multi-factorial origin; where oral bacteria and biofilm are not the only factors that cause oral diseases' initiation and progression, but other host/biological factors and environmental factors such as stress come into play. (Mariotti and Hefti, 2015; Lang and Bartold, 2018)

Certain psychological factors and personality traits predispose the individual to chronic stress which ultimately impacts the oral health negatively. (Bansal *et al.*, 2014) However, those personality factors have not been adequately investigated as risk factors for oral diseases. To our knowledge, this is the first review article that aims to explore existing evidence on the relationship between trait anxiety and oral health status.

Upon reviewing relevant studies, a positive association between TA and periodontal health status was found in two studies. (Vettore *et al.*, 2003, 2005) This can be explained by several direct and/or indirect pathways. For instance, stress associated with TA can trigger physiologic responses of the body such as neuroendocrine and immune system, impairing the stress response of

individuals. (Cakmak *et al.*, 2014) Impairment of stress system can then activate the hypothalamic-pituitary-adrenal axis (HPA), elevating adrenalin and noradrenalin and glucocorticoid hormone levels. This can ultimately end in periodontal breakdown, bone resorption and delay in wound healing. (Preeja *et al.*, 2013; Cakmak *et al.*, 2014; Warren *et al.*, 2014; Choi *et al.*, 2020; Decker *et al.*, 2020) Moreover, inflammatory responses are further suppressed by cortisol, leading to inhibition of certain immunoglobulins and impairment in neutrophils function, which subsequently promote bacterial colonization and hence, development of periodontitis (Preeja *et al.*, 2013; Bansal *et al.*, 2014; Kisely, 2016)

Furthermore, the adverse effect of TA on the periodontal health condition can be explained by other indirect means. For example, heightened levels of psychosocial stress can stimulate some individuals to adopt harmful behaviors such as a diet rich in sugar and fat, smoking, and negligence of oral hygiene. This usually occurs as a manifestation of chronic stress and its accompanying fatigue, leading, at the end, to a range of oral diseases, primarily periodontal disease and dental caries. (Castro *et al.*, 2006; Preeja *et al.*, 2013; Bansal *et al.*, 2014; Delgado-angulo *et al.*, 2015; Do and Lee, 2017; Choi *et al.*, 2020)

On the other hand, another study (Veeraboina *et al.*, 2020) could not find a correlation between TA and periodontal disease. However, this might have occurred due to the relatively younger, and narrow age range used in this study (35-44 years), where periodontal disease is generally not very

prevalent in this age. Different studies have also utilized different study designs, and threshold points for defining periodontal disease, all of which might have resulted in inconsistency of findings.

Concerning dental caries, the two identified studies (Akarslan *et al.*, 2010; Veeraboina *et al.*, 2020) could not detect a correlation between TA and dental caries among females, and one of them (Veeraboina *et al.*, 2020) found a very weak positive correlation among males. This correlation might have occurred due to endocrine system stimulation which results from chronic stress associated with TA, leading to reduced salivary flow. Certain psychotropic drugs, if utilized, can further reduce the salivary flow and end in xerostomia. This, of course, allows better colonization of cariogenic bacteria leading to dental caries. (Kisely, 2016) However, the only two studies conducted on the relationship between TA and dental caries were cross-sectional in nature, therefore a causal relationship could not be inferred. Also, those studies did not adjust for confounding factors.

Although evidence on the association between trait anxiety and oral diseases exist, definite conclusions could not be drawn due to the small number of available studies and their inconsistent findings. However, it is important to note that one important strength point in the four studies is that they all used the gold standard STAI-T for TA assessment. This is owing to its cost- and time-efficiency, its ease of administration and proven good psychometric properties. (Julian, 2011)

We recommend that future studies consider investigating this important relationship, particularly in Middle Eastern countries, such as Egypt. This is because higher levels of TA are generally higher among Egyptians when compared to other populations. (Abdel-Khalek and Tomás-Sábado, 2005)

#### **Conflict of interest:**

All authors declare that they have no conflict of interest.

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#### **4- References:**

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