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Can Personality Traits influence Dental Caries Experience? A Systematic Review

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ABSTARCT

Objective: This paper aims to explore the evidence of the association between dental caries experience in individuals and different "Big-Five" personality traits. **Method:** A systematic review of literature was carried out to identify articles reporting a relationship between dental caries experience and personality traits. An electronic search was performed on the databases of PubMed, Google Scholar, Science Direct, Cochrane Library and Scopus. The keywords used were: "high health risk", "personality traits", "neuroticism", "experience high stress", "experience low stress", "agreeableness", "conscientiousness", "extraversion", "introversion", "Eysenck", "questionnaire", "DMFT", "DMF", "dental caries", "oral health". After eliminating the duplicate articles, the studies were screened for eligibility by two independent investigators to identify "potentially eligible" studies and the disagreements were resolved by consensus after discussion. The inter-reliability score was assessed by Cohen's Kappa (0.00943). **Results:** Six studies were included in the review, most of which were cross-sectional in nature. Neuroticism showed a positive correlation with dental caries in four out of the six studies. **Conclusion:** Individuals with higher neuroticism traits tend to experience increased dental caries prevalence experience. The evidence obtained from this systematic review emphasizes the need for further well-designed, randomized, and controlled clinical trials evaluating the effect of different personality traits in the incidence of dental caries over a period few years.

Keywords – Big five, Dental caries, Neuroticism, Personality traits

INTRODUCTION

Personality significantly impacts health maintenance and disease incidence and progression.¹ Costa and McCrae's widely accepted five-factor model (FFM) categorizes personality traits into extraversion, conscientiousness, openness, agreeableness, and neuroticism.^{2,3} According to the FFM, these traits are relatively stable dispositions, influenced more by biology than individual life experiences. People with higher neuroticism are prone to increased disease incidence and progression compared to those with higher agreeableness and conscientiousness traits.^{4,5} From a dental perspective, specific personality traits are associated with poor oral health.^{6,7} Individuals with higher neurotic traits tend to experience lower oral health-related quality of life (OHRQoL).⁸ Although personality plays a vital role in the incidence, prevalence, and progression of many diseases, its impact on dental caries remains unclear. Dental caries, with its complex etiology involving oral microorganisms, oral environment, host factors, and time⁹, is influenced by factors such as the individual's immune system,¹⁰ dietary habits,¹¹ and oral hygiene¹² all of which are highly connected to personality traits.

While systematic reviews exist on other caries etiological factors, the personality aspect of host factors has not been thoroughly reviewed to date.

Thus, the primary objective of this systematic review is to explore the evidence of the association between dental caries experience in individuals and different "Big-Five" personality traits. Additionally, this review aims to compare caries prevalence between individuals with high health risk neurotic traits and low health risk agreeableness/conscientiousness traits.

MATERIALS AND METHODS

The study protocol that was adopted has been registered in PROSPERO under the registration number CRD42019132489, and it adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines.

Search Strategy

A systematic review of literature was carried out and the following keywords were used. The search was conducted to identify articles reporting a relationship between dental caries experience and personality traits.

An electronic search was performed on the databases of PubMed, Google Scholar, Science Direct, Cochrane Library and Scopus

The keywords used were: "high health risk", "personality traits" "neuroticism", "experience high stress" "experience low stress" , "agreeableness" , "conscientiousness" "extraversion" "introversion" "Eysenck" "questionnaire" "DMFT" "DMF" "dental caries" "oral health"

The Rayyan software tool was used for screening and identification of duplicate studies.

After eliminating the duplicate articles, the studies were screened for eligibility by two independent investigators to identify "potentially eligible" studies and the disagreements were resolved by consensus after discussion. The inter-reliability score was assessed by Cohen's Kappa (0.00943).

INCLUSION CRITERIA

Full-text articles published in English since 1949 were screened for analysis. Observational studies (cross-sectional) measured caries prevalence by clinical examination among population with different personality traits aged 15-90 years.

(a) Population: General Population

(b) Intervention: Not Applicable

(c) Comparison: High health risk (Neuroticism/Experience high stress) personality trait vs Low health risk (Agreeableness/Conscientiousness/Experience lower stress) Personality traits

(d) Outcome: Dental Caries.

EXCLUSION CRITERIA

Investigations with nonspecific data, inadequately designed, editorials, letters, case reports, conference proceedings, and the grey literature, ongoing observational studies, reviews, and studies that did not report statistical tests for dental caries were excluded from the study analysis.

Also excluded were articles which measured caries prevalence by self-reported questionnaire and studies conducted on individuals with known history of mental illness.

DATA COLLECTION

Six eligible studies were identified. The information from the eligible studies were extracted which encompassed author's name, year of publication, participants, population characteristics (age range and dentition), geographic location, DMFT score, diagnostic criteria of dental caries and correlation coefficient value between Big-Five Traits and DMFT. (Fig 1)

QUALITY ASSESSMENT

The quality of the studies that were included in the review was assessed by adopting the Modified Newcastle – Ottawa Scale (NOS) comprising three components (methodology, comparability based on study design, outcome). (Table I).

All 6 studies were of high quality, with a score of 7 and above.

RESULTS

The systematic review investigated the relationship between personality traits, specifically focusing on the Big Five personality traits (neuroticism, extraversion, conscientiousness, agreeableness, and openness), and dental caries experience. Six studies were included in the review, most of which were cross-sectional in nature. (Table II) (Table III)

Neuroticism and Dental Caries:

Neuroticism showed a positive correlation with dental caries in four out of the six studies. Individuals with higher neuroticism traits tend to experience increased dental caries prevalence.

Neurotic individuals may engage in unhealthy behaviour such as poor oral hygiene practices and emotional eating, leading to higher caries risk.

Extraversion and Dental Caries:

The relationship between extraversion and dental caries was inconclusive.

Some studies showed a positive association, while others did not find a significant link.

Conscientiousness, Agreeableness, and Openness:

Conscientiousness, agreeableness, and openness did not show consistent relationships with dental caries across the studies.

The evidence regarding these traits and caries prevalence was inconclusive.

High Health Risk vs. Low Health Risk Traits:

Individuals with high health risk traits, particularly high neuroticism, demonstrated a greater likelihood of experiencing dental caries.

Type A personalities (characterized as more stressful and aggressive, highly neurotic) exhibited a higher prevalence of dental caries compared to Type B personalities (more relaxed, less neurotic individuals)

DISCUSSION

Personality research holds significant importance as it profoundly influences health maintenance and disease incidence and progression. The introduction of the Big Five personality model marked a crucial development in the field of personality psychology.¹³ According to this model, individuals can be categorized based on the extent to which they exhibit specific traits, with neuroticism being considered particularly significant in public health.¹⁴⁻¹⁶

The aim of our systematic review was to summarize empirical findings from observational studies investigating the relationship between personality factors and caries prevalence. After a thorough review of literature, 6 cross-sectional studies were identified and considered for analysis. The evidence regarding the relationship between extraversion, agreeableness, conscientiousness, openness to experience, and caries experience remained largely inconclusive.

One cross-sectional study conducted by Manhold *et al*¹⁷ in 1949 on 50 dental students found a positive association between higher neuroticism and extraversion with DMFT scores. Neuroticism exhibited a higher correlation coefficient (+0.474) compared to extraversion (+0.443).

Contrastingly, another cross-sectional study by Manhold *et al*, in 1954¹⁸ on 101 naval cadet students revealed no significant association between higher neuroticism and extraversion with DMFT scores. However, agreeableness exhibited an inverse relationship with DMFT scores (correlation coefficient -0.13). It is important to note that this study's findings might not be applicable to the general civilian population due to the unique psychological profiles of naval cadet participants, resulting from intensive physical and mental training.

In a separate study by Knorring *et al*, in 1987¹⁹, individuals with higher extraversion demonstrated higher mean caries scores (14.35 +/- 9.58) compared to individuals with lower extraversion.

Various personality assessment tools were used across the reviewed studies. Most studies employed two primary frameworks: Eysenck's Three-Factor Model (used in three studies), comprising neuroticism, extraversion, and psychoticism, and the Five-Factor Model (used in one study), comprising neuroticism, extraversion, agreeableness, conscientiousness, and openness to experience.

Additionally, two studies utilized the Bernreuter Personality Inventory, measuring neuroticism, agreeableness, and extraversion facets.

Amongst the three studies that utilized the Eysenck Questionnaire, one of them appeared to be the junior version, including younger participants. The assessment of caries in this study could be confounded by age, potentially influencing the results.

All studies utilized objective psychological tests to assess personality, with projective psychological tests being notably absent. This preference for objective tests might be attributed to their practicality and ease of application. Nevertheless, there is a need for further research employing more comprehensive personality assessment instruments to enhance our understanding of this phenomenon.

Most of the studies used the decayed missing filled teeth (dmft) index to record dental caries experience. One study used clinical examination to assess presence of dental caries.

Uniformity in using measurement tools in reporting dental caries will generate accurate results.

Regarding specific personality traits and their association with DMFT scores, a plausible link was observed between higher neuroticism and elevated DMFT scores, likely due to the high health risk behaviour associated with this trait. Out of the six studies, five demonstrated relationships between specific personality traits and DMFT scores. For instance, higher agreeableness was associated with lower caries experience, while higher neuroticism and openness were linked to increased caries experience. The association between extraversion

trait and DMFT scores was significant; however, the direction of this association remained inconclusive. Notably, trait conscientiousness showed no significant association with DMFT scores.

Previous research²⁰ has demonstrated the substantial influence of the neuroticism trait on periodontal health. Individuals exhibiting higher neuroticism scores tend to engage in poorer oral hygiene practices, leading to increased plaque accumulation. Given that inadequate oral hygiene is a common risk factor for both periodontal issues and dental caries, the effects of Neuroticism traits may extend to both conditions.

Moreover, individuals with elevated Neuroticism trait scores are more prone to engaging in counter-regulatory external or emotional eating behaviours. This coping mechanism often involves the consumption of high-energy, dense, sweet, and savoury foods. Such dietary habits can lead to constant fluctuations in the oral environment's pH, contributing to an increased prevalence of dental caries.

Yavavgal *et al*(2017)²¹, conducted a comprehensive cross-sectional study involving 300 individuals, revealing a notable correlation between high neuroticism, stress, and aggressive behaviour (Type A personality) with a higher prevalence of dental caries. Conversely, individuals with Type B personalities, characterized by relaxation and lower neuroticism, displayed lower rates of dental caries. This study underscores the potential impact of stress-related personality traits on oral health outcomes.

Limitations

Only a limited number of studies utilized valid questionnaires and relevant tests of personality traits. Homogeneity in the use of tests and studies of dental caries prevalence was absent and hence a quantitative analysis could not be performed. The studies included were also cross-sectional in nature, a dearth of longitudinal studies was observed in literature.

CONCLUSION:

In summary, our systematic review indicates that specific personality traits, especially

higher neuroticism, are linked to increased caries experience. These findings emphasize the importance of considering personality factors when evaluating and addressing oral health risks. Further research, particularly in high-income or developed countries, is necessary to gain a more comprehensive understanding of the relationship between personality traits and dental caries.

Personality characteristics may have indirect, mediating, and moderating effects on dental caries experience. This knowledge could be beneficial in identifying individuals at risk for developing caries. More importantly, it is advisable for healthcare providers such as physicians, dentists, and other healthcare practitioners to routinely assess individuals' personality traits. This assessment could assist in identifying those at risk for developing oral diseases. However, it's important to note that only a few, mainly cross-sectional studies have examined the link between personality factors and caries experience. In terms of clinical significance, the relationships between personality and dental caries experience suggest important implications for policy and practice. We recommend that personality assessment should be conducted more routinely in clinical practice and healthcare research. There is an opportunity to integrate personality measures into electronic health records as a form of patient-generated data, utilizing patient portals and other electronic collection methods. The thoughtful and systematic collection of personality data could prove valuable for both research and clinical practice.

Conflict of Interest - The authors had no conflict of interest to declare.

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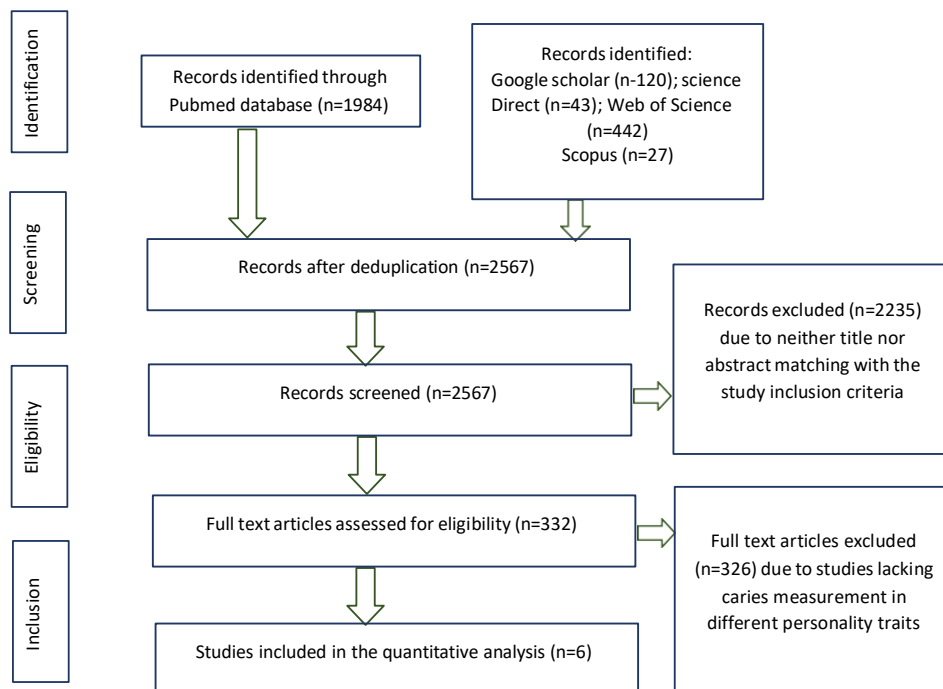


Fig 1 – PRISMA Flowchart

TABLE I

Modified Newcastle-Ottawa Scale

First author - Year		Manhold et.al.1949	Manhold et. al.1954	Knorring et.al.1987	Gupta et.al.2019	Reddy et.al.2020	Shveta et.al.2020
Selection	Representativeness of the sample	0	0	1	1	1	2
	Sample size	1	1	1	1	1	1
	Non- Response rate	1	1	1	1	1	1
	Ascertainment of the screening/Surveillance tool	2	2	2	2	2	2
Comparability	Potential confounders were investigated by subgroup analysis or multivariable analysis	1	0	1	1	1	1

Outcome	Assessment of the outcome	2	2	1	2	2	2
	Statistical test	1	1	1	1	1	1
Total Number of Stars		8	7	8	9	9	10

TABLE II
DATA EXTRACTION SHEET

Study ID :	Author	Year of Publication	Study design	Study Location	Studied Population setting	Sample size	Mean/Range of age (years)	Personality Assessment tools	Assessed Big-Five Traits	Caries Assessment Tools	Study Findings	Study Limitations
1.	Manhold et.al.[17]	1949	Observational cross sectional study	United States	Dental School students	50	Not Reported	The Bernreuter Personality Inventory	Neuroticism and Extraversion/Introversion	DMFT	Higher Neuroticism had higher DMFT scores and associated with higher correlation coefficient compared to introversion-extroversion traits in both men and women	Participants are limited to a dental school which may not represent the population.
2.	Manhold et.al.[18]	1954	Observational cross sectional study	United states	Naval school of Aviation medicine	266	Not Reported	The Bernreuter Personality Inventory	Neuroticism, Agreeableness and Extroversion/Introversion	DMFT	Neuroticism/Introversion and DMFT scores have no significant association. However Lower Agreeableness has higher DMF scores	Participants are Naval Aviation Cadets represent a psychologically screened population. As they are pre screened for facets like neuroticism, the interpretation of the results may not be accurate. Also gender group analysis not

												done.
3.	Knorring et.al [19]	1987	Observational cross sectional study	Sweden	Dental Care Center out Patients	101	15 years	JEPQ (Junior version of Eysenck Personality Questionnaire)	Neuroticism and Extraversion	Clinical Examination	Higher Neuroticism and caries experience have no significant association. However Higher extraversion has more caries experience.	Standardization of caries assessment was not done. Hence there could be variation in caries recordings.
4.	Gupta et.al. [22]	2019	Observational Cross-Sectional Study	India	Outpatients and their attenders visiting hospital	378	35-44 years	Eysenck Personality Questionnaire (EPQR-S)	Neuroticism and Extraversion	DMFT (Clinical Examination)	Neuroticism and combination of neuroticism and extroversion had higher DMFT score when compared to extraversion	Difference in the educational status of the participants can have an impact in their personality trait.
5.	Reddy et.al.[23]	2020	Observational Cross-sectional study	India	General population settings	400	35.11 years	BFI-10 Personality Inventory	Neuroticism, Extraversion, Agreeableness, Openness and Conscientiousness	DMFT (Clinical Examination)	Neuroticism had significantly higher DMFT scores when compared to extraversion, conscientiousness and agreeableness traits	Participants were limited to schoolteachers, hence the generalization of the results with General population is questionable
6.	Shveta et.al.[24]	2020	Observational Cross-section	India	Outpatients visiting dental	480	34-45 years	Eysenck Personality Questionnaire	Neuroticism and Extroversion	DMFT (Clinical Examination)	Neuroticism and combination of neuroticism and extroversion had higher	Validation of Hindi Version of questionnaire was not performed.

			al study		hospita l			aire (EPQR-S		nation)	DMFT score when compared to extraversion	
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TABLE III: RELATIONSHIP BETWEEN PERSONALITY TRAIT AND DMFT SCORES

Personality Traits	Number of Studies	Positive Relationship with DMFT score	Negative Relationship with DMFT score	No significant Relationship with DMFT score		
				+ve	-ve	Not reported
Neuroticism	6	4	0	1*		
Extraversion	6	3	2	1		
Agreeableness	2		1	1*		
Openness	1	1		1		
Conscientiousness	1				1	