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# Assessment of Geriatric Dental Caries, Nutritional Status and Oral Health-Related Quality of Life Among Particularly Vulnerable Tribal Groups in the Nilgiris Biosphere Reserve: A Cross-Sectional Study

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**Abstract** **Introduction:** Oral health significantly influences overall well-being, particularly in elderly populations where poor dental health can affect nutrition and quality of life. Marginalized groups such as the Particularly Vulnerable Tribal Groups (PVTGs) in India face increased risks due to limited healthcare access. This study focused on the Beta Kurumbas and Mullu Kurumbas tribes of the Nilgiris Biosphere Reserve, aiming to assess the dental caries experience, nutritional status and oral health-related quality of life among geriatric individuals in these communities. **Materials and Methods:** A cross-sectional study was conducted among 575 participants aged 65-74 years using snowball sampling. The Decayed, Missing, Filled Teeth (DMFT) Index measured dental caries experience, the Mini Nutritional Assessment (MNA) evaluated nutritional status and the Geriatric Oral Health Assessment Index (GOHAI) assessed oral health-related quality of life. Statistical analyses, including Kendall tau correlation, were used to explore relationships among these variables. **Results:** The mean DMFT score was 18.32±8.12, indicating a high prevalence of tooth loss and untreated dental caries. Nutritional assessment revealed that 62.95% of participants were malnourished, 23.3% were at risk of malnutrition and only 13.73% were classified as normally nourished. GOHAI scores indicated significant psychosocial and functional impacts, with over half of the participants reporting discomfort during eating and difficulty chewing. A strong positive correlation was found between poor oral health (DMFT), malnutrition (MNA) and diminished quality of life (GOHAI). **Conclusion:** The findings underscore the urgent need for targeted interventions to improve oral health, enhance nutritional support and provide accessible dental care services for these vulnerable tribal populations. Integrating oral healthcare initiatives within primary healthcare frameworks and implementing culturally appropriate awareness programs is essential to addressing these disparities.

**Key Words** Oral Health, Geriatric Population, PVTGs, Nilgiris Biosphere Reserve, DMFT, MNA, GOHAI

## INTRODUCTION

### Background

Oral health is an integral component of overall well-being, especially in the geriatric population, where compromised dental health significantly impacts nutritional intake, systemic health and quality of life. Among older adults, dental caries remains one of the most common oral diseases, often worsened by poor oral hygiene practices, limited access to dental care and underlying systemic health conditions. These challenges are further intensified in marginalized and socio-economically disadvantaged groups such as tribal populations, where healthcare access is restricted and awareness about oral hygiene is limited [1,2].

Particularly Vulnerable Tribal Groups (PVTGs) are a subset of tribal communities in India identified by the government based on their primitive technology, stagnant or

declining population, low literacy rates and subsistence economy. Due to geographical isolation, cultural barriers and restricted healthcare access, PVTGs are especially susceptible to health disparities. The Nilgiris Biosphere Reserve is home to two major PVTGs: Beta Kurumbas and Mullu Kurumbas [3,4].

Traditionally, the Beta Kurumbas are hunter-gatherers and subsistence farmers, cultivating small forest clearings with crops such as millets, ragi and seasonal vegetables. Additionally, they collect forest products like honey, medicinal plants and firewood for sale or barter. Their settlements consist of small mud and bamboo huts with thatched roofs [5].

The Mullu Kurumbas are agriculturists who also engage in wage labor in tea and coffee plantations. They are well known for their pottery and handicraft skills and like the Beta Kurumbas, they rely heavily on forest resources for their livelihood [6].

Both tribes face considerable challenges in maintaining proper nutrition. Their diet, traditionally reliant on wild tubers, honey and forest fruits, is seasonal and lacks diversity, increasing the risk of nutrient deficiencies. Poor agricultural productivity, limited access to food markets and lack of awareness about balanced diets further contribute to their vulnerability to malnutrition, particularly among elderly individuals [7,8].

These tribal populations experience a wide range of nutritional deficiencies, including protein-energy malnutrition, anemia and vitamin deficiencies (A, C and D), resulting from food scarcity, cultural food taboos and limited healthcare interventions [9].

**Rationale and Knowledge Gap**

The oral health status of the Beta Kurumbas and Mullu Kurumbas is notably poor, characterized by minimal access to dental care services and inadequate knowledge about oral hygiene practices. Dental hygiene is often maintained through traditional methods such as cleaning with herbal twigs and powders, while standard commercial toothpaste and toothbrushes are rarely used [10,11].

Dental caries, periodontal diseases and tooth loss are highly prevalent in these communities, particularly among the elderly. Excessive consumption of sweets, particularly honey and the widespread habit of chewing betel leaves and areca nut further contribute to oral health deterioration. These practices increase the risk of gum diseases, stained teeth and in severe cases, oral precancerous lesions [12,13].

Access to dental healthcare is severely limited due to the remote location of many tribal settlements. Even when dental services are available, cultural beliefs, fear of dental procedures and financial constraints often deter individuals from seeking timely treatment [14,15].

While extensive research has explored geriatric oral health in urban and semi-urban populations [16-18], studies on the oral health and nutritional status of elderly tribal populations, particularly PVTGs, are scarce. The Beta Kurumbas and Mullu Kurumbas face unique socio-cultural and economic challenges that demand context-specific healthcare interventions.

The interplay between malnutrition and poor oral health presents a significant concern. Poor oral health can impair chewing ability, reduce food intake and exacerbate nutritional deficiencies, creating a vicious cycle that deteriorates both oral and overall health. Although this relationship is well-established in mainstream populations, there is limited research on how these interconnected factors manifest in elderly tribal populations. Furthermore, the impact of oral health on the quality of life in these marginalized groups has received little attention.

**Aim and Objectives**

This study aimed to assess the dental caries experience, nutritional status and oral health-related quality of life among geriatric individuals belonging to the Beta Kurumbas and Mullu Kurumbas tribes, classified as Particularly Vulnerable Tribal Groups (PVTGs) in the Nilgiris Biosphere Reserve.

The specific objectives of the study are:

- To evaluate dental caries experience using the DMFT Index
- To assess the nutritional status using the Mini Nutritional Assessment (MNA) form
- To measure the oral health-related quality of life using the Geriatric Oral Health Assessment Index (GOHAI)
- To identify the interrelationships between dental caries, nutritional status and oral health-related quality of life among the study participants

## METHODS

The present study was a cross-sectional study conducted among the Kurumbas tribal gypsy population residing on the eastern edge of the Nilgiris District within the Nilgiri Biosphere Reserve, specifically in the region of Ambalamoola, during June 2024. The sample size for the study was determined to be 575 participants using G Power software, referencing a previous study conducted by Chellappa *et al.* [19] with a 95% power to ensure sufficient statistical strength.

Inclusion criteria included individuals from both Beta Kurumbas and Mullu Kurumbas tribes, aged 65-74 years (WHO index age group) and belonging to both genders. Individuals who were bedridden or unwilling to participate were excluded from the study.

All participants were informed about the purpose and procedures of the study and confidentiality was assured.

Written informed consent was obtained from all participants before data collection. For participants who faced difficulties understanding the consent form, the contents were explained in their local language to ensure informed participation.

Snowball sampling method was adopted to recruit eligible participants into the study, ensuring comprehensive coverage of the target population.

A comprehensive oral examination was conducted for all participants. Prevalidated tools were used to assess the outcome variables.

To assess dental caries experience, the Decayed, Missing, Filled Teeth (DMFT) Index was used. This index, developed by Henry T. Klein, Caroll E. Palmer and Knutson J.W. in 1938, is widely recognized for measuring caries prevalence and severity [20].

For assessing oral health-related quality of life, the Geriatric Oral Health Assessment Index (GOHAI), introduced by Atchison and Dolan [21], was employed.

Nutritional status was assessed using the Mini Nutritional Assessment (MNA) form, developed by Rubenstein *et al.* [22], which is a reliable tool for evaluating malnutrition risk in geriatric populations.

Data were analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics such as mean and standard deviation were used to describe continuous variables like age and DMFT scores. For categorical variables such as gender, nutritional status and GOHAI scores, frequency and percentage were calculated. To explore associations between variables, Kendall tau correlation was performed. A p-value of $<0.05$ was considered statistically significant.

## RESULTS

The study included a total of 575 participants, of whom 301 (52.34%) were males and 274 (47.66%) were females (Figure 1). The mean age of the participants was 70.56±4.56 years.

The mean DMFT score of the study participants was 18.32±8.12, indicating a substantial burden of dental caries and tooth loss (Table 1). Among the DMFT components, the Missing (M) component was significantly higher than the Decayed (D) and Filled (F) components. This finding reflects a high prevalence of tooth loss, suggesting limited access to restorative dental care and a tendency to extract teeth rather than pursue preventive or restorative treatment options.

Assessment of nutritional status revealed that 362 participants (62.95%) were classified as malnourished, while 134 participants (23.3%) were categorized as being at risk of malnutrition and only 79 participants (13.73%) were found to be normally nourished (Figure 2).

The GOHAI scale assessed oral health-related quality of life across three dimensions: Functional Limitation, Pain/Discomfort and Psychosocial Impact. While 62.26% of participants reported that they seldom or never limited their social interactions due to oral health problems, psychosocial impacts remained evident in other aspects.

Approximately 50% of participants reported experiencing discomfort during eating or chewing, which impaired their

Table 1: Distribution of age and DMFT scores

| Variable | N | Minimum | Maximum | Mean SD |
|---|---|---|---|---|
| Age | 575 | 65 | 74 | 70.56 4.56 |
| DMFT | 575 | 1 | 32 | 18.32 8.12 |

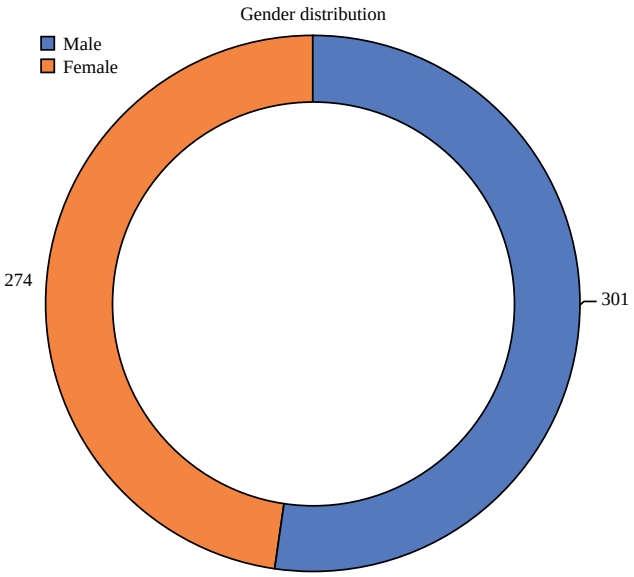


Figure 1: Gender distribution among the study participants

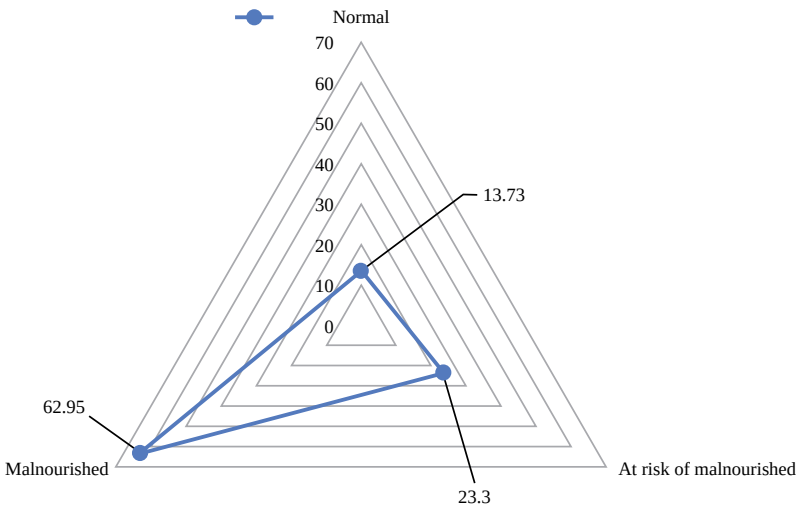


Figure 2: Distribution of nutritional status among the elderly participants

Table 2: GOHAI scale responses of the study participants

| S. No. | Item | Seldom/Never N (%) | Sometimes N(%) | Always/often N(%) | p-value (after chi square test) |
|---|---|---|---|---|---|
| 1 | How often did you limit the kinds or amounts of food you eat because of problems with your teeth or dentures? (Function) | 54 (9.39) | 289(50.26) | 232(40.35) | 0.000* |
| 2 | How often did you have trouble biting or chewing any kinds of food such as firm meat or apples? (Function) | 76 (13.22) | 266 (46.26) | 233(40.52) | 0.000* |
| 3 | How often were you able to swallow comfortably? (Function) | 156(27.13) | 201(34.96) | 218(37.91) | 0.004* |
| 4 | How often have your teeth or dentures prevented you from speaking the way you wanted? (Function) | 89(15.48) | 359(62.43) | 127(22.09) | 0.000* |
| 5 | How often were you able to eat anything without feeling discomfort? (Function/pain/discomfort) | 86(14.96) | 345(60.0) | 144(25.04) | 0.000* |
| 6 | How often did you limit contacts with people because of the condition of your teeth and gums, or dentures? (Psychosocial) | 358(62.26) | 189(32.87) | 28(4.87) | 0.000* |
| 7 | How often were you pleased or happy with the looks of your teeth and gums, or dentures? (Psychosocial) | 109(18.96) | 357(62.09) | 109(18.96) | 0.000* |
| 8 | How often did you use medication to relieve pain or discomfort from around your mouth? (Function/pain/discomfort) | 106(18.43) | 266(46.26) | 203(35.5) | 0.000* |
| 9 | How often were you worried or concerned about problems with your teeth, gums, or dentures? (Psychosocial) | 115(20.0) | 341(59.3) | 119(20.7) | 0.000* |
| 10 | How often did you feel nervous or self-conscious because of problems with your teeth, gums, or dentures? (Psychosocial) | 347(60.35) | 186(32.35) | 42(7.3) | 0.000* |
| 11 | How often did you feel uncomfortable eating in front of people because of problems with your teeth or dentures? (Psychosocial) | 156(27.13) | 278(48.35) | 141(24.52) | 0.000* |
| 12 | How often were your teeth or gums sensitive to hot, cold, or sweets? (Function/pain/discomfort) | 185(32.17) | 296(51.48) | 94(16.35) | 0.000* |

nutritional intake. Speech difficulties and the need for pain-relieving medications were also frequently reported. Additionally, 67% of participants experienced teeth sensitivity to hot, cold, or sweet foods either occasionally or frequently. These findings suggest that oral health concerns are substantial contributors to functional and psychosocial discomfort among the elderly Kurumba tribes. Chi-square analysis revealed significant differences in participants' responses across these GOHAI categories (Table 2).

Kendall tau correlation analysis demonstrated a significant positive correlation between DMFT scores, GOHAI scores and nutritional status. This correlation indicates that individuals with higher DMFT scores (reflecting poorer oral health) were more likely to have poorer nutritional status and lower oral health-related quality of life scores. The observed relationship highlights the interdependency between oral health, nutritional well-being and overall quality of life in this population (Table 3).

These results emphasize the urgent need for targeted interventions aimed at improving oral healthcare accessibility, promoting better nutrition and addressing the broader healthcare disparities faced by the Kurumba tribal community.

Table 3: Kendall tau correlation showing significant positive correlation between nutritional status, DMFT and GOHAI scores

| Correlations | | | | | |
|---|---|---|---|---|---|
| | | | Nutritional status | DMFT | GOHAI |
| Kendall's tau_b | Nutritional status | Correlation coefficient | 1.000 | 0.86* | 0.92 |
| | | Sig. (2-tailed) | | 0.000 | 0.000 |
| | | N | 575 | 575 | 575 |
| | DMFT | Correlation coefficient | 0.86 | 1.000 | 0.95 |
| | | Sig. (2-tailed) | 0.000 | | 0.000 |
| | | N | 575 | 575 | 575 |
| | GOHAI | Correlation coefficient | 0.92 | 0.95 | 1.000 |
| | | Sig. (2-tailed) | 0.000 | 0.000 | . |
| | | N | 575 | 575 | 575 |

*Correlation is significant at the 0.05 level (2-tailed)

## DISCUSSION

### Key Findings

This study investigated dental caries, nutritional status and oral health-related quality of life among geriatric individuals from the Beta Kurumbas and Mullu Kurumbas tribes in the Nilgiris Biosphere Reserve. The findings revealed that poor oral health was a prevalent concern, with tooth loss being notably high due to limited access to dental care services. Malnutrition was also highly prevalent, with over half of the participants being malnourished or at risk of malnutrition. Participants frequently reported discomfort while eating, chewing difficulties and teeth sensitivity, which further impacted their nutritional intake and overall well-being.

A significant correlation was identified between poor oral health (high DMFT scores), nutritional deficiencies and reduced oral health-related quality of life (GOHAI scores). This finding emphasizes the interconnected impact of oral health, nutrition and quality of life in this vulnerable tribal population.

### Strengths and Limitations

This study provides valuable insights into the oral health and nutritional challenges faced by the Beta Kurumbas and Mullu Kurumbas, two Particularly Vulnerable Tribal Groups (PVTGs) that are often overlooked in public health research. By focusing on these under-represented communities, the study highlights specific health concerns influenced by geographic isolation and cultural practices.

The use of validated tools, such as the Mini Nutritional Assessment (MNA) for nutritional evaluation, the GOHAI Scale for assessing oral health-related quality of life and the DMFT Index for measuring dental caries experience, ensured reliable and consistent data collection. Additionally, the inclusion of a sizable sample of 575 participants increased the statistical power of the study, enhancing the reliability and generalizability of the results.

However, certain limitations must be acknowledged. The cross-sectional study design limits the ability to establish causal relationships between oral health, nutritional status and quality of life. Self-reported data for some GOHAI components may have introduced recall bias, as participants may not have accurately recalled or reported their experiences. Cultural barriers and a lack of trust in external researchers may have also influenced the completeness and reliability of the collected data. These factors highlight the need for further longitudinal studies to better understand the long-term impact of these variables.

### Comparison with Similar Research

The findings of the present study are consistent with previous research that established a link between poor oral health, nutritional deficiencies and reduced quality of life.

In a study conducted among the Narikuravar tribe by Chellappa *et al.* [23], high DMFT scores and poor nutritional status were closely associated with limited access to healthcare services, similar to the present study. A study conducted in Gujarat similarly reported a significant association between poor oral health (measured using GOHAI) and malnutrition [24]. Likewise, Mashalkar *et al.* [25] identified a strong link between dental health status and psychosocial well-being among elderly tribal women, reinforcing the psychosocial impacts identified in the GOHAI assessment in the current study.

The present study reported a mean DMFT score of 18.32±8.12, which is notably higher than the national average. Similar findings were reported in a study by Salunke *et al.* [26] in Maharashtra, where the DMFT score was 16.5, underscoring the higher prevalence of tooth loss

due to untreated caries in marginalized communities. Additionally, a systematic review by Anusha *et al.* [27] reported that poor oral hygiene practices and reliance on traditional cleaning methods such as herbal twigs were linked to a higher prevalence of dental caries, findings that closely align with the results observed in the Beta and Mullu Kurumbas tribes.

In the present study, 62% of participants were malnourished, while 23% were at risk of malnutrition. Similar patterns were observed in a study conducted by Nayak *et al.* [28] among tribals in Andhra Pradesh, where one-fifth of the population was found to be at risk of further nutritional deficiencies. Similarly, a study conducted by Kanrar *et al.* [29] among a particularly vulnerable tribe in Odisha reported that 62% of participants were at risk of malnutrition.

**Explanation of Key Findings**

The high DMFT scores observed in the present study can be attributed to several factors, including inadequate oral hygiene practices, poor access to dental healthcare and cultural traditions such as chewing areca nuts and betel leaves. These practices, deeply rooted in cultural customs, are known to increase the risk of dental caries, gum diseases and even oral precancerous lesions in extreme cases.

Reliance on traditional cleaning methods such as herbal twigs, rather than commercial toothpaste and toothbrushes, may also contribute to inadequate plaque control and poor oral hygiene management [30-32].

The observed nutritional deficiencies may be explained by the participants' dependence on seasonal forest produce, limited access to balanced diets and restricted agricultural productivity. Their reliance on subsistence-based farming and traditional dietary practices often results in low intake of protein-rich and micronutrient-dense foods, increasing their vulnerability to malnutrition [33].

The psychosocial impacts identified through the GOHAI assessment, including discomfort during eating, limited social interactions and self-consciousness about one's appearance, highlight the significant emotional burden that accompanies poor oral health. The strong correlation observed between DMFT scores, nutritional status and GOHAI scores underscores the cyclical relationship in which poor dental health limits food intake, exacerbates nutritional deficiencies and further deteriorates oral health [34,35].

**Implications and Action Needed**

Addressing the oral health and nutritional concerns among the Beta Kurumbas and Mullu Kurumbas requires a comprehensive and culturally sensitive approach.

Culturally tailored oral health education programs should integrate traditional beliefs with modern hygiene practices. Emphasis should be placed on reducing harmful habits such as betel nut chewing, with community leaders playing a vital role in raising awareness and promoting positive behavior changes.

Mobile dental clinics can be introduced to improve access to dental care by providing preventive treatments, basic restorative services and regular check-ups in remote tribal settlements.

Community-based nutrition programs should focus on enhancing dietary diversity, promoting fortified foods and introducing sustainable practices such as home gardening to improve nutritional intake.

Healthcare providers should undergo cultural sensitivity training to build trust, improve communication and encourage health-seeking behaviors among tribal populations.

Policymakers must prioritize funding and resource allocation to support sustainable interventions that address both oral health and nutrition. Collaborative efforts between government agencies, non-governmental organizations and local community leaders will be essential in establishing long-term programs that cater to the unique challenges faced by these vulnerable tribal groups.

Regular screening camps should be organized to ensure early detection, timely intervention and consistent education to promote long-term health improvements in this underserved population.

## CONCLUSION

The present cross-sectional study conducted among the Kurumbas tribal community in the Nilgiris Biosphere Reserve highlights the significant relationship between oral health, nutritional status and overall quality of life in elderly individuals aged 65-74 years. The study findings reveal a concerning prevalence of poor oral health, as evidenced by elevated DMFT scores, indicating widespread tooth loss and untreated dental caries. Limited access to restorative dental care and the prevalence of cultural oral hygiene practices have likely contributed to this trend.

Nutritional assessments revealed that over half of the participants were malnourished, with an additional proportion identified as being at risk of malnutrition. The substantial number of individuals reporting discomfort and limitations in essential oral functions-such as eating, chewing and speaking-further underscores the severe impact of oral health deterioration on their daily lives.

The positive correlation observed between DMFT scores, GOHAI scores and nutritional status highlights the interconnected nature of these variables. Poor oral health not only impairs nutritional intake but also significantly affects psychosocial well-being, resulting in diminished quality of life. These findings emphasize the cyclical pattern in which poor oral health exacerbates nutritional deficiencies, further compromising general health.

The results underscore the urgent need for targeted public health interventions. Efforts should focus on

improving access to culturally appropriate dental care services, implementing nutritional support programs and conducting community-based awareness campaigns to promote better oral hygiene practices. Introducing mobile dental clinics, providing affordable preventive care and integrating oral healthcare with general healthcare initiatives can significantly improve outcomes for this vulnerable population.

Future longitudinal studies are recommended to further explore the complex relationship between oral health, nutritional status and quality of life in elderly tribal populations. Such studies can guide the development of sustainable healthcare policies tailored to the unique socio-cultural and environmental challenges faced by these marginalized communities.

## Conflict of Interest

The authors declare no conflict of interest.

## Funding

The study was conducted without any external funding.

## Ethical Statement

Ethical approval for this study was obtained from the Institutional Ethics Committee, Saveetha University (Approval Number: SRB/SDC/UG-1997/24/PHD/211). Written informed consent was obtained from all participants prior to data collection and confidentiality was maintained throughout the study.

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