

Knowledge, attitudes, and practices of dentists toward geriatric health and nutrition: A pan-India cross-sectional questionnaire-based study[☆]

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ARTICLE INFO

Keywords:

Geriatric dentistry
Nutrition
Knowledge-attitude-practice
Prosthodontics
Pan-India survey

ABSTRACT

Background: India's rapidly growing geriatric population faces significant oral health and nutritional challenges. Although prosthodontic care can improve dietary intake, dental practitioners' awareness and integration of geriatric nutrition into routine practice remain unclear. Limited data exist on how Indian dentists address these needs in clinical and educational settings.

Objective: This study evaluated the knowledge, attitudes, and practices (KAP) of dental practitioners across India regarding geriatric health and nutrition and identified gaps to inform education, policy, and clinical interventions.

Methods: A cross-sectional survey was conducted among 462 dental practitioners providing prosthodontic care across 21 states. A validated 28-item questionnaire, including three open-ended questions, assessed KAP. Data were analyzed using descriptives, one-way ANOVA, and Post Hoc Bonferroni tests ($p \leq 0.05$).

Results: Respondents were aware of nutritional assessment methods (72.1 %) and recognized the importance of dietary counselling (97.8 %). Attitudes were highly positive, with 98.1 % supporting inclusion of geriatric nutrition in curriculum. However, only 52 % routinely assessed nutrition, and 63 % provided diet counselling. Prosthodontists had significantly higher knowledge (77.87 %) and practice scores (65.64 %), while institutional practitioners showed the most positive attitudes (74.12 %). Notably, 70 % reported insufficient training during dental education.

Conclusion: This first pan-India study highlights a substantial gap between knowledge and practice in geriatric nutrition. Despite positive attitudes, routine implementation is limited. Structured curriculum reforms, continuing education, and chairside intervention models are urgently needed to enhance oral and systemic health outcomes in the elderly.

Novelty: This nationwide assessment uniquely identifies educational and practice gaps, offering **evidence** to guide policy and clinical interventions to improve geriatric dental care in India.

1. Introduction

The geriatric population is at risk of unsatisfactory oral health and poor nutritional status, which may be due to physical, physiological, or psychosocial factors.¹ Wical (1983), stated that dentists should be aware of nutritional guidance as a part of oral health care.² Studies that analyzed the relationship between tooth loss, denture wearing, food intake, and nutritional status showed that there is a significant increase in food intake after denture wearing.³ But problems associated with the

prosthesis can also affect the food intake of the elderly population, as there is a difficulty in chewing food.^{4,5} Recent studies indicated that prosthetic treatment combined with dietary counselling improved the daily diet intake of edentulous elderly patients. But the awareness, attitude and knowledge of the clinicians on the aforementioned remains vague.⁶ To what extent the knowledge is imparted to these individuals is also a question.

One of the recent studies emphasized the need for a revised and restructured curriculum incorporating geriatric dentistry for dental

[☆] Presentation at a meeting: Nil.

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<https://doi.org/10.1016/j.jobcr.2025.11.009>

Received 18 October 2025; Received in revised form 31 October 2025; Accepted 14 November 2025

Available online 19 November 2025

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students at the undergraduate level.⁷ This will help in understanding the psychological, physical, and socio-economic status while providing oral care to the elderly people. Elderly people should always be categorized under a special group of population as there are various psychological, pharmacological, and medical considerations involved while formulating a treatment plan for the elderly.⁸ Specialized courses or fellowship programmes in geriatric dentistry for dental graduates can help in improving the knowledge, attitude, and skills to provide the quality of oral health care for elderly patients. In countries like the United Kingdom and Australia, geriatrics is practiced under special care dentistry.

Implementing a dietary modification just like western countries that are mentioned in our routine literature, may not be relevant in different geographic regions.¹⁰ With multilingualism, cultural differences and diverse diet patterns, dietary modifications should be developed based on our food, culture, and dietary habits. With an increasing number of geriatric people, geriatric nutrition has to be emphasized as most of the elderly people don't meet their dietary requirements.¹¹ As most of the dental procedures involve multiple appointments, it is feasible to incorporate dietary counselling during the treatment procedure itself.⁹ But adequate knowledge and motivation play a major role in incorporating dietary counselling and dietary modifications to the geriatric population in routine clinical practice.

Review of Literature revealed scant information on the assessment of knowledge, attitude, and practice of dental practitioners providing prosthodontic care towards geriatric health and nutrition. Prior studies have dealt with oral care and awareness at a very superficial level. Despite increasing recognition of the importance of geriatric oral health, there remains limited evidence on how practitioners from different dental specialties perceive and integrate geriatric health and nutrition into their practice. Most prior studies have treated dentists as a single professional category, overlooking potential variations arising from differences in specialization, academic involvement, and clinical focus. Recognizing this gap, the present study is distinct in analyzing and comparing three practitioner groups — general practitioners, prosthodontists, and institutional faculty — to elucidate how educational background and work setting influence their knowledge, attitudes, and practices toward geriatric health and nutrition. Despite the growing elderly population, few studies have examined how dentists translate geriatric health and nutrition knowledge into clinical practice. Understanding this gap is essential to align dental education with the needs of an ageing society.

2. Methodology

This is a descriptive study that was designed as an online, closed-ended, and open-ended questionnaire-based cross-sectional survey conducted across India among dental practitioners providing prosthodontic care.

This study was approved by Institutional Ethical Committee, Indira Gandhi Institute of Dental Sciences, Puducherry (IGID-SIEC2020NRP46PGPRPRI). Informed consent was also taken from the respondents before initiation of the research.

A cross-sectional study design was employed, and participants were recruited through stratified convenience sampling. The minimum required sample size was calculated using Cochran's formula with a 95 % confidence level and 5 % margin of error. The sample size was arrived to be 450. Dental practitioners were stratified into three groups—general practitioners, prosthodontists, and institutional practitioners—to ensure disciplinary representation. The online questionnaire link was circulated via professional dental associations, institutional mailing lists, and social media platforms. Participation was voluntary and anonymous, with only one response allowed per participant. The approach aimed to capture diverse perspectives across different regions and practice settings in India.

The measurement tool was a Tripartite questionnaire consisting of

Informed consent, Demographic data and the questions. The questionnaire consisted of 28 questions comprising of three sections. The first part of the questionnaire had the participants' consent and demographic data. The second part had seven questions exploring knowledge towards geriatric health and nutrition, five questions focused on attitude, and six questions addressed practices towards geriatric health and nutrition. In addition, three open-ended questions were used to assess various opinions regarding knowledge and attitude. An extensive literature review was done to develop the primary version of the questionnaire. The primary version of the questionnaire was tested for its reliability and validity. Face and content validity of the questionnaire was performed by various subject experts from Prosthodontics, other dental specialties and experts in medical education, statistics, and English literature.

As the questionnaire was developed to evaluate the knowledge attitude and practices, the reliability and validity of the primary version of the questionnaire were evaluated. A pilot study with 185 respondents (rule of 10), to check for its validity of its domains was carried out using Principal Component Analysis (PCA).

The questionnaire was sent to 185 dental practitioners across Tamil Nadu and Puducherry. The results of the study were used to identify the principal components in the form of linear combinations of the variables under investigation, and to rank them based on their importance using Principal Component Analysis (PCA). The results of this study were not included in the main study.

The factor structure of the questionnaire was analyzed with the help of principal components analysis (PCA). The PCA used Varimax rotation and Kaiser normalization. Extraction and retention of factors were based on visual examination of the scree plot, and eigenvalues of >0.8 were retained. The factor loading threshold for the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was 0.60. The relevant questions, which enhance the strength factors or with loadings that could be rounded up to 0.60, were retained and were grouped under three domains: Knowledge, Attitude, and Practice. For factor loadings of 0.60 to be significant, results from 185 participants were used to get sufficient statistical power. Internal consistency reliability was determined using Cronbach's alpha, which demonstrated good reliability ($\alpha = 0.82$). The final validated questionnaire consisted of sections assessing knowledge, attitudes, and practices regarding geriatric health and nutrition among dentists.

After the pilot study, necessary modifications were made to the questionnaire, and the study questionnaire was distributed to the dental practitioners all over India. The study was conducted from over a period of three months and 462 responses were obtained. The cluster sampling method was used to get the responses of dental practitioners from various states. Responses were obtained from 21 states and subjected to statistical analysis.

The collected data was analyzed using the Statistical Package for Social Sciences version 25 software. Descriptive statistics were used to summarize the sample and responses of the questionnaire. One-way ANOVA and Post-Hoc Bonferroni test were used for statistical analysis. The level of significance was set at $p \leq 0.05$.

3. Results

Questionnaires were distributed across the states all over India to various faculty in the institutions and general practitioners in social messaging platforms like WhatsApp groups and through emails, based on cluster sampling. We got 462 filled responses. The mean age of the participants was 35.8 years, with a range of 24 (Minimum) to 65 years (Maximum), and the mean years of practice was 10.38, with the range of 2 (Minimum) to 40 years (Maximum). The details of participants according to the age, gender, qualification, years of experience, mode of practice, and state have been given in Table 1 and Fig. 1.

Knowledge about Geriatric Health and Nutrition among the Dental Practitioners providing Prosthodontic Care: The frequency distributions of different responses are mentioned in Table 2. Almost

Table 1

Distribution of the study subjects according to age, gender, qualification, mode of practice, years of experience.

Characteristic	Groups	Number	Percentage
Gender	Male	238	51.5 %
	Female	224	48.5 %
Age	24–30 years	130	28 %
	30–35 years	123	27 %
	35–45 years	157	34 %
	>45 years	52	11 %
Qualification	General Practitioner	153	33.1 %
	MDS – Other specialties	158	34.2 %
	MDS – Prosthodontics	151	32.7 %
Mode of Practice	Institutional	136	29.4 %
	Private	188	40.7 %
	Both	138	29.9 %
Years of Practice	2–5 years	137	30 %
	5–10 years	135	29 %
	11–20 years	155	34 %
	Above 20 years	35	7 %

72.1 % of study participants were aware of the method for assessing nutrients in geriatric patients. Nearly 55.8 % were aware that diet counselling and diet recommendations are essential to improve geriatric care. 32.3 % answered that age is considered as least important on treating older patients, and 93.1 % answered that quality of food is important regarding the consumption of food. 97.8 % suggested, diet counselling will improve the nutritional status of Geriatric patients receiving prosthodontic care. 50.4 % responded with the correct estimated energy requirement per day for a sedentary elderly individual. 92.4 % of participants agreed that problems in the prosthesis may lead patients to eliminate a specific type of food from their diet.

Thematic analysis of the open-ended questions showed that 61.5 % of participants used patient history, built/BMI, and blood investigations to assess the geriatric health and nutrition in their practice. 36.4 %

mentioned that nutrient value, a balanced diet following the food pyramid, and a recommended diet for an elderly person who requires a complete denture.

93.9 % of participants agreed that treating geriatric patients with additional care and concern can bring a better prognosis with prosthodontic treatment, and 98.1 % agreed, geriatric health and nutrition in the dental curriculum is necessary for dentists. 90 % of participants agreed to attend Continuing Dental Education Programmes (CDE) related to geriatric health and nutrition. Almost 97.2 % agreed that evidence-based dietary counselling can improve the efficiency of your routine practice. 96.5 % of participants agreed that it is feasible to implement dietary counselling and advice in prosthodontic care. These results show a clear picture that most dentists have a positive attitude towards geriatric health and nutrition.

Thematic analysis of the open-ended question depicts that 35.9 % of participants answered that articles and books improve their knowledge in geriatric health and nutrition.

52 % of the dental practitioners assess the nutritional status of elderly patients in routine clinical practice, and 63 % of them give diet counselling to their geriatric patients, while 71 % responded that they would recommend an alternate diet without affecting the nutritional value for their elderly patients. One important aspect to be noted is that only 27 % of the dental practitioners reported that their training in dental school was adequate to handle geriatric patients in practice. Nearly 38.1 % were not doing any diagnostic workup to identify nutritional deficiencies.

One-way ANOVA analysis was used to identify the mean difference between different study groups, viz., male-female, institutional faculty-practitioners, prosthodontists-non prosthodontists. The level of knowledge using the Post Hoc Bonferroni test, Group I(a) & Group I(c) were compared, the mean difference (MD) with a confidence interval of 95 % was found to be significant. (MD = -0.784, $p = 0.000$). Similarly, when Group I(b) & Group I(c) were compared, the mean difference (MD) with

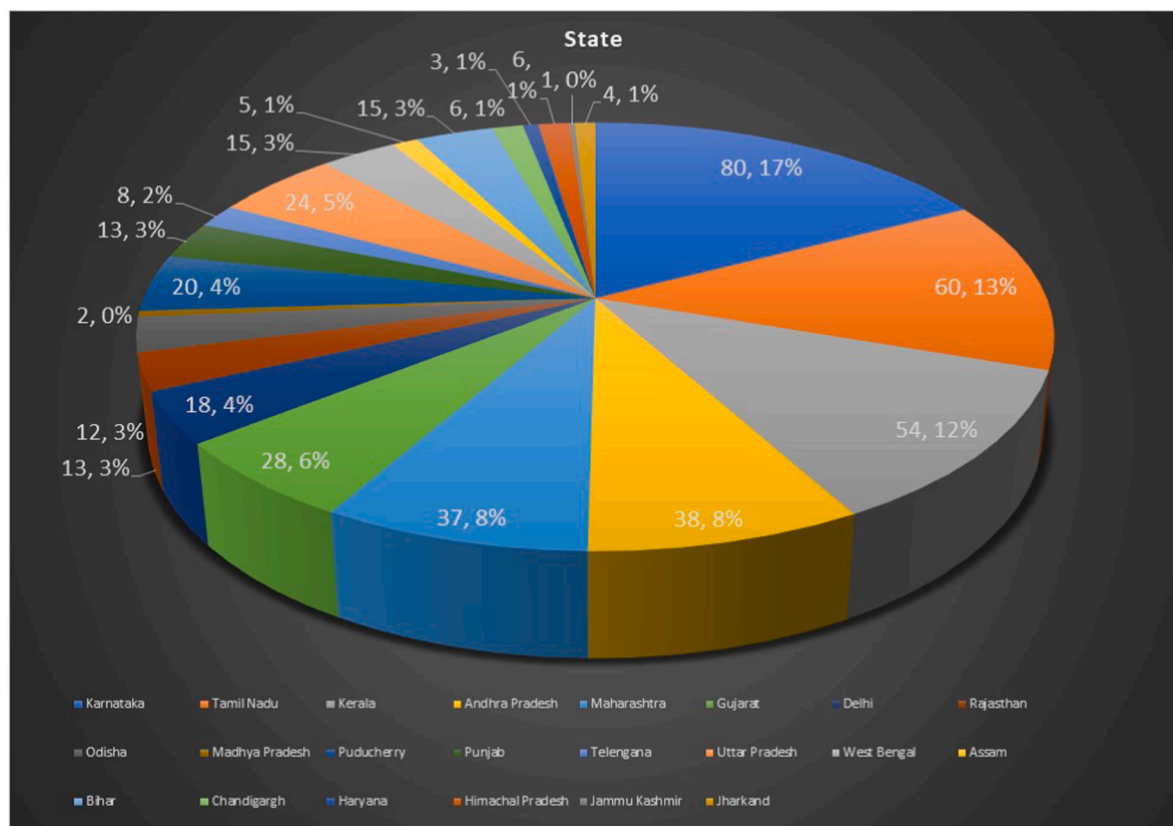


Fig. 1. Pie Chart showing distribution of responses across the states in India.

Table 2
Frequency distribution of questionnaire among the study participants.

S. No	QUESTIONNAIRE	Positive Responses	(%)	GP	MO	MP
1	Methods for assessing nutrition in Geriatric patients	333	72.1	72.5	60.1	84.1
2	Important entity in improving nutritional status in elderly	258	55.8	41.8	52.5	73.5
3	Least important factor when treating elderly	149	32.3	25.5	28.5	43.5
4	Necessities in food consumption	430	93.1	92.8	91.8	95.4
5	diet counselling's role in geriatric care	452	97.8	96.1	97.5	100
6	Estimated energy requirement	233	50.4	47.7	45.5	56.3
7	Denture wearing & associated food problems	427	92.4	90.8	92.7	93.8
8	Treating elderly patients with care & concern	434	93.9	86.9	95.6	99.3
9	Inclusion of geriatrics in dental curriculum	453	98.1	97.4	97.5	99.3
10	Willingness to attend CDEs	416	90	88.9	89.9	91.4
11	Agreed with EBD practice in implementing dietary counselling	449	97.2	97.4	95.6	98.7
12	Feasibility to implement dietary counselling	446	96.5	95.4	96.8	97.4
13	Assessment of nutritional status in routine practice	241	52.2	49.7	48.7	58.3
14	Giving diet counselling & modifications for patients with potential nutritional problems	292	63.2	58.2	63.3	68.2
15	Recommending alternate diet for denture patients	328	71	28.1	24.1	31.1
16	Ability to identify nutritional deficiencies	176	38.1	13.1	12.1	12.8
17	Satisfaction of elderly patients receiving diet counselling along with prosthetic care	89	19.3	7.3	5.7	7.3
18	Training about geriatrics in dental school	128	27.7	8.1	8.4	11.2

a confidence interval of 95 % was found to be significant. (MD = -0.735, $p = 0.000$). There was no significant difference between Group I (a) and Group I(b). These results show that prosthodontists have fairly sufficient knowledge in comparison with the other two groups, which supports the hypothesis as stated in the study [Fig. 2].

Similarly to assess practice, Group I(a) and I(c) were compared; the mean difference (MD) with confidence interval of 95 % was found to be significant. (MD = 0.5562, $p = 0.003$). There was no significant difference between Group I(a) & I(b) and Group I(b) & I(c). These results show that in comparison with the other two groups, prosthodontists were implementing geriatric health and nutrition in their practice.

With Mode of Practice as a variable, when knowledge, attitude, and practice were compared between three groups (Institutional, Private, and both) using Post Hoc Bonferroni test, the results show that there was no significant difference between the three groups in knowledge and practice. In attitude Group I(a) & Group I(c) were compared, the mean difference (MD) with confidence interval of 95 % was found to be significant. (MD = 0.05951, $p = 0.001$). These results show that in comparison with institutional practitioners, private practitioners have less attitude in implementing geriatric health in their practice [Fig. 3].

4. Discussion

Over the last decade, with advancements in medicine, the life span of humans has substantially increased. As a result, the geriatric population (aged 60 and above) is growing at an exponential pace than any other group, globally.¹² The Population census of India (2011) states that the population of elderly persons was around 104 million, which is 8.6 % of the total population. A report by the United Nations Population Fund suggests that these numbers may double by 2026.¹³ This group of individuals goes through multiple crucial changes in their bodily functions, with their health being the major challenging factor for their family and society in general. Elderly people are at a greater risk of compromised general health as well as oral health, which necessitates the need for providing special care to them, which can be accomplished using specialized courses or fellowship programmes in geriatric dentistry for dental graduates.^{7,8}

Charles Heartwell Jr has discussed the role of a prosthodontist in understanding the psychological considerations involved in treating patients and formulating a treatment plan considering both the patient's oral and general health.¹⁴ This concept was well supported by Ronald L Ettinger, who discussed the importance of decision-making and problem-solving while diagnosing and treating elderly people.⁸

Various literature evidence stressed the importance of geriatric health and nutrition in dental practice.^{1,3,8,14,15} Yet, not many studies were conducted among dental practitioners to assess their knowledge, attitude, and practice regarding geriatric health and nutrition across the country systematically. Moreover, the studies that assessed knowledge, attitude, and practice (KAP) was conducted among small groups of dentists or dental students, and they assessed the role of diet and nutrition on oral health.¹⁶

Dentists providing prosthodontic care to the elderly get to interact with the patients more because of the multiple appointments involved.¹⁷ Positive knowledge and attitude on geriatric health and nutrition can help them in implementing it into their practice. The present study is the first pan-India study conducted to assess the KAP of dental practitioners on the importance of geriatric health and nutrition. Once the sample size estimation for the study was done, proportionate distribution of the questionnaire across the states was done based on the data from the Dental Council of India- Dentists registry. Proportionally, from the states with the largest number of registered dentists, like Karnataka, Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala, Gujarat, Rajasthan, Uttar Pradesh, a good number of responses were obtained. This provided a reliable representation from various regions, and this can be considered as the methodological strength of the study.^{18,19} The questionnaire was developed after an extensive literature review and was validated through a factor analysis for domain reliability before administration.^{4,7,20–25}

With elaborate socio-demographic data, we got to analyse the differences between various groups of dentists. Age and years of practice help in analysing the relation between experience and their KAP. The results showed, experienced dentists tend to implement geriatric health and nutrition in their practice. This may be due to the number of CDEs and workshops they get to attend over a period of time and the amount of clinical exposure.

In this study, the mean scores of knowledge, attitude, and practice of general practitioners, postgraduates in Prosthodontics and other specialities were compared, along with a comparison between the dentists who were practicing as institutional, private or in both. It was noted that the mean knowledge and practice score was significantly higher among prosthodontists with positive responses from them in the knowledge (77.87 %) and practice (65.64 %) domains, respectively. And the mean attitude score was significantly higher among Institutional Practitioners, with 74.12 % positive responses. This is also the first study that compared the KAP of geriatric health and nutrition with various groups of dentists based on their qualification and mode of practice.

The study results showed that 72.1 % of the participants (333 out of

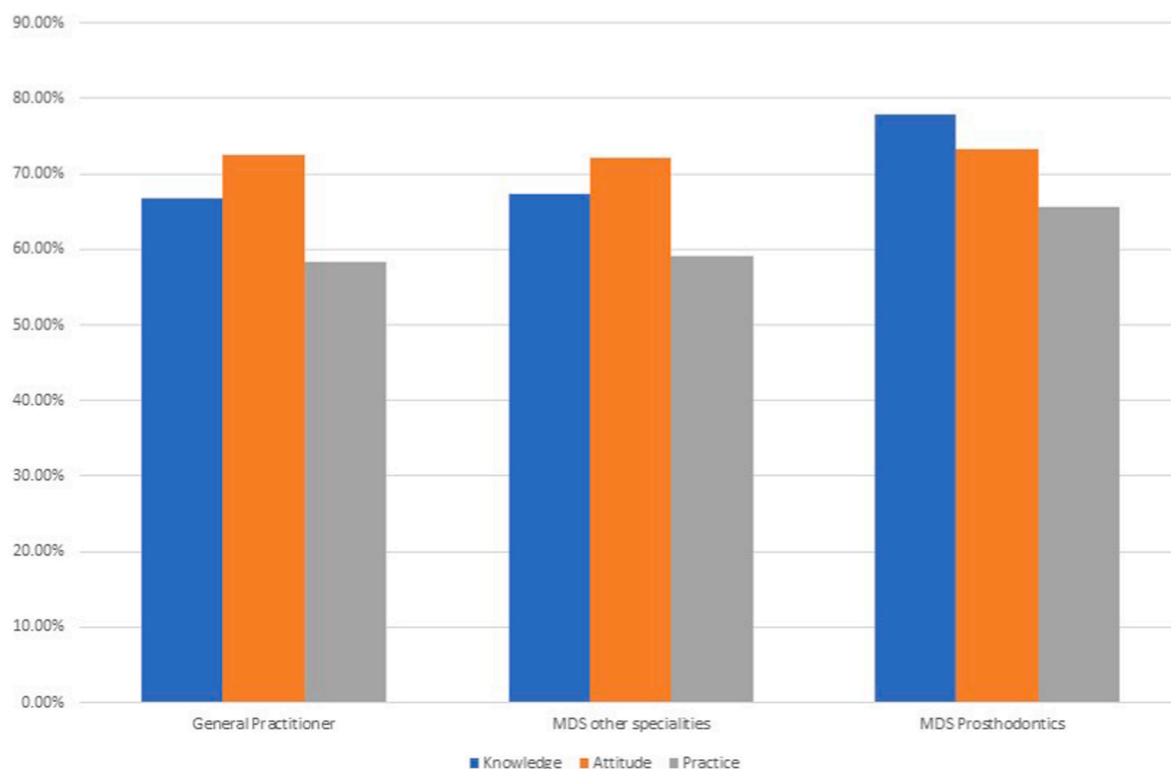


Fig. 2. Graphical representation of knowledge attitude and practice in various groups of professionals.

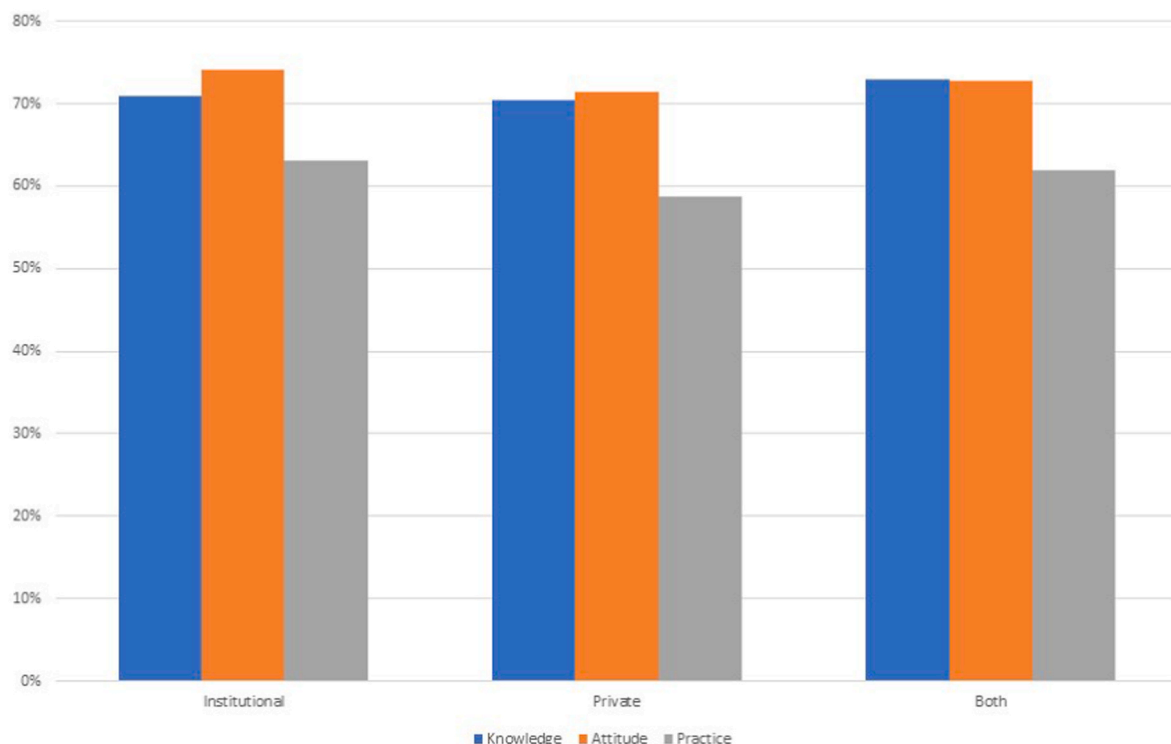


Fig. 3. Graphical representation of knowledge attitude and practice among institutional and private professionals.

462) were aware of the methods for assessing nutrition in geriatric patients. It was agreed that it would be feasible to implement dietary counselling and advice in prosthodontic care, which most of the practitioners (97.8 %) agreed but only 55.8 % were aware that dietary counselling and dietary recommendations play an important role in

improving the nutritional status of the elderly.⁷ In the questions which assessed knowledge, 45 % considered dependency status and 32 % considered aging as the least important factors while treating geriatric patients. The remaining factors, like frailty or systemic health, were considered important, which would affect the outcome of the treatment.

Similarly, 49 % of them were unsure about the estimated energy requirement for a sedentary individual. These results show that there is a lack of knowledge among dental practitioners about geriatric health and nutrition, which needs to be addressed.

36 % of the dentists responded that they will refer to specialists for diet counselling for the elderly. From the thematic analysis of the open-ended questions, we observed that the same number of responses refer to specialists. This shows that the results were coherent with each other.

Though the attitude of dentists was positive towards geriatric health and nutrition, they lacked interest in implementing it in their practice, which was evident from the responses. From the study results, the main area of concern is that almost 70 % of the dental practitioners felt that their training on geriatric health and nutrition in their dental schools was either inadequate or lacked training.

Thematic analysis of the open-ended questions yielded different opinions regarding their methods used to assess geriatric health and nutrition in their practice, the measures they have taken to improve knowledge in geriatric health and nutrition, and their food recommendations for the elderly requiring complete dentures. More than 50 % of the dentists responded that they assess the geriatric health and nutrition by means of patient history, Body Mass Index (BMI), build, gait, and posture, and 18 % of them used nutritional assessment. 20 % responded that they will not use any specific method to assess geriatric health.

On the measures taken to improve their knowledge on geriatric health and nutrition, most of them (36 %) responded that they will refer to literature, which highlights the awareness of an evidence-based approach that exists among practitioners. Regarding the food recommendations for elderly complete denture patients, most dentists preferred a soft diet along with nutrient supplements.

From the Literature search, no study could be found that assessed the knowledge, attitude and practice of geriatric health and nutrition among dental practitioners. So, comparison with other studies was not possible, and a questionnaire study always has a limitation, as the responses were self-reported.²⁶

Overall, the present results suggest that Prosthodontists have fairly sufficient knowledge and attitude toward diet and nutrition and its role in the maintenance of oral health, which may be due to their postgraduate curriculum when compared with other specialties and their association with treating geriatric patients. But in practice, even prosthodontists lacked interest in geriatric health and nutrition. One study among the trainers of dental school felt perceived need for geriatric competencies to be introduced in curriculum.²⁷ The same was also suggested in another review which mentioned that such ventures would improve geriatric care and thereby improve social and economic development.²⁸

Dental procedures are always time-constrained with various limitations like patient co-operation, cost factor etc. So, it may be difficult to implement geriatric health and nutrition in practice, which may look less important from a dentist's perspective. But as dental professionals, we have to understand that proper nutrition is an inevitable need to maintain the health and comfort of oral tissues, which in turn enhances the success of prosthodontic treatment in the elderly. So, nutrition is not the only important factor for oral and general health.

In geriatric patients, many factors like age-related medical conditions, patients' socio-economic status and dietary habits have a profound influence on their dietary selection. It is evident from the literature that prosthodontic rehabilitation alone will not improve the nutritional status in the elderly. The dental team must be aware of these potential detrimental effects of dental treatment and provide counteractive dietary guidance. Problems vary with each patient and the dental condition, so suggestions must be tailored to meet the patient's specific needs.

The following recommendations are suggested based on the outcome of this unique pan india study among students and faculty.

The results of this pan-India study underscore the need for policy-level interventions to strengthen geriatric oral health and nutrition

care. The Dental Council of India (DCI), state dental councils, and professional associations should mandate geriatric dentistry and nutrition counselling as a recognized component of dental education and clinical practice. National oral health programs can integrate routine nutrition screening for older adults, thereby linking dental care with broader public health initiatives. Incentives for clinics and institutions that implement geriatric-friendly care protocols could encourage wider adoption.

At the educational level, undergraduate (BDS) and postgraduate (MDS) programs should adopt a competency-based framework for geriatric dentistry. This framework can include modules on:

- Nutritional assessment techniques for elderly patients,
- Integration of dietary counselling into prosthodontic rehabilitation,
- Interprofessional training with dietitians, geriatricians, and psychologists,
- Case-based learning and clinical rotations in geriatric clinics.

Periodic evaluation through Entrustable Professional Activities (EPAs) and simulation-based assessments can ensure that graduates are well-prepared to address the unique needs of elderly patients.

In routine practice, structured chairside intervention models can bridge the gap between knowledge and implementation. These may include:

- Standardized nutrition screening tools as part of the patient intake form,
- Chairside counselling protocols during prosthodontic treatment,
- Establishing referral networks between dental practitioners and nutritionists,
- Development of patient education leaflets and digital resources tailored for geriatric populations.

Such models not only improve patient outcomes but also reduce the long-term burden of malnutrition and systemic disease in the elderly.

These findings can inform dental councils and universities to include geriatric nutrition modules and continuing education programs to enhance preparedness among practitioners.

5. Conclusion

Within the limitations of the study, it can be concluded that most of the general dental practitioners had basic knowledge regarding geriatric health and nutrition. But they lacked interest in implementing it in practice. They were of the opinion that their training on geriatric health and nutrition was inadequate to incorporate it into their practice. In comparison with the other two groups (non-prosthodontists and general practitioners), prosthodontists were implementing geriatric health and nutritional assessment and advice in their practice. Institutional practitioners show a positive attitude toward geriatric health and nutrition when compared with private practitioners.

It was seen that most of the study participants agreed on the importance of dietary counselling and were willing to participate in continuing education programmes. On the contrary few participants practiced dietary counselling in a routine dental practice. It is necessary to increase the awareness regarding geriatric health, nutrition, and dietary counselling among the dental professionals to provide appropriate care to the elderly.

While dentists recognize the importance of geriatric nutrition, inadequate training and limited practical exposure hinder effective implementation. Incorporating structured geriatric modules in undergraduate and postgraduate programs is imperative.

Ethical clearance

Institutional Ethics Committee approval was obtained for the

questionnaire study. Ethics committee number mentioned in manuscript.

Patient or guardian consent

Consent form is not applicable.

Sources of funding

Sources of funding nil declared.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

The author would like to thank all friends and colleagues who have helped in collection of data all over India.

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