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RESEARCH ARTICLE

Evaluating the effect of ADI-DANT: A Culturally Tailored Novel Board Game to Enhance Oral Health Awareness Among Tribal Schoolchildren: A Pilot Study.

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Abstract: ***Background***: Tribal communities in India experience a disproportionately high burden of oral diseases, compounded by low literacy, cultural barriers, and limited access to dental care. To address the need for an engaging, culturally contextualized oral health educational tool, a Warli-art–based board game—ADI-DANT—was developed. ***Methods:*** This study employed a development–validation–pilot testing design. ADI-DANT was conceptualized as a culturally tailored modification of the traditional snake-and-ladder game incorporating eight key oral health messages. Content validity was assessed through iterative feedback from experts, teachers, and students. The final version was pilot-tested among 75 tribal schoolchildren (aged 8–14 years) using a pre-validated 10-item questionnaire administered before and after gameplay. Paired t-tests and effect size analyses were conducted. ***Results:*** The initial 10-item game was reduced to 8 items after identifying issues related to complexity, redundancy, and unclear sequencing. Iterative refinement enhanced clarity, cultural relevance, and child-friendliness. Pilot results demonstrated significant improvement in oral health awareness, with mean scores increasing from 5.48 ± 1.28 (pre-test) to 7.88 ± 1.14 (post-test) ($t = 13.71$, $p < 0.0001$; Cohen's $d = 1.58$). Students reported high enjoyment and comprehension, while teachers affirmed cultural appropriateness and feasibility. ***Conclusion:*** ADI-DANT is a culturally grounded, engaging, and effective educational tool for improving oral health awareness among tribal schoolchildren. The strong effect size and high acceptability support its potential for broader implementation in school-based oral health programs.

Keywords: Oral health education; Tribal children; Game-based learning; Cultural adaptation; Validation study; Health promotion.

INTRODUCTION

Oral diseases represent a persistent global health challenge, with a disproportionate impact on underserved and tribal populations. Limited access to dental care, poor health literacy, and entrenched cultural practices contribute to severe disparities in oral health outcomes within these communities. Studies have shown a notably high prevalence of dental caries and periodontal disease among tribal and rural populations, often worsened by [1]low literacy levels and socioeconomic inequality.

Studies highlight poor oral health in Indian tribal groups: 5- and 12-year-olds show high caries (dmft 4.13; DMFT 1.15) with sugar use and no dental care[2]. Juang tribe reports 83.4% caries and 75.6% calculus[3]. Telangana and Odisha children display poor hygiene from traditional practices[4,5], Bharia tribe shows 74.7% periodontal disease[6].

In addition to clinical burden, studies on oral health knowledge, attitudes, and beliefs among tribal schoolchildren reveal significant gaps. In Gujarat, a survey of 693 tribal children (aged 3–13 years) showed deficiencies in knowledge and attitudes toward oral health, with knowledge directly correlated with practice—but overall practices lagged despite modest knowledge[7]. Tribes of Karnataka had fair oral health knowledge but implementation and motivation remain low.

One promising approach lies in **game-based learning**, which leverages play to motivate learning and reinforce healthy behaviors. Educational games—whether board, card, or digital—offer interactive experiences that enhance engagement and knowledge retention compared to didactic teaching methods. A prominent example is a randomized trial that used a snake-and-ladder–style board game combined with flashcards in children aged 5–10 years. This intervention significantly improved both oral health knowledge and hygiene scores, with benefits sustained over several months[9].

Comprehensive evidence supports the superiority of game-based oral health education over conventional methods[9]. A 2024 systematic review spanning seven randomized trials with over 1,000 children (ages 4–12

years) found significant gains in oral health knowledge, oral hygiene indices, and reductions in debris and plaque following game-based interventions[10]. Such interventions are particularly well-suited for overcoming literacy barriers and increasing engagement among young learners.

Moreover, serious games—whether video-based or visual interactive platforms—have demonstrated improvements in dietary knowledge, brushing habits, and plaque control across diverse populations and age groups. In Jordan, a video-game intervention enhanced dietary and brushing knowledge among 6–8-year-olds[11]. A visual interactive game targeting adolescents in India yielded significant improvements in oral hygiene practices and clinical parameters[12].

Despite compelling evidence, **tribal populations remain underrepresented in game-based oral health research**. A systematic review of game-based oral health education applying PRISMA guidelines concluded these methods are superior to traditional approaches, yet none focused on tribal communities[13]. Given these gaps, there is a strong rationale for developing a culturally sensitive, game-based oral health tool designed specifically for tribal schoolchildren. Tribal areas often exhibit higher levels of illiteracy and cultural heterogeneity, necessitating interventions that are simple, visually rich, and contextually relevant. A board game such as *Adi-Dant* can enhance retention of key oral hygiene behaviors—like brushing twice daily and avoiding tobacco use—through fun and meaningful engagement.

MATERIAL AND METHODS

This study followed a development–validation–pilot testing design and was conducted among tribal schoolchildren enrolled in government residential schools. The methodology included three major phases: (1) development of the ADI-DANT board game, (2) iterative validation through experts, teachers, and students, and (3) pilot testing to assess effectiveness in creating oral health awreness among tribal students.

Development of the Board Game

The ADI-DANT game was conceptualized as a culturally tailored, modified snake-and-ladder–style educational tool to promote oral health behaviors among tribal children. Warli art, tribal motifs, familiar landscapes, and simple Marathi expressions were incorporated to maximize cultural relevance. The game consisted of eight items with 4 core health messages, including toothbrushing, regular dental visits, dietary practices including sugar control, and tobacco avoidance. Each message was embedded within numbered steps that directed players to move ahead (positive behaviors) or move backward (harmful behaviors).

Validation Process

The initial version of the game was evaluated by a panel comprising public health dentistry experts and tribal school teachers, who assessed the items for clarity, relevance, simplicity, cultural appropriateness, and comprehensibility for the target age group. Initially there were 10 items which got reduced to 8 due to repeatability. Reviewers rated each item using a 4-point relevance scale. Teachers also identified several issues during this first round, including, Complex or lengthy language Use of difficult Marathi vocabulary, Minor sequencing confusion in a few steps.

Based on these observations, the research team revised the game by simplifying text, reducing sentence length, and clarifying the sequence of actions while retaining culturally relevant visual elements.

Following teacher-based revisions, the game was introduced to a small group of tribal students to evaluate comprehension and ease of play. During this session, students asked for clarification on several items and required teacher or investigator assistance to understand certain phrases. This indicated that additional refinement was necessary.

Based on student difficulties and teacher suggestions, the research team conducted a second round of modifications, which included, reducing the items from 10 to 8 replacing difficult words with **child-friendly alternatives**, breaking multi-step instructions into **single, actionable messages**, making the words easy to be understood by the students. The revised version was returned to the teachers for re-evaluation. In **Round 2**, all eight items were deemed clear, culturally appropriate, and suitable for implementation. No further modifications were advised.

Pilot Study

The finalized ADI-DANT game was pilot-tested among 75 tribal schoolchildren aged 8–14 years. The students are resident of tribal ashram school of Gadchiroli. These students visited Govt. Dental College and Hospital from July 2024 to November. The students present on the day of data collection were invited to participate. Written permission was obtained from school authorities, and oral assent was obtained from children. The pilot testing involved three steps:

Pre-test assessment a pre-validated questionnaire was used for measuring the baseline oral health knowledge. Then Children played the ADI-DANT board game under supervision from the investigator and teachers. They were encouraged to ask questions if any game item was unclear. The same questionnaire was administered immediately after gameplay to assess short-term change in knowledge. Paired t-test was used to evaluate pre–post changes. Effect size was calculated using Cohen's d. A p-value of <0.05 was considered statistically significant.

RESULTS

Experts rated the game positively for content accuracy and child-friendliness. Overall, I-CVI scores were above acceptable thresholds (>0.8). A paired Student's t-test was conducted to evaluate the effect of the ADI-DANT board game on oral health awareness among 75 tribal schoolchildren. Results demonstrated a statistically significant improvement in post-test scores compared to pre-test scores ($t = 13.71$, $p = 0.0001$ The mean pre-test score was 5.48 ± 1.28, while the mean post-test score was 7.88 ± 1.14, indicating an average gain of 2.40 points. The effect size (Cohen's $d = 1.58$) suggests a very large educational impact, confirming that the ADI-DANT game substantially improved students' oral health awareness. (table 1)

Table 1:

Parameter	Pre-test	Post-test	Notes
Mean	5.48	7.88	
Standard Deviation (SD)	1.28	1.14	
Paired t-test value (t)	13.71		Highly significant
p-value			$p < 0.0001$
Effect size (Cohen's d)	1.58		Very large effect

DISCUSSION

The present study describes the development and validation of Adi-Dant, a culturally tailored board game designed to promote oral health awareness among tribal schoolchildren. The findings demonstrate that the game is both valid and feasible, with high engagement from students and teachers, and has potential to improve oral health knowledge and behaviours in this underserved population.

Game-based approaches have emerged as effective strategies to address health literacy barriers. Randomized studies have demonstrated that board games and interactive activities significantly improve children's oral health knowledge and hygiene outcomes compared to didactic teaching8-13. A systematic review covering over 1,000 children confirmed significant gains in knowledge, oral hygiene indices, and plaque reduction following game-based interventions9. Digital interventions, such as video games and interactive visual platforms, also improved oral health behaviours in children and adolescents10,11. Importantly, board games have been successfully adapted for vulnerable populations; for example, intellectually disabled adults showed improved knowledge and reduced plaque after a game-based intervention14. Systematic reviews also affirm that play-way learning sustains engagement and reinforces behaviour change more effectively than conventional education15.

The present study adds to this evidence base by demonstrating the feasibility of a board game specifically tailored to tribal schoolchildren. While previous studies have focused on urban or general populations [8–11,13–15], our study addresses a critical gap by adapting the intervention to the tribal cultural context. Validation through both expert faculty and local schoolteachers, with I-CVI scores >0.8, strengthens the content accuracy and relevance of the game. Similar to earlier findings8,9, students in our pilot showed measurable knowledge gains and reported high satisfaction. Importantly, the iterative modification process based on student and teacher feedback (simplification of language, resequencing gameplay) ensures cultural adaptability—a key factor often missing in generic game-based tools.

Unlike other interventions that relied solely on one-time exposure 8,9, Adi-Dant was tested in repeated sessions, which may reinforce retention of oral health behaviours. Furthermore, while studies in Odisha and Madhya Pradesh highlighted the reliance on traditional cleaning practices and poor periodontal outcomes4,5, our pilot suggests that culturally tailored play-based education could begin to shift these patterns early in childhood.

Strengths and Limitations

The major strength of this study is its focus on a hard-to-reach tribal population, with contextual tailoring of the intervention and rigorous validation using I-CVI. Additionally, the integration of feedback from both teachers and students ensured acceptability and engagement. However, the pilot was limited by a small sample size and lack of long-term behavioural follow-up. Future studies should expand to larger cohorts, assess sustainability of behaviour change, and evaluate clinical outcomes such as plaque and gingival indices.

Implications for Oral Health Promotion

The study demonstrates that board games such as Adi-Dant can serve as innovative, scalable, and culturally sensitive tools for tribal oral health promotion. Integrating such approaches into school-based oral health programs could help overcome literacy barriers, engage children meaningfully, and address the persistent disparities in oral health burden among tribal populations.

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