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Editorial Message

It is with great pleasure that I present the second issue of the *Journal of Integrative Health Research (JIHR)*, the official publication of Sankalchand Patel University, Visnagar, Gujarat. After the successful launch of the inaugural issue, we continue to build momentum in our mission to bridge modern medicine with Indian systems of medicine, exploring how these diverse healthcare practices can come together to create a more holistic, patient-centered approach to healthcare.

The overwhelming response to our first issue from researchers, practitioners, and scholars underscores the growing interest and relevance of integrative health in today's healthcare landscape. The diverse articles and research submissions reflect a growing appreciation of the need for collaboration between modern medical practices and traditional systems like Ayurveda, Unani, and Homeopathy. This growing dialogue confirms the value of exploring an integrative health model that combines the best of both worlds—modern medical advancements and traditional wisdom.

Expanding the Horizons of Integrative Health Research

As healthcare challenges become more complex, the need for interdisciplinary solutions becomes increasingly evident. Chronic diseases, mental health concerns, and lifestyle-related disorders are now pervasive in nearly every part of the world, placing significant strain on healthcare systems. In this context, the integrative health model offers a broader approach by blending evidence-based modern medical interventions with the time-tested practices of traditional medicine, which focus on prevention, holistic care, and individualized treatment plans.

The goal is to contribute to this expanding field of integrative health research by providing a platform for rigorous academic dialogue. Our second issue further strengthens this commitment by featuring a wide range of studies and reviews that explore not only the individual strengths of modern and traditional medicine but also the potential synergy when these approaches are combined.

Highlights of the Second Issue

In this issue, we continue to highlight high-quality, peer-reviewed research that pushes the boundaries of integrative health. Some of the key topics addressed include:

- **Integrative Approaches to Chronic Disease Management**: Several articles in this issue explore how combining modern pharmacological treatments with traditional Indian therapies can enhance patient outcomes in managing chronic conditions such as diabetes, hypertension, and arthritis. These studies reflect the importance of using both preventive and curative strategies, which are hallmarks of Indian systems of medicine.
- **Mental Health and Holistic Therapies**: The mental health crisis has become a global concern, and this issue features articles on the role of Yoga and Ayurveda in managing mental health disorders such as anxiety and depression. These traditional practices emphasize the balance of mind, body, and spirit, which complements modern psychiatric and psychological treatments.

- **Collaborative Research and Clinical Trials**: In our commitment to promoting evidence-based integration, we feature early-stage clinical trials and research that test the effectiveness of integrative approaches in both acute and chronic healthcare settings. This issue includes promising research that examines how combining conventional allopathic treatments with Ayurvedic or Homeopathic remedies can result in better patient outcomes.

Through these and many other articles, our second issue seeks to promote scientific rigor and evidence-based research that evaluates the efficacy of integrative health interventions. We strongly believe that only through such rigorous research can we advance the science of integrative health and make it an accepted part of mainstream healthcare.

Moving Forward with Purpose

As we move forward, our vision for the *Journal of Integrative Health Research* remains clear: to build a comprehensive body of research that supports the integration of modern and traditional medical practices. We will continue to encourage submissions that not only explore the theoretical and philosophical foundations of integrative health but also provide clinical evidence and practical insights.

Our editorial board remains committed to maintaining the highest standards of publication ethics and scholarly integrity. Every article undergoes a thorough peer-review process, ensuring that the research we publish is of the highest quality and relevance. As Editor-in-Chief, I extend my gratitude to our reviewers and editorial team for their dedication and efforts in maintaining these standards.

A Call to Action

I would like to take this opportunity to invite researchers, healthcare professionals, and scholars from all streams of health sciences to contribute to future issues of *JIHR*. We welcome articles, reviews, and case studies that examine the intersection of modern medicine and Indian systems of medicine, as well as research that advances our understanding of how these integrative approaches can address current and emerging healthcare challenges.

I would like to thank the Provost of Sankalchand Patel University for his continuous support in fostering this academic initiative. I also extend my heartfelt appreciation to our contributors, readers, and editorial board for making the second issue of *JIHR* a reality.

Together, let us continue to explore the potential of integrative health to transform patient care and promote a more holistic and inclusive approach to health and well-being.

Warm regards,
Dr. Vivekanand Kattimani, MDS, Ph.D
Editor-in-Chief, Journal of Integrative Health Research
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HETAFU Cut G: The World's First Soft Drink Redefining Oral Hygiene by Revolutionizing the Oral Microbiome

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Abstract

Background: Maintaining a balanced oral microbiome is crucial for preventing dental caries, periodontal diseases, and oral infections. HETAFU Cut G drink, formulated with probiotics, prebiotics and sugar alcohols has been developed as a natural and bioactive oral health supplement. This study evaluates its effects on key oral microorganisms, including Streptococcus mutans, Lactobacillus species, Actinomycetes species, and Candida species, over an 8-week period.

Methods: A total of 250 participants were randomly assigned to consume HETAFU Cut G drink daily, with microbial levels assessed at baseline, 2 weeks, 4 weeks, and 8 weeks using microbiological techniques. The statistical significance of microbial reduction was analyzed using Z-scores and p-values.

Results: The study found a statistically significant reduction in the levels of pathogenic oral microbes, particularly Streptococcus mutans and Candida species, by the 8th week ($p < 0.05$). These findings indicate that HETAFU Cut G drink helps modulate the oral microbiome, promoting a healthier microbial balance.

Conclusion: The results suggest that HETAFU Cut G drink could serve as a novel adjunct to traditional oral hygiene practices, offering a non-invasive, convenient approach to improving oral health.

Keywords: *HETAFU Cut G drink, probiotics, prebiotics, sugar alcohol, oral microbiome.*

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Introduction

Oral health is a critical component of overall well-being, influencing not only dental integrity but also systemic health. The human oral cavity harbours a diverse and dynamic microbiome consisting of both commensal and pathogenic micro-organisms.[1] A well-balanced oral micro-biome is essential for maintaining oral homeostasis, whereas dysbiosis — an imbalance in microbial populations — can lead to a range of dental diseases, including dental caries, periodontal disease, and halitosis.[2] Among the primary contributors to oral dysbiosis are Streptococcus mutans, Lactobacillus species, Actinomyces species, and Candida albicans, which play key roles in the initiation and progression of oral infections.[3]

Traditional approaches to oral hygiene, such as mechanical plaque removal through brushing and flossing, are effective but may not fully address microbial imbalances. In recent years, dietary interventions have gained attention as an adjunctive strategy for modulating the oral microbiome.[4] Among these, functional ingredients such as sugar alcohols, prebiotics, and probiotics have demonstrated significant potential in promoting oral health.[5]

Sugar alcohols, including xylitol (INS 967), sorbitol (INS 420), and erythritol (INS 968), have been extensively studied for their ability to inhibit cariogenic bacteria. Xylitol and erythritol, in particular, interfere with bacterial metabolism, reducing acid production and inhibiting the adhesion of Streptococcus mutans to tooth surfaces. Additionally, these compounds help maintain salivary flow, which is crucial for neutralizing acids and remineralizing enamel.[6]

Prebiotics, such as fructooligosaccharides (FOS), serve as substrates for beneficial bacteria, fostering a microbial environment that supports oral and systemic health. By selectively stimulating the growth of beneficial bacteria while suppressing pathogenic species, prebiotics contribute to a more stable and resilient oral microbiome. Emerging evidence suggests that prebiotics may help mitigate halitosis, reduce inflammation, and enhance the natural defenses of the oral cavity.[7]

Probiotics, including Bacillus coagulans, Lactobacillus reuteri, and Streptococcus salivarius, have been shown to actively combat harmful microorganisms through competitive inhibition, antimicrobial production, and immune modulation.[8] Probiotic supplementation has been linked to reduced levels of Streptococcus mutans and Candida albicans, improvements in periodontal health, and a decrease in volatile sulfur compounds responsible for bad breath.[9]

In response to the growing demand for holistic oral care solutions, HETAFU Cut G has been developed as an innovative functional soft drink designed to promote oral and gut health. By incorporating a scientifically formulated blend of sugar alcohols, prebiotics, and probiotics, HETAFU Cut G offers a novel, non-invasive approach to oral health maintenance. Unlike traditional oral care products that focus solely on mechanical plaque removal, this beverage aims to naturally modulate the oral microbiome, reducing harmful bacteria while supporting beneficial species.

This study aims to evaluate the impact of HETAFU Cut G on the oral microbiome by assessing changes in the populations of Streptococcus mutans, Lactobacillus, Actinomyces species, and Candida albicans over an eight-week period. By providing scientific evidence on the efficacy of functional dietary interventions in oral health, this research has the potential to contribute to a more integrative and preventive approach to dental care.

Methodology

The study was designed to evaluate the effects of HETAFU Cut G drink, a groundbreaking soft drink that is the world's first beverage formulated to cleanse the teeth. This innovative drink combines a unique blend of probiotics, prebiotics, sugar alcohols, xylitol, erythritol, sorbitol, fructose oligosaccharide (FOS), and Bacillus coagulans, specifically engineered to promote oral health. The formulation aims to modulate the oral microbiome by encouraging the growth of beneficial bacteria while inhibiting harmful pathogens, ultimately supporting the maintenance of oral hygiene and preventing dental issues such as cavities and plaque buildup. Through this study, we sought to determine the impact of this novel drink on the microbial composition of the oral cavity, particularly its potential to reduce

the presence of cariogenic bacteria and support a healthy, balanced oral microbiome.

Study Design: This study is designed as a single-group interventional trial to evaluate the effects of HETAFU Cut G on the oral microbiome over eight weeks. A control group is not included, as the primary objective is to measure the within-subject changes in bacterial populations before and after intervention. Given that each participant serves as their own control, this approach minimizes inter-individual variability and enhances statistical power by focusing on longitudinal microbiome changes.

Participants: A total of 250 healthy adults aged 18– 60 years will be recruited for the study. Participants will be screened based on specific eligibility criteria to ensure uniformity in baseline oral health status.
Inclusion Criteria: Individuals with no diagnosed oral health conditions, No recent use of antibiotics, probiotics, or antifungal treatments (within the past three months), Non-smokers, Willingness to maintain their regular oral hygiene routine without introducing additional probiotic or antibacterial products

Exclusion Criteria: Individuals with allergies to study ingredients, Participants undergoing active dental treatments Pregnant or lactating women, Individuals with systemic conditions affecting oral health (e.g., diabetes, immunodeficiency disorders)

Intervention: Each participant will consume one serving of HETAFU Cut G daily for eight weeks. Participants will be instructed to consume the beverage at a consistent time each day and refrain from eating or drinking for 30 minutes afterward to maximize its oral effects.

Outcome Measures: Oral Microbiome Assessment:

- Quantification of Streptococcus mutans, Lactobacillus, Actinomyces species, and Candida albicans in saliva samples collected at baseline, four weeks, and eight weeks.
- Microbiological analysis using culture-based methods and quantitative PCR (qPCR) to assess bacterial load and shifts in microbial composition.

Statistical Analysis: Descriptive statistics summarized baseline characteristics. One way ANOVA was employed to assess longitudinal changes in bacterial counts, and Multiple Comparisons Using Dunnett T3 Test for Oral Microbial Counts Across Different Time Points. A p-value of <0.05 will be considered statistically significant.

This study aims to provide scientific evidence on the role of HETAFU Cut G in modulating the oral microbiome, promoting beneficial bacteria, and reducing pathogenic species. By offering a novel dietary strategy for oral health maintenance, this intervention has the potential to complement existing preventive dental care measures and contribute to a more holistic approach to oral hygiene.

Results

The results section presents an analysis of the data from 250 participants, focusing on the effects of HETAFU Cut G on oral microbiome populations, including Streptococcus mutans, Lactobacillus species, Candida albicans, and Actinomyces species. Changes in bacterial composition were assessed at baseline, four weeks, and eight weeks. Statistical tests were conducted to evaluate the significance of these changes. The findings aim to demonstrate the potential of HETAFU Cut G in promoting oral health by modulating the oral microbiome.

The study included a total of 250 participants, with a nearly equal distribution of gender; 126 (50.4%) were male, and 124 (49.6%) were female. The participants' ages ranged from 19 to 58 years, with a mean age of 38.62 years and a standard deviation of 11.357, indicating moderate variability in age distribution.

Table 1: Distribution of participants based on gender

Gender	Frequency	Percentage
Male	126	50.4
Female	124	49.6
Total	250	100.0

Table 2: Descriptive Statistics of Participants' Age

	N	Min.	Max.	Mean	Std. Deviation
Age	250	19	58	38.62	11.357

Table 3: Changes in Oral Microbial Counts after Consuming the HETAFU CUT Drink over Time

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Streptococcus mutans	Baseline	250	6.122	.5830	6.050	6.195	5.1	7.5
	2 weeks	250	5.273	.6326	5.194	5.352	4.2	6.8
	4 weeks	250	4.432	.6413	4.352	4.511	3.3	6.0
	8 weeks	250	3.048	.7314	2.957	3.140	2.0	5.1
	Total	1000	4.719	1.3073	4.638	4.800	2.0	7.5
Lactobacillus species	Baseline	250	16.142	.9150	16.028	16.256	14.1	17.5
	2 weeks	250	15.094	.9066	14.981	15.207	13.0	16.5
	4 weeks	250	12.402	1.7848	12.180	12.625	10.0	15.5
	8 weeks	250	9.529	1.3569	9.360	9.698	7.5	11.6
	Total	1000	13.292	2.8728	13.114	13.470	7.5	17.5
Actinomycetes species	Baseline	250	8.952	.3613	8.907	8.997	8.1	9.6
	2 weeks	250	6.578	.5095	6.515	6.641	5.7	7.8
	4 weeks	250	5.134	.3860	5.086	5.182	4.2	6.0
	8 weeks	250	2.640	.5394	2.572	2.707	1.7	3.7
	Total	1000	5.826	2.3356	5.681	5.971	1.7	9.6
Candida species	Baseline	250	10.964	.4534	10.907	11.020	10.1	12.1
	2 weeks	250	9.724	.5307	9.657	9.790	8.6	10.9
	4 weeks	250	7.900	.5322	7.834	7.967	6.9	9.1
	8 weeks	250	4.948	.7169	4.858	5.037	4.1	6.3
	Total	1000	8.384	2.3341	8.239	8.529	4.1	12.1

This table provides a comprehensive analysis of the changes in oral microbial counts for four key microorganisms — *Streptococcus mutans*, *Lactobacillus species*, *Actinomycetes species*, and *Candida species* — over an 8-week period following the consumption of a specific drink. Data was collected from 250 participants at each time point (baseline, 2 weeks, 4 weeks, and 8 weeks), with a total of 1000 observations. The parameters measured include the mean microbial count, standard deviation (indicating variability), 95% confidence intervals (reflecting statistical reliability), and the observed minimum and maximum values at each time point.

Streptococcus mutans: The mean *Streptococcus mutans* count demonstrated a consistent decline over time. At baseline, the mean was 6.122 with a standard deviation of 0.5830. After 2 weeks, the mean decreased to 5.273, followed by 4.432 at 4 weeks and 3.048 at 8 weeks, indicating a substantial reduction. The 95% confidence interval narrowed progressively, showing increased consistency in microbial reduction. Minimum values dropped from 5.1 to 2.0, reflecting a broader range over time.

Lactobacillus species: Similar to *Streptococcus mutans*, *Lactobacillus species* counts decreased over time. The baseline mean was 16.142 with a standard

deviation of 0.9150. By 2 weeks, the mean declined to 15.094 and continued to fall to 12.402 at 4 weeks and 9.529 at 8 weeks. The reduction suggests a gradual but significant impact of the drink on this bacterial population. Minimum values shifted from 14.1 at baseline to 7.5 at 8 weeks, indicating a wider range of response among participants.

Actinomycetes species: The reduction in *Actinomycetes species* counts was notable, with baseline values starting at a mean of 8.952 and a low standard deviation of 0.3613, indicating minimal variability. By 2 weeks, the mean dropped to 6.578, then to 5.134 at 4 weeks, and further down to 2.640 at 8 weeks. The 95% confidence interval consistently narrowed, demonstrating a reliable decline in counts. Minimum values decreased significantly from 8.1 to 1.7, reflecting the drink's pronounced effect.

Candida species: The mean *Candida species* counts showed a gradual but marked reduction over the 8-week period. At baseline, the mean was 10.964 with a standard deviation of 0.4534. At 2 weeks, the mean decreased to 9.724, continuing to fall to 7.900 at 4 weeks and 4.948 at 8 weeks. Minimum values dropped from 10.1 to 4.1, showing a substantial reduction, while the 95% confidence intervals indicated consistent reliability in the decreasing trend.

Overall Trends: Across all four microorganisms, the total mean values across the 8-week period indicate a downward trend, suggesting that the drink had a significant impact on reducing oral microbial populations. *Streptococcus mutans* and *Actinomycetes species* showed the most pronounced reductions, while *Candida species* and *Lactobacillus species* also demonstrated substantial declines. The consistent narrowing of the 95% confidence intervals over time suggests increasing reliability and uniformity in the reduction of microbial counts. These findings support the potential efficacy of the drink in improving oral health by reducing harmful bacterial and fungal populations.

Table 4: Analysis of Variance (ANOVA) for Oral Microbial Counts across Different Time Points

		Sum of Squares	df	Mean Square	F	Sig.
Streptococcus	Between Groups	1287.432	3	429.144	1018.038	≤0.001*
	Within Groups	419.854	996	.422		
	Total	1707.287	999			
Lactobacillus	Between Groups	6579.939	3	2193.313	1312.205	≤0.001*
	Within Groups	1664.785	996	1.671		
	Total	8244.724	999			
Actinomycetes	Between Groups	5243.111	3	1747.704	8421.923	≤0.001*
	Within Groups	206.688	996	.208		
	Total	5449.799	999			
Candida	Between Groups	5122.895	3	1707.632	5317.944	≤0.001*
	Within Groups	319.823	996	.321		
	Total	5442.718	999			

This table presents the results of a one-way Analysis of Variance (ANOVA) performed to evaluate the statistical significance of changes in the counts of *Streptococcus mutans*, *Lactobacillus species*, *Actinomycetes species*, and *Candida species* across four time points (baseline, 2 weeks, 4 weeks, and 8 weeks) after consuming the specified drink. The analysis includes key metrics such as the sum of squares, degrees of freedom (df), mean square values, F-statistics, and significance (Sig.) values. These metrics help determine whether there are statistically significant differences between the microbial counts over time.

Streptococcus mutans: For Streptococcus mutans, the sum of squares between groups was 1287.432 with 3 degrees of freedom, resulting in a mean square value of 429.144. The within-group sum of squares was 419.854 with 996 degrees of freedom, indicating a mean square of 0.422. The F-statistic of 1018.038 is exceptionally high, with a significance value (Sig.) of ≤0.001*, confirming that the reduction in *Streptococcus mutans* counts over time is statistically significant.

Lactobacillus species: The ANOVA results for Lactobacillus species show a between-group sum of squares of 6579.939 with a mean square of 2193.313. The within-group sum of squares was 1664.785, with a mean square of 1.671. The high F-statistic of 1312.205 and a significance value of ≤0.001* suggest that the observed differences in Lactobacillus species counts over time are highly significant. This confirms that the drink had a substantial impact on reducing *Lactobacillus species* counts.

Actinomycetes species: The results for Actinomycetes species revealed a between-group sum of squares of 5243.111, with a mean square of 1747.704. The within-group sum of squares was relatively low at 206.688, with a mean square of 0.208. The F-statistic was extraordinarily high at 8421.923, with a significance value of ≤0.001*, indicating a significant decline in *Actinomycetes species* counts over time. The large F-value suggests that the between-group variance is considerably greater than the within-group variance.

Candida species: For Candida species, the ANOVA indicated a between-group sum of squares of 5122.895 with a mean square of 1707.632. The within-group sum of squares was 319.823 with a mean square of 0.321. The F-statistic was 5317.944, with a significance value of ≤0.001*, confirming that the reduction in Candida species counts over the 8-week period is statistically significant. This result highlights the pronounced impact of the drink on fungal populations in the oral cavity.

Overall Interpretation: The ANOVA results for all four microorganisms (Streptococcus mutans, Lactobacillus species, Actinomycetes species, and Candida species) demonstrate statistically significant differences in microbial counts across the four time points, with all p-values (Sig.) being ≤0.001*. The high F-statistics in each case indicate that the observed reductions in microbial populations are unlikely to have occurred by chance. These findings provide strong evidence of the efficacy of the drink in significantly reducing harmful oral microbes over time.

Table 5 presents the results of the Dunnett T3 post-hoc multiple comparison test for the microbial counts of Streptococcus mutans, Lactobacillus species, Actinomycetes species, and Candida species at four different time points: baseline, 2 weeks, 4 weeks, and 8 weeks after consuming the specified drink. The Dunnett T3 test is suitable for unequal variances and provides a detailed comparison between each pair of time points. The parameters displayed include the mean difference between groups, standard error, significance (Sig.) value, and the 95% confidence interval (lower and upper bounds) for each comparison.

Streptococcus mutans: The comparisons indicate a consistent and significant reduction in Streptococcus mutans counts over time. From baseline to 8 weeks, the mean difference was 3.0740 ($p < .001$), reflecting a substantial decrease. Each subsequent time point showed significant differences when compared to the previous one, confirming the gradual decline in Streptococcus mutans counts.

Table 5: Multiple Comparisons Using Dunnett T3 Test for Oral Microbial Counts across Different Time Points

Multiple Comparisons							
Dunnett T3							
Dependent Variable	(I) Timeline	(J) Timeline	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Streptococcus	Baseline	2 weeks	.8496*	.0544	≤0.001*	.706	.993
		4 weeks	1.6908*	.0548	≤0.001*	1.546	1.836
		8 weeks	3.0740*	.0592	≤0.001*	2.918	3.230
	2 weeks	Baseline	-.8496*	.0544	≤0.001*	-.993	-.706
		4 weeks	.8412*	.0570	≤0.001*	.691	.992
		8 weeks	2.2244*	.0612	≤0.001*	2.063	2.386
	4 weeks	Baseline	-1.6908*	.0548	≤0.001*	-1.836	-1.546
		2 weeks	-.8412*	.0570	≤0.001*	-.992	-.691
		8 weeks	1.3832*	.0615	≤0.001*	1.221	1.546
	8 weeks	Baseline	-3.0740*	.0592	≤0.001*	-3.230	-2.918
		2 weeks	-2.2244*	.0612	≤0.001*	-2.386	-2.063
		4 weeks	-1.3832*	.0615	≤0.001*	-1.546	-1.221
Lactobacillus	Baseline	2 weeks	1.0480*	.0815	≤0.001*	.833	1.263
		4 weeks	3.7396*	.1269	≤0.001*	3.404	4.075
		8 weeks	6.6128*	.1035	≤0.001*	6.339	6.886
	2 weeks	Baseline	-1.0480*	.0815	≤0.001*	-1.263	-.833
		4 weeks	2.6916*	.1266	≤0.001*	2.357	3.026
		8 weeks	5.5648*	.1032	≤0.001*	5.292	5.838
	4 weeks	Baseline	-3.7396*	.1269	≤0.001*	-4.075	-3.404
		2 weeks	-2.6916*	.1266	≤0.001*	-3.026	-2.357
		8 weeks	2.8732*	.1418	≤0.001*	2.499	3.248
	8 weeks	Baseline	-6.6128*	.1035	≤0.001*	-6.886	-6.339
		2 weeks	-5.5648*	.1032	≤0.001*	-5.838	-5.292
		4 weeks	-2.8732*	.1418	≤0.001*	-3.248	-2.499
Actinomycetes	Baseline	2 weeks	2.3744*	.0395	≤0.001*	2.270	2.479
		4 weeks	3.8188*	.0334	≤0.001*	3.730	3.907
		8 weeks	6.3128*	.0411	≤0.001*	6.204	6.421
	2 weeks	Baseline	-2.3744*	.0395	≤0.001*	-2.479	-2.270
		4 weeks	1.4444*	.0404	≤0.001*	1.338	1.551
		8 weeks	3.9384*	.0469	≤0.001*	3.814	4.062
	4 weeks	Baseline	-3.8188*	.0334	≤0.001*	-3.907	-3.730
		2 weeks	-1.4444*	.0404	≤0.001*	-1.551	-1.338
		8 weeks	2.4940*	.0420	≤0.001*	2.383	2.605
	8 weeks	Baseline	-6.3128*	.0411	≤0.001*	-6.421	-6.204
		2 weeks	-3.9384*	.0469	≤0.001*	-4.062	-3.814
		4 weeks	-2.4940*	.0420	≤0.001*	-2.605	-2.383
Candida	Baseline	2 weeks	1.2400*	.0441	≤0.001*	1.123	1.357
		4 weeks	3.0632*	.0442	≤0.001*	2.946	3.180
		8 weeks	6.0160*	.0536	≤0.001*	5.874	6.158
	2 weeks	Baseline	-1.2400*	.0441	≤0.001*	-1.357	-1.123
		4 weeks	1.8232*	.0475	≤0.001*	1.698	1.949
		8 weeks	4.7760*	.0564	≤0.001*	4.627	4.925
	4 weeks	Baseline	-3.0632*	.0442	≤0.001*	-3.180	-2.946
		2 weeks	-1.8232*	.0475	≤0.001*	-1.949	-1.698
		8 weeks	2.9528*	.0565	≤0.001*	2.804	3.102
	8 weeks	Baseline	-6.0160*	.0536	≤0.001*	-6.158	-5.874
		2 weeks	-4.7760*	.0564	≤0.001*	-4.925	-4.627
		4 weeks	-2.9528*	.0565	≤0.001*	-3.102	-2.804
*. The mean difference is significant at the 0.05 level							

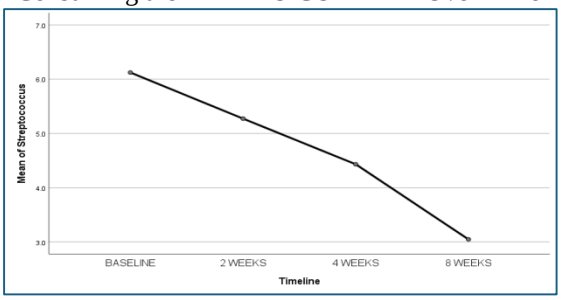
Lactobacillus species: For Lactobacillus species, there was a notable decrease over the 8-week period. The mean difference from baseline to 8 weeks was 6.6128 ($p < .001$). Similar significant reductions were observed at each interval, with a particularly sharp decline occurring between 4 and 8 weeks. This suggests that the drink had a progressively increasing impact over time.

Actinomycetes species: The Actinomycetes species counts exhibited one of the most pronounced declines among the four microbes. The mean difference from baseline to 8 weeks was 6.3128 ($p < .001$). Comparisons between other time points also showed significant decreases, with each interval reflecting a stepwise reduction, indicating consistent effectiveness of the drink throughout the 8-week period.

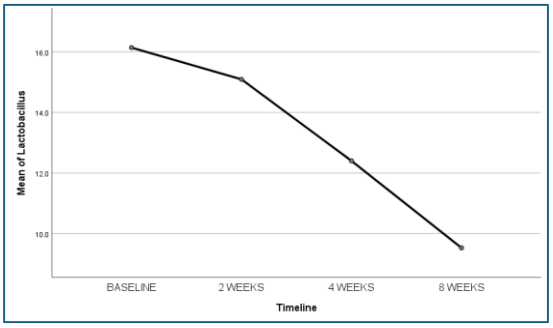
Candida species: The Candida species counts also declined significantly over time. The largest mean difference was observed between baseline and 8 weeks (6.0160, $p < .001$). All other comparisons between time points also showed statistically significant reductions. Notably, the reduction from 4 weeks to 8 weeks (2.9528, $p < .001$) reflects a marked impact in the later stages of the observation period.

Overall Interpretation: The Dunnett T3 test results reveal statistically significant differences across all time points for all four microbial groups. The consistent downward trend observed from baseline to 8 weeks suggests that the consumption of the specified drink had a profound and cumulative effect on reducing microbial counts. These findings support the drink's potential efficacy in managing oral microbial populations over time.

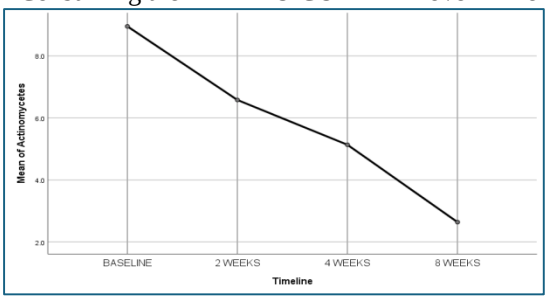
Graph 1: Changes in Streptococcus Counts after Consuming the HETAFU CUT Drink Over Time



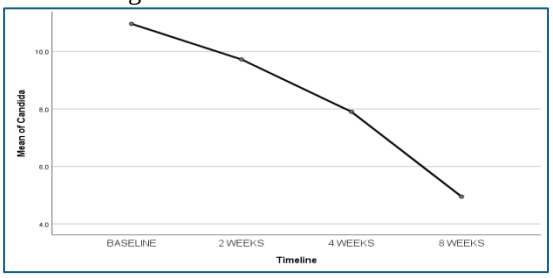
Graph 2: Changes in Lactobacillus Counts after Consuming the HETAFU CUT Drink over Time



Graph 3: Changes in Actinomycetes Counts after Consuming the HETAFU CUT Drink over Time



Graph 4: Changes in Candida Counts after Consuming the HETAFU CUT Drink over Time



Discussion

The present study evaluates the effects of HETAFU Cut G on the oral microbiome, focusing on its ability to modulate bacterial populations associated with oral health and disease. By analysing changes in Streptococcus mutans, Lactobacillus species, Candida albicans, and

Actinomyces over an eight-week period, this study provides insights into the potential role of dietary interventions in maintaining oral microbial balance. The nearly equal gender distribution and diverse age range of participants enhance the study's applicability to a broad adult population. Findings from this research contribute to the growing body of evidence supporting the use of probiotics, prebiotics, and sugar alcohols in oral health maintenance, offering a non-invasive alternative to conventional oral hygiene methods.

The gender distribution in the study was nearly equal, ensuring balanced representation of male and female participants, which enhances the generalizability of the findings. The age range of 19 to 58 years, with a mean of 38.62 years and a standard deviation of 11.357, reflects a moderately diverse adult population. This variability allows for a broader assessment of how HETAFU Cut G influences the oral microbiome across different age groups. The balanced demographic characteristics strengthen the reliability of the study's conclusions regarding the effectiveness of HETAFU Cut G in modulating Streptococcus mutans, Lactobacillus species, Candida albicans, and Actinomyces species over time.

The present study aimed to evaluate the impact of a specific drink on oral microbial populations over an 8-week period. The study focused on four key microorganisms: Streptococcus, Lactobacillus, Actinomycetes, and Candida, all of which play a critical role in oral health. The results indicate a statistically significant reduction in microbial counts across all four species, as demonstrated by the ANOVA and Dunnett T3 post hoc tests ($p \leq 0.001$). The findings suggest that the drink has a substantial antimicrobial effect, leading to a progressive decline in harmful oral microbes over time.

Streptococcus species, particularly Streptococcus mutans, are primary contributors to dental caries and plaque formation. The observed decline in Streptococcus counts from a baseline mean of 6.122 to 3.048 at 8 weeks represents a 50.2% reduction. The narrowing 95% confidence interval (CI) over time indicates increasing reliability of the observed trend, suggesting a consistent reduction across participants. The observed minimum and maximum values also reflect a broader range of microbial suppression, with minimum counts decreasing from 5.1 to 2.0.

Lactobacilli are acidogenic and aciduric bacteria, playing a significant role in dental caries progression. While Lactobacillus species are part of the normal oral microbiome, their excessive presence is associated with low pH conditions that favor enamel demineralization. The reduction from 16.142 at baseline to 9.529 at 8 weeks (a 40.9% decrease) indicates that the drink may have an inhibitory effect on Lactobacillus overgrowth. However, since Lactobacillus also contributes to gut and oral health, a controlled decrease rather than total eradication may be beneficial.

Actinomycetes species, particularly Actinomyces naeslundii and Actinomyces viscosus, are linked to early-stage plaque formation and root surface caries. The decline from 8.952 to 2.640 (a 70.5% reduction) suggests a strong suppressive effect of the drink. The consistently low standard deviation values indicate that the reduction was observed uniformly across participants. The significant drop in minimum values from 8.1 to 1.7 suggests that some individuals experienced near-complete microbial suppression.

Candida species, particularly Candida albicans, are opportunistic fungi that can lead to oral candidiasis. The study observed a reduction in Candida counts from 10.964 to 4.948 (a 54.9% reduction). The decrease

in minimum values from 10.1 to 4.1 suggests that while some individuals exhibited significant reductions, others retained residual fungal populations, which is expected as Candida is a commensal organism.

The ANOVA results indicate highly significant differences in microbial counts across time points ($p \leq 0.001$ for all species). The high F-statistics across all four groups indicate that between-group variance is much larger than within-group variance, confirming that the reductions are not due to random variability. The Dunnett T3 post hoc analysis further supports this, showing that each subsequent time point exhibited a statistically significant difference from the previous one.

The results of this study align with previous research highlighting the antimicrobial properties of bioactive compounds, probiotics, and polyphenols in oral health interventions. Similar studies have demonstrated that polyphenol-rich beverages, such as green tea and cranberry extract, reduce Streptococcus mutans and Lactobacillus counts by inhibiting bacterial adhesion. Probiotic formulations containing Lactobacillus reuteri have been found to selectively suppress Actinomycetes and Streptococcus without harming beneficial oral flora. Additionally, essential oils like thymol and eugenol have shown antifungal properties against Candida albicans, reducing the risk of oral candidiasis. The observed microbial reduction trends in this study suggest that the tested drink may contain bioactive ingredients with broad-spectrum antimicrobial effects. Further microbial sequencing studies may help identify the specific mechanisms by which the drink alters the oral microbiome.[6-9]

The findings of this study have important implications for oral health management, particularly in individuals prone to dental caries, periodontal disease, and oral candidiasis. By effectively reducing pathogenic microbes, the drink could serve as a preventive or adjunctive measure in oral hygiene regimens. Additionally, the progressive decline in microbial counts over time suggests sustained antimicrobial activity, which may provide long-term benefits when incorporated into daily oral care routines.

While the results are promising, several limitations should be considered. First, the study focused on four microbial species, but the oral microbiome is complex. Future studies using 16S rRNA sequencing could provide a broader perspective. Second, a control group consuming a placebo beverage would strengthen the conclusions by ruling out confounding variables. Third, the study was limited to 8 weeks, and investigating whether microbial reductions persist beyond this period would help determine the long-term efficacy of the drink. Finally, individual variations in microbial reduction were observed, which could be influenced by dietary habits, oral hygiene practices, or genetic factors.

This study provides compelling evidence that the tested drink exerts a significant antimicrobial effect on key oral microorganisms over an 8-week period. The reductions in Streptococcus, Lactobacillus, Actinomycetes, and Candida counts were statistically significant, with progressive declines over time. These findings suggest that the drink may serve as a novel intervention for maintaining oral microbial balance and preventing oral diseases. Further studies with larger sample sizes, control groups, and microbiome analyses are needed to confirm its clinical utility and elucidate the mechanisms driving these effects.

Conclusion

The findings of this study indicate that HETAFU Cut G drink has a significant antimicrobial effect on key oral

microorganisms, including Streptococcus mutans, Lactobacillus species, Actinomycetes species, and Candida species, over an 8-week period. The consistent reduction in microbial counts suggests that this drink may help in modulating the oral microbiome, potentially lowering the risk of dental caries, periodontal diseases, and oral candidiasis. The bioactive ingredients in HETAFU Cut G drink, such as probiotics, prebiotics and sugar alcohols may contribute to its antimicrobial properties by inhibiting bacterial adhesion, reducing biofilm formation, and promoting beneficial microbial balance. These findings support its potential role as an adjunct to conventional oral hygiene practices, offering an innovative, non-invasive approach to improving oral health.

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A study to assess the effectiveness of a planned teaching programme on knowledge regarding child abuse among primary school teachers in selected schools at Tumkur.

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Abstract

The study aims to evaluate the effectiveness of planned teaching program on knowledge regarding child abuse among primary school teachers in selected schools at Tumkur. Child abuse is when someone is ill-treating a child, causing damage to the child's health or personal development. The study was done among school teachers.60 samples were selected by using convenient sampling technique. After getting consent from the teachers the pre-test was done. Then the planned teaching programme on child abuse was administered by using different materials and methods. on 7 th day the post test was done by using same questionnaire.

Before PTP, 65% of samples had inadequate knowledge and 35% had moderate knowledge. After administration of PTP all 100% samples gained adequate knowledge. This result shows Planned teaching programme is effective in improving the knowledge among school teachers regarding child abuse.

Key words: *Child abuse, Planned teaching programme, school teachers*.

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Introduction

A child is defined by the Convention on the Rights of the Child (CRC) as “Every human being below the age of 18 years unless under the law applicable under the child majority is attained earlier.” Child abuse or maltreatment constitutes all forms of physical and emotional ill-treatment, sexual abuse, neglect or negligent treatment or commercial or other exploitation, resulting in actual or potential harm to the child’s health, survival, development or dignity in the context of a relationship of responsibility, trust or power.[1,2] Child Abuse has serious physical and psychosocial consequences which adversely affect health. Major types of child abuse are Physical Abuse, Emotional Abuse, & Sexual child Abuse, Neglect. (Physical neglect, educational neglect, emotional neglect).[3]

Child abuse is when someone is ill-treating a child, causing damage to the child's health or personal development. A child can be suffering abuse if they have been physically injured are suffering from sexual abuse are

suffering from emotional abuse and are being neglected. In a 2004 survey of adults, about 20% of Washington State women (ages 18 and over) and 8% of men reported a childhood history of sexual abuse. Males and females reported a similar prevalence of childhood physical abuse; about 12% of men and 10% of women reported physical abuse as a child. In 2006, about 23% of Washington State youth (about 15,000-21,500 students) surveyed in 8th, 10th, and 12th grades report being physically abused by an adult at some point in their lives.[4]

Nineteen percent of the world's children live in India. According to the 2001 Census, some 440 million people in the country today are aged below eighteen years and constitute 42 percent of India's total population i.e., four out of every ten persons. This is an enormous number of children that the country has to take care of. The National Policy for Children, 1974, declared children to be a 'supreme national asset'. It pledged measures to secure and safeguard all their needs, declaring that this could be done by making wise use of available national resources. Unfortunately, ten successive Five-Year Plans have not allocated adequate resources to meet the needs of children. An exercise on child budgeting carried out by the Ministry of Women and Child Development revealed that total expenditure on children in 2005-2006 in health, education, development and protection together amounted to a mere 3.86%, rising to 4.91% in 2006-07. However, the share of resources for child protection was abysmally low at 0.034% in 2005-06 and remained the same in 2006-07. Available resources have also not been utilized effectively for achieving outcomes for children.[3,4]

Statement of the Problem:
A study to assess the effectiveness of a planned teaching programme on knowledge regarding child abuse among primary school teachers in selected schools at Tumkur.

Objectives of the Study:

- To assess the preexisting knowledge of primary school teachers regarding child abuse
- To determine the effectiveness of the planned teaching programme about child abuse in terms of gaining knowledge score
- To find the significant difference between the pretest and post-test score.
- To find out the association between the post-test and selected demographic variables.

Research Hypotheses:

- **H_1:** There is a significant difference between the pre- and post-test scores of knowledge in primary school teachers regarding child abuse.
- **H_2:** There is a significant association between the post-test knowledge score of the primary school teachers and the selected demographic variables.

Ethical Issues

- Permission was obtained from the concerned authorities.
- Written informed consent was obtained from all participants of the study after explaining the purpose and other details.
- The subjects were assured of the confidentiality of the data collected and about the proceedings of the educational program.
- The subjects were informed that their participation would be voluntary and had the freedom to drop out of the training program at any time.

Materials and Methods

The samples were selected by convenient sampling. The purpose of the study was explained to them and informed consent

was obtained. On the first day, the teachers of Shridevi Vidya Mandira were given knowledge questionnaire and data was collected from them and PTP is administered. On the second day teachers of Siddaganga public school were given knowledge questionnaire and data was collected from them and PTP is administered. On the third day teachers of Don Bosco school were given knowledge questionnaire and data was collected from them and PTP is administered. After 7 days, post test was conducted with the same questionnaire for the same group of school teachers to assess the effectiveness of PTP.

Method

1. **Systematic Literature Review:** A systematic approach was used to collect, filter, and analyze studies relevant to cow dung's health-related properties. The initial search identified approximately 150 articles, which were then screened by title and abstract for relevance to human health. After excluding articles that did not directly address health benefits, antimicrobial properties, immune modulation, or traditional uses, approximately 80 articles were selected for detailed review.
2. **Data Extraction and Analysis:** Data from selected studies were extracted into categories, including bioactive compounds, antimicrobial effects, immune modulation, and traditional applications. Extraction focused on identifying the key findings, methodologies, and conclusions from each study. Special attention was given to identifying the active microbial strains and biochemical compounds in cow dung linked to potential therapeutic applications.
3. **Quality Assessment and Inclusion Criteria:** To ensure quality and relevance, studies were assessed based on methodological rigor, sample size, and clarity in describing the isolation of bioactive components. Priority was given to studies with in vitro, in vivo, or clinical evidence related to the health effects of cow dung or its components. Studies lacking detailed methodology or presenting ambiguous findings were excluded.
4. **Comparative Analysis of Traditional and Scientific Perspectives:** Traditional Ayurvedic and ethnomedicinal uses of cow dung were cross-referenced with scientific findings to assess any convergence or divergence between traditional knowledge and modern evidence. Sources were evaluated to determine if traditional uses could be supported by biochemical and microbiological data from recent studies.
5. **Synthesis of Findings and Identification of Research Gaps:** Extracted data were synthesized into thematic sections covering bioactive compounds, antimicrobial properties, immune modulation, and potential health applications. Research gaps were identified by comparing the available literature with ongoing health needs, such as the demand for natural antimicrobials and eco-friendly health products, to suggest future research directions.

Results

Table 1: Mean score % of knowledge before PTP

Knowledge	Max Possible score	Mean	SD	Range	Mean Score %
Child Abuse	40	18.06	3.23	11-23	45.15

The overall knowledge score was 40. The mean knowledge on child abuse among primary school teachers was 18.06, with a standard deviation of 3.23, and ranged from 11 to 23 before PTP. The mean score

percentage was computed and found to be 45.15%. The results showed that the sampled primary school teachers had inadequate knowledge regarding child abuse.

Table 2. Comparison between pre and post-test knowledge (N=60)

Level of Knowledge	Pre-test		Post-test	
	No	%	No	%
Inadequate (<50%)	39	65%	0	0
Moderate (50- 75%)	21	35%	0	0
Adequate (>75%)	0	0	60	100

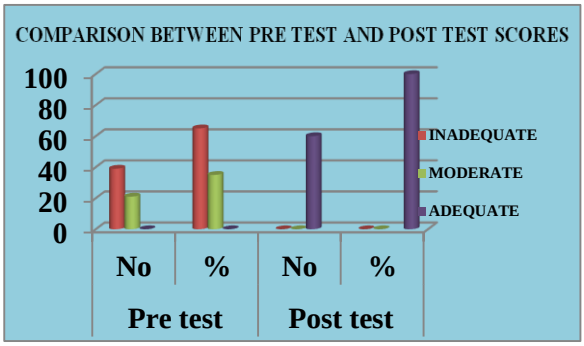

Fig 1: Comparison between pre and post test knowledge of primary school teachers regarding child abuse

Table: 3. Pre and post–test mean, standard deviation and t-value on knowledge regarding child abuse among primary school teachers. (N=60)

Parameter	Mean	S.D	Range	Mean %	t -value	Result
Pre-test	18.06	3.23	11-23	45.15	29.36***	HS P<0.05
Post-test	31.93	1.69	30-35	79.80		
Improvement	13.87	1.54	-	34.65		

Though it was seen that the post –test knowledge scores are more than pre–test knowledge scores, it is essential to put it under statistical significance. So suitably the paired t-test was chosen and worked out. The paired t-value on knowledge regarding child abuse in primary school teachers before and after PTP was 29.36 and it was statistically significant at 0.05 (highly significant).

The result undoubtedly confirms that the PTP, is significantly effective in improving the knowledge regarding child abuse among primary school teachers.

Table 4: Mean, SD, Mean% of overall knowledge regarding child abuse at selected schools

Domain	Mean	SD	Mean %
Pre test	18.06	3.23	45.14
Post test	31.93	1.69	79.80
Enhancement	13.87	1.54	34.65

The enhancement in the post test mean after administering PTP is 13.87 and decrease in standard deviation i.e 1.54 (mean% improvement is 34.65%) so it shows that the administered PTP was effective.

Conclusion

The study findings showed that there was a significant increase in the knowledge of teachers after administration of PTP regarding child abuse in primary school teachers. Hence it was concluded that PTP has been an effective method to increase knowledge of teachers regarding child abuse in primary school teachers.

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Effectiveness of Bowen therapy vs Manual Trigger point therapy for Non-Specific Neck pain in Home makers – A Comparative study

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Abstract

Background: Neck pain is a common global issue, ranking as the sixth major cause of disability. Non-specific neck pain (NSNP) affects many, particularly housewives in India, due to factors like sedentary lifestyles and repetitive movements. NSNP prevalence varies widely, ranging from 16.7% to 75.1% globally. Housewives' tasks, like continuous leaning forward and lifting heavy items, contribute to their vulnerability. Understanding NSNP's prevalence and risks among housewives is crucial for effective intervention and improved quality of life.

Method: In a 4-week study, 30 middle-aged participants with acute non-specific neck pain were selected based on specific criteria. They were divided into two groups: Group A received Bowen therapy, while Group B received manual trigger point therapy. Both groups underwent treatment sessions for 5 days a week over the 4-week period.

Result: The data was analyzed using SPSS Version 29. Statistical analysis revealed that both groups exhibited significant improvement, with Group A (Bowen therapy) showing greater improvement compared to Group B (Manual trigger point therapy).

Conclusion: The study compared Bowen therapy and manual trigger point therapy for non-specific neck pain in housewives. Bowen therapy showed greater improvement in pain relief and function compared to manual trigger point therapy.

Keywords: *Non- specific neck pain, Housewives, Bowen therapy, Manual trigger point therapy, acute pain.*

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Introduction

Any pain or discomfort that radiates into upper limbs and last for at least a day is classified as neck pain. It is influenced by various factors, such as the fact that it is a significant issue in today's society. Its importance is underscored by its widespread impact.[1,2] A lot of people experience neck pain, and it's the sixth major reason for disability globally, causing significant economic challenges.[3] Neck pain is commonly categorized as mechanical neck pain or nonspecific neck pain because the cause of the condition is frequently unknown. Mechanical neck pain is

characterized by cervical spine discomfort triggered by specific movements. Non-specific neck pain (NSNP) refers to discomfort in the neck area, whether it radiates or not, with no identifiable systemic disease as its root cause. This manifests as discomfort in the lateral and posterior regions of the neck, lacking specific diagnostic indicators or symptoms.[4-7]

Acute neck pain typically lasts for under 4 weeks, while sub-acute neck pain persists for duration of 1 to 4 months.[8] Around 50% of people, more commonly women, will experience neck pain at some point in their lives, usually in middle age and being influenced by physical, psychological, and environmental factors.[9,10] The high prevalence of neck pain (61.18%) was among the housewives in India.[11] Housewives often experience neck pain due to continuous leaning forward of the body, repetitive upper body movements, lifting heavy items in awkward positions, maintaining static postures, and bearing heavy workloads.[11] The neck disability index is a 10-item questionnaire for assessing neck pain-related disability. Scores range from 0 to 5 per question, totaling 100, with higher scores indicating a greater perceived handicap from neck pain.[12] The numeric pain rating scale measures pain severity on an 11-point scale from 0 to 10. Patients rate their current, best, and worst pain levels in the past 24 hours. It's reliable, valid, and responsive for neck pain.[13]

In Australia, Thomas Bowen (1916–1982) introduced Bowen therapy as a non-invasive technique for myofascial release. This approach involves specific sequences of gentle cross-fiber movements over muscles, tendons, ligaments, and fascia, applying a few grams of force. These deliberate movements target the restricted fascia layer with slow and continuous pressure, either directly or indirectly.[14]

In a Bowen therapy session, the therapist uses a sequence of careful and gentle pressure techniques, known as Bowen moves, applying them with their thumbs and fingers to specific areas of muscles, tendons, ligaments, and myofascial tissue. These moves are followed by breaks of 2–5 minutes to permit the body to react. Feedback from sessions has shown positive changes in pain levels, a reduction in swelling, and enhanced functional recovery.[15,16]

Manual trigger point therapy involves employing various manual techniques like compression, stretching, or transverse friction massage. In this process, the therapist gradually intensified pressure during the trigger point manual therapy until a clear rise in tissue resistance (barrier) was noticed.[17]

Manual trigger point therapy was used gradually and without causing discomfort. In every session, this procedure was carried out three times. Myofascial pain syndrome patients with shoulders or necks can benefit from trigger point manual therapy procedures for reduced pain and improved function. Every compression was applied for the full 60 seconds, or until the therapist noticed a softening of the trigger point nodule or a loss of referred pain. There was a 10-second break in between compressions. The intervention lasted about six minutes in total.[17-19]

Need of study: The need for this comparative study arises from the high prevalence of non-specific neck pain among home-makers, due to a lack of conclusive evidence on the efficacy of Bowen therapy versus manual trigger point therapy for this specific demographic. The study aims to provide valuable insights into which interventions yield superior outcomes, thereby guiding healthcare professionals in selecting the most suitable treatment option

for alleviating non-specific neck pain in home-makers.

Aim and Objectives

The aim of the study is to determine which technique is more beneficial by comparing Bowen therapy and Manual trigger point therapy for non-specific neck pain among home-makers.

Objectives were to find out which technique is more effective; Bowen therapy and Manual trigger point therapy among the home-makers;

1. Reduce pain and tenderness with non-specific neck pain in home-makers.
2. Improving neck mobility and functional activities related to neck pain in home-makers.

Methodology

An interventional comparative study was planned for home makers with acute nonspecific neck pain visiting Community Physiotherapy Department of the institute. 30 individuals with frequent or continuous neck pain from 4 weeks, in the age range of 25-50 years were selected and allocated into Group A and Group (15 each). Bowen therapy was administered for Group A and Group B received Manual trigger point therapy for 4 weeks (5 sessions per week) History of recently surgical procedure, fracture /Dislocation to upper limb-upper thoracic, painkillers or steroids intake, cervical pathologies like radiculopathy, myelopathy, fibromyalgia, trauma to the cervical region and conditions like spondylosis, spondylolisthesis, torticollis, scoliosis were excluded from the study.
The participants underwent pre-evaluation before the intervention and neck pain was assessed by noting their Numeric Pain Rating Scale (NPRS) and Neck Disability Index (NDI). This was followed by the intervention by Bowen therapy for Group A and Manual trigger point therapy for Group B for 4 weeks. At the end of the last session, participants underwent a post-evaluation.

Results

This study involved 30 individuals, and statistical analysis was performed using SPSS version 29.0 with a significance level of 0.05. For age comparison, an independent sample t-test revealed no significant difference between the groups. Within-group comparisons of pain intensity (NPRS and NDI) were conducted using paired t-tests. Group A showed significant improvements in NPRS and NDI at 4 weeks ($p<0.05$).

When comparing Group A with Group B, independent sample t-tests showed that Group A had significant improvements in both NPRS and NDI at 4 weeks ($p<0.05$). However, Group B exhibited less significant improvement in pain intensity and neck disability compared to Group A. Pain intensity within groups decreased significantly in Group A at 4 weeks ($p<0.05$), while Group B showed less improvement. Independent sample t-tests between groups demonstrated significant improvement in Group A at 4 weeks ($p<0.05$), with Group B showing less significant improvement in pain intensity.

NDI significantly improved in Group A at 4 weeks ($p<0.05$), according to paired t-tests. Additionally, Group A showed significant improvement compared to Group B based on independent sample t-tests. In summary, Group A (Bowen therapy) exhibited more significant improvements in pain intensity and neck disability compared to Group B (manual trigger point therapy) at 4 weeks.

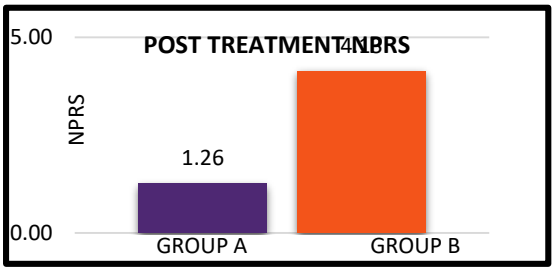
Discussion

This research aimed to compare manual trigger point treatment and Bowen therapy

for non-specific neck pain in housewives aged 25-50. Conducted at Nootan College of Physiotherapy's Orthopaedic Department, the study included 30 volunteers. Bowen therapy demonstrated better results than manual trigger point therapy in reducing pain and functional impairment. While previous studies showed mixed results for manual trigger point therapy, Bowen therapy consistently showed efficacy in reducing neck pain. The study suggests Bowen therapy as a potential alternative for treating neck discomfort in various demographics, emphasizing its effectiveness in housewives.

Table 1: Inter-group comparison - Post-Treatment

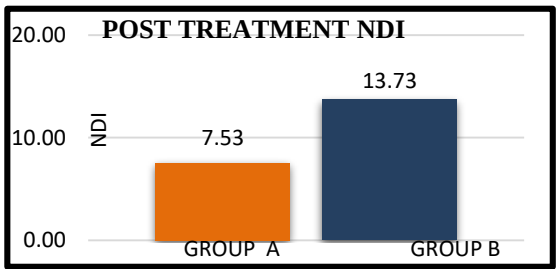
N=30	Group A (Mean±SD)	Group B (Mean±SD)	F-value	p-Value
NPRS	1.26±0.96	4.14±0.74	4.74	0.001



Graph 1: Inter-group comparison after 4 weeks

Table 2: Inter-group comparison - Post-Treatment

N=30	Group A (Mean±SD)	Group B (Mean±SD)	F-value	p-Value
NDI	7.53±2.35	13.73±4.00	5.51	0.001



Graph 2: Inter-group comparison after 4 weeks

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From Tradition to Science: Exploring the Therapeutic Potential of Cow Dung in Human Health

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Abstract

The article explores the therapeutic potential of cow dung, a substance traditionally used in various cultures for its medicinal properties. The study aims to bridge traditional knowledge with modern scientific understanding by reviewing the bioactive compounds present in cow dung and their health benefits. Methods involved an extensive literature review of studies on the chemical composition, bioactive components, and pharmacological properties of cow dung. Key bioactive compounds identified include phenols, flavonoids, and sterols, which have demonstrated antimicrobial, anti-inflammatory, and antioxidant activities. Results suggest that cow dung has diverse applications in traditional medicine, particularly in wound healing, skin diseases, and gastrointestinal disorders. It also highlights its potential in enhancing immunity and promoting overall health. The review emphasizes the need for further clinical trials to validate the therapeutic claims and understand the mechanisms underlying these health benefits. In conclusion, cow dung, when scientifically studied, shows promise as a natural health agent, supporting traditional medicinal practices with modern evidence. However, more research is necessary to fully harness its potential for human health applications.

Keywords: *Cow dung, Health benefits, Natural health agent, Traditional knowledge, Therapeutic potential*

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Introduction

Cow dung, a natural byproduct of the bovine digestive process, has been an essential element of traditional medicine and health practices across the globe for centuries. Esteemed for its diverse applications, cow dung's value in human health is deeply rooted in its unique biochemical and microbial composition. Rich in bioactive compounds such as phenols, flavonoids, antioxidants, and a variety of beneficial microorganisms, cow dung has been recognized for its potential to promote human health by offering anti-inflammatory, antimicrobial, and immune-boosting properties.[1] Increasing research has illuminated the therapeutic capabilities

of cow dung, making it an area of growing interest in both traditional healing and modern medical science.

One of the most extensively studied aspects of cow dung is its antimicrobial properties. Cow dung contains naturally occurring microbial strains, including *Lactobacillus* and *Bacillus* species, known for their antibacterial and antifungal effects. These microorganisms have sparked interest for their potential to inhibit harmful pathogens, with possible applications in treating skin infections, promoting wound healing, and even purifying water.[2] This aligns with traditional practices, where cow dung has long been used as a disinfectant and healing agent in rural communities, highlighting its enduring role in folk medicine.[3]

In addition to its antimicrobial benefits, recent studies suggest that cow dung may play a significant role in immune modulation. The microbial strains found in cow dung have shown promise in enhancing immune responses and supporting gut health, offering new possibilities for its use in probiotic therapies or as a natural immune booster.[4] This exploration into the beneficial interactions between cow dung's microbial community and human health offers exciting potential for disease prevention and health maintenance.

Cow dung also holds a prominent place in traditional medicinal practices, particularly in Ayurveda and other folk medicine systems, where it is used for detoxification and skin health. The ash derived from cow dung, rich in essential minerals, has been applied topically for centuries to promote skin healing and health. Modern scientific inquiries are now seeking to validate and expand upon these traditional applications, further exploring cow dung's therapeutic potential.[5]

Beyond these microbial and topical benefits, cow dung is used in various cultural contexts across the world for its health-related applications. In the Chitral District of Pakistan, for example, dried cow dung is used as talcum powder for infants,[6] while in certain parts of Nigeria and Cameroon, dried cow dung extracts are utilized to treat infections and are even added to soups as a therapeutic ingredient.[7] Such practices, often passed down through generations, highlight the global and cultural diversity in the use of cow dung for human health. Furthermore, ancient practices of incorporating cow dung into treatments for humans and animals continue to inspire new scientific investigations, especially considering the potential for beneficial bacteria in human health.[8]

Widely referred to as a "gold mine," cow dung has immense value not only for its applications in agriculture, energy production, and environmental protection but also for its growing importance in human health. In Indian traditions, for instance, cow dung is revered as part of the sacred "Panchagavya," a mixture used in Ayurvedic medicine for various health benefits, further emphasizing its cultural and medicinal significance.[9]

This review aims to consolidate and critically analyze the wealth of scientific research on the bioactive compounds, therapeutic properties, and health benefits of cow dung. By examining the intersection of ancient wisdom and modern science, this article seeks to unlock new potentials for integrating cow dung into contemporary wellness and therapeutic practices, paving the way for sustainable health solutions in the modern world.

Aim:

The aim of this review is to examine the scientific literature on cow dung's potential

health benefits, with a focus on its bioactive compounds, antimicrobial effects, immune-supportive properties, and applications in traditional and modern medicine. By systematically analyzing these areas, the review seeks to clarify the scientific basis for cow dung's therapeutic uses and propose safe and sustainable health applications.

Objectives:

1. To examine the Bioactive Compounds Present in Cow Dung and Their Health Potential: This objective aims to analyze studies that identify and characterize the various bioactive components of cow dung, such as phenols, flavonoids, and antioxidants, and evaluate their potential therapeutic effects in areas like inflammation and disease prevention.
2. To investigate Antimicrobial and Antifungal Properties of Cow Dung: Cow dung has been shown to contain microorganisms and compounds with antibacterial and antifungal properties. This objective aims to assess the effectiveness of these properties against common human pathogens, which could support its use in disinfectants, wound care, and skin health etc.
3. To explore the Role of Cow Dung in Immune Modulation and Gut Health: Research suggests certain microbial strains in cow dung may help enhance immune response and support gut health. This objective will examine how these microbial interactions contribute to immune modulation, with implications for cow dung's potential as a natural immunomodulatory agent.
4. To evaluate Traditional and Ayurvedic Applications of Cow Dung and Their Scientific Basis: Traditional medicine, particularly Ayurveda, has utilized cow dung for various health purposes. This objective aims to review and scientifically validate the traditional applications of cow dung, such as in skin treatments and detoxification, to bridge traditional knowledge with contemporary science.
5. To assess the Safety and Potential Applications of Cow Dung in Health and Wellness Products: Considering cow dung's bioactive and antimicrobial properties, this objective aims to review studies on the safety of cow dung for human health applications. It will also explore possible formulations for sustainable health products, contributing to eco-friendly health solutions.

Materials and Method

This review article is based on a comprehensive literature survey of peer-reviewed scientific articles, books, and reputable reports focused on the properties and health applications of cow dung. The primary sources included articles from journals related to microbiology, pharmacology, traditional medicine, and environmental science. Databases such as PubMed, Science Direct, JSTOR, and Google Scholar were searched to ensure a thorough and systematic collection of relevant studies.

The keywords used for the literature search included: "cow dung health benefits," "cow dung antimicrobial properties," "bioactive compounds in cow dung," "cow dung in traditional medicine," and "immunomodulatory effects of cow dung." Only articles published in English from the year 2000 to the present were included to ensure the inclusion of recent research. Studies focusing on human health applications, bioactive compounds, antimicrobial effects, immune responses, and traditional uses were prioritized.

Method:

1. Systematic Literature Review: A systematic approach was used to collect, filter, and analyze studies relevant to cow dung's health-related properties. The initial search identified approximately 150 articles, which were then screened by title and abstract for relevance to human health. After excluding articles that did not directly address health benefits, antimicrobial properties, immune modulation, or traditional uses, approximately 80 articles were selected for detailed review.
2. Data Extraction and Analysis: Data from selected studies were extracted into categories, including bioactive compounds, antimicrobial effects, immune modulation, and traditional applications. Extraction focused on identifying the key findings, methodologies, and conclusions from each study. Special attention was given to identifying the active microbial strains and biochemical compounds in cow dung linked to potential therapeutic applications.
3. Quality Assessment and Inclusion Criteria: To ensure quality and relevance, studies were assessed based on methodological rigor, sample size, and clarity in describing the isolation of bioactive components. Priority was given to studies with in vitro, in vivo, or clinical evidence related to the health effects of cow dung or its components. Studies lacking detailed methodology or presenting ambiguous findings were excluded.
4. Comparative Analysis of Traditional and Scientific Perspectives: Traditional Ayurvedic and ethnomedicinal uses of cow dung were cross-referenced with scientific findings to assess any convergence or divergence between traditional knowledge and modern evidence. Sources were evaluated to determine if traditional uses could be supported by biochemical and microbiological data from recent studies.
5. Synthesis of Findings and Identification of Research Gaps: Extracted data were synthesized into thematic sections covering bioactive compounds, antimicrobial properties, immune modulation, and potential health applications. Research gaps were identified by comparing the available literature with ongoing health needs, such as the demand for natural antimicrobials and eco-friendly health products, to suggest future research directions.

Result

The systematic review of the literature on cow dung in human health has revealed several significant findings across multiple areas, including its bioactive composition, antimicrobial properties, immune-modulating effects, and traditional applications. These findings collectively highlight cow dung's diverse therapeutic potentials while also identifying areas requiring further study.

Bioactive Composition and Therapeutic Potential: Studies have demonstrated that cow dung contains a range of bioactive compounds, including phenolic acids, flavonoids, and enzymes with antioxidant and anti-inflammatory properties (Chaudhary et al., 2021). These compounds are believed to neutralize free radicals and reduce inflammation, supporting potential applications in natural health products. Additionally, cow dung's rich microbial content, including beneficial bacteria such as *Lactobacillus* and *Bacillus* species, suggests further possibilities for therapeutic use in probiotic and skin health formulations.

In traditional practices, the dung of indigenous (desi) cows has been used to protect homes from ultraviolet radiation and as an organic manure for sustainable farming. Studies suggest that the dung of these cows may play a significant role in organic farming, owing to its high nutrient content and its eco-friendly benefits. Comparative studies on dung from desi and crossbred cows could further reveal differences in their nutrient profiles, supporting their value in organic agriculture.[10]

Cow dung has long been valued for its antiseptic properties, believed to prevent diseases by killing harmful microbes. Traditionally, it has been used to clean floors, wash vessels, and rinse clothes, especially in Indian villages, where it is still practiced to keep living areas hygienic.[11,12] Recent research, such as that by Mozhi et al. (2018), confirms these beliefs, showing cow dung extract—especially the methanol variant—effectively combats pathogenic microbes.[13]

Cow dung contains antifungal compounds, especially patulodin-like substances from bacteria like *Eupenicillium bovifimosum*, which inhibit pathogenic fungi.[14] This effect is enhanced when combined with cow urine, with studies showing cow dung and its extracts can effectively combat various harmful bacteria and fungi.[15]

Burning cow dung patties and applying cow dung coatings are traditional methods to repel mosquitoes, flies, and pests, with the ash acting as a natural insect repellent. Combining cow dung with neem leaves or herbs like tulsi and lemon grass has proven effective, offering eco-friendly mosquito control without synthetic chemicals, as supported by studies from Mandavgane et al. (2005) and Mukherjee et al. (2020).[16-19]

Unpublished data suggests cow dung smoke has antioxidant properties, with studies like Jirankalgikar et al. (2016) demonstrating its effectiveness.[20] Panchagavya ghrit, a ghee made from cow products, is also known for its antioxidant and hepatoprotective benefits, potentially aiding in degenerative diseases, cancer, and liver conditions.[21-23]

Cow dung smoke, often combined with camphor in incense sticks, is traditionally used as a natural antimalarial measure.[24] Studies also suggest cow dung's odor has antimicrobial effects, potentially aiding tuberculosis patients by reducing TB-related microbes in their environment.[25]

Antimicrobial Properties: A significant body of research highlights the potent antimicrobial effects of cow dung against various pathogens. In vitro studies have shown that the microbial strains in cow dung can inhibit common pathogens, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*.[26] These findings align with traditional uses of cow dung as a natural disinfectant and underscore its potential as a sustainable alternative to synthetic antimicrobial agents, particularly in topical applications and rural health care settings.

Immune-Modulatory and Gut Health Benefits: The immune-supportive role of cow dung has been documented in recent studies, with findings suggesting that its microbial strains may positively influence immune response. Certain bacteria in cow dung, including species from the *Lactobacillus* genus, have shown promise in balancing gut microbiota, enhancing immune resilience, and potentially acting as a natural immunomodulator.[27] This aligns with traditional Ayurvedic practices where cow dung is considered beneficial for overall vitality and immunity. However,

further clinical studies are needed to fully validate these effects in humans.

Validation of Traditional Ayurvedic Applications: Traditional Ayurvedic applications of cow dung, such as its use in wound healing and detoxification, were reviewed and found to have some scientific support. Cow dung ash, often used in Ayurveda, has demonstrated antibacterial activity that can support its use in traditional medicine as a disinfectant (Sharma & Tripathi, 2019). Additionally, cow dung's mineral composition, including calcium and magnesium, offers benefits in skin health, supporting its historical use in topical treatments. However, the need for standardized procedures and safety protocols remains crucial to ensure efficacy and minimize risks.

In Ayurveda, "Swedana" is a method used to purify *Ativisha*, which involves using cow's juice, known as *gomeya rasa*, as a key ingredient. This process using cow dung juice make a substance suitable for human consumption, helping by removing toxins and promoting overall detoxification of processed drug.[28] Cowpathy, an ancient system of medicine rooted in Ayurveda, is centered around the use of Panchagavya (a mixture of five cow-derived products) to enhance the immune system and protect the body from various diseases.[29] While some traditional texts mention the medicinal benefits of cow products, only a few claims have been scientifically validated. Notably, research has confirmed the beneficial properties of cow urine through patents, though there is limited evidence supporting the antimicrobial effects of cow dung.[30]

Safety Considerations and Product Development: While cow dung exhibits promising health benefits, safety considerations are essential due to the potential for contamination with harmful pathogens if improperly handled. Studies suggest that with controlled processing, cow dung can be safely used in health applications, particularly in products like natural disinfectants, wound dressings, and eco-friendly hygiene products.[31] The need for rigorous quality control and further toxicological studies remains a critical recommendation for future product development.

Environmental Protection and Sustainable Farming: Cow dung's role in environmental preservation is significant. When burned, cow dung can neutralize certain radiation levels, and its use in rural household construction (coating walls with cow dung) has been shown to reduce the impact of environmental pollutants, As evidenced during the 1984 Bhopal gas leak, where those living in cow dung-coated homes were less affected. Cow dung is also used in India and Russia to shield atomic power centers from radiation. Additionally, the practice of burning cow dung with ghee strengthens the ozone layer and shields the Earth from harmful solar radiation. Furthermore, cow dung is used in water treatment to neutralize acidity, particularly in ponds, reducing water pollution.[32]

Skin, Dental, and Eye Health Benefits: Cow dung is traditionally used for skin ailments, often in combination with neem leaves, to treat rashes and boils and also has potential as a natural and organic sunscreen, offering protection against harmful sun exposure.[33] Additionally, cow dung has found applications in dental care, where it may help in polishing teeth and reducing toothaches. The smoke from burning cow dung is also traditionally believed to benefit eye health, potentially by cleansing and stimulating tear production.[34] A study has documented the use of Bos taurus L. urine, dung and the bile in the regions of South Africa and Nigeria for treating skin infections.[35]

Disinfectant: Cow dung, along with its by-products like ash and urine, has been found to be effective in purifying water, particularly in removing heavy metals, making it suitable for drinking. As a natural, eco-friendly, and cost-effective disinfectant, cow dung ash can serve as an alternative to chlorine in water purification, while also enhancing the mineral content of water. It has long been used as a pesticide, and recent studies have further established its water purifying and disinfecting properties.[36]

A study has evaluated the effectiveness of cow dung ash (CDA) and activated cow dung ash (ACA) in removing organic contamination from wastewater, specifically landfill leachate. The results showed that ACA achieved up to 79% removal of Chemical Oxygen Demand (COD) at optimal conditions (30ºC, pH 6.0) in 120 minutes, outperforming regular CDA, which removed 66% COD at pH 8.0. The study also found that ACA was 11-13% more efficient than CDA, with strong correlations to Freundlich and Langmuir adsorption isotherms (0.921 and 0.976, respectively).[37]

One another study has found that cow dung ash removed up to 96% of chromium at different initial concentrations and adsorbent doses. The adsorption process followed the Freundlich and Langmuir models, highlighting cow dung ash as a promising material for metal ion removal from aqueous solutions.[38]

Safety and Quality Control in Product Development: While cow dung offers promising health applications, there are concerns around safety, particularly regarding contamination with harmful pathogens if not handled properly. Controlled processing methods can mitigate these risks, allowing for its safe inclusion in products such as natural disinfectants and hygiene solutions.[39] Rigorous quality control and toxicological studies are recommended to confirm the safety and efficacy of cow dung-based health products.

Controversial Insights of Cow Dung: In research, it has been stated about the highly dangerous risk of combined infections who live in close proximity to cows and/or their family member involved in cattle caring mainly cows.[40,41] A study has reported that cow dung is applied externally as an antiseptic on the stump of the cord immediately after the delivery and/or even some of the days after their delivery.[42] Though there are evidence and practices confirming the powerful antimicrobial effects of cow dung, the pregnancy deliveries performed in house involving the umbilical cord procedures and/ or discharged from the health centers after the cord procedures were counselled to take proper precautions. There is a risk of the incidence of new-born tetanus by the application of cow dung paste in the stump. Some of the raw practices in the name of rituals and beliefs were advised to be avoided since they are believed to have dangerous effects especially the rituals involving the application of plaster on the stump of the cord. Rather it can be replaced with the other medical practices or medicated plasters which are hygienic.[42]

Summary of Research Gaps and Future Directions:

The review identified several gaps in the current literature, including the need for more clinical trials to confirm cow dung's immunomodulatory effects, the establishment of safe processing protocols, and deeper exploration into its bioactive compounds. Addressing these gaps could support the development of cow dung-based natural health products that are both effective and safe for consumer use.

Discussion

The findings from this review underscore a growing body of research supporting cow dung's potential in human health applications, grounded in its rich bioactive and microbial composition. This discussion synthesizes the primary findings related to its therapeutic compounds, antimicrobial properties, immune-modulating effects, and potential integration into traditional and modern medical practices, as well as highlights the critical need for safety protocols and further research.

Bioactive Compounds and Antioxidant Properties: The bioactive compounds in cow dung, including phenolic acids, flavonoids, and enzymes, contribute to its anti-inflammatory and antioxidant effects, which may be beneficial in reducing oxidative stress and inflammation in various health conditions (Chaudhary et al., 2021). These antioxidant effects are significant, as oxidative stress is linked to numerous chronic diseases. The presence of natural antioxidants provides a scientific basis for the traditional use of cow dung in promoting general health, although further biochemical analysis and clinical trials are needed to quantify and confirm the efficacy of specific compounds.

Antimicrobial Efficacy Against Common Pathogens: One of the most compelling aspects of cow dung is its antimicrobial properties. The review reveals consistent findings across multiple studies regarding cow dung's ability to inhibit various pathogens, including *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* (Kumar et al., 2020). These effects support traditional practices of using cow dung as a disinfectant and topical treatment for skin infections. Notably, these properties could provide a foundation for developing natural antimicrobial products, which may serve as sustainable alternatives to chemical-based disinfectants and antibiotics. However, the potential for pathogenic contamination in cow dung necessitates controlled processing methods to ensure safety.

Immune-Modulatory and Gut Health Benefits: The immune-modulatory effects of cow dung appear linked to specific microbial strains within it, such as *Lactobacillus* and *Bacillus* species, which may support gut health and immune resilience (Patel et al., 2022). These findings align with the increasing interest in microbiome therapies for immune health, suggesting that cow dung's microbial content may act as a natural probiotic. However, robust clinical evidence is currently limited, particularly regarding the safety and efficacy of cow dung as an immune-modulatory agent in humans. Clinical trials assessing the microbiome and immune response impacts could strengthen the basis for integrating cow dung in gut health and immunity-supporting products.

Validation of Traditional Applications Through Scientific Evidence: The review indicates a substantial overlap between traditional Ayurvedic applications of cow dung and scientifically demonstrated properties. For example, the use of cow dung ash in Ayurveda as a disinfectant aligns with studies on its antibacterial properties (Sharma & Tripathi, 2019). This validation bridges traditional practices and modern scientific understanding, suggesting that certain applications of cow dung may hold therapeutic potential. Nevertheless, developing standardized formulations based on traditional practices would require stringent quality control to prevent health risks and ensure consistent efficacy.

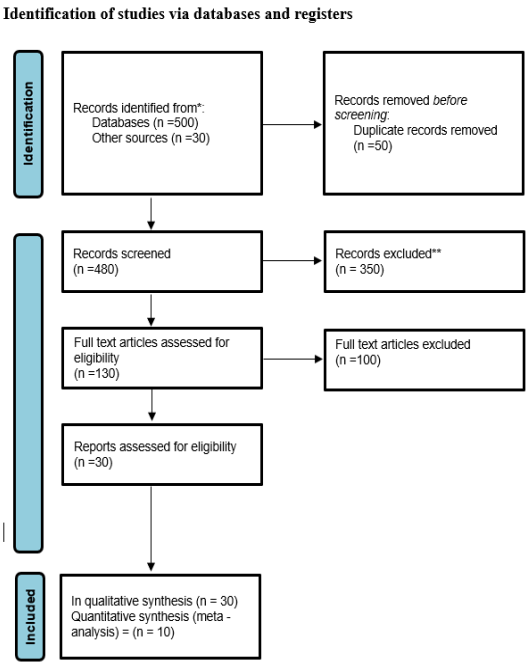
Safety Concerns and Need for Standardized Processing: While cow dung shows promise in health applications, its safety

remains a significant concern, particularly due to the risk of pathogenic contamination if improperly processed. The studies reviewed highlight the need for strict protocols in the processing and handling of cow dung to mitigate risks associated with harmful microbes and environmental toxins (Jadhav et al., 2020). Research focusing on sterilization and safe handling techniques could pave the way for cow dung-based products in healthcare while minimizing health risks. Additionally, standardizing dosage and formulation for specific therapeutic uses is crucial to ensure consumer safety and regulatory compliance.

Research Gaps and Future Directions: The review highlights notable research gaps that limit the comprehensive understanding of cow dung's health potential. Firstly, further research is needed on the specific mechanisms by which cow dung's bioactive and microbial components exert their health benefits, particularly in immune modulation and microbiome support. Clinical trials assessing cow dung's effects on human health outcomes are sparse but essential for developing safe and effective health products. Moreover, establishing regulatory frameworks and quality standards for cow dung-based products is a critical future step, especially as interest grows in sustainable and natural healthcare solutions.

Conclusion and Implications for Health Applications

The review indicates that cow dung has a scientifically supported basis for certain health applications, particularly as an antimicrobial agent and a potential immunomodulatory supplement. Its alignment with traditional medicinal practices further underscores the cultural and therapeutic value of cow dung, suggesting potential roles in modern natural health products. However, the review also calls for rigorous safety protocols, standardized processing, and clinical validation to enable safe, effective, and responsible applications of cow dung in human health.



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Oral Malodor (Halitosis)

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Abstract

The public is greatly concerned about the impact of breath on personal and professional aspects of life. It is an issue that affects one's quality of life and social relationships leading to feelings of self-esteem, sadness and other mood disorders. Professionals such as dentists, doctors, dietitians and psychologists should collaborate to assess and provide treatment for this problem. Therefore, it is crucial to study the causes and explore treatment options for halitosis. With society's increasing emphasis on cleanliness interest in odor has also grown. Bad breath can cause distress and impede social interactions because it is challenging to detect oral malodor on our own. Even individuals who do not have bad breath might experience anxiety or distress when they notice others reacting by pinching their noses or making grimaces during conversations. Given its origins, addressing breath requires a comprehensive evaluation and intervention from experts, in dentistry, medicine, nutrition and psychology.

Key words: *Malodor, Halitosis, Bad breath, Volatile sulfur compounds*.

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Introduction

Each of the many complex compounds that make up human breath has a unique scent that can lead to unpleasant conditions like halitosis. Halitosis is a combination of the Latin words halitus, which means "breathed air," and osis, which means "pathologic alteration."[1]

The disagreeable breath odor that emanates from the mouth is known as oral malodor, or halitosis.[2] Regardless of whether the disagreeable components in expired air originate from nonoral or oral sources, the term "oral malodor" encompasses any offensive odor. It is also known as breath malodor, halitosis, or fetor ex ore or fetor oris. Anaerobic oral bacteria that create volatile sulfur compounds (VSCs) are responsible for about 80% to 90% of cases of halitosis.[3]

Oral malodor is mostly caused by volatile sulfur compounds (VSCs), which include hydrogen sulfide, methyl mercaptan, and dimethyl sulfide. These molecules have been linked to the pathophysiology of

periodontal disease because of their extremely low toxicity to oral tissues, detrimental effects on human gingival fibroblast protein production and collagen metabolism, activation of oxidative stress, and other variables.

This suggests that many patients who first complain of bad breath will also have some degree of gingival and periodontal disease. People with periodontitis who have bad breath are said to have more advanced disease than those without.[4] Halitosis is thought to involve non-oral causes in 10–20% of cases.[5]

Oral health behavior is significantly influenced by attitudes and beliefs about oral health.[1] The patient and dentist must work together to maintain a healthy oral profile. How a population feels about their dentition is one of the most important elements influencing their dental health.[6] Interest in odor has increased as society becomes more sanitary. Mouth odor is difficult to detect on one's own, therefore foul breath has a significant negative impact. Many people worry or get upset about their mouth odor, even if they do not have it. During a conversation, people may assume someone has foul breath if they grimace or squeeze their nose.[7]

Classification of Halitosis (Types of Halitosis)

According to origin

Physiologic malodor: Caused by a reduction in salivary flow.

For instance, the aromatic molecules in tobacco and some foods, such as onions and garlic, can also contribute to foul breath.

- Pathologic malodor: The existence of a preoccupation with unpleasant mouth odor.

  e.g.: Periodontal disease, poor oral hygiene, tongue coat, food impaction, unclean dentures, faulty restorations, oral carcinomas, and throat infections.
- Pseudo malodor: Others do not notice halitosis, and with counseling and easy fixes, the issue gets better.
- Halitophobia: When a patient continues to have halitosis despite the absence of overt symptoms.

According to cause

- **Oral:** Xerostomia, tongue coating, dry socket, exposed necrotic pulp, smoking, stress, poor oral hygiene, periodontal diseases, and food impaction.
- **Non-oral:** Infection of the tonsils, maxillary sinuses, throat, nose, ear, or pulmonary system

Malodor: Oral malodor is common and can affect people of all ages. When severe or chronic, it may reduce self-confidence and social relationships.[8]

Box 1: Common causes of the manifestation of oral halitosis

Oral disease
- Food impaction
- Acute necrotising ulcerative gingivitis
- Acute gingivitis
- Adult and aggressive periodontitis
- Pericoronitis
- Dry socket
- Dry mouth
- Oral ulceration
- Oral malignancy

Respiratory disorder
- Foreign body
- Sinusitis
- Tonsillitis
- Malignancy
- Bronchiectasis

Volatile foodstuffs
- Garlic
- Onions
- Spiced foods

Problems faced by patients: Oral malodor is a major problem for the public because of its detrimental consequences on both personal and professional lives.4. It is a significant problem that harms quality of life and social interactions, which in turn directly contributes to depression, low self-esteem, and other mood disorders.[9] The barrier that the afflicted people's foul breath places in their connections with their

friends, family, and coworkers has a devastating effect on their everyday social life and interpersonal contact. Therefore, it is commonly known that when someone sees oral bad breath, whether real or imagined, it causes them to take behavioral action to breathe fresh air again, which in turn promotes their social and psychological well-being.[10] Understanding one's own sense of mouth odor, the harmful effects of smoking, and one's own oral hygiene habits may therefore be necessary.[3]

Sources of malodor: Oral odor is prevalent upon awakening and is not believed to be a sign of halitosis. The most common causes of persistent foul breath are oral or, in rare instances, nasopharyngeal diseases. The most common cause of foul breath is the buildup of food particles and dental bacterial plaque on the tongue and teeth due to inadequate oral hygiene, which causes inflammation of the gingiva and periodontal tissues. The most noticeable halitosis is caused by acute necrotizing ulcerative gingivitis (Vincent's disease, trench mouth), while it can be caused by most forms of gingivitis and periodontitis. Unpleasant oral scents can result from aggressive periodontitis, which is characterized by rapid loss of periodontal bone and consequent tooth movement. Bad breath can also be caused or made worse by poor oral hygiene brought on by xerostomia (dry mouth), and some research indicates that wearing dentures may sometimes make bad breath worse by increasing deposits of tongue coat.[8]

Other sources of malodor: A common mild, transient mouth odor that often develops after sleeping is called morning halitosis. This may be more common in those who sleep in warm, dry conditions or those who have nasal blockages, such as those who have upper respiratory infections. A person may experience transient bad breath after eating volatile foods like garlic, onions, or spices (durian is said to be the worst). This smell could last for a few hours. Cigarettes and alcohol can produce unique mouth scents that can linger for several hours, much like betel nut products can have an almost constant stench if a person has a chronic habit.[8]

Oral malodor may be caused by respiratory tract diseases or by nasal or sinus secretions that reach the oropharynx, or by those who breathe mostly via their mouth. Tonsillitis can also result in halitosis. Additionally, a strong stench coming from the breath could be caused by foreign items in the nose.[11] Lung infections like bronchiectasis and lung infections linked to malignancy can also cause halitosis.

In rare cases, foul breath can result from several systemic diseases. The halitosis linked to these conditions is typically an unintentional discovery made during a clinical examination rather than an early indication of the disease, like undiscovered type 1 diabetes mellitus. Interestingly, Helicobacter pylori infection has been connected to a subjective alteration in oral odor.[12] Bad breath is a rare side effect of many drugs. For example, nitrates, dimethyl sulfoxide, phenothiazines, amphetamines, and nitrates.

Body odor and chronic bad breath are hallmarks of trimethylaminuria, sometimes known as "fish odor syndrome," an uncommon condition. Trimethylamine in excess produces a powerful ammoniacal smell like that of rotting fish. This disease can be brought on by either flavin defective (usually genetically determined) monooxygenase activity or an overabundance of flavin monooxygenase precursors, like those generated when choline is used to treat Alzheimer's disease or Huntington's chorea.[13]

Hypermethioninemia is another rare metabolic condition that can result in foul breath.[14]

To lessen their perceived issue, these people may eventually begin to do a variety of things, such as covering their lips when speaking, avoiding other people, or avoiding social situations. Such individuals typically misunderstand other people's actions as a sign that their breath is offensive.[8] Halitophobics usually get obsessed with cleaning their teeth and tongue, abusing mouthwash, mints, chewing gum, and sprays to ease their discomfort.[8]

Box 2: Clinical assessment of oral halitosis

Subjective

- Intensity-the organoleptic procedure
  - Smelling expelled air of mouth and nose separately
  - Easy to do, requires no clinical training
- Quality-the hedonic procedure
  - Rarely clinically applicable
  - Requires well trained clinical judges

Objective

- Detection of sulphides with appropriate monitor—simple, but may fail to detect oral halitosis caused by non-sulphides components
- Gas chromatography—not applicable for routine clinical practice
- Bacterial detection (such as benzoyl-arginine-naphthylamide test, polymerase chain reaction, dark field microscopy)—not applicable for routine clinical appication

Diagnosis: The clinical assessment of oral malodor is usually subjective (organoleptic evaluation) and involves smelling and comparing the air exhaled from the mouth and nose. If you smell bad in your mouth but not in your nose, it is most likely emanating from the throat or mouth. The sinuses or nose are most likely the source of any odor that originates only from the nose.[15] In rare cases, a systemic cause of the malodor may be expected if the severity of the mouth and nose scents is similar (box 2). The hedonic approach uses trained clinical judges to assess the quality of odor.[16,17]

Objective evaluation of the breath components is rarely used in routine clinical practice due to its high cost and time commitment. Although it is feasible to measure volatile sulfur compounds with a portable sulfide monitor, the source and intensity of oral malodor may not be precisely identified because it can be caused by substances other than volatile sulfur compounds. Despite being a potential method for determining the constituents of oral foul odor, gas chromatography of breath is not routinely employed in clinical settings. Similarly, the typical clinical assessment of oral malodor does not include the identification of bacteria that have trypsin-like activities (as shown by the benzoylarginine-naphthylamide test, dark field microscopy, and real-time quantitative polymerase chain reaction).[8]

Treatment of halitosis: Box 3 explains the halitosis treatment procedure. Reducing the accumulation of oral bacteria and educating the patient about the causes and prevention of the condition are the primary objectives of treatment. Bad breath can be significantly reduced by practicing good oral hygiene, such as brushing and flossing between teeth, especially for people with gingival and periodontal disorders. [18,19]

It is recommended to clean the tongue since it may be the source of foul breath if oral hygiene is already good or improves but the habit persists. A recent systematic analysis suggests that tongue scraping may only offer a slight long-term advantage in getting rid of mouth odor.[20] On the other hand, patients may benefit—at least temporarily—and no harm is anticipated if tongue cleaning is done regularly and

gently. Chewing gum seems to only momentarily lessen foul breath.[1]

Box 3: Treatment of oral halitosis
- Examine and manage possible systemic (non-oral) source if organoleptic procedure detects halitosis from both mouth and nose
- More oral hygiene by professional and patient administered tooth cleaning
- Routine atraumatic tongue cleaning
- Routine use of antimicrobial toothpastes and mouthwashes, such as Chlorhexidine gluconate, Methylpyridinium, Oil-water rinse, Triclosan/co-polymer/sodium fluoride toothpaste
- Routine clinical review to ensure maintenance of effective oral hygiene
- Halitophobia warrants referred to clinical psychologist

Lowering the bacterial load or the odoriferous substances that accompany it is how the range of mouthwashes suggested for treating oral malodor work.[22] Because it lowers the quantity of bacteria that produce volatile sulfur compounds, mouthwash or spray containing chlorhexidine gluconate may be more effective than oral hygiene alone at reducing oral odor for a few hours.[23] Another way to lessen oral odor is to use a mouthwash that contains cetylpyridinium chloride, zinc lactate, and chlorhexidine. Patients may be reluctant to use chlorhexidine for an extended length of time, though, due to its disagreeable taste, ability to burn the oral mucosa when used excessively, and potential for (reversible) tooth discoloration. A two-phase oil and water mouthwash can get rid of dental odor for hours without having any bad side effects.[24, 25] Additional mouthwashes that help lessen oral halitosis for hours include zinc chloride, cetylpyridinium chloride, and chlorine dioxide.[26,27]

Because triclosan has an antibacterial effect in addition to its direct action on volatile sulfur compounds, it may reduce oral halitosis when added to mouthwashes and toothpaste. The solubilizing agent used to administer triclosan, however, seems to have the biggest impact on the medication's capacity to neutralize volatile sulfur compounds. A combination of triclosan, co-polymer, and sodium fluoride seems to be particularly effective in reducing volatile sulfur compounds, oral bacteria, and bad breath.[28,29]

Experimental strategies to lessen oral halitosis include the use of glycosylation inhibitors, like d-galactosamine, the probiotic placement of bacteria, like Streptococcus salivarius, that alter the bacteria causing oral halitosis, light uncovering that directly inhibits bacteria that produce explosive sulfur compounds, or lethal photosensitization.
A licensed psychologist must refer patients with halitophobia for assessment and therapy. Unfortunately, few of these patients are prepared to proceed with this treatment.

Conclusion

As society grows more hygienic, interest in odor has grown. Bad breath is extremely painful psychologically and might interfere with social interactions because it is impossible to identify on one's own. Oral malodor can cause anxiety or distress for many people, even if they do not have it. People may presume someone has oral malodor if they see them clutching their nose or grimacing during a discussion. It required an interdisciplinary assessment and treatment plan from specialists such as psychologists, doctors, dietitians, and dentists because of its complex nature.

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Behavioural Problems

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Abstract

Childhood is a phase of development when children develop motor and social skills, language & behavior, learn to regulate emotions and control their behavior. Any disruption to a child's mental or emotional development might result in behavioral problems. Certain kids exhibit remarkably tough and demanding behaviors that defy expectations for their age group. Childhood mental health problems are quite prevalent. These include developmental issues anxiety, depression, ODD, CD, and emotional-obsessive-compulsive disorder.
Keywords: *Behavior, Epidemiology, Types*

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Introduction

The point at which two gametes that have been charged with energy come together to form a zygote is where life begins. Life has always operated under the principle of survival of the fittest; over its lengthy journey from a single-celled zygote to a multi-organ baby, life has adapted to its mother's womb. Every stage, from the initial union to the child's rearing, influences how a child develops into a typical youngster or one who exhibits certain behavioral issues.

Children are invaluable to their parents and represent the future of the nation. Childhood is a critical period during which children acquire motor and social skills, develop language and behavior, and learn to manage their emotions and actions. From the time they are in the womb, children undergo various stages of physical, mental, and social growth until they reach adulthood. Interruptions in a child's mental or emotional development can lead to behavioral issues.

It's common for young toddlers to occasionally act impulsively, defiantly, and naughtily. Nonetheless, certain kids exhibit remarkably tough and demanding behaviors that defy expectations for their age group. These days, it's typical for behavioral issues to surface currently as kids attempt to adjust to the changing environment, establish their independence, and go through different changes like starting school or meeting new friends.

Epidemiology

Children under the age of 15 make up about one-third of the global population, with an

estimated 10–15% affected by behavioral disorders. Approximately 80% of these children live in developing countries where mental health services are minimal or unavailable. Recent studies indicate that mental health issues among school-aged children range widely, from 6.33% to 43.1%. Among orphans, the prevalence of behavioral and emotional problems is even higher, varying between 18.3% and 64.53%. Overall, research shows that behavioral disorders affect 10% to 42% of children and adolescents, with a higher occurrence in males. In India, community-based studies have reported prevalence rates between 6.3% and 12.5% among children aged 0 to 16 years across different regions.

As per the Government survey > 400 Indian students lost their life in abroad due to Suicide in last 5 years. Childhood mental health problems, or MHDs, are quite prevalent. These include developmental issues (speech/language delay, intellectual impairment, autism spectrum), anxiety, depression, ODD, CD, and emotional-obsessive-compulsive disorder (OCD).

Causes:

The exact causes of Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), and Attention Deficit Hyperactivity Disorder (ADHD) remain unknown, but several risk factors have been identified:

- Gender: Boys are more commonly affected than girls.
- Gestation and Birth: Complications during pregnancy, premature birth, low birth weight, and isolated environments can contribute to behavioral problems later in life.
- Temperament: Children who display early signs of moodiness or aggression are at higher risk for developing behavioral disorders.
- Family Environment: Dysfunctional family settings, such as those involving domestic violence, poverty, poor parenting, or substance abuse, increase the likelihood of behavioral issues.
- Learning Difficulties: Problems with reading and writing often correlate with behavioral challenges.
- Intellectual Disabilities: Behavioral problems are twice as common in children with intellectual impairments.
- Brain Development: Research suggests that children with ADHD show reduced activity in brain regions responsible for attention control.
- Modern Technology: Increased exposure to screens like mobiles and TVs, along with reduced outdoor playtime, may hinder the development of communication skills.

Studies indicate that consumption of energy drinks may raise the risk of mental health disorders in children.

Types of Behavioral Problems

- Oppositional Defiant Disorder (ODD): Approximately 10% of children under 12 are affected, with boys twice as likely as girls to develop the disorder.
- Conduct Disorder (CD): Children with CD often engage in delinquent behavior, reject rules, and are frequently labeled as “bad kids.” Boys are four times more likely than girls to have CD. Typical behaviors include frequent disobedience, lying, running away from home, early drug and alcohol use, aggressive tendencies (including fighting and weapon use), criminal acts (such as theft, arson, and vandalism), lack of empathy, and cruelty towards animals or others, including bullying and abuse.
- Attention Deficit Hyperactivity Disorder (ADHD): Affecting around 2–5% of children, boys are three times more likely to have ADHD than girls. Symptoms include difficulty focusing, forgetfulness, inability to complete

tasks, impulsiveness (such as interrupting others or quick temper), hyperactivity (restlessness and constant movement), avoidance of eye contact, repetitive movements (like hand waving or spinning), and delayed milestones such as walking and talking.

- Anxiety: Children with anxiety disorders suffer from persistent fears and worries that do not subside. They may fear separation from parents, avoid social situations like school, constantly worry about disasters, and often experience panic attacks.
- Depression: Depressed children struggle to overcome feelings of sadness for extended periods. They may lose interest in activities, experience sleep disturbances (too much or too little), have low energy, become absent-minded, change eating habits, and sometimes engage in self-harm.
- Post-Traumatic Stress Disorder (PTSD): Children exposed to traumatic or stressful events may develop PTSD, showing long-lasting emotional distress. Symptoms include frequent replaying of the trauma, nightmares, sleep disturbances, avoidance of reminders, emotional numbness, and heightened sensitivity to triggers.

Conclusion

Children facing behavioral challenges should be treated with kindness and understanding. It is important to identify the underlying causes of these issues and implement appropriate interventions to help the child experience a healthy and normal childhood.

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Therapeutic Massage: Role in Homoeopathic Treatment – A Review

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Abstract

Homoeopathy is a therapeutic system follows Similia similibus curentur i.e. like is cured by likes. Here substances are used as curative agents which are applied by above mentioned principle. Massage is used in homoeopathy as an accessory method in convalescent stage after a long chronic sufferer cured from his disease. Massage brings a speedy recovery of lost flesh, weakness of digestion & loss of sleep, in subjects who are already cured by homoeopathic medication.

Key words: *Organon of Medicine, Therapeutic massage, Chronic disease, Homoeopathic massage, Mesmerism*

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Introduction

The term *massage* is derived from the Arabic word *mass*, meaning "to press." It involves the skilled manipulation of the body's soft tissues using the hands to influence the nervous, muscular, and circulatory systems. This technique helps enhance or restore bodily function. Massage serves as a natural method for generating energy and promoting the recovery of injured areas, whether localized or widespread. Mastery of massage requires both mental focus and manual skill, which are developed through practice.

Effects of Massage

Mechanical Effects

- Helps remove dead skin cells.
- Clears blockages in sweat glands, hair follicles, and sebaceous glands, improving their function.
- Enhances the skin's natural lubrication.
- Generates warmth in the treated area.
- Assists in the treatment of scar tissue and adhesions.
- Supports and maintains the mobility of newly formed skin tissue.
- When applied over the lungs, it helps loosen mucus stuck in the bronchial passages.
- Stimulates increased blood flow (hyperaemia) through histamine release, which improves tissue flexibility, boosts parasympathetic activity, relaxes muscle tone, and helps reduce swelling (edema).

Physiological Effects

Circulatory System

- Skin color changes occur as a result of enhanced blood circulation, increased blood flow velocity, and greater blood viscosity.
- Massage can influence blood pressure, heart rate, skin temperature, electrical conductivity of the skin, and oxygen consumption.
- It also stimulates the release of histamine from mast cells, basophils, and platelets, triggering the "triple response":
  - ✓ Dilation of small blood vessels
  - ✓ A red flush or flare around the treated area
  - ✓ Mild swelling or puffiness

Nervous System

- Spinal motor neuron excitability is lowered due to a decrease in the Hoffman reflex, indicating reduced activity in spinal reflex pathways.
- Massage has an inhibitory effect on alpha motor neuron excitability, although this effect is temporary and doesn't persist after treatment.
- It promotes the release of endorphins, which helps in alleviating chronic pain.

Musculo-Skeletal System

- Influences muscle fatigue, helping to reduce it.
- Alters the level of muscle tone, either relaxing or stimulating the muscles depending on the technique used.

Psychological Effects

- Has a beneficial impact on psychological well-being.
- Enhances feelings of relaxation and restfulness.
- Lowers anxiety levels and reduces the production of stress hormones.
- Boosts immunoglobulin A levels, supporting a stronger immune system.
- Aids in alleviating depression and managing adjustment disorders.
- Contributes to better pain management and increases mental energy.
- Leads to improved sleep quality and more restful sleep.

Contraindications

Absolute contraindications

- Presence of tissue inflammation or cancer (malignancy)
- Circulatory issues, such as a tendency to bleed easily
- Impaired or abnormal sensation in the area
- Skin conditions or infections
- Early-stage bruising
- Unhealed scars or open wounds
- Areas near a recent bone fracture
- Active inflammation or tubercular infection affecting joints or soft tissues
- History or suspicion of deep vein thrombosis (DVT)
- Burn injuries
- Severe or advanced osteoporosis

Relative contraindications

- Elderly individuals
- People with delicate or sensitive skin
- Those in the initial stages of osteoporosis
- Children
- Adults with cognitive and/or physical impairments
- Individuals recovering from infections or bone-related conditions

Treatment Planning

Patient examination involves assessing both subjective and objective history, including the onset, characteristics, and intensity of symptoms, as well as factors that worsen or relieve them. It also includes evaluating clinical signs, posture, range of motion, activity levels, muscle strength, balance, coordination, gait, and any muscular issues.

Determine indications

- The decision to perform massage and choose specific techniques is made based on the patient's examination.
- Careful observation and palpation are essential.
- Assess the quality of tissue movement—for example, use kneading or lifting techniques for loss of elasticity, and skin rolling for stiffness.

Outcome measures include: heart rate, blood pressure, respiratory rate, electromyography (EMG), mood and anxiety levels, pain intensity, lung vital capacity, joint range of motion, muscle spasms, swelling, edema, and proprioception.

Palpation & Skills

- Palpation must be consistent, dependable, and accurate.
- Both the patient's and physiotherapist's positioning should be carefully considered to ensure the hands are precise, sensitive, and correctly assessing the intended areas.
- Make well-informed decisions about when massage should or should not be performed.

Preparation Before Massage

- Ensure all body parts to be treated are easily accessible.
- Be ready to adjust the patient's position smoothly if necessary.

Self-Preparation of the Therapist

- Maintain good personal hygiene, neat appearance, and well-groomed nails.
- Wear comfortable, protective clothing that allows freedom of movement and is easy to wash.
- Secure long hair and remove jewelry.
- Take good care of your hands.
- Practice strict cleanliness by washing hands before and after treatment to prevent infection.
- Warm your hands prior to contact.
- Maintain good range of motion in your forearm and arm, including thumb abduction and extension, wrist flexion and extension, and forearm pronation and supination.

Hand Exercises: Include stretching and abduction of fingers, prayer pose, and reverse prayer pose.

Hand Relaxation

- Keep full contact with the patient, molding your hands to their body shape.
- Hands should be naturally relaxed with thumbs and fingers slightly flexed and spaced.
- Relax the entire arm, especially for certain manipulations.
- Practice relaxation techniques, such as reciprocal relaxation, to enable coordinated and fatigue-free movements without physical strain.

Environment Setup

- Use a quiet, warm, and well-ventilated room.
- Provide padded, adjustable couches or chairs with washable covers.
- Have towels to cover untreated areas, pillows for support, and disposable paper sheets available.

Contact Medium

- Use substances that allow smooth hand movement and reduce friction, such as talcum or corn starch powder, pure lanoline, liquid oils (vegetable oils, liquid paraffin), creams, water-based lubricants, or soap and water.
- Always check for allergic reactions before use, as some contact media can cause mild to severe allergies

Patient Preparation

- Instruct the patient to undress the area being treated and remove all jewelry.
- Areas commonly treated include:
  - Upper limb (neck to fingers)
  - Lower limb (groin to toe)
  - Back (head to buttocks)
  - Neck (head to T12 vertebra)
  - Face (hairline to just below the clavicle)
- Keep the patient warm and comfortable using pillows for support.

Examination of the Area

- Assess the skin's condition—whether it is dry, oily, wet, or hairy—and check for bruises, abrasions, or cuts.
- Evaluate the texture and feel of the tissue.

Precautions for Ticklish Patients

- Maintain firm, continuous hand contact; avoid lifting your hands as this can cause tickling.
- Avoid using only fingers during contact, as light touches tend to provoke ticklish responses.
- Perform manipulations at the deepest level the patient can tolerate to minimize tickling sensations.

Massage in Homoeopathy

In homoeopathy massage is an auxiliary therapeutic procedure which is used in convalescence stage after recovery from chronic disease. As per Hahnemann it should be given by good-natured vigorous person & massage is to be applied on chronic invalids, who, though cured, still suffers from loss of flesh, weakness of digestion and lack of sleep due to slow convalescence. As we have discussed above Hahnemann given the same caution as it is not to be applied on hypersensitive patients. Hahnemann also stated that mesmeric influence (animal magnetic influence by which a vigorous person infuses his energy into a debilitated patient) of the procedure is the chief feature which helps in recovery of the patients.

There is another procedure mentioned by Hahnemann in 5th edition of Organon of medicine as "Rubbing-in" method where medicinal preparation is rubbed in patients' sensitive part of skin, thus the medicinal power is communicating to the whole organism. But he also mentioned, in Homoeopathy, we hardly ever require for its cures the rubbing-in of any medication.

Conclusion

In Homoeopathy massage is an important therapeutic method which helps in speedy recovery after the patient cured by homoeopathic medicine.

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3D Printing: Techniques and Application in Dentistry: A Review.

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Abstract

Three-dimensional (3D) printing technologies are advanced manufacturing techniques that use computer-aided design digital models for the automated manufacture of customized 3D products. With a history spanning over three decades, these technologies have found widespread applications across various industries, including design, engineering, and manufacturing. Within the realm of process engineering, 3D printing brings numerous advantages and finds applications in diverse fields such as prosthodontics, oral and maxillofacial surgery, oral implantology, orthodontics, endodontics, and periodontology. The purpose of this paper is to provide a practical and technical overview of 3D printing technology by introducing modern 3D printing processes such as powder bed fusion, photopolymerization molding, and fused deposition modeling. Furthermore, it delves into the clinical applications of 3D printing in dentistry, including the creation of functional models and primary applications in prosthodontics, oral and maxillofacial surgery, and oral implantology. The benefits of 3D printing technologies encompass efficient material utilization and the capability to fabricate intricate geometries, but they come with drawbacks such as high costs and time-intensive post-processing. Looking ahead, the future trajectory of 3D printing in dentistry points toward the evolution of new materials and technologies, leaving no doubt that 3D printing holds a promising and vibrant future within the field.

Key words: *3D printing, applications in dentistry, techniques*

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Introduction

Recent years have seen technology play a crucial role in dentistry, transforming treatment procedures and educational tools across various dental specialties. Dentistry now embraces a digital workflow consisting of three main elements: scanning for data capture, CAD software for data processing, and CAM for producing dental products. Traditional subtractive manufacturing methods were slow, wasteful, and unsuitable for complex anatomical structures. To address these issues, 3D printing technology was introduced to revolutionize dentistry.[1]

Evidence indicates that the inaugural 3D printing technique was introduced by Charles Hull in 1986. Subsequently, a

multitude of advancements spanning various fields and encompassing numerous therapeutic applications have been documented. Hull was a trailblazer in the realm of stereolithography (SLA), having conceptualized and refined a 3D printing approach in the year 1986.[2-5] Additionally, Scott Crump secured a patent for fused deposition modeling (FDM) in 1990. Subsequent to these pioneering efforts, 3D printing has undergone substantial evolution and progress.[6]

The term "3D printing" typically describes a manufacturing process in which objects are built by adding material layer upon layer. This process is more precisely known as additive manufacturing or rapid prototyping. It is often referred to as desktop fabrication, involving the synthesis of a structure from a 3D model.[7] The 3D design is typically stored in STL (surface tessellation language or Stereolithography) format and then sent to a 3D printer. Various materials like ABS (Acrylonitrile butadiene styrene), PLA (Polylactic Acid), and composites can be used in this process.[8]

The development of RP (Rapid Prototyping) technology unfolded in three distinct phases:[9]

- In the initial phase, skilled craftsmen manually crafted prototypes.
- The second phase, in the mid-1970s, a development emerged that introduced the idea of applying precise materials to soft prototype models in a virtual manner, utilizing 3D curves.
- The third phase, which began in the 1980s, embraced a layer-by-layer approach to prototype creation.

This summary focuses on three primary 3D printing methods: powder bed fusion (PBF), light curing, and FDM. It also explores the diverse applications of 3D printing in the field of dentistry, which encompass creating functional models and its significant contributions to various aspects of oral healthcare, including oral medicine and radiology, endodontics, orthodontics, periodontology, prosthodontics, oral and maxillofacial surgery, and oral implantology.

3-D Printing Techniques

Three primary 3D printing technologies, namely PBF, light curing, and FDM, can be further categorized into specific methods, each offering its unique advantages. [(7)] These methods include SLA, FDM, Selective Laser Sintering (SLS), Selective Heat Sintering (SHS), Selective Laser Melting (SLM), Electron Beam Melting (EBM), Binder Jetting (BJG), Photo polymerization, DLP projecting, and Laminated Object Manufacturing (LOM).[10]

The table, summarizes the three main 3D printing technologies, their classifications, materials used, and their key advantages:[2-6]

Powder Bed Fusion
- Classifications: SLM, SLS, EBM, DMLS
- Materials: Metal materials
- Advantages: No binding process required, suitable for metal, and offers high strength.

Light Curing
- Classifications: SLA, DLP, PJ
- Materials: Resin, Ceramic [11]
- Advantages: Good mechanical resistance, reduced construction time, and high surface quality of printed objects.

Fused Deposition Modelling:
- Materials: Thermoplastic materials
- Advantages: Biocompatible, high mechanical strength of fabricated scaffolds.[12]

In short, these 3D printing technologies offer various advantages such as strength, speed, and quality, depending on the materials and methods used.[12]

1. Powder Bed Fusion (PBF) - Versatile 3D printing technology that uses laser or

electron beam radiation to sinter or fuse powdered materials, solidifying them upon cooling.[14] PBF includes methods like Selective Laser Melting (SLM), Selective Laser Sintering (SLS), Electron Beam Melting (EBM), and Direct Metal Laser Sintering (DMLS), all relying on heat to melt powders. In dentistry, PBF is employed to create various metal products, such as titanium (Ti) dental implants, custom Ti implants, cobalt-chromium (Co-Cr) frames, and even ceramic restorations like frame crowns and model casting abutments.[15,16]

It's important to note that the terms "laser sintering" and "selective laser melting" can be ambiguous. SLS and DMLS operate below materials' melting points, resulting in partial melting, porosity, and rough surfaces.[17] In contrast, SLM and EBM directly melt the powder at the material's melting point in an inert environment. Powder Bed Fusion involves applying powdered material onto a build platform and selectively fusing particles based on a CAD file's design. The build platform descends layer by layer until the object is complete.[16]

Titanium and its alloys, particularly when processed with SLS, exhibit impressive strength and ductility. Ceramics can also be used in SLS for dental applications, usually involving polymer bonding and sintering.[18] SLM eliminates the need for debinding, resulting in shorter fabrication times compared to other 3D printing methods. However, rapid heating and cooling can induce thermal stress, which can be mitigated by preheating the powder. SLS-based products may exhibit weaknesses and porosity, requiring complex post-processing, whereas DMLS products tend to be denser. An innovative use of DMLS involves creating custom Ti meshes for bone regeneration in atrophied maxillary dental arches, as demonstrated by Ciocca et al.[19]

2. Light Curing - Subset of 3D printing methods that utilize photosensitive resin materials solidified by exposure to light.[20] This category includes Stereolithography (SLA), Digital Light Processing (DLP), and Photo Jet (PJ). The process in SLA and DLP involves three main steps: light exposure, platform movement, and resin replenishment.[19]

SLA, one of the earliest 3D printing technologies, employs a UV laser to solidify a liquid resin.[21] In SLA, the build platform can move either from the top-down or bottom-up, with the bottom-up approach being preferred in most cases due to advantages like reduced oxygen interference, operator safety, and automatic resin replenishment via gravity.[20]

In ceramics applications, SLA combines ceramic particles with a curing resin, selectively curing a ceramic slurry. Achieving the right balance between ceramic powder content and resin viscosity is crucial for mechanical properties. Ceramics like alumina and zirconia, known for their mechanical resistance, are commonly used in applications such as polycrystalline ceramic crowns (Fig 1).[20-22]

In contrast, Photo Jet (PJ) employs a photopolymerizable inkjet system in which the printhead moves along the X/Y-axis, spraying photopolymer onto the table. Simultaneously, an ultraviolet lamp emits light in the same direction as the printhead's movement to cure the photopolymer, completing one layer of printing. The table then descends along the Z-axis, and this process repeats until the object is fully printed. PJ is distinguished by its material versatility, accommodating a wide range of materials from thermoplastics to resins and ceramics, including zirconia paste. It has

the capability to blend materials, allowing for objects with diverse properties.[21] PJ also produces high-quality surfaces and print resolutions, eliminating the need for extensive post-printing polishing.[22]

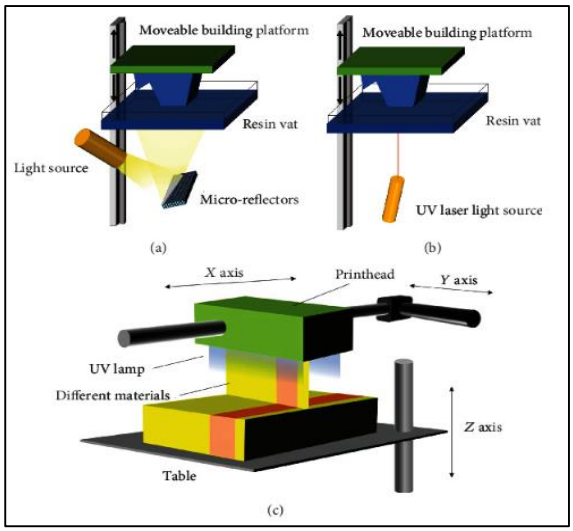

Fig 1: Schematic diagram of three-dimensional (3D) technologies. (a) Digital light processing. (b) Stereolithography. (c) Fused deposition modelling

Light-curing technology encompasses SLA, DLP, and PJ, each with its unique approach to 3D printing using photosensitive resins. These methods offer a variety of material options and distinct advantages, making them suitable for diverse applications and industries.[20]

3. Fused Deposition Modelling (FDM) - Widely utilized and cost-effective 3D printing technology in dentistry. It involves heating and melting a filamentous thermoplastic material through a nozzle.[21] The nozzle and worktable are operated by a computer, causing them to move in the horizontal (X-axis) and vertical (Y-axis) directions. As they move, they extrude the molten material onto the worktable in layers, which then solidify to form the desired end product.[22] FDM is favored in dentistry for its versatility and affordability, capable of using various engineering thermoplastics.[21] PLA, for instance, is suitable for oral applications, and FDM has shown promise in producing biocompatible dental scaffolds and custom dental devices.[22]

Application in dentistry

3D printing's digitalization has ushered in substantial progress in dentistry, delivering precision and versatility across various applications. This emerging technology has enhanced diagnostic precision, simplified treatment processes, and minimized chair-side time, empowering dentists to offer effective and accurate treatments. Today, 3D printing stands as a preferred method in dental care, ensuring both quality and quantity in patient treatment.[23]

3D printing technology is widely applied in various dental procedures, with factors like printer type, materials, and build thickness influencing the precision of printed models. These applications include bioprinting tissues and organs, 3D printed teeth, implant-supported restorations, aesthetic inlays, guided endodontic procedures, custom myofunctional appliances, maxillofacial prostheses, obturators, full dentures, digital impressions, Invisalign, and customized 3D printed drug delivery systems.[24]

The advent of 3D printing has transformed dentistry, allowing for the creation of top-notch dental prosthetics characterized by outstanding precision. This innovation has significantly improved patient care and treatment results.[23]

Oral Medicine and Radiology: 3D printing has found early and frequent use in evaluating head and neck pathologies, particularly in dentistry and craniofacial diagnosis over the last decade. These technologies are employed to create detailed maxillofacial models, offering precise information about lesion extent and boundaries. This assists diagnosticians in

devising more effective treatment strategies and gaining insights into prognosis.[25] Experienced radiologists frequently contribute their knowledge to the manufacturing process to ensure the precision of these 3D-printed models.[24]

In radiation oncology, achieving the best treatment plan must consider the impact of tumor distortion on normal anatomy and irregular tissue surfaces. Three-dimensional printing offers a potential solution to address these challenges. Sun and Wu utilized 3D printing to create a patient-specific cranium based on CT images, allowing for the testing of different treatment options. Similarly, Zemnick et al introduced a patient-specific extraoral radiation shield using 3D printing technology, ensuring patient comfort and homogeneous radiation delivery for skin cancer treatment, even in cases of uneven superficial tissue topography.[25]

Endodontics: Recent advancements in digital technology, including the use of 3D printed objects in dentistry, have significantly impacted the teaching and management of case related to implant, craniofacial, maxillofacial, orthognathic, and periodontal treatments. These 3D printed models and guides have proven beneficial in planning and addressing complex non-surgical and surgical endodontic procedures, as well as facilitating skill development.[27] Furthermore, 3D printing technology has enhanced the management of endodontic procedures by enabling the duplication and maintenance of accurate records, educating patients, aiding treatment planning through improved visualization, identifying crucial anatomical landmarks and pathologies such as root resorption, and facilitating the production of laboratory-made directional or surgical guides. Specifically, 3D printed guides are valuable for guided non-surgical and surgical endodontic interventions.[28]

Oral and Maxillofacial Surgey: The utilization of 3D printing techniques allows for the creation of anatomical models, offering a novel approach to surgical treatment planning and simulation. This technology provides surgeons with a comprehensive view of complex structures before they perform surgery.[29] The surgical correction of a broad midline craniofacial cleft in an 8-month-old patient was made possible by Anderl et al.'s effective use of CT-guided stereolithography to construct an acrylic model in the early 1990s. This acrylic model allowed for preoperative planning and intraoperative care.[25]

When reconstructing maxillofacial defects, it is essential not only to restore anatomical appearance but also tissue functionality.[27] Autologus bone grafts are the current gold standard for this purpose due to their ability to support bone growth. However, they have the drawback of requiring manual shaping to match the defect, prompting the search for less invasive treatments for bone defects.[29]

Orthodontics: Recent advancements in intraoral digital scanning technology have revolutionized orthodontics by eliminating the need for uncomfortable impressions, providing more precise appliances, and shortening treatment durations.[30]

When using the Invisalign System, a patient's teeth are digitally realigned to produce a set of 3D printed models from which aligners are made. Patients receive new aligners every two weeks, gradually repositioning their teeth. This technology saves time, allows for digital storage of patient data, reduces physical storage needs, and integrates bracket production and positioning into a single CAD/CAM process. This approach combines individualization with space efficiency.[29,30]

Periodontology: With numerous uses including the treatment of alveolar bone abnormalities, implant placement guidance, serving as a drug delivery system, and producing human bone and skin grafts in vitro, 3D printing is becoming an increasingly important part of periodontal therapy. The results of treatment could be completely changed by these developments in periodontology.[31]

Bioresorbable scaffolds for periodontal recuperation and regeneration, socket preservation, bone and sinus augmentation operations, guided implant placement, peri-implant maintenance, and implant education are some specific applications of 3D printing in periodontology.[29]

Prosthodontics: 3D printing has rapidly evolved in recent years and has found numerous applications in prosthetic dentistry. This technology offers significant advantages, including time and labor savings and the assurance of a perfect fit for fabricated dental constructions.[15]

The capacity to produce items utilizing a variety of materials, including polymers, composites, metals, and alloys, all with precise structural integrity and predetermined surface roughness, is a key advantage of additive technology in prosthetic dentistry.[32] This adaptability enables the creation of complex shapes without the requirement for specialized CAM unit adjustments and permits the controlled use of various materials in various regions of the same design.[15]

Implants placement: Implant placement is a common procedure in dentistry, known for its reliability in replacing missing teeth.[33] However, it's technically complex and, if not performed correctly, can result in complications like aesthetic issues, harm to vital structures, infections, and implant failure.[28] Utilizing 3D printing to create surgical guides for guided implant placement is a solution to avoid these problems. These guides ensure precise 3D implant placement, minimizing the risk of anatomical damage and saving time during the procedure.[31]

Conclusion

The influence of 3D imaging, CAD technologies, and 3D printing in dentistry is profound. Digital data allows for the creation of precise and intricate shapes in various materials, either locally or in industrial settings. This technology enhances patient consultations, elevates diagnostic accuracy, improves surgical planning, serves as a surgical guide, and offers templates for surgical procedures. Moreover, as bio-cell printing continues to advance, there is potential for the creation of tissues and organs through 3D printing. Overall, 3D printing has the potential to greatly benefit both patients and doctors providers through personalized and patient-specific medicine.

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Management of Large Complex Odontoma of Posterior Mandible: A Rare Case Report

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Abstract

Odontomas are hamartomatous lesions or malformations rather than true neoplasms which are generally asymptomatic. Making up 22% of all odontogenic tumors of the jaw, it is the most prevalent benign odontogenic tumor. It can be either compound or complex odontoma. Complex odontomas do not resemble teeth at all, whereas compound odontomas, which are composed of calcified tissues which resemble tooth. Odontomas usually are diagnosed accidentally on routine radiographic examination. Complex odontomas are frequently found in the posterior mandible. We report the case of unusually large sized complex odontoma in right posterior mandible which had been successfully managed by surgical excision by multiple separated blocks via intraoral approach to prevent pathological fracture of mandible and avoiding extraoral incision which leads to unwanted extraoral scar.

Key words: *Odontoma, Complex odontoma, Hamartomata, Odontogenic tumor, Scar*

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Introduction

Broca first used the term "odontoma" in 1867, referring to any tumor that resulted from the excessive, either temporary or permanent, and growth of dental tissues. Of all the odontogenic tumors of the jaw, they make up 22% and are the most prevalent benign odontogenic tumors.[1,2] The incidence of odontomas was found to be equal in male and female patients, in accord with results of some studies. Odontomas were found most frequently at 10 to 19 years of age.[3,4]

According to the World Health Organization, odontomas can be divided into compound and complex odontomas. The dental tissue in a compound odontoma is arranged in a well-ordered manner, resulting in a lesion that is made up of numerous tooth-like structures while when this calcified dental tissue is merely an uneven mass that does not resemble even rudimentary teeth morphologically it is referred to as a complex odontoma.[1,5]

Although the exact cause of the disease is unknown, established etiological variables include genetic alterations, trauma experienced during primary dentition, and heredity. Odontomas may also present as a component of the following syndromes:

Gorlin-Goltz syndrome, Herrmann syndrome and Gardner syndrome.[3-5]

Odontomas frequently have a slow growth rate and are not aggressive. The majority of complex odontomas described in literature typically have a diameter of no more than 3 cm which are considered not to increase in size after calcification of the odontogenic tissues but rarely they can increase in size with a diameter larger than 3 cm, also called giant or large odontomas[6] and shows symptoms like cortical plate expansion, displacement of the neighboring tooth. The diagnosis can be made either during routine radiographic examination or while evaluating the causes of delayed eruption.[2,7]

Surgical excision is the preferred course of treatment to remove the odontoma. Complex odontomas have no known risk of recurrence, and conservative treatment frequently permits the surrounding dentition to be preserved.[6-9]

This case report presents large complex odontoma in posterior mandibular region which was removed carefully to avoid pathological mandibular fracture.

Case Report

An 8-year-oldmalechild presented with the complaint of missing lower right back teeth. Medical history was found to be insignificant. On examination, no gross facial asymmetry was detected, and an intraoral swelling was present extending from 84 to retromolar region which was obliterating the vestibule without any pus discharge (Fig.1). A permanent first molar and deciduous second molar were missing. On palpation, swelling was non-tender, bony hard in consistency and bucco-lingual cortical expansion was present.

OPG (Fig.2) showed a radio-opaque mass with a thin, radiolucent border that measured 4x5 cm and extended from 84 to the crown of the unerupted 46 antero-posteriorly and from the alveolar crest to the inferior border of the mandible supero-inferiorly. The erupting permanent canine and premolars could be seen at mesial aspect of the tumor mass. The clinical and radiographic examination led to provisional diagnosis of complex odontoma.

Fig.1: Intraoral photograph showing bone expansion, vestibular obliteration and missing teeth in the right posterior mandible.

Fig.2: Pre-operative radiograph showing radiopaque mass in the body of mandible with retained deciduous canine and 1st molar and impacted 2nd and 3rd molar.

Surgical excision was performed under general anaesthesia via intraoral approach. Crestal incision was placed and expanded buccal cortical plate was seen which was removed and the exposed tumor mass was separated in multiple blocks and removed using micromotor (Fig.3) carefully keeping intact inferior border of the mandible and inferior alveolar nerve. Closure was

achieved using simple interrupted Vicryl 3-0 sutures.

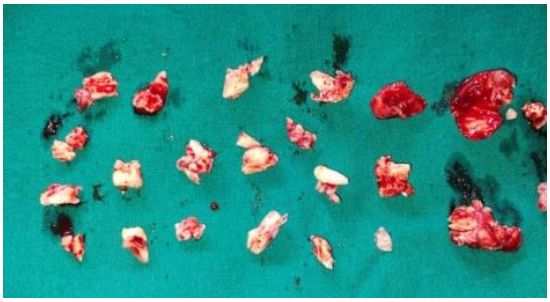

Fig. 3: Tumor is removed in multiple bits with deciduous teeth.

The Specimen was sent to histopathological examination, which was in correlation of clinical presentation suggestive of complex odontoma. Patient was kept on a soft diet for 1 month. Post operative OPG (Fig.4) showed removal of tumour mass along with 84 and erupting permanent teeth was preserved. The patient had no pain or abnormality in the affected area over a 2-year follow-up period and did not reveal any signs of recurrence.

Fig. 4: Post-operative radiograph showing preservation of continuity of inferior border of mandible.

Discussion

Large odontomas are associated with higher rates of morbidity during treatment because of their size and proximity to vital anatomical structures like the inferior alveolar artery and nerve. Clinical and radiographic features should be taken into consideration when deciding on a surgical strategy and to decide whether bone reconstruction is needed or not.[10]

In the past, odontomas were considered as odontogenic tumors and required radical excision. This radical excision was unjustified despite the expansion and thinning of the mandibular bony plates. Selective removal of the denticles and related connective tissue capsule is the preferred choice for the treatment of odontomas.[7]

The approaches for the removal of the benign tumor in the posterior mandible are extraoral approach or an intraoral approach.[9,11-13]

1. Extraoral approach, which includes partial resection of the mandible, and may entail a portion of the inferior alveolar nerve, requiring bone grafting for reconstruction and strict internal fixation. In addition, a scar might show. It is thought that this approach is quite aggressive because odontomas are thought to be benign lesions.
2. The lesion can be removed intraorally by removing the buccal cortex keeping intact only a narrow inferior border. Considering that the lingual bone is typically thin, fracture risk needs to be thought of.[9]
3. Intraoral approach using sagittal split osteotomy (SSO) - With this technique, significant cortical bone defects are avoided, and the tumor site is well accessible. Since the canal can be seen clearly and adequately with the SSO, lesions close to the IAN can be removed without causing permanent damage to the neural structure.[11,13]

Two-stage surgery or immobilization of the mandible may be indicated since mandibular fractures can occur after a large lesion is removed in one stage.[10,14]

In this technique, removal of most of the lesion and preserving the adjacent unerupted tooth is done, thus reducing the chance of a pathological fracture of the mandible. Anterior maxillary fixation and soft diet for a period of 4 weeks is recommended. The second stage should be carried out once the substantial bone consolidation is observed 3 months after the first surgical stage. It is then considered safe to remove the unerupted tooth and the remaining lesion.[9]

Since the inferior border of mandible and lingual cortex was intact after removal of the tumor and due to economic constraint for patient, reconstruction was not considered in this case. The prognosis is generally good with a low relapse index, but if removal is done during the initial stage of calcification, the rate of relapse rises.

Conclusion

Even though complex odontomas associated with missing teeth are uncommon, it's crucial to diagnose them. Panoramic radiography will be helpful in identifying these lesions early on. Surgical excision is the preferred treatment for complex odontomas of any size. Timely and accurate diagnosis and treatment can prevent further complications and reconstruction needs in young growing patients. With very little chance of recurrence, the prognosis for complex odontomas is very favorable.

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