Original Article

Effectiveness of Probiotic and Herbal Mouthwashes on Gingival Health among Children with Intellectual Disability: An Interventional Study

C. S. Aarthy, Swetha Gadde[1], Parangimalai Diwakar Madankumar

Departments of Public Health Dentistry and [1]Periodontics, Ragas Dental College and Hospital, Chennai, Tamil Nadu, India

Abstract

Background: Maintaining good oral health is particularly challenging among children with intellectual disability (ID) because of increased oral health risks due to underlying disease, limitations on access to care, and competing demands. For ID children, the standard oral hygiene procedures such as brushing and flossing are too difficult to practice due to reduced manual dexterity and difficulty for the caregivers to handle these tools. Moreover, usage of mouth rinses is a nightmare for parents of children with ID as they lack the dexterity to spit the mouthwashes. Although many studies support the use of chlorhexidine mouth rinses, it should be taken into account that the side effects of chlorhexidine are well documented, but the same is not so in case of herbal and probiotic mouth washes. With this milleu, this interventional study was formulated to compare the efficacy of probiotic and herbal mouth rinses on gingival health among intellectually disabled children. **Materials and Methods:** The present study included thirty children with ID aged 10–15 years at New Hope Child Development Centre. The participants were randomly divided into two Groups: I and II, with 15 children in each group as follows: group I: probiotic mouthwash and Group II: herbal mouth wash. Baseline scores of plaque index (PI) and gingival index (GI) were recorded. The designated mouth rinses were distributed to the respective groups, and they were instructed to rinse once daily. Their parents supervised the children during the use of mouthwash. At the end of 3 months, the children were assessed to the same clinical measurements. **Results:** Intragroup comparisons for both the GI and PI scores were statistically significant ($P \leq 0.001$) in both the groups. Intergroup comparisons between the two groups were not statistically significant. There was a significant difference in the effect of herbal and probiotic mouthwashes on plaque accumulation, gingival health status of these children. **Conclusion:** Herbal and probiotic mouthwashes can prove to be effective in reducing plaque and in improving the gingival status of children.

Keywords: Children, herbal, intellectual disability, mouthwashes, probiotic

Introduction

Intellectual disability (ID) is defined as a group of developmental conditions characterized by significant impairment of cognitive functions, which are associated with limitations of learning, adaptive behavior, and skills. With a prevalence of 2%–3% worldwide, these neurodevelopmental disorders represent one of the biggest medical and social challenges in society.[1]

Good oral health is one of the reliable indicators for good overall health and well-being of an individual throughout his lifespan. The barriers to oral health that children with disabilities experience will vary by age and the level of parental or social support received. These changes, throughout life, with particular problems were associated with transitional periods. Attitudes to oral health, oral hygiene, and dental attendance and the relative value placed upon these factors must be viewed in the context of illness, disability, socioeconomic status, and stresses imposed upon daily living for the individual, family, and care takers.[2]

Oral health may have a low priority in the context of these pressures and other disabilities, which are more life

Access this article online

Quick Response Code:

Website: www.ijcommdent.com

DOI: 10.4103/ijcd.ijcd_15_21

Address for correspondence: Dr. C. S. Aarthy, Department of Public Health Dentistry, Ragas Dental College and Hospital, 2/102, East Coast Road, Uthandi, Chennai - 600 119, Tamil Nadu, India.
E-mail: aarthycharms@gmail.com

How to cite this article: Aarthy CS, Gadde S, Madankumar PD. Effectiveness of probiotic and herbal mouthwashes on gingival health among children with intellectual disability: An interventional study. Int J Community Dent 2021;9:129-33.

Received: 15-07-21; **Accepted:** 06-09-21; **Web Published:** 26-03-22

threatening.[3] Hence, it requires a change in attitude and practice for parents/care takers to include oral health as a part of routine care. Evidence confirms that uptake of screening services for children with disabilities is lower and that they have poor oral health when compared with the general population. Poor oral health may add an additional burden, whereas good oral health has holistic benefits in that it can improve general health, self-esteem, and quality of life.[4]

Maintaining good oral health is particularly challenging among children with ID because of increased oral health risks due to underlying disease, limitations on access to care, and competing demands.[5] The lack of oral hygiene has been implicated as a fundamental factor in the development of periodontal diseases and dental caries in ID children. The child's age, developmental disabilities, and/or special health-care needs may make it difficult or impossible for a child to perform daily oral care for themselves. For ID children, the standard oral hygiene procedures such as brushing and flossing are too difficult to practice due to reduced manual dexterity and difficult for the caregivers to handle these tools. Toothbrush is an effective mechanical means to remove plaque. However, most of the intellectually disabled are not able to handle it properly and often need a help of their caregivers. It has been suggested that complete plaque removal with a conventional toothbrush is not realistic for ID children.[6] Use of chlorhexidine, the treatment of choice for gingivitis is indicated in intellectually disabled children, but there is no sufficient evidence in regard to its safety if swallowed. Therefore, finding the new alternative mouthwash with undesired side effects is mandatory. Moreover, usages of mouth rinses are a nightmare for parents of children with ID as they lack the dexterity to spit the mouthwashes. There arose a need to identify harmless substances as substitutes for the same. Hence, search for an effective and safe alternative to CHX mouthwash has led to introduction of various herbal products in dentistry which are without any major side effects, besides being cheap and locally available.[7] Natural herbs, when used in mouthwashes, have shown significant advantages over the chemical ones.[8,9] Probiotics, another potential tool of antiplaque activity, have been reported to have beneficial effects on oral health.[10] Still, probiotics are not widely used in clinical dental practice due to a lack of awareness about probiotics. This calls for actions to be taken in this direction because once the probiotics set a foothold in dentistry, they can be concomitantly beneficial for oral as well as systemic health of the human body and can apparently prove to be a panacea of health promotion. Although many studies support the use of chlorhexidine mouthrinses, it should be taken into account that the side effects of chlorhexidine are well documented, but the same is not so in case of herbal and probiotic mouthwashes.[11]

Probiotics have been used safely in the fermentations of food products for decades. Therefore, the United States Food and Drug Administration has designated probiotics as generally recognized as safe, and the European authorities provided a list of bacterial species with a qualified presumption of safety. Various studies done in the past have shown that probiotics can tilt the balance of the oral flora toward the beneficial species, reducing gingivitis.[12]

Probiotics aim to restore normal balance of human gut microbiota and have been shown to be effective in treating other GI disorders. The effect of probiotics on the brain is not new, with several studies showing its benefit in treating several psychological conditions such as depression and anxiety. It is theorized that there exists a complex interplay between the brain and the GI tract termed the "gut–brain axis." The main postulation behind this is that probiotics act through the gut–brain axis to influence neurotransmission and mood states. Probiotics are able to influence several neuroactive metabolites such as gamma-aminobutyric acid and serotonin. Serotonin has been shown to be influenced by gut bacteria and also specifically in individuals with autism spectrum disorder (ASD), there are hyper activation of a gene that codes for serotonin reuptake transporters. Studies have also linked the neuropeptide oxytocin to social behavior and the pathogenesis of ASD. In particular, there is some anecdotal evidence that probiotics are able to alleviate GI symptoms as well as improve behavioral issues in children.

With this milleu, this interventional study was formulated to compare the efficacy of probiotic and herbal mouth rinses on gingival health among intellectually disabled children.[13]

Materials and Methods

The current study was carried out among 12–15-years-old children with ID and the study participants were recruited from the HOPE Care and Protection Center for Mentally Retarded Children, Aminjikarai, Chennai.

A detailed study protocol explaining the objectives and methodology of the study was approved by the Institution Review Board, Ragas Dental College and Hospital. The study was initiated after obtaining ethical clearance. Permission was obtained from the Principal of HOPE Care institute. Informed consent was obtained from the participants' parents after the parents have duly read the information sheet.

This interventional study with two parallel arms was designed to assess the effectiveness of probiotic and herbal mouthwashes on gingival health. A total of 30 ID children were recruited for the study. Sample size of 30 was calculated using Software G Power (Version 3.1.9.2, 2014).

Inclusion criteria

a. Children with ID the age group of 12–15 years
b. ID children were diagnosed using Wechsler intelligence scale-IV (1997)
c. Children with dental plaque index (PI) score >1.9 were recruited.

Exclusion criteria

a. Children who cannot cooperate and participate in the study
b. Children with any systemic disorders were excluded from this study

c. Those parents who did not give consent were excluded from the study.

A total of thirty children were divided into two groups of 15 each (Groups A and B) and each group was randomly assigned one mouthwash.

Oral examinations of children in the both groups were assessed, and oral health status of the children was assessed using PI (Silness and Loe, 1964) and gingival index (GI) (Loe and Silness, 1963). The calibrated investigator recorded both the plaque and GI. Intraexaminer reliability was checked during the calibration sessions and found to be 0.8.

Group allocation

After the baseline examination, the two types of intervention (probiotic and herbal mouthwashes) were given to the children.

Group A rinsed with 15 ml of HiOra (herbal) mouthwash for 60 s twice daily 30 min after tooth brushing for 3 months.

Group B rinsed with Darolac (probiotic) sachets dissolved in 20 ml of water for 60 s twice daily 30 min after toothbrushing for 3 months and then swallowed it. The children were asked not to eat or drink anything for next half an hour to achieve the effect of the mouthwash.

All the children received the toothbrushes and toothpastes of same made to overcome the confounding bias. The subjects were instructed to withdraw the use of mouthwashes and report immediately if they experienced any side effects due to the use of mouthwashes. Subjects were instructed to brush twice daily with the given toothbrush and toothpaste. Follow-up examinations were also carried out among both groups using PI (Silness and Loe, 1964) and GI (Loe and Silness, 1963) at the end of 3 months [Figure 1].

Statistical analysis

Data collected were entered in Microsoft Excel 2007 and analyzed using Statistical analyses were performed using a personal computer in IBM corp. Statistical Package for Social Sciences software for windows; version 20.0 (Armonk, NY). Kolmogorov–Smirnov and Shapiro–wilks test were used to check the distribution of mean plaque and gingival score. Since it does not follow normal distribution, Wilcoxon-signed rank test was used to compare both the outcomes. For all the tests, the statistical significance level was set at 5%.

Results

This study was done among thirty children for a period of 3 months who fulfilled the eligibility criteria. Of the 30 children, 15 were given probiotic and 15 were given herbal mouth washes.

All the 30 children who were enrolled in both the groups were male and they participated for the entire duration of the study period. The mean age of the study population with both males and females was 13.17 ± 1.12 years of age.

Plaque scores at baseline and at the end of 3rd month, for both the groups, are tabulated in Table 1. The mean scores of PI at baseline for probiotic and herbal groups were (2.04 ± 0.08) (2.00 ± 0.00), respectively, and at 12 weeks for probiotic and herbal groups were (1.46 ± 0.10) (1.44 ± 0.11). There was a statistically significant difference in scores at baseline and at the end of 3 months ($P = 0.001$).

Gingival scores at baseline and at the end of 3rd month, for both the groups, are tabulated in Table 2. The mean scores of GI at baseline for probiotic and herbal groups were (1.08 ± 0.17) (1.01 ± 0.05), respectively, and at 12 weeks for probiotic and herbal groups were (0.50 ± 0.10) (0.46 ± 0.90), respectively. There was a statistically significant difference in scores at baseline and at the end of 3 months ($P = 0.001$).

Discussion

Oral health is fundamental to general health and well-being and affects physical and psychological aspects of human life. Children diagnosed with ID not only suffer from physiological problems but also lack the social skills required for adapting in their routine environment. Therefore, this has become a major concern in dealing with these children, which makes clinical research more challenging.[14]

Mechanical means of plaque removal by brushing and flossing is the most effective method to prevent plaque formation and dental caries. The use of a mouthwash augments maintenance of oral health through its antiplaque and antibacterial chemical properties.[15] The present study compared the effectiveness of probiotic and herbal mouthwashes on oral health using three two variables, i.e., GI and PI. The results obtained showed that there was a significant improvement in gingival and plaque status after the use of both the mouthwashes.

Herbal mouthwash used in the study contains Miswak (salvadorapersica), bibhitaka (terminaliabellerica),

Table 1: Assessment of plaque score at baseline and 12 weeks for both the groups

Groups	Mean PI scores ± SD		*P*
	Baseline	12 weeks	
Probiotic	2.04±0.08	1.46±0.10	0.001*
Herbal	2.00±0.00	1.44±0.11	0.001*

*Wilcoxon-signed rank test P=<0.005 statistical significant. PI: Plaque index, SD: Standard deviation

Table 2: Assessment of gingival score at baseline and 12 weeks for both the groups

Groups	Mean GI scores ± SD		*P*
	Baseline	12 weeks	
Probiotic	1.08±0.17	0.50±0.12	0.001*
Herbal	1.01±0.05	0.46±0.90	0.001*

*Wilcoxon signed rank test P=<0.005 statistical significant. GI: Gingival index, SD: Standard deviation

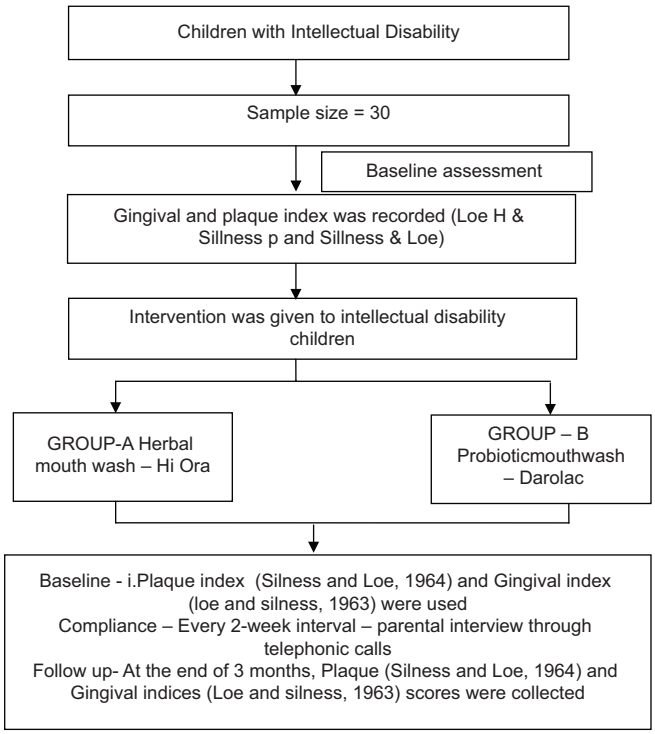

Figure 1: Flowchart illustrating the methodology of the study

gandhapurataila, and nagavalli (piper betle) andela. It has antiplaque, analgesic, antimicrobial, antiseptic, and refreshing properties. It has active herbal ingredient that acts against common strains of oral bacteria and fungi and helps in the prevention and treatment of gum diseases. Silica in Miswak acts as an abrasive material to remove stains giving the teeth whiteness. Tannins also inhibit the action of glucosyl transferase, thus reducing the formation of plaque and gingivitis. The alkaloid present in Salvadorapersica is Salvadorine, which yields trimethylamine on hyrolytical cleavage, exerts a bactericidal effect and stimulatory action on the gingiva. The mild bitter taste stimulates the flow of saliva, which is antiseptic. The sulfur compounds present in Miswak have a strong bactericidal effect which prevents the formation of complex biofilm.[16-18]

The present study also employed probiotic mouth rinse which contains 1 g powder of 1.25 billion freeze-dried combination, a mixture of *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, *Bifidobacterium longum*, and *Saccharomyces boulardii*. Lactobacilli produce low-molecular weight bacteriocins which has an inhibitory effect against a wide range of bacterial species related to oral diseases.[19] *L. rhamnosus* demonstrates both antimicrobial activity and tolerance of environmental stress.[20] *S. boulardii* also has an antimicrobial action. Hence, the probiotic Darolac inhibits the bacterial cell association, colonization, and invasion that are responsible for the antiplaque action due to the synthesis of compounds such as bacteriocin or biosurfactant. In the present study, Darolac improved gingival health due to abovementioned facts.[21] Darolac sachets dissolved in water were used as mouthwashes by "Swish and Swallow" technique in accordance with the study conducted by Jindal *et al*.[22] The "swishing" part ensured oral benefits and "swallowing" was supposed to provide systemic benefits.

In this study, probiotic and herbal mouthwashes were equally effective in reducing plaque and in improving the gingival status of children (P = 0.001). A study by Purunaik *et al*. showed that probiotic mouthrinse was significantly more effective than chlorhexidine at the end of 14th day.[21] Jothika *et al*. showed that there was reduction in colony-forming units of Streptococcus strains in plaque samples with usage of probiotic mouthwash.[23]

According to Ng *et al*., prebiotics only improved certain GI symptoms showed a significant reduction in antisociability scores. As for probiotics, there is limited evidence to support the role of probiotics in alleviating the GI or behavioral symptoms in children with ASD. Shah *et al*. compared the effectiveness of probiotic, chlorhexidine, and fluoride-based mouthwashes in 6-to 10-year-old children and found promising results with usage of probiotic mouthwash in plaque reduction and improvement of gingival status.[24]

The results of this study can be generalized to children with intellectual disabilities since we have included even children with severe form of disability. This was a short-term intervention study that was conducted only in one school in Chennai. Therefore, further multicentric studies done for longer periods are needed to be conducted to validate the present findings.

Conclusion

It can be concluded that the two mouthwashes, i.e., herbal and probiotic were equally effective in improving oral health. Further clinical trials on a large scale are recommended to promote the herbal as well as probiotic mouthwash so that risk of adverse effects is reduced and general health is promoted along with oral health.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Salvador-Carulla L, Reed GM, Vaez-Azizi LM, Cooper SA, Martinez-Leal R, Bertelli M, *et al.* Intellectual developmental disorders: Towards a new name, definition and framework for "mental retardation/ intellectual disability" in ICD-11. World Psychiatry 2011;10:175-80.
2. Tesini DA. An annotated review of the literature of dental caries and periodontal disease in mentally retarded individuals. Spec Care Dentist 1981;1:75-87.
3. Ohmori I, Awaya S, Ishikawa F. Dental care for severely handicapped children. Int Dent J 1981;31:177-84.
4. Fiske J, Hyland K. Parkinson's disease and oral care. Dent Update 2000;27:58-65.
5. S Dheepthasri. Oral health status and treatment needs among intellectually disabled in Madurai. J Adv Oral Res 2018;9:45-8.
6. Plaza EA. Oral Health Care for Children with Special Health Care

Needs: A Guide for Family Members/Caregivers and Dental Providers; 2008.
7. Bhambal A, Jain M, Saxena S, Kothari S. Oral health preventive protocol for mentally disabled subjects – A review. J Adv Dent Res 2011;3:21-6.
8. Amruthesh S. Dentistry and ayurveda-III (basics-ama, immunity, ojas, rasas, etiopathogenesis and prevention). Indian J Dent Res 2007;18:112-9.
9. Khairnar MR, Karibasappa GN, Dodamani AS, Vishwakarma P, Naik RG, Deshmukh MA. Comparative assessment of Cranberry and Chlorhexidine mouthwash on streptococcal colonization among dental students: A randomized parallel clinical trial. Contemp Clin Dent 2015;6:35-9.
10. Stamatova I, Meurman JH. Probiotics: Health benefits in the mouth. Am J Dent 2009;22:329-38.
11. Deshmukh MA, Dodamani AS, Karibasappa G, Khairnar MR, Naik RG, Jadhav HC. Comparative evaluation of the efficacy of probiotic, herbal and chlorhexidine mouthwash on gingival health: A randomized clinical trial. J Clin Diagn Res 2017;11:ZC13-6.
12. Markowiak P, Śliżewska K. Effects of probiotics, prebiotics, and synbiotics on human health. Nutrients 2017;9:1021.
13. Clapp M, Aurora N, Herrera L, Bhatia M, Wilen E, Wakefield S. Gut microbiota's effect on mental health: The gut-brain axis. Clin Pract 2017;7:987.
14. Slack-Smith L, Ree M. Oral health and children with an intellectual disability: A focus group study of parent issues and perceptions. J Disabil Oral Health 2010;11:171-7.
15. Kandaswamy SK, Sharath A, Priya PG. Comparison of the effectiveness of probiotic, chlorhexidine-based mouthwashes, and oil pulling therapy on plaque accumulation and gingival inflammation in 10- to 12-year-old schoolchildren: A randomized controlled trial. Int J Clin Pediatr Dent 2018;11:66-70.
16. Singh A, Daing A, Dixit J. The effect of herbal, essential oil and chlorhexidine mouthrinse on *de novo* plaque formation. Int J Dent Hyg 2013;11:48-52.
17. Aspalli S, Shetty VS, Devarathnamma MV, Nagappa G, Archana D, Parab P. Evaluation of antiplaque and antigingivitis effect of herbal mouthwash in treatment of plaque induced gingivitis: A randomized, clinical trial. J Indian Soc Periodontol 2014;18:48-52.
18. Pahlajani V, Pathak AD, Thadani J. Commonly used plants in India to maintain oral hygiene – A review. Natl J Med Dent Res 2013;1:22-5.
19. Dhawan S, Dhawan R. Role of probiotics on oral health – A randomized, double blind, placebo-controlled microbiological study. J Res Pract Dent 2013;2013:1-9.
20. Kõll P, Mändar R, Marcotte H, Leibur E, Mikelsaar M, Hammarström L. Characterization of oral lactobacilli as potential probiotics for oral health. Oral Microbiol Immunol 2008;23:139-47.
21. Purunaik S, Thippeswamy HM, Chavan SS. To evaluate the effect of probiotic mouthrinse on plaque and gingivitis among 15-16-year-old school children of Mysore city, India- randomized controlled trial. Glob J Med Res 2014;14:9-14.
22. Jindal G, Pandey RK, Agarwal J, Singh M. A comparative evaluation of probiotics on salivary mutans streptococci counts in Indian children. Eur Arch Paediatr Dent 2011;12:211-5.
23. Jothika M, Vanajassun PP, Someshwar B. Effectiveness of probiotic, chlorhexidine and fluoride mouthwash against *Streptococcus mutans* – Randomized, single-blind, *in vivo* study. J Int Soc Prev Community Dent 2015;5:S44-8.
24. Ng QX, Loke W, Venkatanarayanan N, Lim DY, Soh AY, Yeo WS. A systematic review of the role of prebiotics and probiotics in autism spectrum disorders. Medicina (Kaunas) 2019;55:129.