

Laboratory Evaluation Of The Efficacy Of Formulated Polyherbal Toothpaste “Oralis S” On Dental Caries In Rats

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Abstract

Objective: To Evaluate the efficacy of Formulated Polyherbal toothpaste on dental caries in the rats.

Method: The efficacy of topically applied formulated polyherbal toothpaste Oralis(S) was evaluated in thirty albino rats. Dental caries was induced by inoculating their mouths with *Streptococcus viridans* and then fed a cariogenic 56% sucrose sugar in addition to rat pellets. The animals were then divided into 3 equal groups with 10 rats per group. Group 1, the (control) had daily molar teeth brushing with water, while Group II formulated polyherbal toothpaste Oralis (S) had molar teeth brushing daily with the paste and Group III Apollo had molar teeth brushing using Apollo toothpaste. Water was available throughout the eight weeks of the study after which the animals were sacrificed, the jaws separated and the molar teeth scored for dental caries.

Results: The results showed a significant caries reduction of 67.66.% by the formulated polyherbal toothpaste Oralis(S) and 54.33% by Apollo toothpaste. This reduction suggested the inhibitory role the experimental formulated polyherbal toothpaste Oralis(S) plays in caries development.

Conclusion: The results of the study support the traditional application of the medicinal plants and suggest that various herbs which were used in Polyherbal formulation possess antimicrobial properties that can be used as antimicrobial agents, and toothpaste developed can be utilized to prevent various dental diseases.

Key Words: Dental caries, Polyherbal toothpaste , Caries Scores

Introduction

Dental caries is an infectious microbial disease that results in localized dissolution and destruction of the calcified tissues of the teeth¹. The untreated condition may lead to pain, tooth loss, infection and finally death in severe cases. Today, caries remains one of the most common diseases throughout the world. *Streptococcus mutans* is known as the causative bacteria in the formation of dental plaque and dental caries. The acid producing *S. Mutans* causes damage by dissolving tooth structures in the presence of fermentable carbohydrates such as sucrose, fructose, and glucose².

The food debris, acid, bacteria, and saliva combine in the mouth to form a sticky substance called “plaque” that adheres to the teeth³. Dental disease is painful, and most importantly, it has also been suggestively linked to diabetes, high blood pressure, heart disease. The pain can be worsened by heat, cold or sweet foods and drinks^{4, 5}. Treatment often prevents further infection of the

tooth structure. Early treatment is less painful than treatment of extensive decay. Dental caries can also cause bad breath and foul tastes. In highly progressed cases, infection can spread from the tooth to surrounding soft tissues which may lead to an edentulous mouth⁶. Antibiotics such as Amoxicillin and Gentamicin have been reported to effectively prevent dental caries in animals and humans, but they are never used clinically because of many adverse⁷.

Indian medicine is one of the oldest organized systems of medicine. Its earliest concepts are set out in the sacred writings called the *Vedas*, especially in the metrical passages of the Atharvaveda (2nd millennium BC). Recent natural remedies with the use of medicinal plants, which are good reservoirs of chemotherapeutants are being becoming as an alternative for antibiotic adverse effects such as hypersensitivity reaction, supra infections, and teeth staining^{8, 9}. Despite

several anticaries agents being available commercially, the search for an effective natural agent still continues. Natural products have shown to be a good alternative to synthetic chemical substances for caries prevention.

All studies have shown some benefits in reducing caries incidence over a period of the clinical trial, the percentage reduction varying between 8 and 53%¹⁰⁻¹⁴. The replacement of fluoride by a more active agent in topically applied product has been the subject of many investigations. In recent years, however, toothpaste have been developed containing antibacterial substances, which are thought may reduce bacterial activity in plaque and in the stagnant parts of the mouth.^{15, 16}

Laboratory studies have tried to simulate oral conditions as closely as possible, and in order to find out whether conclusions reached from in vitro studies are correct, a biological model is desirable¹². There is a preponderance of various brands of herbal and fluoride toothpastes being marketed all over the place and the literature is not clear about their acclaimed efficacy or inhibition of caries development. Therefore the thrust of this study was to evaluate the efficacy of formulated Polyherbal toothpaste on dental caries reduction in the rat and compare this reduction with a fluoride containing toothpaste ie (Apollo).

Material and Methods

Thirty albino rats (21 days old), and of both sexes were inoculated orally, with 0.2ml of a freshly prepared glucose nutrient broth culture of *Streptococcus viridans* for the first five days of the

experiment. The animals were then divided into three groups and fed rat pellets containing in addition 56% sucrose in granulated form. Water was provided *ad libitum*.

Group I had daily brushing of their molar teeth with water and therefore served as control. Group II had brushing of their molars with the Polyherbal toothpaste formulation Oralis (S). Group III had molar teeth brushing with Apollo toothpaste. The toothpaste application was given daily for two to three minutes per rat with the use of cotton buds (modified tooth brush) in back and forth motion on the molars from the sixth day and for a period of eight weeks. The animals were sacrificed at the end of the experiment after which the jaws were dissected out and put in 95% ethyl alcohol. The maxillary and mandibular molar teeth were then scored for dental caries using modified Blechman et al¹⁶ scoring method with the aid of a demonstration magnifying lens.

Composition of Polyherbal toothpaste 'ORALIS S'

Polyherbal toothpaste formulation is the composition of *Stevia rebaudiana*. Leaves(SR)-1part , *Glycyrrhiza glabra*.Root(GG)-1part, *Azadirachta indica*.Bark(AZ)-1part, *Ocimum Sanctum*.Leaves(OS)-1part, *Terminalia belirica*.Fruit (TB)-1part, *Terminalia chebula*.Fruit (TC)-1part, *Piper longum*.Fruit(PL)-1part,*Curcuma longa*.Rhizome(CL)-1part, *Emblica Officinals*.Fruit(EO)-1part, *Acacia Arabica*.Bark (AA)-1part, *Mimusops elengi*.Bark(ME)-1part, *Quercus Infectora*.Galls(QI)-1part and *Salvadora Persica*.Bark(SP)- 1part used.

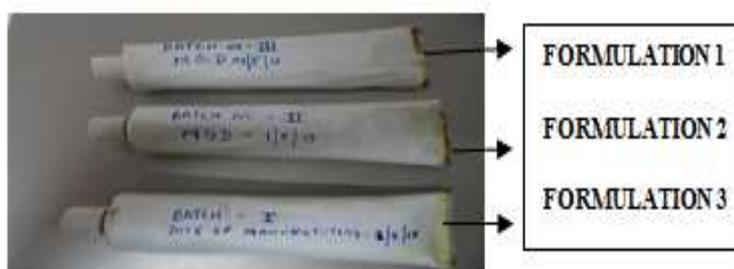


Figure 1 Polyherbal Toothpaste

Table 1: Ingredients for (base) polyherbal toothpaste formulation

Ingredients	Quantity(g)
Dicalcium Phosphate	36
Water	8
Calcium Phosphate	2
Glycerine	12.6
Gum carragean	0.7
Peppermint oil	1.05
Clove oil	0.3
Herbal extracts	10
Sodium chloride	1

Table 2 Ingredients For Herbal Extracts

F1	F 2	F 3
<i>Stevia rebaudiana</i> (3g)	<i>Stevia rebaudiana</i> (5g)	<i>Stevia rebaudiana</i> (4g)
<i>Emblica Officinalis</i> (1g)	<i>Quercus Infectoria</i> (1g)	<i>Azadirachta indica</i> (1g)
<i>Terminalia chebula</i> (1g)	<i>Azadirachta indica</i> (1g)	<i>Quercus Infectoria</i> (1g)
<i>Ocimum Sanctum</i> (2g)	<i>Salvadora Persica</i> (1g)	<i>Ocimum Sanctum</i> (1g)
<i>Curcuma Longa</i> (1g)	<i>Glycyrrhiza glabra</i> (0.5g)	<i>Salvadora Persica</i> (1g)
<i>Terminalia belirica</i> .(1g)	<i>Piper longum</i> (0.5g)	<i>Acacia catechu</i> (1g)
<i>Azadirachta indica</i> (1g)	<i>Acacia Arabica</i> (1g)	<i>Mimusops elengi</i> (1g)
Total – 10g	Total – 10g	Total -10g

Table 1: Animal Scoring

ANIMAL	Maxillary Molar Score			Mandibular Molar Score			Mean Caries Score	
	1	2	3	1	2	3	Maxilla	Mandible
GROUP CONTROL (I)	15	13	10	27	23	21	12.66	23.6
ORALIS S (II)	11	9	7	21	19	16	22.33	45.33
Dose 250mg/kg APOLLO(III)	8	7	7	18	14	13	17.33	36.33

Statistical Analysis:

Results are expressed as mean caries score. Comparison between control and experimental values was performed.

Results

The mean caries scores observed in Group I, II and III are shown in Table 1. The total caries score in the control Group was 38 with the mean caries score of (mandibular 23.6 and maxillary 12.66).

The total caries score in Group II (Oralis S) was 22.3 with the mean caries score of (mandibular 45.33 and maxillary 9) the caries score in Group III was 22 with the mean score of (mandibular 36.33 and maxillary 17.33). The Oralis S (Polyherbal formulated toothpaste) Group significantly reduced caries scores in both jaws while the Apollo Group caries reduction was not significant.

Discussion

The cariostatic efficacy of fluoride containing toothpaste in various clinical trials cannot be over emphasized. However, the trend in the use of

herbal products in combating oral diseases is on the increase and in order to find out whether conclusions reached from in vitro studies are correct, a biological model is desirable.

Therefore, the choice of rat is in agreement with previous reports²⁰. In this study, the mean caries score in the control was (mandibular 23.6 and maxillary 12.66) while the experimental Oralis S (Polyherbal formulated toothpaste) Group was (mandibular 45.33 and maxillary 9). Caries was significantly reduced 67.66% in the experimental Group II, but the 53.66% reduction in Apollo Group was reduced. This significant level of reduction is also consistent with the findings of Guggeheim, Lutz and Schmid²⁰. The mechanism of action of fluoride paste is well-documented^{21, 10, 12, 14-19}. However, the mechanism by which Oralis S (Polyherbal formulated toothpaste) reduced dental caries is not clear. However, it may be largely related to (i) a highly potent antibacterial agent in the herbal extract, (ii) oral acid neutralizer in the extract, (iii) decreased enamel solubility and (iv) plaque bacterial enzyme inhibitor in the extract.

The abrasive property of Oralis S Poly herbal toothpaste may also be adduced as a co-factor to its caries reduction.

Conclusion

The results of the study also support the traditional application of the plant and suggest that plant extracts possess compounds with antimicrobial properties that can be used as antimicrobial agents. And the developed polyherbal toothpaste Oralis S could be utilized in the treatment of various dental diseases. In addition, studies on the humectants quantification as well as abrasivity of this product are required before final conclusions can be drawn on the mechanism of herbal toothpaste as shown in this study.

“Cite this article”

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