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FORMULATION AND CHARACTERIZATION OF ANTIMICROBIAL CHEWING GUM DELIVERY OF SOME HERBAL EXTRACTS FOR TREATMENT OF PERIODONTAL DISEASE

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Chewing gums are mobile novel drug delivery systems, with a potential for administering drugs either for local action or for systemic absorption via buccal route. An antimicrobial chewing gum delivery system of the methanolic extracts of *Beatea monosperma* (barks and twigs), *Cordia obliqua* (leaves and seeds) and *Cuminum cyminum* (seeds) against periodontal diseases caused by some oral pathogens, was designed and characterized on various parameters.

INTRODUCTION: Oral diseases are major health problems with dental caries and periodontal diseases among the most important preventable global infectious diseases. The association between oral diseases and the oral micro biota is well established. Several agents are commercially available these chemicals can alter oral micro biota and have undesirable side-effects such as vomiting, diarrhea and tooth staining. Development of bacterial resistance to presently available antimicrobial agents and their side effects has necessitated the search for new antimicrobial agent. Hence, the search for alternative products over synthetic continues and natural, plant extracts and Phyto- chemicals isolated from plants used as traditional medicines are considered as good alternatives. It was considered worldwide to explore Indian traditional medicinal plants for development of herbal anti microbial chewing gum (as a novel drug delivery system) The aim of the present work was to develop a chewing gum with antimicrobial activity which will cure/protect from various periodontal diseases such as periodontitis, gingivitis, and pyorrhea.

EXPERIMENTAL METHODS: Plant materials procured from local suppliers, and authenticated by taxonomist Dr. Manjusa Saxena. Extraction of plant materials was done by methanol followed by preliminary investigations (Physical characteristics and qualitative chemical tests) and standardization of extracts. Screening of antimicrobial activity was carried out with the help of disk diffusion method against some gram positive (*Streptococcus mutans*, *S.mitis* and *S.sanguis*), gram negative (*A. actinomycetemcomitans*, *P. gingivalis* and *B. forsythus*) and fungal strain (*Candida albicans*). Minimum inhibitory concentration assay was performed by agar dilution method recommended by the National Committee for Clinical Laboratory Standards. Dried Extracts of *Beatea monosperma*, and *Cordia obliqua*, sucrose, glycerol, dried extract of *Cuminum cyminum* as flavoring and coloring agent, magnesium carbonate, and citric acid were added to melted wax and gum base at appropriate temperature. Antimicrobial chewing gums were cut in to the pieces of suitable size and coated by acacia solution (2%w/w) sugar dusting followed by acacia-sugar-calcium carbonate until a smooth surface was produced. Organoleptic characterization was performed at every stage of the development of the formulation. Gum's weight variation, thickness, hardness, friability, drug content uniformity were determined. Standardization of the formulation was performed by taking nicco gum as standard marketed formulation. Release of drugs was studied in pH 6.8 using a mastication device. Total phenolic and flavonoid contents were estimated by folin-Ciocalteu and aluminium chloride method, and stability studies were performed (40°C and RH 75% ± 5% for 90 days) to assess the effect of temperature and humidity on the concentration of phenolic and flavonoid contents. The results of accelerated stability conditions were compared with that of samples kept at controlled conditions (RT). The control samples were kept at room temperature. (25°C, 35% RH for 180 days.)

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RESULTS AND DISCUSSION: Results are encouraging, as all other antibiotics were inactive against these strains. Methanolic extract from *Cordia obliqua*, *Beautea monosperma* and *Cuminum cyminum* possess significant antimicrobial activity at very low concentration (15µg/disc, 20µg/disc and 15µg/disc) on oral pathogenic bacteria. Qualitative chemical tests shown presence of flavonoids, phenolics in the extracts, might be responsible for the activity. Formulated chewing gum has optimal hardness, thickness and weight variation (in limit $\pm 5\%$) as well as has pleasant appearance, fragrance, texture and taste is highly acceptable by the volunteers, as compared to marketed formulation. The drug loading efficiency of the drug in chewing was found to be in range of $98.2 \pm 1.80\%$ to $99.2 \pm 0.35\%$. In all the cases, the R values of korsmayer papas model were close to 1. The diffusion coefficient values ranged from 0.6655 to 0.9164. Since the R values of korsmayer papas were close to 1, Drug release from formulation follows matrix diffusion kinetics. Hence, diffusion was the mechanism of the drug release from the medicated chewing gums. Further, observed diffusion coefficient values are indicative of the fact that the drug release from the formulation follows non-Fickian transport mechanism. Most Formulations released 50% of their contents within 25-30 minutes. Results obtained from the accelerated stability studies are indicative of a slight reduction in flavonoids and phenolic contents with time on long time storage. Initial on 0 days the concentration of flavonoid and phenolic contents was 72.98 mg/gm and 18.56 mg/gm on 54th day it was observed 69.56 mg/gm and 16.50 mg/gm and on 90th day it was observed 67.78 mg/gm and 16.00 mg/gm from the results it can be concluded that flavonoid and phenolic contents are reducing with time by the effect of the temperature and moisture. When measured degradation under ambient conditions, degradation was significantly lower than in accelerated stability study.

CONCLUSION: The results of the study support the traditional application of the plants and suggest, plant extracts possess compounds with antimicrobial properties that can be used as potential antimicrobial agents and gums can be a good carrier of herbal extracts. Developed formulation will cure/protect from various periodontal diseases. Further development and evaluations chewing gums including the isolated compounds on commercial scale and their clinical and toxicological studies are the future challenges.

Biography

Dr. Reenu Yadav has completed her PhD at the age of 32 years from NIMS University and postgraduate studies from VNS Institute of Pharmacy, RGPV University. She is professor in Bhabha Pharmacy Research Institute, Bhopal, a premier organization. He has authored 3 books, published more than 30 papers in reputed journals and has been serving as an editorial board member of repute. She has lectured worldwide; she is member of many national and international bodies and awarded with many grants from government.

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