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Mini Review

Uses of Snail Mucin as Drug and in Drug Delivery

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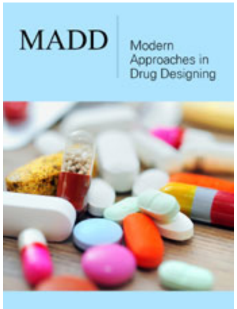

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Abstract

Snail mucin has been used in various formulations. This minireview shows some of the important uses of snail mucin in pharmaceutical applications. The uses range from use as unprocessed mucin in wound healing and its use in formulations.

Introduction

Some of the physico-chemical properties of snail mucin have been reported [1-7]. These range from toxicological to rheological and anesthetic properties. Its effect of platelet aggregation as well as on neutrophils has earlier been reported. In an earlier study, it was found that mucins bind microorganisms such as Staphylococcus aureus [8]. Apart from the binding effect, it may possess properties such as the immobilization of bacterial cells in contact with it.

It has been clearly demonstrated that snail mucin possesses wound healing property [9]. The rate of healing of wound onto which mucin preparation has been applied is determined by a number of factors such as depth and the level of microbial infection. It is also affected by the type of mucin formulation. The following formulations have been tested.

Ointments

The ingredients were weighed into a clean dry glass mortar. The materials were then thoroughly mixed for one hour until there was a uniform and smooth distribution of the ingredients. Mixing was continued until no gritty feeling was experienced when applied to the skin. Ointments are semisolid substances that are greasy, normally anhydrous, and insoluble in water. They have the advantage of being moisturizing, more occlusive than creams and forming a protective layer over the wound or burn. They tend to provide anaerobic environment and thus aid in decreasing microbial growth. Ointments containing mucin were applied to both wounds and burns with rapid healings. The healing rates for burns were much more rapid than for other open wounds when tested experimentally in an orthopedic hospital [9].

Creams

Wool fat and water were separately warmed to 80 oC. The two were mixed and stirred until a whitish cream was obtained. The mucin was added at about 40 oC. and the mixing continued until a semi-solid, well mixed cream was obtained. Creams are either water soluble or oily and so easily washed off. Creams are less messy and less occlusive than ointments and are suitable for use in the flexural or napkin areas. They are the preferred form for treatment of suppurating (weeping) wounds and burns and for use under wet dressings. When mucin cream is prepared, additional caution should be taken to the mucin when the cream base is almost cold to avoid degradation. Mucin creams were found to be highly effective in wound healing [9].

Gels

The gelling materials plus the mucin were dispersed in water and thoroughly mixed with a homogenizer. The mixture was allowed to stand until a semi-solid gel was obtained. Gels are semi-solid or even solid preparations made from high molecular weight polymers in an aqueous or alcoholic base. They are easy to apply and wash off. Gels are useful for promoting wound granulations. In preparing mucin gel, a preservative is essential to prevent spoilage. When the mucin gel was applied to wounds, there were rapid healing ranging from 5 days to two weeks depending on the thickness and depth [10].

Films

Films containing the mucin were prepared from the same formula as the gel. When uniformly gelled, the water was removed by evaporation at 50 ˚C. for 24h. At the end, the films were cut into small pieces for further study. The proposed films or adhesive patches are intended for use on weeping surfaces. Being solid, they may reduce the fluid exuding from weeping or suppurating surfaces. Mucin films should be applied to minor abrasions [10].

Bio-adhesive Drug Delivery

Snail mucin was found to be excellent in in bio adhesive drug delivery particular for protein drugs such as insulin [11]. When evaluated for bio adhesive strength the mucin was found to be very highly bio adhesive to the rat intestinal mucosa with a 100% muco-adhesion at 20%w/v concentration. The adhesions were tested in various simulated intestinal fluids such as simulated gastric fluid. The snail mucin did not lose its adhesion strength in the simulated gastric fluid, but adhesive strength was lost by about 20%. When prepared into granules, the mucin affected the gastrointestinal motility of gastrointestinal transit time of charcoal meals. Segmental contractions of the smooth muscle mix the intestinal contents. In general, the walls of the viscera are relaxed, and both tone and propulsive movements are diminished. The gastric emptying time, therefore, is prolonged and intestinal transit time lengthened. Abnormal activity of the gut may cause accelerated, retarded, or retrograde (reflux) movement of its contents. Blockade of muscarinic receptors has dramatic effects on motility and some of the excretory functions of the gut. The administration of snail mucin significantly ($p<0.05$), reduced in a dose-related manner the charcoal meal transit although optimally at a dose of 400mg/kg. The inhibition thus produced was of 1.I % whereas 10 mg of atropine gave an inhibition of 1.0% of the gut transport of the charcoal plug. This shows that snail mucin lowers intestinal motility at high doses.

Insulin stability represents one of the main problems related to the development of new delivery systems containing this hormone. Adikwu et al. [11] explored the stability of insulin in mucin and the possibility of delivering insulin rectally using snail mucin as the delivery agent. The stability of insulin adsorbed on mucin powder at different temperatures was evaluated. The mucin powder was extracted from the giant African snail Archachatina maginata by differential precipitation with acetone. The study of the extent of adsorption showed an increasing amount of insulin adsorbed in the following order: 1.68%, 2.24%, 2.80%, 5.04% and 10.08% in the corresponding mucin-insulin ratio of 150:1, 300:1, 450:1, 600:1 and 750:1. The study also showed that with increasing temperature, there is a corresponding decrease in the amount of insulin adsorbed on the mucin powder. The effect of the insulin stabilized in mucin of varying proportions subjected to different temperature conditions on the percentage basal blood glucose level of the experimental animals revealed decreased stability of the insulin with increased temperature as shown by the decreased effect on the plasma glucose level on the experimental animals. The insulin stabilized in mucin showed an enhanced lowering of the plasma glucose level to 49% when compared to the non-significant blood glucose lowering effect of non-stabilized insulin administered to the control group of rats. Consequently, mucin incorporated with insulin can be developed as a safe method for the rectal delivery of insulin.

Conclusion

This review has clearly shown that snail mucin has great potential in pharmaceutical applications. It should be noted that more studies on this biological material should be encouraged as the knowledge of the properties of snail mucin might lead to some compounds of interest as far as human aliments such as some types of cancer are concerned. It should be noted that the mucin from this source may not be too far from human epithelial mucins that coat various body orifices such intestinal surfaces.

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