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Formulation, Characterization, and Evaluation of the Antibacterial Activity of a Polyherbal Hand Sanitizer Gel

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Abstract

Hand sanitizer is a popular method to maintain hand hygiene. Alcohol-based hand sanitizers have drawbacks such as skin irritation, dryness, and harshness. Thus, this study was aimed to formulate a novel antibacterial hand sanitizer gel using aqueous flower extract of *Cassia auriculata*, fruit extract of *Phyllanthus emblica* (PE), and ethyl acetate flower extract of *Nyctanthes arbor-tristis* (NA) and assess its antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* through the well-diffusion method. Carbopol 940, distilled water, 95% ethanol, glycerin, and triethanolamine were used to formulate the gel base and its stability was examined. The gel was prepared by incorporating antibacterial plant extract combinations (1PE:1CA:1NA, 2 PE:1CA:1NA, 1PE:2CA:1NA, 1PE:1CA:2NA) into the gel base. The effectiveness of the formulated herbal sanitizer gel was evaluated against *S. aureus* and *E. coli* through well-diffusion method and Minimum Inhibitory Concentration (MIC) was determined in triplicates and the trials were analyzed as mean $\pm$ standard error of mean (SEM) of the replicates. Among the plant extract combinations, 2PE:1CA:1NA represented the most potent antibacterial activity, and 1PE:1NA:1CA was used to formulate sanitizer gel considering stability studies. The gel was semi-solid, soft, and light brownish-colored, with an acceptable fruity odor and the gel was stable up to 60 days at both 4°C and room temperature. The formulated gel exhibited potent antibacterial activity against both microorganisms, with the highest activity against *S. aureus*, while gel base (negative control) was not shown activity. The gel's MICs were 9.375 mg/mL and 18.75 mg/mL against *E. coli* and *S. aureus*, respectively. The gel's pH was 5.82 and compatible with the skin's pH range. The formulated polyherbal hand sanitizer gel could be a promising candidate for hand sanitation in comparison to alcohol-based hand sanitizers.

Keywords: *Polyherbal, Hand sanitizer, Antibacterial C. auriculata, P. emblica, N. arbor-tristis.*