



Original Article - Open Access

Development and evaluation of topical ointment formulation containing gallic acid as an active pharmaceutical ingredient against bacterial infection and oxidative damage

Parvesh Kumar Dhama, Shabnam Ain**, Babita Kumar and Qurratul Ain

Sanskar College of Pharmacy and Research (SCPR), Sanskar Educational Group, Ghaziabad-201302, Uttar Pradesh, India

Article Info

Article History

Received 15 March 2022
Revised 1 May 2022
Accepted 2 May 2022
Published Online 30 June 2022

Keywords

Topical formulation
Ointment
Gallic acid
Antibacterial activity
Network pharmacology

Abstract

Bacterial infections and oxidative damage are becoming more concerning health problems to be addressed by health professionals due to the multidrug resistance of pharmaceuticals. Despite topical preference, oral administration compliance, and bioavailability barriers, still remains the opacity to developed an alternative topical formulation with better compatibility. The study is aimed to prepare different topical ointment formulations containing gallic acid as an active pharmaceutical ingredient, followed by optimization of the best formulation. *In vitro* drug release profile was determined followed by antibacterial evaluation against *E. coli* and *S. aureus* viability. DPPH assay, *in silico* pharmacokinetic and network pharmacology analysis were performed to determine antioxidant potential, bioavailable response and multi-mechanistic therapeutic role of formulation/gallic acid in alleviation of bacterial infection even oxidative damage. The outcomes of the study showed that the formulation F3 was found as an optimized formulation which showed 5.76 ± 0.0707 pH, 1457.35 ± 4.868 Pa viscosity, 129.42 ± 1.665 g/cm³ spreadability index. In antibacterial activity, the average zone of inhibition was found 5.324 ± 0.458 mm and 5.324 ± 0.458 mm against the growth of *E. coli* and *S. aureus*, respectively. The developed formulation exhibited significant ($p < 0.01$) antioxidant activity. *In silico* pharmacokinetic showed good bioavailable response of gallic acid while network pharmacology analysis showed multi-mechanistic action of gallic acid in alleviation of inflammation and oxidative stress induced by the biological stimulus. Hence, it can be concluded that the developed optimized formulation can be used for the bacterial infection as well as oxidative damages induced by the biological stimulus.

1. Introduction

Infectious diseases are still a major health problem which accounts about 41% of the global disease burden measured in terms of disability-adjusted life years (DALYs). Microorganisms are the smallest or tiny living organisms found everywhere in our surroundings that are too small in shape which could not be seen by the naked eye. Mostly, microorganisms live in water, ground soil with the highest density, and in the air. Among the high abundance of microorganisms, some of them are beneficial for humans and some of them harm human health, drastically. Furthermore, the human body is also acknowledged as the home of millions of microorganisms of different diversities (Venkateshram et al., 2021; Cavicchioli et al., 2019).

World health organization (WHO) is an international body accountable for preserving the highest level of human health and well-being. As per WHO, microorganisms are one of the thought-provoking threats that are distressing global health, exponentially.

Notably, less than 5% and percentage as little as 1% of all bacteria can be cultured in the laboratory (Aboudhannan et al., 2010; Mourya et al., 2019). Most of the growing species of microorganisms in the laboratory are used to explore the determinant effect of natural or synthesized antibacterial agents. Other than, the advancement of pharmaceuticals criticized the necessity for those pharmaceuticals having antibacterial resistance (Clebak and Malone, 2018; Piddock, 2012). Antimicrobial resistance of contemporary medicine is being incessantly growing emergency accredited because of their overuse or misappropriation of such medications (Kiran et al., 2021). Besides, economic incentives and challenging regulatory necessities are the principal deficient reason which creates complication in the development of new antibacterial drugs by the pharmaceutical industry. For decades, bacterial resistance to the current pharmaceuticals is incessantly amplified, thus to curtail resistance and capitalize on the biological efficiency of antimicrobial agents. It is essential to reconnoiter the mechanism of antibacterial resistance through another biomolecular approach and disavow the efficiency of the therapeutic drug (Aishabi et al., 2020; Breijyeh et al., 2020).

Topical formulations are the type of pharmaceuticals which are available in different form such as creams, emulsions, foams, powders, liquids, gels, etc., containing one of more than one active pharmaceuticals for treating the affected site. Among them, ointments are the well-known pharmaceutical formulation due to

Corresponding author: Dr. Shabnam Ain
Professor and Head, Department of Pharmaceutics
Sanskar College of Pharmacy and Research (SCPR), Sanskar
Educational Group, Ghaziabad-201302, Uttar Pradesh, India.
E-mail: shabnam.ain@sanskar.org
Tel: +91-9310897567

Copyright © 2022 UKAAZ Publications. All rights reserved.
Email: ukaaz@yahoo.com; Website: www.ukaazpublications.com