Investigating the Anti-Inflammatory and Therapeutic Potential of *Solanum nigrum* Extract in the Management of Inflammatory Bowel Disease

Background and Rationale

Inflammatory Bowel Disease (IBD), encompassing Crohn's disease and ulcerative colitis, is a chronic and relapsing inflammatory condition of the gastrointestinal tract with no definitive cure. Existing treatments primarily focus on managing symptoms and modulating the immune response, but they are often associated with adverse effects and variable efficacy. There is a growing interest in exploring natural products with anti-inflammatory properties as potential therapeutic agents in IBD management.

Solanum nigrum (black nightshade) is a medicinal plant traditionally used in several cultures for treating inflammatory conditions, liver disorders, and infections. Preliminary pharmacological studies suggest that it possesses anti-inflammatory, antioxidant, and cytoprotective effects, potentially due to its bioactive constituents such as solanine, saponins, and flavonoids. Given these properties, *Solanum nigrum* may offer therapeutic benefits in the context of IBD. This proposal outlines a study designed to evaluate the efficacy and safety of *Solanum nigrum* extract in an experimental model of IBD.

Objectives

The primary objective of this study is to evaluate the anti-inflammatory effects of *Solanum nigrum* extract in an animal model of IBD. Secondary objectives include assessing histopathological changes in the colon, quantifying inflammatory biomarkers such as tumour necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and C-reactive protein (CRP), and determining the extract's safety and toxicity profile.

Hypothesis

It is hypothesized that *Solanum nigrum* extract will exhibit significant anti-inflammatory effects and reduce both clinical and histological signs of IBD in an induced animal model, without producing adverse effects.

Methodology

This study will utilize 40 Wistar rats, each weighing between 200 and 250 grams. The animals will be randomly divided into five groups: a normal control group, an IBD

control group (induced with dextran sulfate sodium (DSS) or trinitrobenzene sulfonic acid (TNBS)), a group treated with a low dose of *Solanum nigrum* extract, a group treated with a high dose of the extract, and a group treated with a standard anti-inflammatory drug such as mesalamine.

IBD will be induced in the relevant groups using DSS or TNBS, which are well-established methods for simulating colitis in animal models. Following induction, the treatment groups will receive oral administration of *Solanum nigrum* extract daily for 14 days.

Clinical observations such as body weight changes, stool consistency, and rectal bleeding will be recorded throughout the study. Blood samples will be collected to evaluate inflammatory markers, including IL-6, TNF-α, and CRP. At the end of the treatment period, colon tissues will be harvested for histological examination to assess mucosal integrity, ulceration, and inflammatory infiltration. Additionally, liver and kidney function tests will be performed to evaluate systemic toxicity, and acute toxicity studies will be conducted to confirm the safety of the extract.

Expected Outcomes

It is anticipated that treatment with *Solanum nigrum* extract will lead to a reduction in inflammatory markers, improvement in colon histopathology, and better clinical outcomes compared to the untreated IBD group. The extract is also expected to demonstrate a favourable safety profile, making it a promising candidate for further development as a plant-based therapeutic agent.

Significance

This study may contribute valuable evidence supporting the use of *Solanum nigrum* as a natural, cost-effective, and potentially safer alternative or adjunctive treatment for IBD. It will also deepen our understanding of the plant’s pharmacological mechanisms, encouraging further research and development of phyto therapeutic agents for chronic inflammatory conditions.