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**Title: Development of a Novel Functional Soup mix incorporating leaves of Black Nightshade (*Solanum nigrum* L.)**

**Abstract**

A sharp rise in lifestyle diseases and an increase in health-conscious consumers have led to the dawn of functional foods, like functional soup. Soups retain most nutrients from their basic ingredients during processing and are also least prone to processing losses. Functional soups majorly act as sources of functional carbohydrates and proteins.

The current study was undertaken to develop a novel functional soup mix incorporating leaves of black nightshade (*Solanum nigrum* L.). Its composition, biochemical, physical, functional, organoleptic, shelf life, digestion based bioaccessibility, assimilated bioavailability and economic aspects were taken up for evaluation.

The *S. nigrum* leaves dried using recirculatory air drying (RAD) treatment (65°C) showed minimum nutrition loss. The leaves were devoid of  $\alpha$ -solanine (HPLC-DAD). The LC-ESI MS/MS profiling of the leaves indicated the presence of polyphenols like quercetin, gallic acid, naringenin and kaempferol.

These dried (65°C RAD) leaves were used for the development of a novel functional soup mix, using the D-optimal mixture design. The optimised formulation was 3.96% leaf powder, 30.04% corn starch and 66% spice mix. The developed soup had a viscosity of 1942 cP and a hedonic overall acceptability of 6.42. The optimised soup mix was also rich in functional components like polyphenols and antioxidants.

The optimised novel functional soup mix was shelf-stable under normal storage conditions (25°C, 55% RH) for 91 days, without any preservatives. Moisture content and microbial growth rate predicted shelf life of 161 and 191 days, respectively, under normal storage conditions.

The in vitro digestion and assimilation studies indicated good retention of essential nutrients and functional components as bioaccessible and bioavailable fractions. The soup mix had an IC<sub>50</sub> of 15.16 mg/mL for amylase inhibition activity and a predictive glycaemic index of 53.27, making it a low glycaemic food.

The cost of a small-scale soup mix production unit was estimated to be cheap (Rs. 7/unit pack) and profitable (1.25 as Profitability index). Thus, the current study indicates that the leaves of black nightshade are functionally potent. The novel functional soup mix was found to be organoleptically acceptable, commercially viable, shelf-stable and proved to be functionally active upon digestion and assimilation.

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**Keywords:** Black nightshade, polyphenols, functional soup, antioxidant, D-optimal mixture design, in vitro digestion, starch-digestion kinetics, low glycaemic index.

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