

Storage Stability, Gastrointestinal Release and Sensory Properties of Cookies Incorporated with Protein-based *Moringa oleifera* Leaf Extract microcapsule

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ABSTRACT

Moringa oleifera leaves have been known for the numerous nutritional and health benefits. In this study, the bioactive compounds present in *M. oleifera* leaf extract were extracted and encapsulated in soy protein isolate (SPI) and pea protein isolate (PPI). The *M. oleifera* microcapsules (MM) produced were incorporated in cookies on replacement basis at 2.5%, 5% and 10% (w/w), respectively with wheat flour. Total polyphenolic contents (TPC) of *M. oleifera* microcapsules with soy protein isolate (MM-SPI) cookies were 0.72, 0.89 and 1.11 mg GAE/g at 2.5%, 5% and 10%, respectively and the TPC for *M. oleifera* microcapsules with pea protein isolate (MM-PPI) cookies were 0.74, 0.84 and 0.93 mg GAE/g at 2.5%, 5%, and 10%, respectively. The antioxidant scavenging properties (DPPH) of incorporated cookies for MM-SPI cookies were 0.70, 0.84 and 1.22 mg TE/g at 2.5%, 5 % and 10%, respectively and MM-PPI cookies were 0.43, 0.52 and 0.63 mg TE/g at 2.5%, 5% and 10%, respectively. The storage stability of MM cookies showed slight levels of degradation in the TPC and the percentage TPC retained after 90 days storage were 96.84%, 80.65% and 49.26% for cookies with 5% MM-SPI, 5% MM-PPI and 0% MM cookies, respectively. The gastrointestinal stability of the MM cookies showed a higher released rate at the intestinal system. The MM were able to mask *M. oleifera* greenish colouration, although at 10% incorporation of MM in cookies; the beany flavour of SPI and PPI were intense, which led to low sensory evaluation scores.

Keywords: *Moringa oleifera*, Microencapsulation, Soy protein isolate, Pea protein isolate, Cookies, Total polyphenolic content

INTRODUCTION

In recent time, due to the advent of chronic diseases affecting the nations of the world consumers no longer need foods with basic nutritional benefits. Hence the need for developing food products with optimal health benefits, such food products are rich in bioactive compounds which contains anti-inflammatory, antidiabetic, anticancer and antioxidant properties. In addition, these food products could act as a better substitute for food supplements regarding its efficiency in bioactive compounds, consumption, safety, delivery, and bioavailability (Tumbas et al., 2016).

Moringa oleifera is an Indian local medicinal herb, which was first discovered from ‘Sub-Himalayan tracts of Indian’. It is well known in the tropics and subtropical regions of the world (Ramachandran et al., 1980). *M. oleifera* has gained importance in the area of functional food ingredients due to its nutritional and health-promoting attributes. According to Kasolo et al. (2010), *M. oleifera* leaves contain numerous essential nutrients, which includes, amino acids, vitamins, β-carotene, minerals, and several polyphenolics as well as antioxidants, anti-inflammatory, omega-3 and omega-6 fatty acids. The extract of *M. oleifera* leaves contains high amount of polyphenolic contents which has high antioxidant properties against free radicals, preventing oxidative damage to biomolecules and enables adequate defence from its damage (Sarwat et al., 2012). *M. oleifera* leaves have slightly bitter taste and its green colour limit its utilisation as functional food ingredient. However, bioactive compounds present in leafy vegetables like the polyphenols are not stable during food processing, storage and along the intestinal tract. The above limitation could lead to a reduction of its potential health benefit (Fang and Bhandari, 2010). To avoid this limitation, ensure stability, palatability and retention of its essential properties during processing, storage and consumption; there is the need for microencapsulation of *M. oleifera* leaf extract.

Microencapsulation is a method by which droplet size and tiny particles are bounded by a polymer wall material, or are enclosed in a homogeneous or heterogeneous matrix, to form a micro size capsule (Gharsallaoui et al., 2007). It is the entrapment of a gaseous, liquid, or a solid substance within another substance in a very small microcapsule. The core materials are mainly bioactive compounds, which gradually diffused through the capsule walls, ensuring a controlled release under the desired conditions (Fang and Bhandari, 2010). Microencapsulation preserves bioactive constituents and ensures better handling properties. It provides barriers against oxygen, light and temperature. It also masks unpleasant taste and colour. Spray-drying technique is a method of microencapsulation. It is an uninterrupted transformation of feed from a fluid