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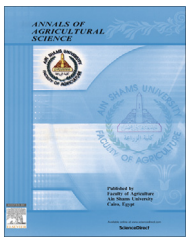

Physico-chemical properties of yoghurt containing cress seed mucilage or guar gum

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Abstract The changes in physico-chemical properties of yoghurt containing cress seed mucilage (CM) compared with yoghurt containing guar gum (GG) or plain yoghurt during storage at 5 ± 2 °C for 15 days were evaluated. CM was prepared and added to standardized buffalo's milk (~3.2% fat and ~15.0% TS) at rate of 0.025%, 0.05% and 0.10% but GG was added at the rate of 0.025% and 0.05% to create 5 treatments. The latter batch had no CM or GG, serve as a control (C). No significant changes in pH values and proteolysis (SN/TN ratio) of all yoghurt samples throughout the storage period were observed. CM containing yoghurts showed adverse effect on the concentration of acetaldehyde and diacetyl until day 10 and day 15, respectively compared with C and that containing 0.025% GG. Yoghurt samples containing different levels from CM or 0.025% GG exhibited lower in wheying-off and whey syneresis compared with C. No significant changes in the firmness of the yoghurt containing 0.025% and 0.05% CM or 0.025% GG were found throughout the storage period, while yoghurt containing 0.05% GG exhibited lower firmness compared with other yoghurt samples. Apparent viscosity of yoghurt containing GG or CM was higher than that of C until day 10. However, yoghurt containing 0.025% and 0.05% CM or 0.05% GG showed continued increase in apparent viscosity until day 10 while for yoghurt containing 0.10% CM, the increase was observed until day 5 and decline thereafter.

Introduction

Food is a complex and heterogeneous system containing many different chemical types and species. In a product consisting of proteins, lipids, carbohydrates and electrolytes such as milk, cream, yoghurt, cheese, beverages, the interactions among various constituents need to be well balanced so that a stable system evolves (Samant et al., 2007). Edible hydrocolloids are used in the food industries as thickeners, stabilizer, gelling agents, syneresis control, emulsifiers or suspension stability and prebiotic (Lucey, 2002; Nikoofar et al., 2013). Recently, they have attracted much attention for their function as dietary fiber which is expected to lower cholesterol and blood pressure

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thus preventing life style related diseases. In the same time, they control flavor and aromas release (Zhao et al., 2009).

Mucilages are polysaccharide complexes formed from sugar and uronic acid units. They form slimy masses in water which are typically heterogeneous in composition. Mucilages are obtained mainly from seeds or other plant parts. Some are obtained from marine algae, and from selected microorganisms (Rangari, 2002). Plant mucilages have been widely explored as pharmaceutical excipients (Verma and Razdan, 2003) and have been known since ancient times for their medical uses (Murray et al., 2006). They are widely used in the industry as thickeners, water-retention agents, emulsion stabilizers, gelling agents, suspending agents, binders, film formers, and sustained-release agents (Kapoor et al., 1992; Reid and Edwards, 1995). Cress seeds (*Lepidium sativum*) contain large amounts of mucilaginous constituents when soaked in water and a transparent gel forms around the whole seed (Karazhiyan et al., 2009). Cress seed mucilage contains L-arabinose, D-xylose, D-galactose, L-rhamnose, D-galacturonic acid, and 4-O-methyl-D-glucuronic acid as major components with D-glucose and mannose as trace components. Cress seed mucilage is widely used in many traditional medicinal preparations such as cough syrups. It also has antihyperglycaemic properties which help to control glucose level in diabetics (Behrouzian et al., 2014).

Physico-chemical properties of cress seeds mucilage were widely studied (Lin et al., 2005; Karazhiyan et al., 2009; Karazhiyan et al., 2011; Naji et al., 2012). However, there are few controversial reports in the literature for using cress seed mucilage as dairy food supplement (Bhatty and Cherdkiatgumchai, 1990; Behnia et al., 2013). The growing awareness of the relationship between diet and health has led to an increased demand for food products that support health above and beyond providing basic nutrition (Karagul-Yuceer et al., 2001; Fiszman et al., 1999). Therefore, the objective of this study was to evaluate the physico-chemical properties of yoghurt containing cress seed mucilage compared with guar gum during storage at 5 ± 2 °C for 15 days to select the best concentration gives high quality.

Materials and methods

Materials

Fresh buffalo's skim milk and sweet cream (~40.0% fat) were obtained from the farm of Fac. Agric., Cairo Univ., Egypt. Skim milk powder (low heat) made in the USA was purchased from the local market at Cairo, Egypt. Cress seeds (*L. sativum*) were purchased from local market (Cairo, Egypt) with moisture content of ~6.84%. Guar gum was purchased from Sigma (Sigma Aldrich Co., St. Louis, MO, USA). *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus salivarius* ssp. *thermophilus* were obtained from stock cultures of Dairy Microbiology Lab., National Research Centre, Cairo, Egypt.

Methods

Cress seed mucilage extraction

Cress seeds (100 g) were washed in water for 1 min to remove the surface dust, and then mixed with 900 ml distilled water. The cress seeds and water were then stirred for 5 h at a speed of 300 rpm/min, in a 60 °C water bath, according to the method of Cui (2001). The extracted cress seed mucilage solution was filtered through 40-mesh screen and precipitated with two volumes of 95% ethanol. The cress seed mucilage was separated by centrifugation at 3000 rpm/min for 10 min. The precipitated cress seed mucilage was then dried in a hot air oven at 60 °C over night.

Yoghurt manufacture

Fresh buffalo's skim milk was standardized to ~3.2% fat and 15.0% total solids using skim milk powder and sweet cream, and divided into six equal portions. Cress seed mucilage was added to the milk at rate of 0.025%, 0.05% and 0.10% (CM_1, CM_2 and CM_3, respectively), but guar gum was added at the rate of 0.025% and 0.05% (GG_1 and GG_2, respectively) to create 5 treatments. The latter batch had no cress seed mucilage or guar gum, serve as a control (C). All mixtures were preheated to 60 °C, homogenized using laboratory double stage homogenizer (Rannie, Copenhagen, Denmark), 13.6 MPa first stage and 3.5 MPa second stage, then heated to 85 °C for 10 min and cooled to 42 °C. The treated yoghurt milks were inculcated with 3.0% of mixed starter culture (1:1), dispensed into plastic cups (150 ml) and incubated at 42 °C until a uniform coagulation was formed (Barrantes et al., 1994). The yoghurt samples were stored at 5 ± 2 °C and analyzed at day 1, 5, 10 and 15 of storage. Three replicates were made from each treatment.

Chemical analysis

The changes in pH in the yoghurt samples during storage were measured using a laboratory pH meter with glass electrode (HANNA, Instrument, Portugal). Total nitrogen and soluble nitrogen contents in the yoghurt samples were determined according to the methods described by AOAC (2007). The extent of proteolysis in the yoghurt samples during storage was calculated as a ratio of soluble nitrogen/total nitrogen (SN/TN ratio). The concentration of acetaldehyde and diacetyl in the yoghurt samples were measured using spectrophotometer (Shimadzu, 240-UV–Vis, Japan) as described by Less and Jago (1970).

Physical properties

Whey separation

The volume of whey on the surface of the plastic cup of yoghurt sample was taken as an indicator for wheying-off (ml/100 g yoghurt) according to the siphon method described by Amatayakul et al. (2006). Whey syneresis was estimated as mentioned by Aguilera and Kessler (1989). An amount of 25 g of the yoghurt sample was placed into centrifuge tube and centrifuged at 1290*g* for 20 min (Sigma Laborzentri Fugen, 2 K15, Germany). The weight fraction of the supernatant liquid was used as index of whey syneresis (ml/100 g yoghurt).

Apparent viscosity

The yoghurt samples were gently stirred 5 times in clockwise direction with a plastic spoon prior to viscosity measurements. Apparent viscosity was measured at 7 °C using a Brookfield digital viscometer (Model DV-II, Canada) fitted with spindle-4. The yoghurt sample was subjected to selected shear rates