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Evaluation of the Effect of Fermentation, Hydrothermal Treatment, Soda, and Table Salt on Phytase Activity and Phytate Content of Three Iranian Wheat Cultivars

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ABSTRACT

This study was carried out to determine the effect of fermentation, hydrothermal treatment, soda (Na_2CO_3), and table salt (NaCl) addition on the extent of phytase activity and phytate degradation in three Iranian wheat cultivars, namely, Mahdavi, Ghods, and Roshan. The samples were milled to three different extraction rates, i.e. whole, 85%, and 75% flours and three kinds of leavening procedure (fermented, soda, and control), and four NaCl percentages (0.0, 0.5, 1.0, 1.5%) were used for preparing dough in three replications. To evaluate the effect of heat treatment on phytic acid breakdown, baking was also done. The results indicated that among the wheat varieties, Mahdavi had the highest level of phytase activity and phytic acid content followed by Ghods and Roshan; in which, most of the phytate was concentrated in bran fractions. Fermentation (1% yeast at 37ºC for 3 hours), hydrothermal treatment (pH 4.8 at 55ºC for 12 hours) and salt addition (0 to 1.5%) to the dough samples resulted in an increased phytase activity, whereas soda addition (1%) decreased the enzyme activity. Heat treatment reduced phytic acid content significantly.

Keywords: Fermentation, Hydrothermal, Phytase, Phytate, Soda, Table salt.

INTRODUCTION

Phytate is typically found in the outer (aleuron) layers of cereal grains and in the endosperm of legumes and oil seeds constituting approximately 1-3% of their dry weight (Graf, 1983; Bohn *et al.,* 2004). Although there are reports on phytate beneficial effects such as anticancer properties (Shamsuddin and Vucenik, 1999), its typical negative effect is to form a complex with multivalent metal ions, especially zinc, calcium, and iron. This binding can result in the formation of very insoluble salts with poor bioavailability of the minerals. (Reddy, 1982; Wu *et al.,* 2009). Phytic acid is hydrolyzed enzymatically by phytases, or chemically, to lower inositol phosphates during storage, fermentation, germination and food processing. Various food processing methods such as soaking, malting, and fermentation activate the endogenous phytase that catalyze the stepwise hydrolysis of phytic acid, while processing methods such as heat treatments i.e. blanching, baking, autoclaving, and frying, cause autolysis of phytic acid (Servi *et al.*, 2008; Garcia-Estepa *et al.*, 1999). Phytase enzymes, widely present in organisms such as plants, microorganisms, and animal cells enhance minerals availability (Lonnerdal, 2002; Konietzny *et al.,* 2002) and release of phosphorus. Phytate is susceptible to degradation during the fermentation of bread dough (Giovanelli *et al*., 1994) that involves phytase activity of endogenous enzymes, naturally present in cereals, or microbial

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