Journal of Food Quality and Hazards Control 1 (2014) 29-31

Determination of phytic acid content in different types of bread and dough consumed in Yazd, Iran

M.H. Mosaddegh Mehrjardi [1] (PhD), A. Dehghani [2] (PhD), G.R. Jahed Khaniki [3] (PhD), F. Shah Hosseini [4*] (MSc), B. Hajimohammadi [4] (PhD), N. Nazary [5] (BSc)

1. Department Pharmacology, Faculty of Pharmacy, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
2. Department of Biostatistics and Epidemiology, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
3. Department of Environmental Health Engineering, Faculty of Public Health, Tehran University of Medical Sciences, Tehran, Iran
4. Department of Food Hygiene and Safety, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
5. Yazd Health Office, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

Article type
Short communication

Keywords
Phytic acid
Bread
Iran

Received: 2013-12-15
Revised: 2014-02-25
Accepted: 2014-03-19

ABSTRACT

Introduction: Bread made from wheat flour is an important source of minerals such as iron and zinc, but its phytic acid content is a contributing factor that can cause decreased absorption of these minerals. This survey aimed to determine phytic acid content in different types of bread and dough consumed in Yazd, Iran.

Materials and methods: A descriptive, cross-sectional study was carried out in 2013 on 100 samples including 50 samples of bread and 50 ones of dough from Yazd, Iran. After extraction and preparation stages, samples were analyzed by HPLC system to determine phytic acid.

Results: The results demonstrated that in 15 samples (30%) of dough and in 9 samples (18%) of breads, phytic acid concentration was more than acceptable level (10 mg/100g). Among the studied breads, Barbari had the lowest (7±1.5 mg/100g) and Lavash (9.8±0.4 mg/100g) had the highest amount of phytic acid. Also, there was an inverted correlation among fermentation time and phytic acid concentrations, especially in Tafton dough (p=0.03) and Barbari (p= 0.005).

Conclusion: It is a necessity to offer practical solutions for prevention of anti nutritional effects of phytic acid in bread and dough.

Copyright © 2014, Shahid Sadoughi Uni Med Sci. All rights reserved.

Introduction

Wheat bread is a staple food in human diet in many parts of the world including Iran (Gargari et al., 2007). Bread can provide about half of the protein, over the 60% of thiamine and niacin, approximately 40% of calcium and 80% of iron that an adult person needs. Bread is consumed in all daily three meals. Also, it can be used in foods that have an important role in provision of required energy for daily activities. The bread made from wheat flour is an important source of inorganic materials such as iron and zinc (Garcia-Estepa et al., 1999; Roohani et al., 2012).

Phytic acid is a chelating agent of minerals like copper, calcium, magnesium, zinc and iron. Many of the phytate-mineral complexes are insoluble, and thus, non-absorbable in normal physiological conditions. The ability of phytic acid to chelate these essential minerals is a matter of human nutritional concern (Garcia-Estepa et al., 1999; Jamalian and Sheikholeslami, 2004). Daily intake of phytic acid is estimated approximately 200 to 800 mg in industrial countries and about 2000 mg in developing countries, whereas the lower quantities of phytic acid (about 10mg/100g) can reduce the absorption of minerals (Gargari et al., 2007) and may cause the anti-nutritional effects. (Roohani et al., 2012; Tavajjoh et al., 2011).

Regarding the nutritional role of micronutrients (calcium, iron, zinc, etc.) in different groups, especially children and pregnant women, the inhibitory effect of phytic acid on the absorption of micronutrients and risk of nutritional deficiency and nutritional diseases is extremely important. Many studies have shown that in Iran particularly in Yazd, there is the risk of inadequate intakes of micronutrients such as iron and calcium, and the nutritional disorders have frequently increased. For example, in Yazd, 34.7 % of high school girls and 73.9% of the children are

*Corresponding author
Email: fshahosaini90@gmail.com

[Downloaded from jfqhc.ssu.ac.ir on 2026-09-14]

suffering from iron and zinc deficiency respectively (Mozaffari-Khosravi et al., 2009). Phytic acid is one of the most important anti-nutritional compounds found in wheat that effectively reduces the absorption of minerals; thus the necessity of this research was felt in Yazd.

The aim of this survey was to determine phytic acid content in different types of bread and dough consumed in Yazd, Iran.

Materials and methods

In 2013, 50 samples of bread and 50 samples of dough were randomly obtained from bakeries of Yazd, Iran including Tafton, Baguett, Lavash, Sangak and Barbari. Samples were transported to the laboratory within 12 hours and analyzed immediately.

Extraction and preparation of samples and the final injection into the HPLC column was based on Dost and Tokul (2006) procedure. Samples were analyzed using High Performance Liquid Chromatography Shimadzu (lc-6a) system equipped with C_{18} (25 cm *0.6 mm) column and a florescence detector. Chromatographic determination of phytic acid was based on metal replacement reaction of phytic acid from colored complex of iron (III)–thiocyanate and monitoring any reduction in concentration of colored complex.

The mobile phase was a mixture of 30% acetonitrile and water including 0.1M HNO_3. The injection volume was 20 µl and the retention time was about 3.5 minute. The detection wavelength was set at 460 nm.

Statistical analyses were performed by t-test and one-way analysis of variance followed by post hoc multiple comparisons using the SPSS. Significant level considered when $p<0.05$.

Results and discussion

As indicated in Table 1, phytic acid concentration in 9 samples of breads (18%) and in 15 out of dough samples (30%) was more than acceptable level (10 mg/100g).

In a research by Jamalian and Sheikholeslami (2004), average concentration of phytic acid in Lavash and Sangak breads produced in Mashhad, Iran was reported 516.53 and 400.12 mg/100g, respectively, but in our study, it was 9.8 and 9.4 mg/100g, respectively.

Gargari et al. (2007) reported that the amount of phytic acid in Baguette distributed in Tabriz, Iran was 18.41 mg/100g while in our study it was 7.3 mg/100g. Also, in the study by Roohani et al. (2012), content of phytic acid in Baguette bread samples of Isfahan, Iran was reported less than 15 mg/100g. The difference between our results and the previous mentioned research is presumably related to difference of the methods applied. So, we removed most of inorganic phosphates by extraction in our HPLC method with a little modification. However, the different geographic conditions of wheat breeding and variety of wheat are maybe effective in the amount of phytic acid (Gargari et al., 2007; Roohani et al., 2012).

Our study showed that the fermentation time has an inverse relationship with the amount of phytic acid in the stage of dough preparation that is similar to the results of Turk and Sandberg (1992) and Reinhold (1971). Relation of fermentation time with the amount of phytic acid in bread samples is shown in Table 2. In Tafton and Barbari breads, increasing the fermentation time in the stage of dough preparation, has significantly reduced ($p<0.05$) the concentration of phytic acid.

Table 1: Phytic acid concentration in bread and dough samples of Yazd, Iran

	Number of samples	Range (mg/100 g)	Exceeded acceptable limit	Mean concentration (mg/100 g)
Bread types				
Tafton	24	6-15	6 (25%)	8.7±2.1
Baguette	8	6-9	0	7.3±0.9
Barbari	8	7-15	3 (37.5%)	7.0±1.5
Lavash	5	9-10	0	9.8±0.44
Sangak	5	9-10	0	9.4±0.5
Total	50	6-15	9 (18%)	8.36±1.9
Dough types				
Tafton	24	8-13	8 (33.3%)	10.1±1.3
Baguette	8	8-11	2 (25%)	9.7±1.03
Barbari	8	8-10	0 (0)	9.1±0.83
Lavash	5	9-13	2 (40%)	10.6±1.5
Sangak	5	9-12	3 (60%)	10.6±1.1
Total	50	8-13	15 (30%)	10.02±1.2

Journal website: http://jfqhc.ssu.ac.ir

[Downloaded from jfqhc.ssu.ac.ir on 2026-09-14]

Table 2: Relation between fermentation time and concentration of phytic acid in different types of dough

Dough Types	Fermentation time (minute)	Mean concentration (mg/100 g)	*P* value
Tafton	60	11.2±1.1	0.03
	120	9.8±1.2	
Baguette	60	10.0±1.2	0.5
	120	9.5±1	
Barbari	60	10.0±0.0	0.005
	120	8.6±0.5	

Nowadays, consumption of bread made from flour with high extraction rate is recommended, because it contains higher amounts of fiber, vitamins and minerals, but despite the beneficial nutrition effects of whole wheat flour, concentrations of some substances such as phytic acid in more than white flour (Garcia-Estepa et al., 1999; Jamalian and Sheikholeslami, 2004).

When the bread made from flour with high extraction rate forms part of the human diet, its adverse effects as mineral deficiency will occur in the human body. It should be noted that the amount of phytate degradation is higher in the dough prepared with flour of low extraction rate (Turk and Sandberg, 1992).

Since the extraction degree of flour used in bakeries of Yazd is similar, so we cannot express a significant relation between the extraction rate and the amount of phytic acid in bread and dough samples. The amount of phytic acid in the studied breads and dough were considerable and needs to offer practical solutions for prevention of anti nutritional effects of phytic acid found in these products. Considering the per capita consumption of bread in Iranian meals**,** the high risk groups should necessarily be informed, especially children, pregnant women and adolescent girls.

Conflicts of interest

There is no conflicts of interest.

Acknowledgement

Special thank is given to Mr. A. Zohourtabar (MS graduated at Food Hygiene and Safety) for his kindly help and assistance during sampling of bread and dough samples. Also, we thank sincerely Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

References

Dost K., Tokul O. (2006). Determination of phytic acid in wheat and wheat products by reverse phase high performance liquid chromatography. *Analytica Chimica Acta.* 558: 22-27.

Garcia-Estepa R.M., Guerra-Hernandez E., Garcia-Villanova B. (1999). Phytic acid content in milled cereal products and breads. *Food Research International.* 32: 217-221.

Gargari B.P., Mahboob S., Razavieh S.V. (2007). Content of phytic acid and its mole ratio to zinc in flour and breads consumed in Tabriz, Iran. *Food Chemistry.* 100: 1115-1119.

Jamalian J., SheikholEslami Z. (2004). Effect of fermentation parameters and extraction rate of flour on phytic acid content of Sangak and Lavash breads. *Journal of Science and Technology of Agriculture and Natural Resources, Water and Soil Science*. 8: 183-193.

Mozaffari-Khosravi H., Noori-Shadkam M., Naghiaee Y. (2009). Prevalence of iron deficiency and iron deficiency anemia in high-school girl students of Yazd. *The Journal of Shahid Sadoughi University of Medical Sciences*. 17: 135-141

Reinhold J.G (1971). High phytate content of rural Iranian bread: a possible cause of human zinc deficiency. *The American Journal of Clinical Nutrition.* 24: 1204-1206.

Roohani N., Hurrell R., Wegmuller R., Schulin R. (2012). Zinc and phytic acid in major foods consumed by a rural and a suburban population in central Iran. *Journal of Food Composition and Analysis.* 28:8-15.

Tavajjoh M., Yasrebi J., Karimian N., Olama V. (2011) Phytic acid concentration and phytic aicid: Zinc molar ratio in wheat cultivars and bread flours, Fars province, Iran. *Journal of Agricultural Science and Technology*. 13: 743-755.

Turk M., Sandberg A.S. (1992). Phytate degradation during breadmaking: effect of phytase addition. *Journal of Cereal Science.* 15: 281-294.

Journal website: http://jfqhc.ssu.ac.ir

[Downloaded from jfqhc.ssu.ac.ir on 2026-09-14]