M. Constandache. Journal of Agroalimentary Processes and Technologies,
Volume XIII, No.2 (2007), 461-466
Communication – Food Science

THE INFLUENCE OF FORTIFICATION OF BREAD WITH EXOGENES PROTEINS ON THE PROTEIN DIGESTIBILITY

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Abstract

One cannot consider the protein quality only from the point of view of the composition, quantity and quality of the amino acid. Therefore, there are many elements that can influence proteins quality, their degree of use and their digestibility. The purpose of this study was to determine protein digestibility of bread fortified with five different sources of protein: pea proteinic isolated, soy degreased flour, lupine proteinic concentrate, sodium caseinate and wheat germs. The digestibility of bread proteins varied according to the type of the protein source. Finally, the conclusion was that, regardless of the protein source, the digestibility of bread protein decreased compared to the control sample. The most important decrease was obtained in the case of bread fortified with wheat germs, followed by the ones fortified with pea proteinic isolated, lupine proteinic concentrate and soy degreased flour.
Keywords*: proteins quality, protein digestibility, pea proteic isolate, soy degreased flour, lupine proteic concentrate, wheat germs.*

Introduction

Metabolic balance is essential for human health, its maintaining being determined by the nature and quality of active biological compounds. The level of these compounds in the body could be taken like an indication of health spirit, functioning like biomarkers of alimentation quality. Some of the most important active biological compounds are the proteins (Costin, 1999). The protein importance in alimentation is owing to the fact that in deficit determines a reduction of the metabolic and enzimatic activity, of energetic metabolism, the inhibition of biosiynthesis process, reduction of the imunity and organism resistance on the extern agents action. The proteical

contribution determines the growth, mental dezvoltation, physical and intelectual performances, the reactions at aggressions, family and socialy behaviour. Being involved in all life preocesses, we can say that proteins are the main material carrying of life.

The proteic value of bread is determined not only by the content and quality of proteins but by the way those compounds react at the necessities of our body. Even if the content of some amino acids is high, the deficiency of one or more amino acids may generate a proteic insufficiency, against the background of high protein consumption by the organism. It may also be an excess limiting factor because the organism can't tolerate the individual variations of only one amino acid. The protein assimilation is determined by the level of the specific limiting amino acid (Segal, 2004). The biodisponibility of proteins is influenced by a big number of factors, moreover by their structure, their rapport, by their content of essential amino acids and by the presence of other compounds. The technological processing has a determinant influence on the biodisponibility of proteins, causing either a good influence or a bad one. The good influence is determined by the thermic processing which assures the inactivation, one way or another, of the anti nutritional factors and the unfolding of hard enzymatic hydrolyzed macromolecules. The bad influence is determined by one of the next processes: the forming of the melanoidinic compounds because of the heating, the destruction of amino acids which causes the unbalance of their rapport (Segal, 1983).

The objective of this study is to determine the biodisponibility of proteins of bread fortified with four different sources of proteins: pea proteic isolate, degreased soy flour, lupin proteic concentrate and wheat germs.

Experimental

The optimization of exogene proteins concentration used for obtaining the bread fortified with the four different sources of exogen proteins was the objective of a previous study (Constandache, 2006). The result of that study showed that the increase of bread proteic value is not possible with the fortification of wheat flour with concentrations biger than 5% pea proteic isolate, 10% degreased soy flour, 5% lupin proteic concentrate and 15% wheat germs. The overtaking of these

technological limites determines majore modifications in bread's sensorial quality which may lead to the rejection of the product by the consumers.

The pepsine method was used to determine the in vitro protein digestability of the fortified products. Bread samples fortified with each of the four types of exogen protein were analized in concentrations that determined an acceptable modification in bread's sensorial properties: bread fortified with 5% pea proteic isolate, bread fortified with 10% degreased soy flour, bread fortified with 5% lupin proteic concentrate and bread fortified with 15% wheat germs. The samples were dryed for 36 hours at 40°C, grinded and then sifted with a diameter of 1mm.

The 200mg sample is weighed in an Erlenmeyer glass and then mixed with 35ml pork pepsine solution (EC 3.4.23.1 – Merck, enzimathic activity 0.7FIP-U/mg) with the concentration of 1.5 pepsine/l in a solution 0,1m KH_2PO_4, pH = 2. The samples are digested for 2 hours at 37°C, stirring continuously on steam bath. The digestion is stopped with the addition of 2ml solution NaOH 2n. The samples are centrifugated (4900 · g/4°C) for 20 minutes and the supernatant is taken away. The residue is washed with 20ml buffer (KH_2PO_4 0,1m, pH = 7) and centrifugated, operations executed twice. Undigested nitrogen is determined in the residue using the Kjeldahl micromethod.

$$\text{Protein digestibility} = \frac{N_{sample} - N_{indigestible}}{N_{sample}} \cdot 100 \ [\%]$$

Results and Discussions

Though due to the fortification the content in proteins of bread increased and the rapport between the essential amino acids got better with the remaking of the lisyne shortage, the presence of some compounds, especially in the case of leguminuous, generated the reduction of protein digestibility. The results of these analysis are presented in table no.1.

It can be noticed that the protein digestibility decreases in the case of wheat flour fortificated with exogen proteins, based on the nature and concentration of the proteic addition used. The lowest decreasement of digestibility appeared in case of bread fortified with

10% degreased soy flour, followed by bread fortified with 5% lupin proteic concentrate. The bread fortified with 5% pea proteic isolate had a medium decrease of digestibility, but the semnificative one appeared in case of the bread fortified with 15% wheat germs (table 1).

Table 1. Protein digestibility of products fortified with semiconventional proteins

Semiconventional protein	proteins, (%), (samples before hydrolysis)	proteins, (%), (samples after hydrolysis)	Protein digestibility (%)
reference	10.2	1.19	88.83
5% ipm	13.6	3.19	76.54
10% fds	12.7	2.39	81.18
5% cpl	13.6	3.1	77.20
15% gg	12.1	3.19	73.63

Though with the fortification of bread with exogen proteins the rapport between essential amino acids increased, with remaking of the unbalance in lysine, the protein digestibility decreased due to the presense of anti nutritives factors in the sources of exogene protein used. The diversity of the antinutritive secondary compounds in plants is very large (over 80000). Taking into account that from 400000 plants only 15-20% of them were phytochemistry studied, it seems that the number of these secondary compounds is higher and their structures are very varied.

From the leguminuous, the biggest reduction of protein digestibility appeared in the case of bread fortified with pea proteic isolate, followed by the one obtained with the fortification of bread with lupin proteic concentrate. The protein digestibility from the bread fortified with the degreased soy flour, though the high concentration used at fortification, had the lowest decrease. These results are explained by the presence of a big variety of anti nutritive compounds in leguminuous, their content having a variation of species and pedioclimatic conditions. The alkaloids, tipical secondary compounts from leguminous structure, may produce malfunctions of the nervous

system, regulate the level of sodium and potassium from nervous cells, and in bigger amounts they have a negative influence on proteins biosynthesis and membrane permeability (Segal, 2004). The alkaloids level of protein sources that has been used in bread fortification is considerably reduced with the aplication of specific technological process. Though, the presence of remanent quantity in those compounds reduce the protein biodisponibility. The results obtained demonstrate that the lowest quantity of anti nutritives compunds can be found in degreased soy flour, followed by the lupin proteic concentrate and the pea proteic isolate.

Conclusions

The fortification of bread with wheat germs determined a decrease of protein digestibility bigger than the ones determined by the leguminuous. This result could be explained with the presence of anti nutritive substances in wheat germs, represented by hemaglutinins and growing inhibitors.

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