THE QUANTIFICATION OF PROTEIN CONTRIBUTION OF BREAD FORTIFIED WITH DIFFERENT EXOGENOUS PROTEINS

Mihaela Constandache
„ Dimitrie Cantemir" University, Constanta, Romania

Abstract

Bread fortified with different types of exogenous proteins contributes to improve food habits, to maintain and develop population's health, being designed to prevent protein malnutrition.This study shows the evaluation of the quality of bread products fortified with exogenous, semi-conventional proteins like soy degreased flour, lupine proteic concentrate and sodium caseinate. The evaluation will be made by calculating the chemical value of limitant essential amino acids and of the essential amino acids EAA-Index.
***Key words**: quality, fortified products, semi-conventional proteins, chemical value, limitant essential amino acids, EAA-Index.*

Introduction

The new nutrition concepts have justified, during the last 10-15 years, the medical authorities concerns from various countries, for stimulating and sustaining researches regarding the establishment of the physiological effects of some food components and their benefits to our health.

The European Commission of Functional Food Science appreciates that an aliment can be considered "functional" if it is satisfactory proved that it positively affects one or more "target" functions of the body, besides the corresponding nutritional effects.

Functional food has to remain under the form of food products and prove their effects in quantities which are normally consumed in a diet. The Action Commission in the field of Functional Food Science in Europe (Functional Food Science – FUFOSE), from the International Life Science Institute (ILSI), affiliated to OMS, proposed to establish a scientifically substantiated approach for concepts regarding functional food science, through examining the actual knowledge rather from a functional perspective than from one of the product's. The aim of this study is the proteical fortification of wheat flour using three different sources of semi-conventional exogenous proteins like soy degreased flour, lupine proteic

concentrate and sodium caseinate, and the analysis of the obtained results from a quality and natural point of view, as well as the ratio of compound essential amino acids and especially the quantity and the proportion of essential amino acids.

For a good evaluation of the quality of the proteins of fortified products, the chemical values of essential limitant amino acids of bread fortified with different exogenous proteins have been calculated, as well as the values of essential amino acids EAA – Index.

Experimental

The flour used in this study was a 650 white flour, as a result of milled wheat from Triticum Aestivum L., in S.C. Boromir Prod Mill Buzău. Before being used in this analysis, the quality of flour was tested in mill and the results may show that flour has a medium quality, a relative low amylase activity, with poor capacity of fermented glucids formation.

For content standardization of α-amylase content, flour was improved in mill by adding 3g α-amylase at 100 kg flour. For a better quality of the flour, also for better mixing dough capacity, high dough extensibility, low negative effect of insoluble hemicelluloses on the gluten film continuity, 10g hemicelluloses at 100 kg wheat flour was added.

For a better strength of gluten network, ascorbic acid was added.
In this study those protein additions were used: soy degreased flour without enzymatic activity (PROVABIS), lupine proteic concentrate (LUPIDOR P 52-H 125) and sodium caseinate (EM-6). Each source of protein was added into witness flour in different concentrations of 3, 5, 10 and 15%, studying the influence of those additions on the proteical value of bread.

Results and Discussion

The chemical values have the inconvenient that they do not permit the nutritional availabilities of dozed amino acids to be known.

The „Chemical Score" represents the proportion between the content of the limitant essential amino acid of the tested protein biological value and the content of the suitable amino acid from the proper protein (Segal, R., 1983).

The chemical values of bread products fortified with leguminous semi-conventional exogenous proteins are presented in table 1.

Table 1: The chemical values of bread products fortified with different semi-conventional proteins

Chemical value, [%]	The size of the semi-conventional exogenous addition				
	control	3%	5%	10%	15%
Soy degreased flour					
$I_{c\ Lys}$	32,64	33,51	40,25	53,80	56,44
$I_{c\ Tre}$	77,25	82,55	83,58	87,00	92,13
Lupine proteic concentrate					
$I_{c\ Lys}$	32,64	33,16	36,91	39,53	44,07
$I_{c\ Tre}$	77,25	81,78	82,38	84,90	85,35
Sodium caseinate					
$I_{c\ Lys}$	32,64	45,91	60,07	65,91	72,75
$I_{c\ Tre}$	77,25	90,28	90,33	90,70	96,53

The obtained results indicate an increasing variation of all the values of lysine chemical ratings, for all sources of exogenous protein used, with the growth of the concentration of protein addition used at fortification. Thus, the fortification of wheat flour with degreased soy flour assures an increasing variation of the chemical value of lysine with the growth of protein addition used, between 33,51%, which corresponds to a protein addition of 3%, and 56,44%, that corresponds to a fortification with 15% exogenous protein. The bread fortified with 10% degreased soy flour (the biggest technological limit admitted) are also the ones that our body needs, to maintain the nitrogenous balance sheet, with a chemical value of lysine of 53,80% (Constandache, M., 2006).

In case of wheat flour fortification with lupine proteic concentrate, the chemical value of lysine varies between 33,16%, that corresponds to a concentration of 3% protein addition, and 44,07% that corresponds to a fortification with 15% exogenous protein. Because all the products fortified with lupine proteic concentrate, no matter the protein addition used, showed values of the chemical rating of lysine lower than 50%, it may be considered that these products cannot respond to the needs of our body, to maintain the nitrogenous balance sheet. The products fortified with 5% lupine proteic concentrate (the biggest technological limit admitted) show a value of 36,91% of the chemical value of lysine (Constandache M., 2006).

The fortification of wheat flour with sodium caseinate assures an increasing variation of the chemical value of lysine with the growth of protein addition used, between 45,91%, that corresponds to a protein addition of 3%, and 72,75%, that corresponds to a fortification with 15% exogenous protein. The bread fortified with 10% sodium caseinate (the biggest technological limit admitted) are also the ones that our body needs,

to maintain the nitrogenous balance sheet, with a chemical value of lysine of 65,91% (Constandache M., 2006).

The chemical value of treonine, the second essential limitant amino acid of bread products, showed increasing values with the growth of the concentration of the protein addition used, no matter the nature of the exogenous protein used at fortification. The values of this chemical rating varied between 81-90% according to the nature and the concentration of the exogenous protein used at fortification, these values proving that the contribution of treonine in fortified products assures, no matter the situation, the maintaining of the nitrogenous balance sheet of the body.

The chemical values of essential amino acids of bread products fortified with different semi-conventional exogenous proteins are indicated in table 2.

Table 2: Chemical values of essential amino acids of bread products fortified with different semi conventional exogenous proteins

Protein addition	EPV Lys	EPV Tre	EPV Tyr+Phe	EPV Val	EPV Ile	EPV Leu	EPV Cys+Met	EPV Trp
Soy degreased flour								
control	32,64	77,25	154,05	97.48	105.73	120.26	124.66	121.10
3%	33,51	82,55	155,60	97.90	106.53	120.53	125.31	121.90
5%	40,25	83,58	155,63	98.28	106.95	120.61	125.49	123.10
10%	53,80	87,00	155,65	98.60	107.15	120.93	151.89	124.60
15%	56,44	92,13	155,78	98.82	107.48	121.20	152.83	124,90
Lupine protein concentrate								
control	32.64	77.25	154.05	97.48	105.73	118.99	119.54	109.40
3%	33.16	81.78	154.27	97.60	106.23	120.00	121.83	114.60
5%	36,91	82,38	154,70	97.66	106.40	120.16	122.29	117,90
10%	39,53	84,90	154.82	97.78	106.95	120.29	122.71	119.60
15%	44,07	85,35	154,98	98.06	107.18	120.47	122.83	121.60
Sodium caseinate								
control	32.64	77.25	154.05	97.48	101.93	122.34	111.20	111.00
3%	45.91	90.28	154,32	97.66	102.45	123.71	114.03	111.10
5%	60,07	90,33	154,78	100.54	104,38	123,89	114.43	112.70
10%	65,91	90,70	156,25	107,56	112,23	132,09	114.54	113.50
15%	72,75	96,53	156,37	115.66	113,18	132.21	114.60	113,90

The biological value of a protein is influenced not only by their limitant amino acids but by the deficit of other essential amino acids, and because of that, it is recommended the reckoning of the value of essential amino acids (EAA – Index), that it is based on the ensemble of all the essential amino acids (table 3).

The biggest values of the ratings of the essential amino acids, EAA – Index, were obtained in the case of wheat flour fortified with sodium caseinate and degreased soy flour. The lowest increases of the value of essential amino acids were obtained at products fortified with lupine proteic concentrate.

Table 3: The values of EEA-Index essential amino acids of bread products fortified with different semi conventional exogenous proteins

Protein addition	EAA-Index
Soy degreased flour	
control	96,09
3%	97,65
5%	100,31
10%	107,33
15%	108,99
Lupine proteic concentrate	
control	94,26
3%	96,09
5%	97,94
10%	99,48
15%	101,23
Sodium caseinate	
control	93,47
3%	100,04
5%	104,37
10%	108,61
15%	112,03

If the high values of the rating of essential amino acids obtained by the products fortified with sodium caseinate are explained through the big concentration of proteins of those sources, the values showed by the products fortified with degreased soy flour are surprising because, in spite of a small content of proteins used at fortification, they are almost equally to the ones generated by the pea sodium caseinate. This shows that degreased soy flour assures the quantity needed by the essential amino acids, as well as the right balance for those, superior to the one corresponding to the other two protein sourcess.

Conclusion

It appeared a growth of the content of all the essential amino acids with the growth of the concentration of protein addition used, fact that can be

noticed through the growth of the values of the chemical values of all the essential amino acids.

It can be noticed that the limitant amino acids of the fortified samples with different semi-conventional exogenous proteins are still the lysine and the threonine, though their deficit gets lower through fortification.

Thus, the results show an increasing variation of all the values of the chemical ratings of lysine, for all the sources of used exogenous protein, with the growth of the protein addition used at the fortification.

The highest values of the ratings of essential amino acids EAA – Index were showed at products fortified with sodium caseinate and degreased soy flour, while the lupine proteic concentrate generated the lowest values of this rating.

REFERENCES

Segal, R., Gheorghe, V., Segal, B., Vitalie, T. (1983). The nutritive value of the agro-alimentary products, *Ceres Publisher*, Bucharest.

Constandache, M. (2006). The implications of bread fortification with leguminous proteins on the quality of bread, *Global Safety of Commodities and Environment and Quality of Life*, 2006, vol.II, 847-851.