M. Constandache. Scientifical Researches. Agroalimentary Processes and Technologies, Volume XI, No. 1 (2005), 79-84

EFFECTS OF VEGETAL PROTEIN EXTRACTS TO THE QUALITY OF BREAD

Mihaela Constandache
Christian University "Dimitrie Cantemir", Touristic and Commercial Management Faculty, 286 Mamaia Street, 900552 Constanta, Romania

Abstract

Different sources of vegetal protein were used to fortify wheat flour. While the fortification with concentrates and isolates affected bread characteristics adversely, even at a low level (10%) of fortification, most of soy flours, especially full-fat and high fat products, permitted fortification at 15 to 20% level and produced bread of acceptable volume, flavor and overall quality, with resultant substantial increases in protein content and greatly improved amino acid balance. Wheat breads baked with addition of 1 or 2% tomato seed flour to wheat flour were equal in quality to the control wheat bread, but greater additions resulted in crumb darkening.

***Key words**: vegetal protein, fortify, quality, protein content, amino acid balance.*

Introduction

Wheat flour fortification with high-protein material had been used by many researchers to increase protein content and to improve essential amino acid balance of bread and to combat worldwide protein malnutrition. The value of such fortification would largely depend on the acceptability of the baked product. From various potential protein-rich additives tested, soy protein derivates seem to hold a greater promise, because of their availability and the low cost. Not all commercially available soy protein products can be used at a level high enough to achieve substantial increase in protein and lysine content because of their negative influence on bread quality.

Carlson et al (1981) reported that tomato seeds, an abundant waste of tomato processing, contain high amounts of crude fat and protein. He also showed that tomato seed protein is especially high in lysine,

the limiting amino acid of cereal products, and that the supplementation of wheat flour bread at the 10 and 20% levels increased lysine content by 40.2 and respectively, 69%. Canella et al (1979) reported that tomato seeds, which make up 55% of canning waste, contain 28.4-31.0% protein and 36.0-37.9% fat. Yaseen et al (1991) reported that wheat breads baked with the addition of 1 or 2% tomato seed flour to the wheat flour were equal in quality to the control wheat bread, but greater additions resulted in crumb darkening. Brodowski et al (1980) reported that tomato seed protein contains approximately 13% more lysine than soy protein, which would allow it to be used in fortifying foods low in lysine content. Yaseen et al (1991) studied the effects of adding tomato seed meal to wheat flour on the gas production of dough and the organoleptic characteristics of bread.

Experimental

Ranhotra et al (1975) used different soy products to fortify wheat flour and studied their influences on bread quality. They tested three levels of fortification with soy: 10% soy, 90% wheat flour; 15% soy, 85% wheat flour; and 20% soy, 80% wheat flour. In order to study the effects of these fortification levels assessment of water absorption and mixing time of the dough was made. For studying the effects of these fortification levels on quality bread the loaves were weighted and their volume was measured the morning after the breads were baked. After the volume had been measured, loaves were sliced and general bread quality, based on appearance was assessed and a flavor evaluation was made.

Whole and defatted tomato seed meal was blended with wheat flour at 5, 10 and 15% levels (Yaseen et al, 1991). Rheological properties were analyzed with a farinograph and ten panelists evaluated the organoleptic qualities of breads for appearance.

Results and Discussions

Water absorption and mixing requirements of the dough fortified with soy proteins varied greatly (table 1). Heat treatment of soy, which denatures protein and decreases its solubility, increased water

absorption. Soy must be heat-treated to dispel objectionable bean flavor.

Table 1. Rheological characteristics of wheat flour fortified with soy and tomato seed protein

Sample		Water absorption (%)	Mixing time (min.)
Control		63	35
Soy protein isolate	10%	64	26
	15%	68	17
	20%	73	36
Soy protein concentrate	10%	84	22
	15%	90	15
	20%	95	32
Soy full-fat flour	10%	60	35
	15%	63	31
	20%	68	32
Soy defatted flour	10%	63	29
	15%	68	22
	20%	72	27
Whole tomato seed flour	10%	63.2	35
	15%	63.6	33
	20%	63.8	33
Defatted tomato seeds flour	10%	63.6	32
	15%	64.3	30
	20%	65.3	28

In most cases, water absorption tended to increase with the level of soy or tomato seed flour used in fortification. Dough mixing time was the highest for one of the soy protein concentrates, but not consistent trend emerged otherwise (Ranhotra, 1974). The fortification of wheat flour with tomato seed flour decreased dough extensibility and the resistance to extension but increased gas production. The higher gas production may be due to the fermentable sugars in the added tomato seed flour. In agreement with the results of Ofelt et al (1954) the degree of heat-treatment of soy did not appear to influence bread quality (table 2). The variations in protein content and fat composition

of soy tested seem to be factors that affected bread quality. It has also been shown that the baking quality of defatted soy flour is inferior to that of full fat soy flour. Results presented in table 2 seem to support this. The presence of soy lecithin influenced bread quality quite favorably. Mizrahi et al (1967) reported that the addition of 1% lecithin greatly counteracted the decrease in volume of wheat bread quality with 6% isolated soy protein.

Table 2. Bread characteristics of wheat flour fortified with various soy and tomato seed protein

Sample		Loaf total volume (ml)	General bread quality[1]	Flavor [2]
Control		2,450	3.3	++++
Soy protein isolate	10%	1,775	2.0	++
	15%	1,075	1.3	+
	20%	850	1.4	+
Soy protein concentrate	10%	2,050	2.3	+
	15%	1,550	1.5	+
	20%	1,250	1.4	+
Soy full-fat flour	10%	2,200	3.1	++++
	15%	2,050	2.6	++
	20%	1,850	2.3	++++
Soy defatted flour	10%	2,250	3.2	++++
	15%	2,200	2.7	++++
	20%	1,300	1.6	++
Whole tomato seed flour	10%	2,400	3.2	++++
	15%	2,200	3.0	++++
	20%	1,850	2.3	++
Defatted tomato seeds flour	10%	2,300	3.2	++++
	15%	2,050	2.7	+++
	20%	1,800	1.6	+

[1] Based on: appearance, crust and crumb color, texture and grain. Very good, 4; good , 3; acceptable, 2; and poor, 1;

[2] Unacceptable, +; slightly acceptable, ++; moderately acceptable, +++; and acceptable, ++++.

In the overall acceptability of bread, flavor plays a decisive role. Although some soy flours, especially full-fat flour produced loaves of acceptable volume and flavor at 15 to 20% level, fortification with soy concentrates and isolates have negative effects on the bread quality, even at a low level (10%). The overall quality of bread with tomato seed flour correlates with the ratio of addition. The 5 and 10% recipes received a fancy grade in quality measurements while the 15% recipe received an extra standard grade in quality. The crust and crumb of the breads fortified with 5% tomato seed flour were golden; at higher levels of supplementation they were darker. Mokhnacheva et al (1975) reported that wheat breads baked with 1 or 2% tomato seed flour added to wheat flour were equal in quality to control wheat bread, but greater additions resulted in crumb darkening. Taste score decreased as the level of tomato seed flour increased. A slightly bitter taste at a 10% or greater replacement level may be due to a steroid compound found in crushed tomato seed (Zagibalov et al, 1985).

Conclusions

The protein content of the bread was increased as a result of the addition of soy or tomato seed flour. Most soy flour permitted fortification at 15 to 20% level, and produced breads of acceptable volume, flavor and overall quality while bread baked with 1 or 2% tomato seed flour added to wheat flour were equal in quality to control wheat bread. Fortification with concentrates and isolates has a negative effect on the bread quality even at low level. Additions of tomato seed flour greater than 2% have a negative effect on bread quality, too.

Based on these results it could be recommended that soy or tomato seed flour to be used to supplement wheat flour in making bread.

References

Brodowski, D., and Geisman, J. R. (1980). Protein content and amino acid composition of protein of seed from tomatoes at various stages of ripeness. *J. Food Sci*. 45, 228-229, 235.

Canella, M., Cardinali, F., Castriotta, G., and Nappucci, R. (1979). Chemical properties of seeds of different tomato varieties. *Riv. Ital. Sostanze Grasse* 56 (1), 8-11.

Carlson, B.L., Knorr, D., and Watkins, T.R. (1981). Influence of tomato seed addition on the quality of wheat flour breads. *J. Food Sci.* 46, 1029-1031,1042.

Mizrahi, S., Zimmermann, G., Berk, Z., and Cogan, U. (1967). The use of isolated soybean proteins in bread. *Cereal Chem.* 44, 193-200.

Mokhnacheva, A. I., Ostrovskaya, L., and Rakhmankulova, R.G. (1975). Use of tomato seeds in breadmaking. *Zerno Perera Batyrayushchayai Pishchevaya Promyshlnost.* 5, 44-49.

Ofelt, C.W., and Smith, A. K. (1954). Baking behavior and oxidation requirements of soy flour. I. Commercial full-fat soy flours. *Cereal Chem.* 31, 15-22.

Ofelt, C.W., and Smith, A. K. (1954). Baking behavior and oxidation requirements of soy flour. I. Commercial defatted soy flours. *Cereal Chem*. 31, 23-30.

Ranhotra, G.S., and Loewe, R.J. (1974). Breadmaking characteristics of wheat flour fortified with various commercial soy protein products. *Cereal Chem*. 51, 629-634.

Yaseen, A.A.E., Mohamed, H.A, Shams, and E.D.,Ramy Abd El/Latif, A. (1991). Fortification of Balady Bread with Tomato Seed Meal. *Cereal Chem*. 68(2), 159-161.

Zagibalov, A.F., D'Yakonova, A.K., Gubanov, S.N., and Savchenko, S.N. (1985). Causes of bitterness in protein isolate from tomatoes. *Izv. Vyssh. Uchebn. Zaved. Pishch. Tekhnol.* 4, 42-43. Abstracted, *FSTA* (1987) 19(11), 90.