PROTEIN FORTIFICATION OF BREADS USING CEREAL GERM PROTEIN ISOLATES

E. A. HEBSHI*

Department of Food Technology
Higher Inst. of Technology, Brack Lybia

Received May 14, 1990
Presented by Prof. Dr. R. LÁSZTITY

Abstract

Medium extraction wheat flour breads were enriched with protein by addition of 1, 2 and 3% of wheat germ-, rice germ-, maize germ- and malted barley germ protein. The volume of the loaves and the height-length ratio were measured. In addition, the texture and elasticity of the crumb, the crust, and the taste and smell of experimental breads were evaluated organoleptically.

A slight decrease (5—10%) of bread volume was observed if germ protein concentrate was added. Higher quantities (3%) of germ protein addition adversely affected the crust properties and texture of the crumb. The taste and smell of all experimental breads was satisfactory.

Keywords: bread, protein fortification, wheat germ, maize germ, rice germ, malted barley germ

1. Introduction

Since the beginning of agricultural production in the prehistoric time, cereals have been the main agricultural products in most parts of the world playing an important role in nutrition generally, and in the protein supply. Although the amino acid composition of the cereal proteins and the role of essential amino acids were not known, the mixed diet containing different proteins was characteristic of the greatest part of population allowing a compensation of the effects of the unsatisfactory content of some essential amino acids in cereal proteins. Later the steady growth of the population and the limited increase of agricultural production (especially animal husbandry) changed this situation. In many countries predominant consumption of cereals became characteristic (LÁSZTITY and HIDVÉGI, 1985).

* Present address: Department of Biochemisty and Food Technology, Technical University of Budapest, Budapest, Hungary

In many parts of the world, particularly in developing countries, imbalances in animal protein food are more and more prevalent. One solution to the problem of protein malnutrition is the replacement of expensive animal proteins by high carbohydrate foods such as pasta and bread, without creating imbalances in the essential amino acid supply (KÁRPÁTI et al., 1985).

For such purposes high quality plant proteins such as legume proteins, oilseed proteins seem to be most suitable. Investigations of some non-conventional protein sources available in developing countries (LÁSZTITY et al., 1986, 1986a, 1986b, 1986c, 1988) showed that some of them may be used successfully in the enrichment of basic cereal foods.

Among other possible sources cereal germs may be mentioned. Cereal germs are long known for their excellent nutritive value, high protein content and high lysine content. Cereal germs can be used as valuable nutrient fortifiers in both food and feed (TSEN, 1980). Although addition of wheat or rye germ flour to the wheat breads significantly increases the nutritive value, the dough properties will be adversely affected. The weakening of the dough can be reduced by addition of surfactants (TSEN, 1980, 1985), but the quality of bread will be lower than without addition of germ flour.

Defatted cereal germs, particularly defatted corn germs, have some advantage in comparison with full germs due to higher protein content and better storability (CERLETTI and RESTANI, 1985). It seems that the best solution of use of cereal germ proteins may be the application of protein concentrates and isolates.

In this paper some results of investigations of breads prepared with addition of cereal germ protein concentrates will be summarized.

Materials and methods

Wheat germ-, rice- and malted barley germ proteins were extracted with 3% NaCl solution after defatting of germs using petroleum ether. After dialysis the precipitate was separated by centrifugation and freeze-dried. Maize germ protein was prepared according to the procedure of NIELSEN et al. (1973).

Wheat flour type BL-112 (maximal ash content 1.12% DWB) was used for bread making. Experimental breads were prepared using formula prescribed in Hungarian Standard (ANON, 1954) except for the fact that 1, 2 and 3% of germ protein concentrate was added to the flour. A five point scoring method was used for the organoleptic evaluation of the breads. The volume of breads was determined using mustard seeds as described in Hungarian Standard (ANON, 1954).

Table 1

Characteristics of the experimental breads

Type of bread	Weight of dough (g)	Volume of the bread (cm^3)	Height-Length ratio
Control	400	860	0.62
With 1% WGPC	400	840	0.57
2% WGPC	400	820	0.53
3% WGPC	400	810	0.52
With 1% MGPC	400	830	0.60
2% MGPC	400	830	0.57
3% MGPC	400	800	0.49
With 1% RGPC	400	860	0.60
2% RGPC	400	850	0.62
3% RGPC	400	810	0.54
With 1% BGPC	400	820	0.50
2% BGPC	400	820	0.47
3% BGPC	400	800	0.45

WGPC = wheat germ protein concentrate
MGPC = maize germ protein concentrate
RGPC = rice germ protein concentrate
BGPC = barley germ protein concentrate

Results

The characteristics of experimental breads prepared with addition of germ protein concentrates are summarized in Table 1 and Table 2. As it is seen from Table 1 a slight decrease of volume was observed in all cases except for the bread containing 1% of rice germ protein concentrate. The breads containing rice germ protein concentrate had the highest average volume and the barley germ protein concentrate caused the greatest decrease in volume. The volume decrease seems to be proportional to the quantity of protein added.

Concerning the organoleptic properties (Table 2) it can be stated that although generally a decrease of quality characteristics is observed (except crust properties) the experimental breads have acceptable properties including taste and flavour. Off flavour was observed only in some cases on addition of 3% of protein concentrates.

Table 2

Organoleptic properties of experimental breads
(5 point scoring system)

Type of bread	Scores				
	Texture	Crust	Elasticity	Taste	Flavour
Control	4.5	4.3	4.5	4.8	5.0
With 1% WGPC	4.7	4.6	4.6	4.2	5.0
2% WGPC	4.3	5.0	4.5	4.0	4.8
3%WGPC	3.8	3.5	4.4	4.0	3.8
With 1% MGPC	4.8	4.2	4.5	4.6	5.0
2% MGPC	4.4	4.5	4.2	4.0	4.4
3% MGPC	4.0	4.7	4.0	4.0	4.3
With 1% RGPC	4.8	4.2	4.7	4.5	4.8
2% RGPC	4.3	4.5	4.7	4.5	4.5
3% RGPC	3.8	4.5	4.2	4.0	4.0
With 1% BGPC	4.2	4.5	4.5	4.5	5.0
2% BGPC	4.3	4.2	4.0	4.5	4.8
3% BGPC	4.0	3.8	4.0	3.8	4.0

WGPC = wheat germ protein concentrate
MGPC = maize germ protein concentrate
RGPC = rice germ protein concentrate
BGPC = barley germ protein concentrate

Bearing in mind the higher essential amino acid content it can be stated that addition of cereal germ protein concentrates is adventageous from the nutritional point of view and does not cause any serious changes in the organoleptic properties of the bread.

References

1. ANON (1954): Standard Analytical Methods for Food Products (in Hungarian), Budapest
2. CERLETTI, P. and RESTANI, P. (1985): Maize germ proteins, their composition, nutritive value and functional properties. In: "Amino Acid Composition and Biological Value of Cereal Proteins", LÁSZTITY, R. and HIDVÉGI, M. Eds. Reidel Publ. Co. Dordrecht, pp. 467—480.
3. LÁSZTITY, R.—ABD EL SAMEI, M. B.—EL MORSI, E. A.—EL SAVED, A. H. and ISMAEIL, H. A. (1986): Fractionation and characterization of *Pisum sativum* albumins. *Acta Alimentaria, 15* (2), 101—110.
4. LÁSZTITY, R.—ABD EL SAMEI, M. B. and EL SHAFEI, M. (1986a): Biochemical studies on some non conventional sources of protein: Part 2. Cucurbitaceae seeds. *Die Nahrung, 30* (6), 621—627.

5. LÁSZTITY, R.—EL MORSI, E. A.—ABDEL SAMEI, M. B.—EL SAYED, A. E. and ISMAEIL, H. A. (1986b): Fractionation and characterization of Pisum sativum globulins. *Acta Alimentaria, 15* (3), 165—174.
6. LÁSZTITY, R.—M. B. ABDEL SAMEI and EL SHAFEI, M. (1986c): Biochemical studies on some non conventional sources of protein. Part 1. Tomato seeds and peels, *Die Nahrung, 30* (6), 615—620.
7. LÁSZTITY, R.—EL SHAFEI, M. A.—ABDEL SAMEI, M. B.—HATOUR, F. S. and LABIB, M. (1988): Biochemical studies of some non conventional sources of protein. Part 4. The proteins of mango waste stone kernel. *Die Nahrung, 32* (9), 867—873.
8. NIELSEN, H. C.—INGLETT, G. E.—WALLAND, J. S. and DONALDSON, G. L. (1973): Corn germ protein isolate. Preliminary studies on preparation and properties. *Cereal Chem., 50,* 435—443.
9. TSEN, C. C. (1980): Cereal germs used in bakery products: Chemistry and nutrition. In: "Cereals for Food and Beverages, Recent Progress in Cereal Chemistry" INGLETT, G. E. and MUNCK, L. Eds., Academic Press, New York and London, pp. 245—253.
10. TSEN, C. C. (1985): Amino acid composition and biological value of cereal germs, In: "Amino Acid Composition and Biological Value of Cereal Proteins" LÁSZTITY, R. and HIDVÉGI, M. Eds. Reidel Publ. Co., Dordrecht, pp. 453—466.

E. A. HEBSHI H-1521, Budapest