THE EFFECTS OF DIFFERENT TREATED BRANS ADDITIONS ON BREAD QUALITY

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This paper describes the effects of raw and pulverized wheat brans on pan bread quality. White wheat flour was substituted with 20%, 30%, 50% of raw, cooked, pulverized and cooked pulverized brans to determine the effects on technological properties of dough and pan bread quality. Product acceptability was judged by sensory evaluation. The addition of pulverized brans in the flour blends decreased water absorption that was reflected in technological and sensory properties of pan bread. Replacement by 20%, 30% or 50% of wheat flour with raw or cooked pulverized brans reduced the loaf volume. Pan bread, in which the raw pulverized brans replaced up to 50% of the wheat flour, contained significantly more ash, protein and dietary fibre. The results on organoleptic characteristics showed that products with cooked brans have better texture and can be better swallowed than the other ones. The technological properties of these pan breads were positively affected.

brans; dough; bread; sensory quality; dietary fibre; pulverization

INTRODUCTION

Grain based foods are highly regarded by nutritionists. Cereals containing a wide range of macro- and micro-nutrients are used as a vehicle for nutrient fortification. Enrichment of foods by addition of high-fibre cereal grain components is one way to increase fibre intake (Jung, 1997; McQueen, Nicholson, 1979; Muchová, 2001). Since dietary fibre intake is limited, scientists are working on how to produce qualified food with high dietary fibre content (Sozer, Dalgic, 2006).

By-products as brans, deserve special attention among numerous natural ingredients used to enrich baking products. Specially brans, germs offer many options for production of consumer goods with enhanced health benefits (Aamondt et al., 2004; Jung, 1997; Katapodis et al., 2003; Marcinie et al., 2000). Several studies have reported the use of brans in various baking products (Aamondt et al., 2004; Basman, Koksel, 2001; Mubarak, 2001; Muchová et al., 2004; Silva, Taylor, 2004). The objective of this study was to assess the effects of raw (milled), cooked, pulverized and cooked pulverized brans on dough properties, bread characteristics, and to analyze the effects of addition of brans on chemical composition of the bread. High additions can negatively influence the technological properties of the dough and the quality of the product. The main problems with the fibre addition (in the form of bran) are reduced product volume, differential texture accompanied by other organoleptic changes (Basman, Koksel, 2001) which is in agreement with similar findings of many authors (Basman, Koksel, 2001; Katapodis et al., 2003; Marcinie et al., 2000; Mubarak, 2001; Silva, Taylor, 2004; Sozer, Dalgic, 2006).

When using an appropriate portion of bran in the mixture, it is expected that the resulting product will be accepted by the consumers. Nevertheless, the use of (higher doses of) raw, only slightly processed, bran is being refused by researchers and in bakery production.

MATERIAL AND METHODS

Main analytical data of the wheat flour and brans used in this study are given in Table 1. The commercial wheat flour, T-550, trial milling with the laboratory mill Quadrumat Senior – resultant are 4 milling streams (flour I, flour II, bran I, bran II), brans II were used. The additions of brans were produced from a sample of typical wheat. In all raw materials– flour and brans were determined: fibre content and its fractions and changes, starch content, saccharides and protein contents, amino acids and minerals.

Pulverized brans from *Triticum aestivum*, L. – using the laboratory mill type ACM-10, on the Sichtermuhle, from Hosokawa flours from trial milling were used.

Brans – wheat flour blends – flour was replaced by 20%, 30%,50% of raw, cooked, pulverized and cooked pulverized brans. The commercial white flour was used as control.

Table 1. Fibre fractions ($g.kg^{-1}$) and starch content (%) of brans used

Brans	Crude Fibre	ADF	NDF	Lignin	Cellulose	Hemicellulose	Starch
Raw	92.5	126.1	392.63	36.33	89.73	266.61	19.64
Cooked	70.25	96.42	285.76	22.85	73.52	189.35	10.35
Pulverized	130.7	157.3	468.7	41.43	115.8	311.47	13.15
Pulverized cooked	86.67	109.76	374.7	32.03	77.75	264.95	9.59

Rheological dough properties of the control and the nine blends were determined with the help of farinograph (300 g of flour at 14% moisture; C.W. Brabender Instruments, Inc.,) by the procedure of the ICC 115/1. Loaves of pan bread were baked from the white flour and the blends: cooked by a straight dough baking procedure with a 1-hr fermentation, and a proofing temperature of 26 °C. The baking formula based on flour weight was as follows: WF or blends (250 g), compressed yeast (10 g), salt (4.5%), and variable amounts of water added according to baking absorption determined with farinograph. The loaves of pan bread were baked at 220 °C for 40 min. Technological characteristics determined: ash content, gluten content and its properties, seditest, falling number, water binding capacity, rheological properties of dough.

Trial baking:
PM = 100% white flour
SO2 = 80% WF + 20% SO
SO3 = 70% WF + 30% SO
SO5 = 50% WF + 50% SO (SO = raw brans)
PO2 = 80% WF + 20% PO
PO3 = 70% WF + 30% PO (PO = cooked brans)
PUO2 = 80% WF + 20% PUO
PUO5 = 50% WF + 50% PUO (PUO = pulverized brans)
PPUO2 = 80% WF + 20% PPUO
PPUO5 = 50% WF + 50% PPUO (PPUO = cooked pulverized brans)

Pan bread quality was evaluated by panelists who were asked to score the bread according to the point own scale-sensorical characteristics.

ICC – standard methods were used to determine moisture content: No. 110/1, ash: No. 104/1, and protein: No. 105/2. Fat was determined according to the standard method for cereals and cereal products. Neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL) and acid cellulose (ADC) were determined according to Van Soest method. Thermostable α-amylase was used to digest starch (McQueen, Nicholson, 1979). The hemicellulose content was calculated as the difference between NDF and ADF.

Amino acids (Silva, Taylor, 2004) content was determined by the AAA 400 ($g.kg^{-1}$). Mineral elements were determined by spectrophotometry (Ca, Na, P, K).

Statistical processing

All the results are means of at least three determinations, which were used for statistical analysis.

Statistical processing was performed and expressed with the use of cluster analysis of multidimensional data (similarity dendograms) and as (PCA) biplots. Data were computed in R language using R software environment for statistical computing and graphics.

RESULTS AND DISCUSSION

Since wheat bran seems to be a potentially valuable grain part, a series of studies were conducted to evaluate the properties of bran products and their role in the baking.

Sensory quality of pan bread (Fig. 1) at raw materials addition decreased, but cooking of brans before their application to the dough caused significant improvement. The appearance of pan breads made with raw and cooked wheat bran at the 50% level of substitution was liked moderate. The quality of pan breads with 20% cooked and raw wheat brans were the most liked. The 20% pre-cooked wheat bran bread received the higher scores as compared

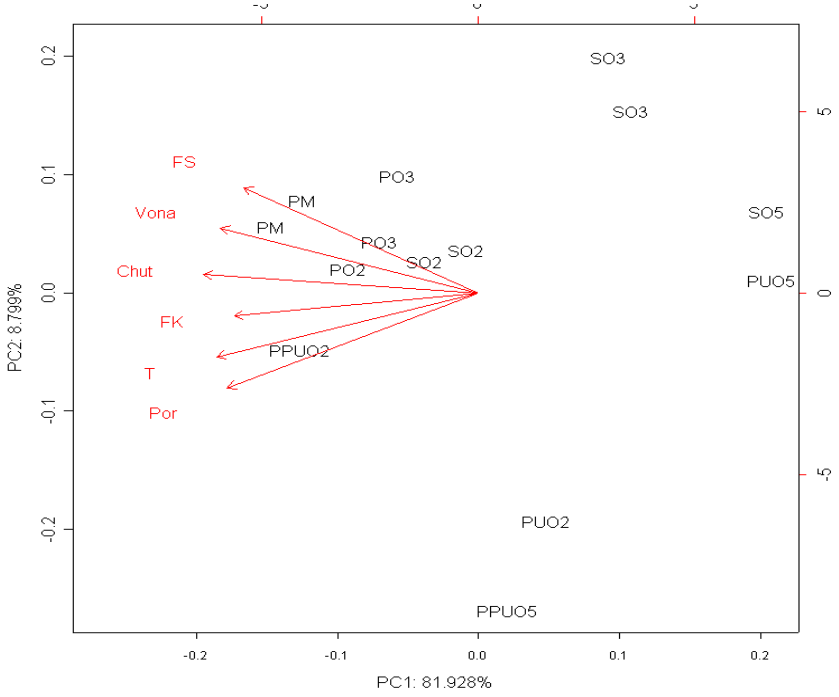


Fig. 1. Biplot of sensory properties of wheat pan bread with different additions of brans
Chut = taste, Vona = smell, FS = color of crumb, FK = color of crust, T = texture, Por = porosity

to 50% wheat bran bread and the control one. The crumb colour of wheat bran breads was a little darker than that of the control one. The crust colour of all the bran-breads was acceptable.

Some of authors (G a n z et al., 1992; A a m o n d t et al., 2004) reported that bran additions cause problems with the structure, quality of dough and that products are of smaller size and shape. G u j r a l et al. (2003) recommend additions no more than 30%, M u b a r a k (2001) reported that up to 20% wheat bran could be incorporated into white pan bread without seriously affecting loaf volume and appearance. Regarding to the nutritional effect we wanted to find such kind of brans treatment with no negative influence at 50% brans addition on sensory and technological value. Pulverization of brans was found to be very useful point in term of technology in pan bread making. Pulverization made better use of bran in the dough preparation.

The results on organoleptic characteristics showed that products with cooked brans have better texture and can be better swallowed than the other ones. From the point of nutrition, nutritional value was decreased a little e.g. in NDF content at use of cooked pulverized brans but still was found to be better compared to the control.

C h a u d h a r y (1999) found that wheat bran added at a level of 20% caused the smallest decrease in loaf volume, produced a loaf with substantially increased dietary fibre and reduced energy value, and gave the highest score of the different fibre-enriched breads.

The effects of addition of wheat bran on the fiber complex are shown in Fig. 2. With the increase adding of wheat bran increased ADF, NDF, lignin content. Addition of 20–30% pulverized brans caused 2.2–4.8 fold increase of NDF in the pan bread. Cooked bran-breads and pulverized bran-breads showed slight but significant increases in ash, protein and NDF contents over control pan bread. NDF content increased significantly with the increase in pulverized and cooked pan bran breads substitution. NDF level in pan breads with 20% and 50% pulverized raw or cooked pan breads was higher than in the control pan bread (Table 2). The representation of cellulose, lignin and hemicellulose fractions were also higher in pan breads with brans in compared to the control pan bread. The hemicellulose fraction dominated in all pan bran-breads.

Table 2. Chemical compositions of pan breads

Parameter / Bread sample	Brans (%)	Ash (%)	Protein (%)	Fibre complex (mg.kg^{-1})				
				NDF	ADF	cellulose	lignin	hemicellulose
Control	0	0.82	11.3	35.7	13.4	11.6	1.8	20.3
Pulverized bran	20	2.03	12.7	78.3	57.8	27.3	20.6	33.4
	50	4.22	13.6	160.5	81.3	52.7	28.5	88.3
Cooked bran	20	1.8	11.4	51.6	34.7	22.3	18.5	29.3
	50	3.0	12.5	126.5	62.2	49.4	27.8	76.5

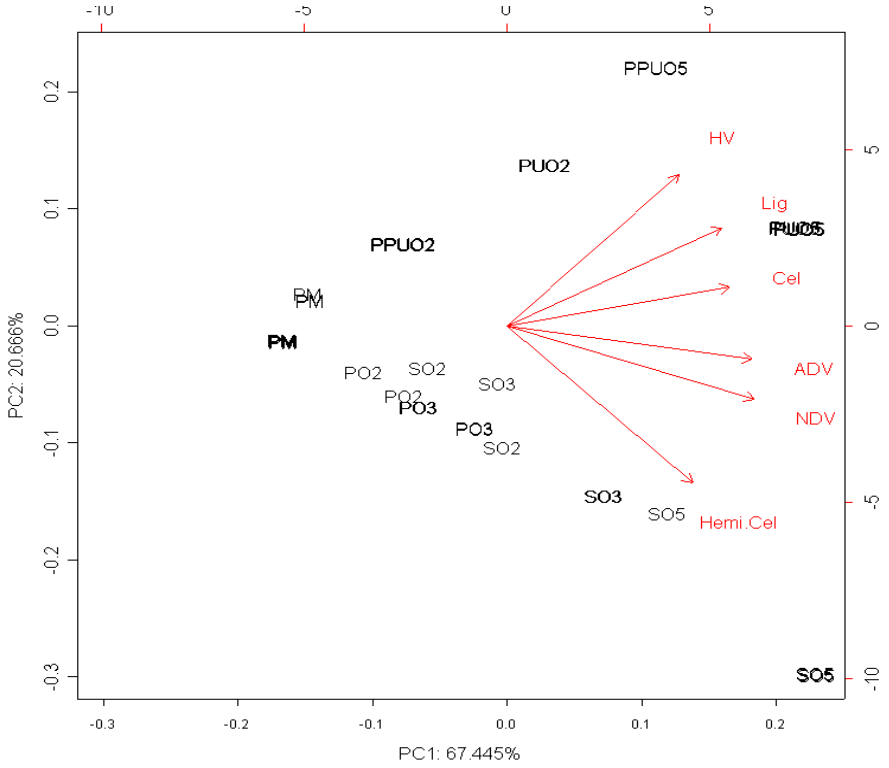


Fig. 2. Biplot of fibre representation in the wheat pan bread with different additions of brans
HV = crude fibre, NDF = neutral detergent fibre, ADF = acid detergent fibre, Lig = lignin, Cel = cellulose, Hemi.Cel= hemicellulose

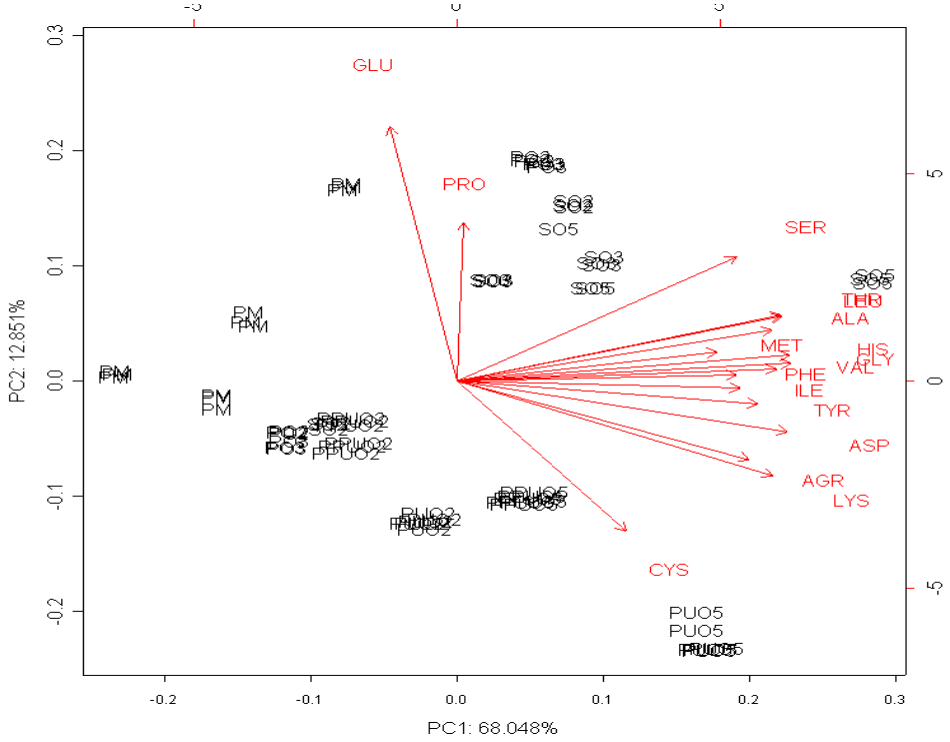


Fig. 3. Biplot of amino acids representation in the wheat bread with different additions of brans

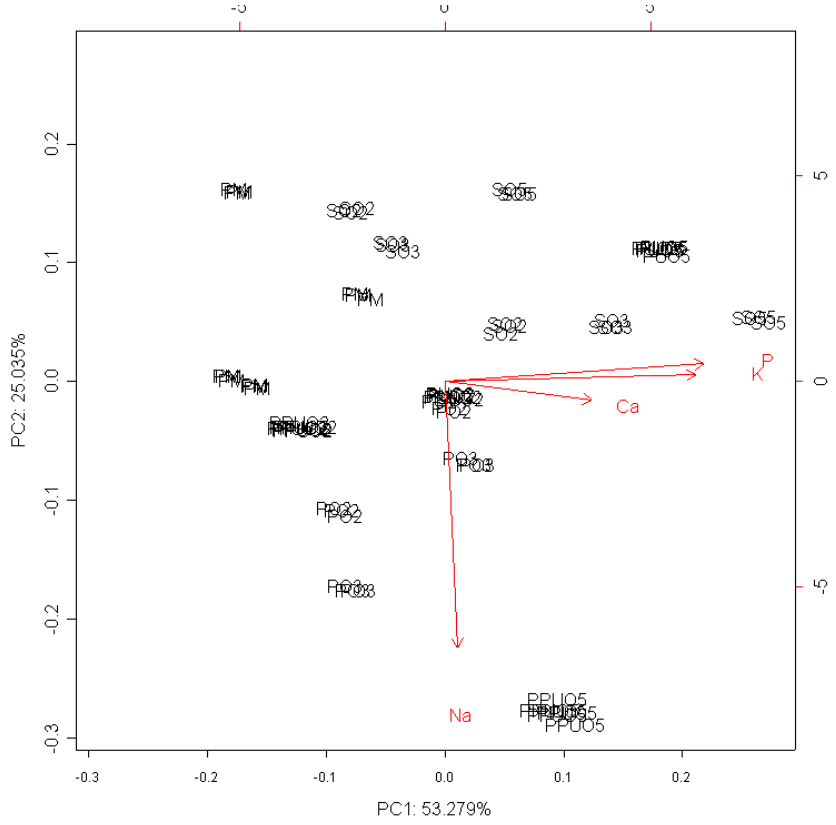


Fig. 4. Biplot of minerals representation in the wheat bread with different additions of brans

Pulverization decreased water absorption, this fact was reflected in technological (less baking loss, yield of product was not decreased) and sensory properties of pan bread. By cooking of brans especially product volume was improved. Some of authors (Nelles et al., 1998; Salmenkallio-Martilla et al., 2001) also tested different treatments of brans, but pulverization has not been introduced or tested by anyone.

The wheat bran bread was reported to contain higher amounts of crude protein, fat, fibre and ash. The minimum and the maximum values of nutrients in different treatments of wheat bran ranged from 11.3 to 13.6% for protein

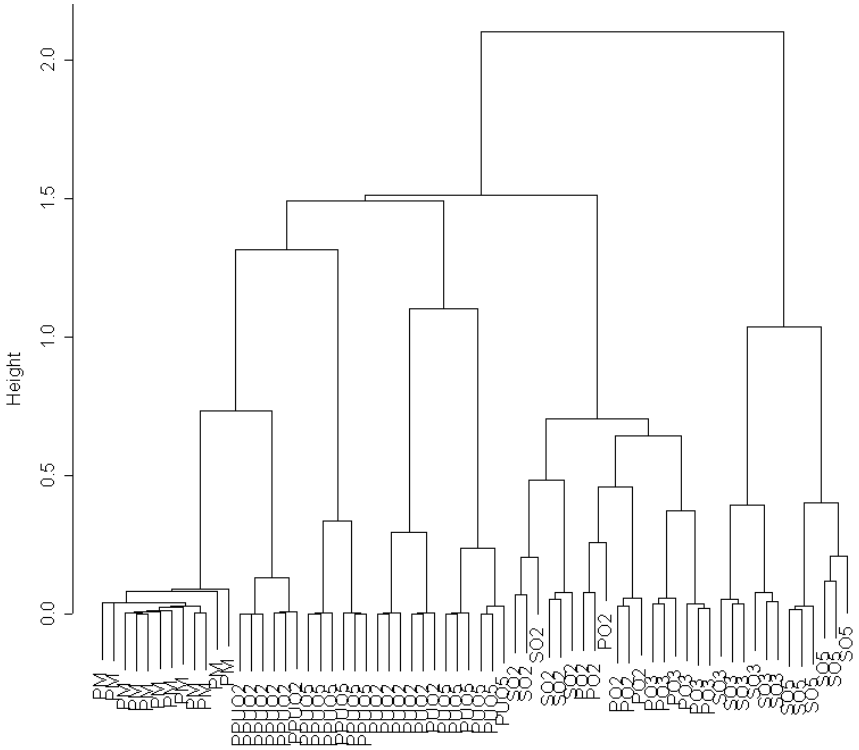
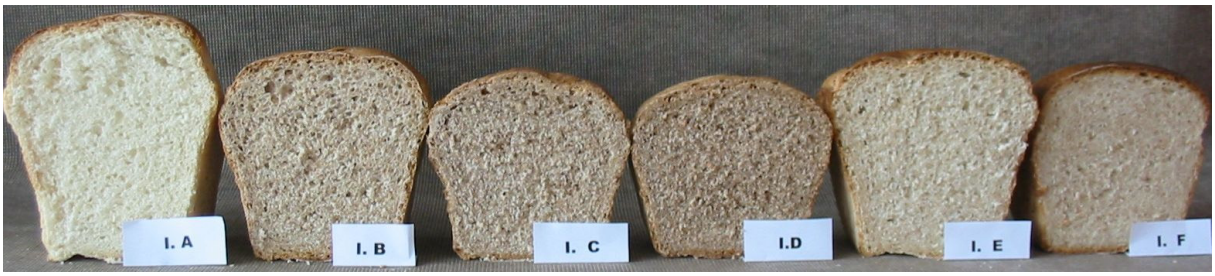


Fig. 5. Similarity dendrogram of sensory and technological properties of the wheat breads with different treated bran additions



Picture 1. Pan breads with addition of raw (B–D) and cooked brans

Picture 2. Pan breads with addition of pulverized brans

content, 0.82 to 4.22% for total ash content, to 160.5 $mg.kg^{-1}$ for NDF, 13.4 to 81.3 $mg.kg^{-1}$ ADF, to 28.5 $mg.kg^{-1}$ lignin, 52.7 to $mg.kg^{-1}$ cellulose and 20.3 to 88.3 $mg.kg^{-1}$ hemicellulose. Therefore the nutrients were found to be increased with the increase in the bran proportion in the pan bread (Table 2).

Protein content and its quality was affected by addition of brans. The best amino acids composition of pan breads (Fig. 3) was found in the pan breads with 50% addition of pulverized raw brans – favourable for lysine, phenylalanine, threonine, leucine, arginine content.

Increasing amounts of brans affected content of minerals more favourable for raw brans. Sensory and technological properties similarity of products is shown in the Fig. 5. From technological point of view the best effect was found at 20% addition of raw and pulverized brans. From sensory point of view was confirmed also 20% addition of brans as the best accepted but in cooked (pulverized) form. Pulverization made possible and acceptable product with 50% addition of bran.

CONCLUSIONS

The incorporation of the brans into wheat pan bread formulation led to a decrease in loaf volume. Cooking of brans caused decrease of the nutrition value compared to the raw ones, but it was still significantly higher than in the control with respect to all the components. Cooking of brans showed technological advantages in dough preparation and better acceptability of product. Pan breads containing cooked pulverized brans had more acceptable sensory quality than pan breads with raw pulverized brans. Pulverized brans can be possible added to pan bread in the amounts of 20–50%, in case of raw brans addition it is suitable to add in the amounts of 20–30%.

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Vplyv prídavku rôzne upravených otrúb na kvalitu chleba.

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Príspevok popisuje prídavok surových a pulverizovaných pšeničných otrúb na výslednú kvalitu chleba. Biela pšeničná múka T-550 bola nahradená 20 %, 30 % a 50 % surových, pulverizovaných, povarených a povarených pulverizovaných otrúb na zistenie ich vplyvu na vlastnosti cesta a kvalitu chleba. Prídavok pulverizovaných otrúb v zmesiach znižoval väznosť vody, čo sa prejavilo na technologických a senzorických vlastnostiach chleba. Náhrada pšeničnej múky otrubami znižovala objem bochníkov. Chlieb, v ktorom bol prídavok surových otrúb až do 50 %, obsahoval významne viac minerálnych látok, bielkovín a vlákniny. Senzorické hodnotenie produktov preukázalo, že prídavok povarených otrúb vo výrobkoch mal za následok lepšiu textúru a prehĺtavosť aj pri vysokých prídavkoch. Rovnako technologické charakteristiky boli pri povarených (aj vysokých) prídavkoch lepšie.

otruby; cesto; chlieb; senzorická kvalita; vláknina; pulverizácia

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