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TRENDS IN THE PRODUCTION OF BAKED GOODS BASED ON A CASE STUDY OF "TOSTA" CO-OPERATIVE

TENDENCJE W PRODUKCJI WYROBÓW PIEKARNICZYCH NA PRZYKŁADZIE SPÓŁDZIELNI PRODUKCYJNEJ „TOSTA”

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Streszczenie. Chleb stanowi bardzo ważną pozycję w codziennej diecie polskiego społeczeństwa. Celem badania było wskazanie tendencji w produkcji wyrobów piekarniczych przez lokalnych producentów oraz wskazanie dynamiki zmian cen pieczywa. Badanie przebiegało dwuetapowo. Pierwszy etap badań miał na celu zbadanie opinii na temat tendencji w spożyciu pieczywa w gospodarstwach domowych na terenie województwa kujawsko-pomorskiego. W drugim etapie dokonano analizy struktury spożycia wybranych gatunków chleba mieszanego sprzedanego przez Spółdzielnię Produkcyjną „Tosta”. Wyniki badań z lat 2010–2013, dotyczące sprzedaży pieczywa w analizowanej spółdzielni, pozwalają na stwierdzenie, że stosunkowo niewielki udział w całej wyprodukowanej ilości dotyczył chleba żytniego i pszennego, a zdecydowanie największym popytem charakteryzował się chleb mieszany. Badania dynamiki cen wskazują, iż w badanym okresie ceny pieczywa rosły.

Key words: bakery products, breads, energy values and nutritional breads.

Słowa kluczowe: produkty piekarnicze, rodzaje pieczywa, wartości energetyczne i odżywcze pieczywa.

INTRODUCTION

Food is indispensable for life. Its basic function is to provide energy and nutrients to build the human body, making it capable of performing its intended, physical and mental, functions. Bakery products, bread in particular, occupy an important place in our everyday diet. Bread fulfils about 30% of our daily calorie and nutrient demand, and helps human body to function properly (Mielcarz 2005). Whole grain bread, rich in nutrients and minerals, is of particular importance (Table 1). Consumption of wholemeal bread is also recommended, particularly the rye wholemeal (Mielcarz 2005a) type, with the highest amount of fibre, iron and folates (Piekut 2008).

According to the booklet published by the Institute of Agricultural and Food Economics, there has been a 40-kilo slump in the consumption of bread among Poles in comparison to 1993. This phenomenon is also confirmed by Karczewska and Ceglińska, who analyzed data for 2013, collected by the Central Statistical Office in Poland. In 2000 an average Pole ate 79.5 kg of bread, whereas in 2013 – only about 47.8 kg (Karczewska and Ceglińska 2013). It is projected that this decreasing consumption of bread is not going to change in the next few

years. Although bread is often substituted with other products made of grain, it is hoped that this tendency can be reversed. The production of bread is already predominating in other EU countries such as Germany and Sweden (Portal spożywczy..., www.portalspozywczy.pl/zboza-oleiste/wiadomosci/produccenci-spozycie-pieczywa-w-polsce-spada).

Table 1. Energy and nutrition of bread (per 100g)

Bread type	Energy [kcal]	Protein [g]	Fat [g]	Carbo-hydrates [g]	Fibre [g]	Thiamine [mg]	Folates [mg]	Iron [mg]
Rye wholegrain	225	6.8	1.8	53.8	9.1	0.192	44.8	2.5
Rye wholemeal	213	5.9	1.7	51.2	8.4	0.140	28.5	2.3
Rye	243	3.8	1.3	57.4	4.1	0.092	11.0	0.8
Pumper-nickel	240	5.9	2.0	58.2	9.4	0.138	28.4	2.5
Crunchy	353	8.7	2.4	78.9	6.0	0.257	40.0	4.0
Mixed sunflower seed	240	6.8	4.5	48.9	6.4	0.203	27.5	1.8
Wheat bread-rolls	277	8.8	1.6	58.0	2.1	0.146	61.5	1.7
Butter bread-rolls and croissants	327	8.5	5.9	61.0	1.8	0.107	33.8	1.1
Plait/twist rolls	333	7.8	7.0	60.8	1.8	0.104	38.0	1.1
Poppy seed yeast rolls	352	7.8	8.1	63.8	2.6	0.078	38.0	1.2

Source: Piekut (2008).

One of the main components of bread are carbohydrates. White wheat bread contains the highest amount of carbohydrates: 40–50 g per 100 g of bread. Carbohydrates are also rich in starch, which retains water during baking. Carbohydrates also contain simple sugars, (2–4%), mainly saccharose, and small amount of glucose. Simple sugars make food easier to digest since they are readily soluble in water, and penetrate through the mucous membranes. Lignin, cellulose and pentosans are parts of dietary fibre (Mielcarz 2005b).

Fibre components increase the volume of food without increasing its energy content. Fibre is also known to lower cholesterol level in blood. Its main sources are grain foods, fruit and vegetables. Rye grains contain the highest amounts of fibre (20–25 %), thus wholemeal rye bread is the richest in fibre (Mielcarz 2005b).

Polish wheat grain contains about 13% of protein (called gluten) which retains gases during the fermentation and, consequently, increases the volume of bread. Although rye grain has higher biological value, its gluten content is only 10.8%. Typically, bread contains between 4.8 to 9 grams of protein. Powdered whey or powdered milk are sometimes added to increase the protein content in bread. Long baking process and the addition of sugar significantly reduce biological value of protein in bread (Mielcarz 2005b). Although wheat bread contains more protein than rye bread, its nutritional value is lower in comparison. Rye flour contains 1.7 times as much lysine as wheat flour. Baked products ought to be enriched with plant protein ingredients, whey or gluten, to increase the value of protein. Soy protein is rich in quality amino-

-acids, and thus it is an important bread additive. It is particularly useful in dietetics. Long baking lowers the biological value of bread protein, especially in presence of sugars (Szajewska et al. 2001).

Another important ingredient of bread are fats. They are not heavy for the digestive tract, and prevent food from building up in it. Contrary to rye and wheat flours, bread baked from whole-grain flour is rich in fibre. Oil plant seeds are often added to bread to provide unsaturated fatty acids and fibre. This boosts fat content in bread by 2–3% (Mielcarz 2005b).

Cereal products are naturally rich in vitamin B. As shown in Table 2, pumpernickel bread contains the least amount of vitamin B₁ (Thiamine), due to extended baking time. Wholemeal wheat bread contains the highest amount of vitamin B₁. Under normal circumstances, the loss of Vitamin B content in bread, resulting from long baking process, is 19% in white, and 25% in brown bread. Human body needs 1.5 mg of thiamine every day, and 300g of bread provides only half of its recommended daily amount. The amount of vitamin E in bread can be increased by adding oil plant seeds. Cereals contain neither vitamins A nor C (Mielcarz 2005b).

Table 2. Selected vitamin content (per 100 g of bread)

Product	Vitamin B ₁ [µg]	Vitamin B ₂ [µg]	Niacin [µg]	Vitamin E [µg]
Bread rolls	98	34	1.10	0.39
Wheat bread	86	60	0.85	0.05–2.20
Wholemeal wheat bread	250	150	3.30	1.34
Crunchy rye bread	200	180	1.10	2.07
Rye-wheat bread	170	79	0.96	2.06
Wheat-rye bread	140	73	1.20	1.99
Rye bread	100	40	1.80	1.65
Pumpernickel	25	–	–	1.34
Wholemeal rye bread	180	150	0.56	2.40

Source: Mielcarz (2005b).

Minerals are essential for proper functioning of the human body. It is estimated that their daily consumption is 20–30 g, and thus must be supplied on a regular basis. Typically, the outer part of the grain, the hull, is rich in minerals. Therefore, wholemeal and whole grain foods contain the highest amounts of minerals. Potassium, magnesium, sulphur, iron, calcium and phosphorus are most common elements to be found in cereal grains, which may also contain trace amounts of zink, manganese and Ccpper. Mineral content depends on flour quality and bread moisture (Mielcarz 2005b).

METHODS

This current research aimed to take a closer look at different ways of baking bread by local producers in Poland. The research proceeded in two stages. The first stage consisted in gathering information about bread consumption preferences in the Kuyavian-Pomeranian region. The second stage focused on the consumption of selected types of mixed bread sold by "Tosta" co-operative, and price change dynamics in Poland.

In order to carry out the study, the researchers used the Targeted Selection Interviewing, and the Direct Interview techniques, including questionnaires. With regard to data evaluation, the Structured Data Analysis, and the Timed Event Dynamics Analysis were applied. They also defined constant increases, which showed how events changed in relation to the basis period.

Overall, one hundred and five respondents took part in the study. Out of 27 questions included in the questionnaire, 19 were closed, 8 were semi-open, and 6 were the matrix type. Data for 2010–2013 were used to determine the bread sales model (in kg) according to type (wheat/rye/mixed). Other types of mixed bread such as *bydgoski*, *kolodziej* (whole grain rye bread), *slonecznikowy* (sunflower seed), *sojowy* (soy), *krolewski*, *pur-pur*, *pomorski*, and *wielozziarnisty* (multigrain) were also included. The price change dynamics was studied in the 2010–2013 period. The following products were selected for the price study: 50 g wheat bread roll, 500 g wholemeal rye bread, and 500 g wheat/rye bread.

RESULTS

Trends in bread consumption according to interviewees

Consumption of cereal products, including bread, depends on many factors such as the number of inhabitants in a household, their age, income, education level and marital status (Piekut 2008). Consumers can choose between white, brown and mixed-type bread. Currently, bakeries strive to meet customers' demands and offer a wide range of bakery products such as traditional bread, bread with extra additives, bread rolls and confectionery. Customers can choose their favourite flavour, size, smell, price, nutritional value, availability, and decide if they want the loaf sliced or not.

68.6% of interviewees were female, while 31.4% were male. The vast majority of interviewees declared that they meals contained bread. Out of 99.1 % of respondents who provided that answer, 31.4% were male, and 67.6% – female. Out of all women, 35.6% declared that they often make bread-based meals. By comparison, only 16.4% of men responded in the affirmative to the same question.

The researchers found out that white bread was the most popular type with consumers. Such preference was given by 30.1% of the female respondents, and 22.1% of the male. The study also showed that brown bread is chosen by women aged 29 to 40 (31.6%), and those aged between 41–65 (47.4%). This may mean that middle-aged women tend to eat wholemeal products because they are more health-conscious. Men displayed considerably less interest in wholemeal bread (5.3%). This meagre result could be attributed to the fact that men often do sports in order to keep fit and look slim, and thus do not need to vary their diet. Young women aged 18–28 usually choose white bread (25%). The questionnaire also proved that 81.7% of interviewees prefer sliced bread. Only a fraction (18.3%) said that they prefer their bread unsliced. Probably, they are either the conservative types, who have the habit of buying bread loaves, or customers not willing to spend extra money to have their bread sliced. Interestingly, female customers are more concerned with the taste of bread, as they know how it can affect the taste of the whole meal.

The data gathered by the Central Statistical Office in 2011–2012 point at meal preparation time as an important factor for 3% of women aged 20–74. It is women who spend more time preparing a meal (about 90 min) – as opposed to men who typically need only 26 minutes for the same task (Statistical Yearbook... 2013). Our own findings revealed that men value not only good taste and reasonable price, but also proper look of their bread. The taste of bread is a decisive factor when buying bread for 26.8% of male respondents, 19.3% pointed at colour of bread, 18.4% – smell, and 17.2% – crunchy crust.

This response is consistent with the feedback given by female interviewees, who also ticked "taste" (58.8%), "smell" (31.6%) and "colour" (17.2%) as important factors when buying bread.

Nutritional value of cereal products depends on several factors, such as the type and the quality of grain used for production, how well the grain embryo and hull have been removed, and the production technology (Mościcki 2009). Whole grain bread is particularly important due to its high fibre content. It boosts metabolism and facilitates intestinal movement. Eating whole grain bread is recommended for those people who want to stay slim, and also for the overweight and obese. Consumption of wholemeal bread is continually increasing, especially among city dwellers and those who are well-off (Jurga 2013). However, switching to a more conscious, healthy everyday diet is happening fairly slowly and requires time. The recommended daily portion of bread is 240 g for women, and 360 g for men. Dieticians stress that eating less than 75 kg of wholemeal bread annually, can annihilate a well-balanced diet (Świetlik 2012).

According to Świetlik, an average Pole consumed about 53.52 kg of bread in 2011, 39.8 kg of which was mixed-type bread, 11.2 – wheat, and 2.5 – rye bread (Świetlik 2012). The vast majority of interviewees declared that they would be interested in buying more brown bread in the future. This view was expressed by 43.5% of the female, and 15.2% of the male respondents respectively. Only 2.2% of the female respondents expressed no interest in switching to brown bread, while 39.13% of the whole group had no opinion on the matter.

Both sexes displayed similar preference with regard purchasing white bread. 23.1% of the male, and 37.2% of the female interviewees had no opinion on whether or not they were going to buy it in the future. Only 33.3% of all respondents admitted that they would be less interested in buying white bread in the future. In case of mixed bread, 23.3% of the female, and 4.7% of the male respondents declared that they would be more interested in buying it in the future.

Upon analysing the data gathered, the researchers concluded that customers are likely to be more interested in purchasing brown bread in the future. According to interviewees, especially those aged 41–65, eating bread is good for health. Including brown bread in a diet provides not only valuable nutrients that are essential for our bodies to function, but it can also act as a dietary preventive measure, or even treatment. In the light of the above, it is important to promote brown bread in advertising and educational programmes. On the other hand, producers should adhere to the highest standards of quality. Such endeavours may eventually change customers' behaviour, and raise awareness about choosing brown bread, which is not only beneficial to customers' health, but also tasteful.

Consumption structure of selected types of bread

"Tosta" co-operative specializes in three types of bread: wheat, rye and mixed. Data provided by the producer confirm that sales figures ranging from 2.60% to 4.79% for rye bread in 2010–2013 were the lowest. Wheat bread, on the other hand, noted slightly bigger sales,

ranging from 3.11% to 6.24%. This leaves mixed bread with the highest sales figures ranging from 89.80% in 2011 to 94.29% in 2013.

The study also showed that rye bread sales had been on the rise until 2011. Bread consumption was considerably higher in 2011 in comparison to 2010 (29.6% increase) and 2012 (5.5% increase). In comparison to the previous year, a 33.4% slump in the production of baked goods was noted in 2013. What is more, the production of rye bread in 2013 was also lower than in 2010 (29.6% decrease) and 2012 (13.7% decrease).

Wheat bread sales showed similar trend; apart from a minor increase in sales in 2012 (2.5% rise compared to 2011), the sales figures exhibited a steady decline. The amount of 82 955 kg of wheat bread was put on the market in 2013. This was considerably less than in 2010 (36.3% decrease), 2011 (25.9% decrease) and 2012 (27.7% decrease).

In the period examined, mixed bread had the biggest share in overall bread sales in "Tosta" co-operative. The highest volume, over 2.75m kg, was sold in 2012. The amount fell by 8.8% in the following year. Nevertheless, it must be stressed that 2012 and 2013 saw a considerable increase in bread sales when compared to 2010 and 2011. In 2012 the sales were higher by 46.9% than in 2010, and by 49.6% than in 2011. In 2013 the sales noted an increase of 34% (compared to 2010) and 36.4% (compared to 2011) – Table 3.

Table 3. Mixed bread sales in "Tosta" co-operative in 2010–2013 [%]

Mixed bread type	YEAR			
	2010	2011	2012	2013
Bydgoski	88.1	85.8	91.0	90.5
Kolodziej	7.0	7.2	4.0	3.9
Słonecznikowy (Sunflower seed)	1.8	3.4	2.4	2.5
Sojowy (Soy)	1.3	1.5	1.1	1.1
Krolewski	0.7	1.0	0.9	1.1
Pur-pur	0.5	0.6	0.4	0.4
Pomorski	0.5	0.5	0.1	0.0
Wielozarnisty (multigrain)	0.0	0.0	0.1	0.5
Total	100	100	100	100

Of all the mixed bread types sold by the co-operative, the researchers noted that "Bydgoski" bread enjoyed the highest demand in every year studied (Table 1). In the record 2012, its production exceeded 2.5m kg, which was 51.8% more than in 2010, and 58.6% than in 2011. In 2013, a 9% decrease in the sales was registered, with the sales volume amounting to 2.27m kg. In other words, the "Bydgoski" bread sales in 2013 were considerably higher than in 2010 and 2011 (increase by 37.6% and 43.8% respectively).

The second best-selling mixed flour type of bread in 2010–2013 was "Kolodziej" (volumes ranging from 96 954 kg to 132 808 kg). Its share in the mixed bread sales figures in 2010, 2011, 2012 and 2013 amounted to 7.02%, 7.21%, 4.04% and 3.86% respectively. When comparing data from 2013/2012 with those from 2010/2011, it was noted that the sales of "Kolodziej" fell by 26.4%/27% and 15.4%/16.2%. The figures show a decrease in the production of this type of bread and, accompanied by a decreasing demand.

In 2012 "Tosta" co-operative launched a new type of mixed-flour bread called "Wielozziarnisty" (multigrain). In the first year its sales registered a 1697 kg figure, and a massive 12 t in the following year, which translates to a 700% sales increase. It seems that the new bread received a warm welcome from the market, and especially the ever more demanding customers.

Consumption of bread in Poland has been decreasing in the recent years. An average monthly consumption of bread in 2001, 2006 and 2011 was 6.62, 5.9 and 4.67 kg per person, which leaves little doubt about the apparent regression in bread consumption (30% decrease in last decade). According to the Polish Baked Goods Institute, this trend is likely to continue, with next years showing a similar, declining pattern.

The study on 2010–2013 bread sales in "Tosta" co-operative allowed the researchers to conclude that the sales of rye and wheat bread constituted only a small share of the overall bread sales (2.6% – 4.79% and 3.11–6.24% respectively). Undoubtedly, the mixed-flour bread was the most popular type with customers (from 89.80% of all bread sales in 2011, to 94.29% in 2013) – Fig. 1.

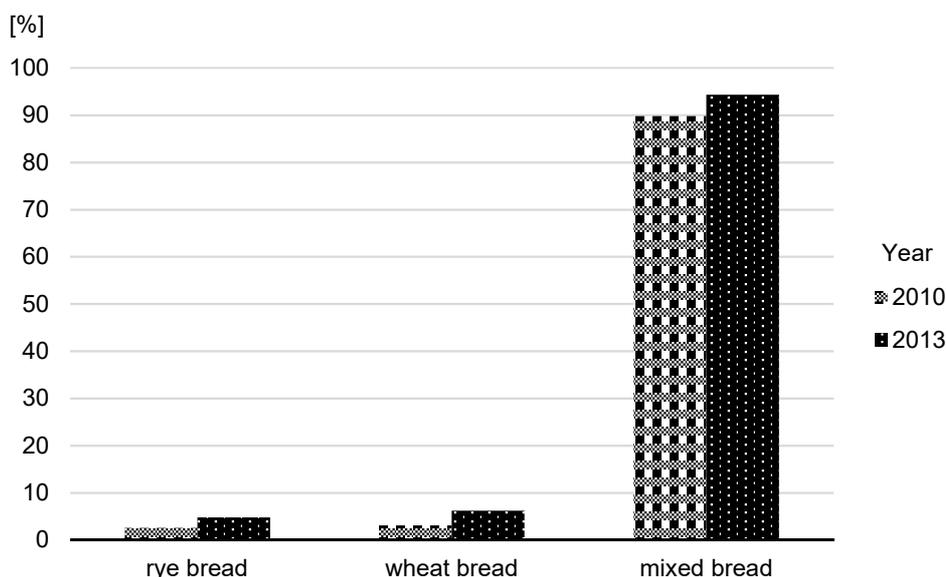


Fig. 1. Bread sales in 2010–2013

The sales of mixed-flour bread in 2012 totalled 2.75m kg. However, in the following year its sales decreased by 8.8% in comparison to 2012. In spite of that, it must be said that in 2012 and 2013 exceptionally high sales of mixed-flour bread (2012: 46.9% increase from 2010, and 49.6% increase from 2011, 2013: 34% increase from 2010, and 36.4% increase from 2011) were recorded.

The analysis of bread prices was based on data for a four-year period, from 2010 to 2013. Prices of the following products were examined in detail: 50 g wheat bread-roll, 500 g wholemeal rye bread, and 500 g wheat-rye bread. During that period, the price of a bread-roll ranged from PLN 0.39 (central Poland) to PLN 0.5 (south-western Poland).

The overall price trend for this product was decreasing; initially the prices increased by 10%, then remained stable, and finally decreased by 2% (Table 4).

Table 4. Wheat bread roll prices in 2010–2013 in different regions, including VBIs (Variable Base Indexes)

Area	Wheat bread roll – prices in PLN per 50 g			
	2010	2011	2012	2013
Nationwide	0.40	0.44	0.44	0.43
VBI		1.10	1.00	0.98
Central	0.39	0.42	0.43	0.40
VBI		1.08	1.02	0.93
South	0.37	0.41	0.40	0.42
VBI		1.11	0.98	1.05
East	0.39	0.43	0.43	0.42
VBI		1.10	1.00	0.98
North-West	0.43	0.46	0.45	0.45
VBI		1.07	0.98	1.00
South-West	0.45	0.50	0.50	0.50
VBI		1.11	1.00	1.00
North	0.40	0.44	0.43	0.42
VBI		1.10	0.98	0.98

In the aforementioned period, wholemeal rye bread cost between PLN 2.14 and PLN 3.31. The lowest prices were noted in the north-western parts, and they peaked in the south-western parts with a 23% increase rate (PLN 0.62) compared to 2010. Generally, the prices exhibited a growing trend in the whole study period, increasing by 13% (2010–2011), 4% (2011–2012), and 1% (2012–2013) – Table 5. In case of wheat-rye bread, it was observed that its prices were lower than those of rye bread.

The prices of wheat-rye bread exhibited a growing trend in the study period, increasing by 15% (2010–2011), 2% (2011–2012). The prices remained stable between 2012–2013 (Table 5).

Table 5. Rye and wheat-rye bread prices [PLN] in 2010–2013 by regions, including VBI

Area	Wholemeal rye bread – price per 500 g				Wheat-rye bread – price per 500 g			
	2010	2011	2012	2013	2010	2011	2012	2013
Nationwide	2.48	2.80	2.90	2.93	1.93	2.21	2.25	2.24
VBI		1.13	1.04	1.01		1.15	1.02	1.00
Central	2.56	2.93	2.92	2.85	1.87	2.15	2.19	2.20
VBI		1.14	1.00	0.98		1.15	1.02	1.00
South	2.72	3.02	3.21	3.28	2.13	2.43	2.50	2.50
VBI		1.11	1.06	1.02		1.14	1.03	1.00
East	2.14	2.49	2.58	2.66	1.81	2.07	2.11	2.10
VBI		1.16	1.04	1.03		1.14	1.02	1.00
North-West	2.61	2.81	2.93	2.96	1.97	2.23	2.29	2.23
VBI		1.08	1.04	1.01		1.13	1.03	0.97
South-West	2.69	3.11	3.21	3.31	2.15	2.44	2.49	2.49
VBI		1.16	1.03	1.03		1.13	1.02	1.00
North	2.30	2.60	2.73	2.77	1.81	2.07	2.11	2.09
VBI		1.13	1.05	1.01		1.14	1.02	0.99

CONCLUSIONS

For ages bread was fundamental to human diet. However, data on food consumption show that bread is being continually substituted with other, easier to prepare and highly-processed foods. Nutrition experts emphasize that the decreasing consumption of baked goods, which constitute the foundation of the food pyramid, can seriously disturb the balanced nutrition guidelines, and lead to illness. Dieticians stress that baked goods should exceed our cereal products' intake.

The study, which relies on questionnaire-based data, gives hope that customers will tend to buy more whole-grain bread in the future. The interviewees, especially those aged 41–65, believe that consumption of bread is beneficial for human health. They understand that eating whole-grain bread provides many nutrients that allow to maintain the body in optimal health. This is why it is essential to promote brown bread in advertising and educational programmes. What is more, its producers should strive to maintain the highest standards of quality. Such endeavours may eventually change customers' behaviour, and raise awareness about choosing this type of bread, which is not only beneficial to customers' health but also tasteful.

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Summary. Bread plays a very important role in the daily dietary habits of the Polish society. The aim of the study was to identify changes in the production schemes of bakery products by local producers, and the fluctuation in pricing. The study was carried out in two stages. The first stage was to investigate bread consumption preferences among households in the Kuyavian-

-Pomeranian province. In the second stage, researchers examined the consumption of different types of mixed bread produced by "Tosta" cooperative bakery. Studies for 2010–2013 proved that mixed bread was the most popular type of bread sold by the co-operative bakery, considerably more successful than the other two types of bread - rye and wheat. This is confirmed by the sales results for the period. Throughout the whole period steady increase in the price of bread was observed.