



Acceptability of bread supplemented with yeast extract to consumers

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ABSTRACT

A new type of functional food products – bread supplemented with yeast extract – was developed and optimized. In the next product development phase, samples of bread with yeast extract were tasted and evaluated by 536 randomly selected consumers, and their acceptability was analyzed. The survey results showed that consumers in all groups had a high level of awareness about the importance of product labeling and the impact of food on health, while low requirements for special diets. Bread sensory characteristics were highly acceptable, while the final price of bread with yeast extract was 20% higher than regular bread. Correspondence analysis showed differentiation among categories of consumers and their responses. Despite the high importance of product price and lack of proper marketing, there was a high level of consumers' willingness to change their current bread, and buy this new type.

Keywords: yeast extract; bread making; consumer survey, correspondence analysis.

ИЗВОД

Развијена је и оптимизована нова врста функционалног производа, хлеб са екстрактом квасца, а у наредној фази развоја производа, потрошачи су пробали хлеб са екстрактом квасца и њихови ставови су анализирани. Укупно 536 насумично одабраних потрошача тестирали су узорке хлеба са екстрактом квасца. Резултати анкете показују да потрошачи у свим групама имају високу свест о значају декларисања производа и утицаја хране на здравље, док имају мале потребе за специјалном исхраном. Сензорне карактеристике хлеба су веома прихватљиве, док је крајња цена нове врсте хлеба 20% виша од уобичајене. Анализа кореспонденције је показала разлике у категоријама потрошача, као и њиховим одговорима. Иако је испитиваним потрошачима цена производа била веома значајна, чак и без одговарајућег маркетинга, био је висок ниво спремности да замене врсту хлеба коју тренутно конзумирају и купе ову нову врсту хлеба.

Кључне речи: екстракт квасца, пекарство, потрошачки тест, кореспондентна анализа.

1. Introduction

Bread has an important place in the human diet, and it is consumed daily, in a wide range of qualities, types, and diets in the whole world (Filipović, 2010; De Boni et al., 2019). Its nutritional value and health benefits might be improved by significantly adding functional components and decreasing its salt content (Filipović, 2010; Sajdakowska et al., 2019). These changes may be accompanied by the deterioration of sensory qualities, which can significantly affect consumers' product acceptance (Sajdakowska et al., 2019).

Yeast extract, as a functional ingredient, could be a source of nutrients and an excellent natural seasoning. It is widely used as an ingredient for the production of savory foods (Zhang et al., 2017; Zhang et al., 2019). Yeast extract is a natural ingredient with many peptides, nucleotides, B-complex vitamins, minerals,

and proteins rich in essential amino acids (Zhang et al., 2019).

Most research regarding functional food is focused on its possible health effects, while there are relatively scarce data describing the consumer acceptance of food (Saher et al., 2004).

Regardless of its nutritive role, it is uncertain how functional food will be accepted among consumers due to uncharacteristic taste or other sensory characteristics. Therefore, consumers' acceptance of products is recognized as a critical feature during functional product positioning (Siró et al., 2008).

Previous researchers have reported the following reasons why people do not use functional food: lack of knowledge, reduced interest in functional food, and price (Niva, 2007; Košutić, 2012).

In a previous study (Filipović et al., 2019), a new type of functional products, bread supplemented with yeast extract, was developed and optimized. Hence, this

research aims to test and analyze the consumer acceptance of new products as the next product development phase.

Based on previous research (Filipović et al., 2019) concerning the technology and nutritional quality of the new products (bread with 5% yeast extract), this study aims to test and analyze product acceptability to a wide group of consumers.

2. Materials and methods

2.1. Materials

For making bread with 5% of yeast extract in this experiment the following raw materials were used: wholemeal spelt flour (manufactured by Jeftić, Serbia), yeast extract (manufactured by Alltech Serbia d.o.o, Senta, Serbia), salt (a commercial product) and bakery yeast (manufactured by Alltech-Fermin, Senta, Serbia).

2.2. Methods

2.2.1. Preparation of bread

Bread with yeast extract was prepared according to the AACC method (Kaluderski and Filipović, 1998). Wholemeal spelt flour was mixed with 0% and 5% yeast extract, bread was baked and cooled. Eight to ten hours after baking, bread was prepared for consumer testing.

2.2.2. Consumer survey

The acceptability of bread supplemented with 5% yeast extract on the market was assessed by a consumer survey. Consumers evaluated two types of bread: bread with 0% yeast extract and bread with 5% yeast extract. Based on the sample test, consumers gave answers to the questions listed in Table 1. Table 1. means "how do they like the new bread with 5% yeast extract".

This research was performed as a self-administered online survey, in which the cross-sectional data were collected in Serbia's Autonomous Province of Vojvodina. Bread samples were distributed to 536 randomly selected consumers for testing, and the consumers were asked to provide answers to eight questions, including three general and five specific ones, formed according to Košutić (2012), as stated in Table 1.

Table 1.
Questions in the consumersurvey

Type of questions	Question No.	Question
General questions	Q1	Do you read labels on packaged bread?
	Q2	Does your health condition require a special diet?
	Q3	In your opinion, does diet type affect health conditions?
Specific questions	Q4	Is the color of bread with yeast extract acceptable?
	Q5	Is the taste of bread with yeast extract acceptable?
	Q6	Is the odor of bread with yeast extract acceptable?
	Q7	Is the price of bread with yeast extract an important factor for purchase?
	Q8	Would you buy bread with yeast extract instead of your current bread?

The first part of the study was related to the socio-demographic characteristics of respondents, regarding consumers' age, level of education, income level, and gender.

Consumers were divided into 4 age groups:

- Teenagers (under 18 years of age) – 28 consumers,
- Young people (18– 30 years of age) – 140 consumers,
- Middle-aged people (31– 50 years of age) – 224 consumers,
- Older people (over 50 years of age) – 144 consumers.

Consumers were divided into 4 groups based on the level of education:

- Primary school – 28 consumers,
- Secondary school – 156 consumers,
- College – 60 consumers,
- University – 292 consumers.

Consumers were divided into four groups based on income:

- Low income (less than RSD 30,000) – 120 consumers
- Medium income (RSD 30,000–60,000) – 204 consumers

- Higher income (RSD 60,000–90,000 RSD) – 160 consumers
- Highest income (more than RSD 90,000 RSD) – 52 consumers

Gender was divided into male and female.

Information regarding consumers' age, level of education, income level, and gender was also anonymously collected to analyze consumers' answers by different socio-economic parameters.

2.2.3. Correspondence Analysis

Each participant of the survey evaluated bread by choosing an answer ("yes" or "no") to each question (Q1–Q8). The obtained responses were assessed using correspondence analysis. Correspondence analysis is a statistical technique for analyzing data collected in social surveys. It presents numerical tabular data in a simple graphical presentation using scatter plot representation with points concerning two coordinate axes (Greenacre, 2017). Correspondence analysis with the asymmetric normalization model (Beh, 2004; Hoffman & Franke, 1986; Lebart et al., 1984) was performed using the statistical software Statistica 12.

This multivariate statistical method is suitable for exploring relationships between items of two nominal variables. Accordingly, in the present study, in the correspondence analysis, the frequency of the specific answer ("yes" or "no") was assigned to each question (Q1–Q8), which was related to the particular consumer's preference.

2.2.4. Bread price calculation

Bread price was calculated based on the prices of the raw materials: spelt flour, salt, yeast extract, and fresh bakery yeast.

Table 2.

Direct material costs for the production of bread with 5% yeast extract

Raw material	Price of raw material (din kg ⁻¹)	Bread with 5% yeast extract		Bread with whole meal spelt	
		Quantity of raw material (kg)	Cost of raw material (din)	Quantity of raw material (kg)	Cost of raw material (din)
Whole meal spelt	200.00	1	200.00	1	200.00
Fresh bakery yeast	212.00	0.02	4.24	0.02	4.24
Yeast extract	800.00	0.05	40.00	-	-
Salt	50.00	0.01	0.5	0.02	1.00
Total raw material costs	-	-	244.74	-	205.24

The results of the correspondence analysis showed that the first two dimensions explained 83.43% of the total percent of inertia, using a considerably good quota of the raw information, statistically significant at $P < 0.001$ level among the considered categories (total inertia was 0.019, chi/square was 207.95).

The analysis of consumers' socio-demographic (Table 3) characteristics showed that older people were more educated and better paid than young people. Middle-aged persons (31–50) were the most educated and best paid survey participants. Male consumers were more educated and better paid than female consumers.

The results presented in Table 3 and Figure 1 indicate that the increase in consumers' age, level of education, and income level led to an increase in positive responses to the question regarding labels on bread packages, Q1. Furthermore, a higher percentage of positive answers was provided by male consumers. Positive answers were given by 63.43% of all consumers surveyed.

A positive answer to the question Q2: Does their health condition require a special diet, was provided by

3. Results and discussion

Based on the price of the raw materials used, price calculation showed that (Table 2) the cost of raw materials for bread with yeast was 20% higher than the cost of the control bread (made with the same raw materials, except yeast extract).

The graphical representation of the correspondence analysis is presented in Figure 1.

a low percentage of consumers, and 0% of consumers under 18 years of age. Young people (18–30 years) rarely had health concerns and requirements for special diets. However, older people (>50 years) were very interested in this matter. Female respondents were more likely to consider special diet regarding their health condition. A positive answer was provided by 17.91% of all consumer respondents, pointing at a generally low percentage of consumers having health problems and needing a special diet.

Positive answers to the last general question (Q3) regarding consumers' opinion on whether diet type affects health conditions, were extremely high, close to 100% in most consumer groups. The young and middle-aged people (18–30 and 31–50 years, respectively) were convinced that the diet could affect health conditions more than the young and older correspondents. The obtained answers were similar regardless of the educational level or the personal income status of the correspondents. A positive response was provided by 98.51% of all consumers surveyed, and this high rate indicated a high level of awareness of the importance of a quality diet.

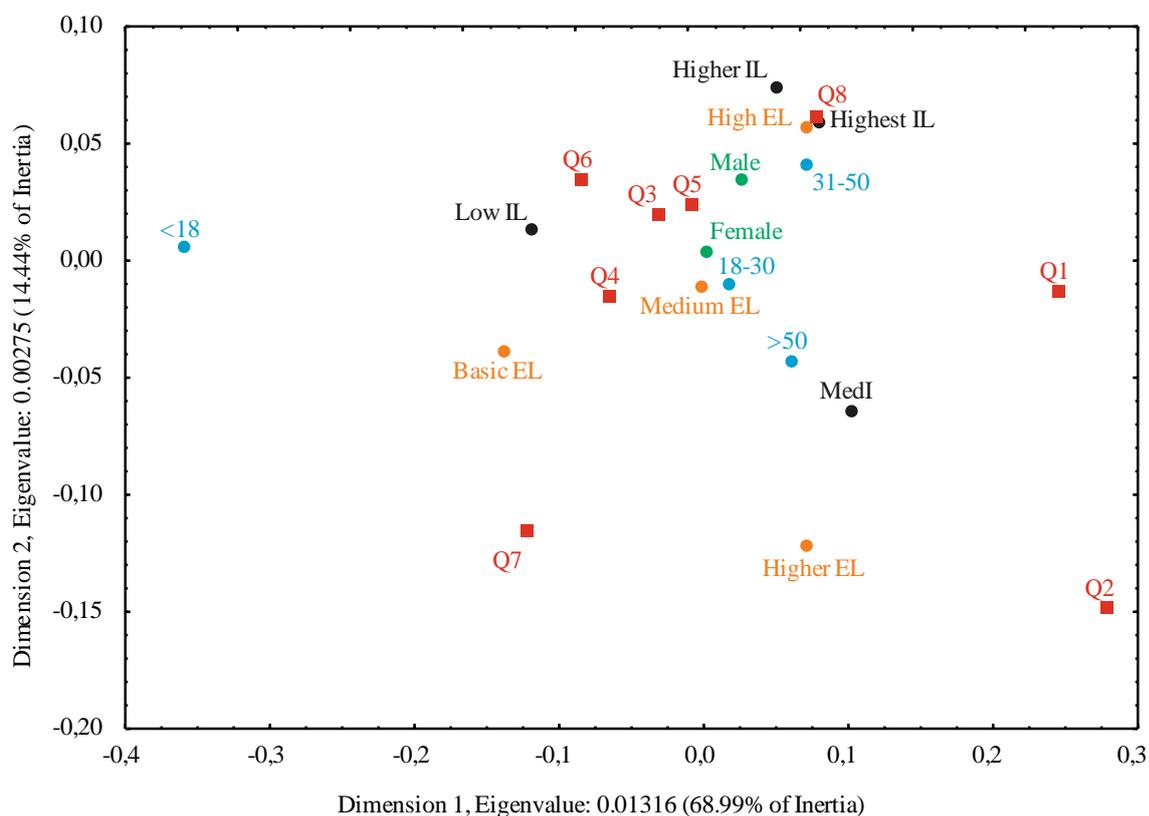


Figure 1. Biplot – Correspondence analysis between different categories of consumers and the intention to use bread with yeast extract

Table 3.

Consumers’ answers in the survey of the acceptability of bread with yeast extract (%)

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
		Percentage of positive answers (%)							
Consumers’ age	<18	14.29	0	85.71	100	85.71	100	71.43	42.86
	18-30	62.86	22.86	100	100	85.71	97.14	51.43	60
	31-50	76.79	17.86	100	91.07	94.64	94.64	53.57	76.79
	>50	83.33	16.67	97.22	100	94.44	83.33	63.89	61.11
Level of education	Primary	42.86	14.29	100	100	85.71	100	71.43	57.14
	Secondary	64.10	17.95	100	100	87.18	92.31	58.97	64.10
	College	86.67	20.00	86.67	100	93.33	80.00	73.33	53.33
	University	75.34	17.81	100	93.15	95.89	94.52	47.95	73.97
Income level	Low	46.67	10.00	100	100	83.33	93.33	56.67	50.00
	Medium	78.43	29.41	96.08	96.08	92.16	90.20	64.71	76.47
	Higher	80.00	10.00	87.50	95.00	97.50	97.50	50.00	70.00
	Highest	76.92	15.38	100	92.31	100	84.62	46.15	69.23
Gender	Male	67.44	16.28	97.67	93.02	93.02	93.02	51.16	65.12
	Female	61.54	18.68	98.90	97.80	92.31	92.31	58.24	69.23
Total in all groups		63.43	17.91	98.51	96.27	92.53	92.53	55.97	67.16

Specific questions regarding the quality of bread with yeast extract, i.e. the acceptability of bread color (Q4); bread taste (Q5) and bread odor (Q6) provided a very high rate of positive answers, nearly 100% in most consumer groups, for all three quality characteristics. Filipović et al. obtained a positive response from consumers regarding the sensory properties of nutritive bread with chokeberry (Filipović et al., 2021).

The color of bread with yeast extract was found acceptable for most consumers (question Q4). A somewhat lower percent was noticed for middle-aged consumers (31–50 years), university-level educated persons, and more prosperous survey participants. Male participants were less likely to accept the bread color.

The taste of bread with yeast extract was more acceptable for older survey correspondents (31–50 and >50 years) and more educated people (question Q5). The lower-income population was more likely to accept the taste of this bread. The gender of the correspondents was not important for the acceptability of the taste of bread with yeast extract.

The odor of the bread with yeast extract was more repulsive for the older population and the more highly educated correspondents (question Q6). The gender of the correspondents was irrelevant for the odor of bread.

The highest percentage of positive answers was achieved for bread color (96.27% of all consumers surveyed). In comparison, bread taste and odor

reached insignificantly lower acceptance levels (92.53% of all consumer respondents for both bread quality characteristics), indicating high overall acceptability of all sensory aspects.

Figure 1 shows substantial differentiation among categories of consumers and the intention to use bread with yeast extract. In general, all categories of the consumers and the intentions to use bread were clearly distinguished one from the other. The questions such as: does diet type affect health conditions and the acceptability of bread with yeast extract (regarding color, taste, and odor; Q3–Q6) were placed close to the origin, indicating similarity in respondents' answers (i. e. small differences in answers).

The price of bread with yeast extract was a significant factor for potential purchase for the young consumers (question Q7), probably since they are usually without personal income. On the other hand, consumers with the highest levels of education and income gave the lowest percentage of positive answers to Q7, indicating that price is not an important factor for their purchase. Male consumers also provided a lower rate of positive responses than female consumers. A positive answer was given by 55.97% of all consumers surveyed.

If consumers would buy bread with yeast extract instead of their current bread, Q8 showed that positive answers increased with increasing consumers' age, level of education, and income level. Female consumers also provided more positive answers in comparison to male consumers. The overall result achieved in all consumer groups was very high (67.16% of positive responses) and higher than the positive answers to Q7, indicating that the increased price of bread with yeast was not a crucial factor in purchasing decisions since greater importance was given to the overall quality and nutritional benefits of the new bread.

4. Conclusions

The survey results suggest that:

- Consumers in all socio-demographic groups had a high awareness about the importance of products' labels and the impact of food on health, while low requirements for special diets due to health conditions;
- There was high acceptability of all sensory characteristics;
- Addition of yeast extract to the bread formula increased the final price by 20%;
- Correspondence analysis, using scatter plot representation, showed differentiation among the categories of consumers and their intention to purchase bread with yeast extract;
- Despite the high product price and lack of proper marketing, which this type of product requires, there was a high level of consumers' willingness to change their current bread and buy this new type.

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