

## KNOWLEDGE AND OPINIONS OF STUDENTS ON ADDITIVES USED IN FOOD PRODUCTION

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Key words: food additives, students, opinion.

### Abstract

The objective of the study was to analyse the knowledge and opinions of students on additives used in food production. The studies were conducted in 2010 with a survey methodology using a questionnaire among 215 students from the University of Warmia and Mazury with a varied socio-demographic profile. The statistical analysis of empirical material included the analysis of frequency distribution of the recorded responses and the evaluation of the significance of the impact of the socio-demographic features on the investigated phenomena. chi-square test of Statistica 9.0 software (StatSoft Inc., USA) was applied to compare the data.

It was demonstrated that the majority of respondents paid attention to the presence of additives in food products. By analyzing the results of students opinions on additives, it was shown that the highest proportion of respondents indicated that the use of additives was rather necessary. The knowledge of the purpose of adding preservatives, aromatizing compounds and stabilizers to food was predominantly correct among students. It was observed that the knowledge of antioxidants was smaller. Among a substantial proportion of the respondents, there were some fears on the use of additives. The existing fears may indicate a need for a wider informative approach towards consumers.

### WIEDZA I OPINIE STUDENTÓW NA TEMAT SUBSTANCJI DODATKOWYCH STOSOWANYCH W PRODUKCJI ŻYWNOŚCI

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Słowa kluczowe: substancje dodatkowe do żywności, studenci, opinia.

### Abstrakt

Celem pracy była analiza wiedzy i opinii studentów w odniesieniu do substancji dodatkowych stosowanych w produkcji żywności. Badania przeprowadzono w 2010 r., metodą wywiadu z użyciem kwestionariusza ankiety wśród 215 studentów Uniwersytetu Warmińsko-Mazurskiego o zróżnicowanej charakterystyce socjo-demograficznej. W analizie statystycznej materiału empirycznego zastosowano analizę rozkładu częstości uzyskanych odpowiedzi oraz ocenę istotności wpływu cech socjo-demograficznych respondentów na badane zjawiska. Do analizy danych zastosowano test chi-kwadrat programu Statistica 9.0 (StatSoft Inc., USA).

Wykazano, iż większość respondentów zwracała uwagę na obecność substancji dodatkowych w produktach żywnościowych. W wynikach dotyczących opinii studentów na temat konieczności stosowania substancji dodatkowych wykazano, że największy odsetek respondentów stwierdził, iż stosowanie substancji dodatkowych jest raczej konieczne. Wiedza dotycząca celu stosowania substancji konserwujących, aromatyzujących oraz stabilizujących w żywności wśród większości studentów była poprawna. Zauważono natomiast mniejszą wiedzę z zakresu stosowania substancji przeciwutleniających. Wykazano istnienie obaw dotyczących stosowania substancji dodatkowych wśród znacznej liczby respondentów.

Obawy te mogą świadczyć o konieczności szerszego informowania konsumentów na ten temat.

## Introduction

Although food additives, without which it is difficult to imagine food production, are not nutrients, they are components of a product and impact its properties. The necessity for their addition is determined by technological, health and economical factors. In each country, the laws on food and nutrition specify which substances may be added to food, for specified purposes and in specified amounts (GERTIG 2008). In Poland, the list of additives that may be traded and used in food are detailed in the Commission Regulation (UE) No 1129/2011 and (UE) No 1130/2011 of 12 November 2011 (Dz.Urz. UE L 295) according to their technological functions, detailed conditions of their storage and their maximum permissible limits.

Studies aimed at identifying the permissible additives include numerous aspects, such as a determination of their impact on human health, histopathological, embryotoxic and carcinogenic lesions as well as safe and toxic genetic doses (GERTIG 2008).

The use of additives is a controversial issue and it thus provokes predominantly negative emotions. Nowadays, consumers are searching for healthy products that are attractive in their colour, tastiness and durability with the lowest number of additives possible (RUTKOWSKI 2006). In the last five decades, the use of additives has been found to be an essential element of technological processes, especially for additives which impact durability and the health properties of food products (RUTKOWSKI 2006).

The optimal durability of food is ensured by using substances with preserving and antioxidative properties. Preservatives (E200-E299) are used to inhibit or prevent unfavourable microbiological (growth of bacteria, moulds, fungi),

chemical (non-enzymatic browning) and biochemical (inactivation of metabolites, some enzymes and substances essential for microbial growth) changes. No preservative has the same effect on all microorganisms (ROGOZIŃSKA, WICHROWSKA 2011). Benzoic acid has been known for years and used as a preservative. It shows its preservation properties in an acid environment, predominantly towards fungi. It is mainly used to preserve effervescent non-alcoholic beverages as well as fruit and vegetable preserves. The disadvantages of benzoic acid are that it reduces taste, causes turgidity of protein-containing solutions, irritates the epithelium and acidifies the body (GERTIG 2008).

Antioxidants constitute a group of substances which extend the durability of products, yet with a different mechanism than for preservatives (GERTIG 2004). The action of these substances refers to two groups of phenomena: biological oxidation (with air oxygen) of non-lipid substances with enzymes and chemical lipid oxidation which is commonly called "rancidity" (ROGOZIŃSKA, POBIEREŻNY 2008). Antioxidants reduce the speed of oxidative reactions of food nutrients, thereby preventing the degradation of free radicals into volatile odour substances or the activation of polyphenol oxidase enzymes which generate a greyish pigment, i.e. melanin (ZIELIŃSKI, KOZŁOWSKA 2008). Of the natural antioxidants, special attention should be paid to tocopherols and organic acids that prevent enzymatic browning and simultaneously create the conditions that are unfavourable for microorganisms, such as bacteria and moulds. Antioxidants that are most beneficial to food products due to their synergic action are labelled with the symbols E300-E321 (ROGOZIŃSKA, WICHROWSKA 2011).

Food products are also supplemented with deficient compounds which are thought to eliminate disease conditions and vitamin deficiencies or deficiencies in other nutrients. The objective of food supplementation is, apart from increasing its nutritional value, to restore its natural value that has been lost during technological processing. In Poland, L-ascorbic acid is added to powdered milk, effervescent fruit beverages and vegetable preserves; retinol or  $\beta$ -carotene and cholecalciferol – to margarines; and calcium carbonate and iron(III) sulphate – to flour. Vitamin B is added to flour, cereal products, fruit juices and some beverages (GERTIG 2008). TARKO et al. (2012) describe several plant products which are used in food production as sources of polyphenols with high antioxidant potential.

Technological processes often require using different additives in order to make a production process run smoothly and correctly as well as to make it economically efficient. Such additives include stabilizers, emulsifiers, surface covering substances and thickeners. These are chemical substances with varied properties whose application must be justified by the conditions and method of manufacturing a given food product (GERTIG 2008).

Despite strict human health requirements, additives considered to be safe have been discovered to be harmful after many years of usage and have been removed from the list of permitted compounds. For instance, for many colorants and synthetic sweeteners, it has been found that they induce neoplastic lesions or are teratogenic. Many additives, despite being authorized for the use in food, may cause skin allergic reactions or food allergies in sensitive individuals. It is thus important to thoroughly investigate the composition of a given product, especially if it is bought for the first time (GERTIG 2008, ZIELIŃSKA, CZERWIONKA-SZAFLARSKA 2008).

According to studies carried out in 2000 on a group of 100 persons, nearly 75% of the respondents declared that information featured on food packages was important (OZIMEK 2005) while the studies conducted in 2004 on a group of 1,250 consumers demonstrated that information on the lack of preservatives, taste enhancers and colorants was a factor influencing purchase decisions (GUTKOWSKA, OZIMEK 2005). SOON-MI et al. (2011) indicated that consumer education on food additives should be more widespread.

The objective of the study was to analyse the knowledge and opinions of students on additives used in food production.

## **Materials and Methods**

The study was carried out in 2010 on a group of 215 students (148 women and 67 men) from the University of Warmia and Mazury in Olsztyn. The respondents represented four faculties: The Faculty of Social Sciences (24.7%), The Faculty of Technical Sciences (29.8%), The Faculty of Food Science (23.3%) and The Faculty of Theology (22.3%). The study was of a survey type and a questionnaire was used as a research tool. The questions in the questionnaire related to the interest of the respondents in the additives in food products, knowledge of the functional properties of selected additives and opinions on the necessity to use additives in food production. The results of the studies are presented as the frequency distribution of the recorded responses and they were statistically analysed with chi-square test of Statistica 9.0 software (StatSoft Inc., Tulsa, USA) in order to determine the significance of the impact of gender and faculty of study on the investigated phenomena. The relations were assumed significant at  $p \leq 0.05$ .

## Results and Discussion

The studies demonstrated that the most common answer to the question on the frequency of attention paid to the content of additives in purchased food products was “sometimes”, which was indicated by 31.6% of the respondents (Table 1). This response was more often given by women than by men, yet the difference between these groups was not statistically significant (34.5% vs. 25.4%,  $p = 0.45$ ). The option “rarely” was most often selected by students from the Faculty of Food Science (16.0%). The studies by KOŚCIOŁEK et al. (2012) showed that 64% of students from postsecondary schools “sometimes” paid attention to additives in food products. Similar results were reported in the studies by KREJPCIO et al. (2011) in which this response was selected by 50% of students from the Faculty of Architectural Engineering and Environmental Engineering. DZIUBANEK and ZUŻAŁEK (2008) recorded that 30% of students from the Poznań University of Technology and 50% of students from the University of Natural Sciences “sometimes” paid attention to the content of additives in food products. TARNAVÖLGYI and MOLNÁR (2004) demonstrated that the content of additives in food did not have any impact or had only a moderate impact on the selection of food by consumers.

Table 1  
The frequency of paying attention to the presence of additives in purchased food products

Criterion		Respondents [%]					<i>p</i>
		frequency					
		always	often	sometimes	rarely	never	
Gender	total	6.5	22.3	31.6	23.3	16.3	0.45
	women	6.1	23.0	34.5	23.0	13.4	
	men	7.5	20.9	25.4	23.9	22.3	
Faculty	Technical sciences	9.3	18.8	25.0	28.1	18.8	0.56
	Social sciences	9.4	18.9	30.2	26.4	15.1	
	Food science	2.0	30.0	40.0	16.0	12.0	
	Theology	4.2	22.9	33.3	20.8	18.8	

*p* – statistically significant at  $p \leq 0.05$

By analyzing the results on the opinions of the students on the necessity to supplement food products with additives, it may be pointed out that the highest proportions of both women (33.8%) and men (35.8%) were of the opinion that the use of these substances was rather necessary (Table 2). Considering the faculty of the respondents, the highest proportion of the students who believed that it was definitely needed or rather necessary to use

food additives came from the Faculty of Food Science (52.0%) while the lowest was observed for the Faculty of Theology (20.8%). The responses given by the respondents, both in relation to gender and the faculty, did not differ statistically ( $p = 0.93$  and  $p = 0.21$ , respectively). KREJPCIO et al. (2011) demonstrated that 65% of students represented the view that the use of additives in food was necessary. KOŚCIOŁEK et al. (2012) found that 34% of respondents thought that food could be produced without additives whereas 24% of respondents believed that it was impossible.

Table 2  
Opinion on the necessity of the use of additives in purchased food products

Criterion		Respondents [%]					<i>p</i>
		opinion					
		definitely needed	rather necessary	no opinion	rather unnecessary	definitely not necessary	
Gender	total	4.7	34.4	23.7	27.9	9.3	0.93
	women	4.1	33.8	24.3	29.1	8.8	
	men	6.0	35.8	22.4	25.4	10.4	
Faculty	Technical sciences	4.7	34.4	23.4	26.6	10.9	0.21
	Social sciences	7.6	35.9	17.0	28.3	11.2	
	Food science	6.0	46.0	24.0	22.0	2.0	
	Theology	0.0	20.8	31.3	35.4	12.5	

*p* – statistically significant at  $p \leq 0.05$

The results of the conducted studies demonstrated that 55.4% of the respondents expressed some fears related to the use of additives in food (Table 3). A slightly higher proportion of women (57.4%) than men (50.7%) expressed such fears, although the difference in the distribution of responses was not statistically significant between these groups ( $p = 0.13$ ). The highest proportions of persons who selected this response were recorded among the students of the Faculty of Food Science (62.0%) and the Faculty of Theology (62.5%). Among the respondents from the Faculty of Theology, the proportion of students not showing any fear of additives was lowest (14.6%). OZIMEK et al. (2004) and KREJPCIO et al. (2011) also demonstrated that consumers expressed some fears in relation to the use of food additives. Similar results were recorded in Korea by SOON-MI et al. (2011) who found that consumers were very concerned about the amount of preservatives, artificial colorants and sweeteners in food. Over 2/3 of the respondents felt that information on food additives was insufficient.

Table 3

Concerns with the application of additives in foods products

Criterion		Respondents [%]					<i>p</i>
		concerns					
		definitely I have concerns	rather I have concerns	I have no opinion	rather I do not have concerns	definitely I do not have concerns	
Gender	total	15.4	40.0	17.2	23.3	4.1	0.13
	women	15.5	41.9	18.9	21.6	2.1	
	men	14.9	35.8	13.4	26.9	9.0	
Faculty	Technical sciences	10.9	31.3	20.3	29.7	7.8	0.32
	Social sciences	17.0	41.5	15.1	22.6	3.8	
	Food science	14.0	48.0	10.0	26.0	2.0	
	Theology	20.8	41.7	22.9	12.5	2.1	

*p* – statistically significant at  $p \leq 0.05$

In the present study, the knowledge of the students on the purpose of using antioxidants, preservatives, aromatizing substances and stabilizers was verified by providing several answers with a possibility to select only one correct response.

The analysis of the results demonstrated that 34.9% of the respondents selected the correct answer regarding the purpose of using antioxidants, with women displaying higher knowledge than men (36.5% vs. 31.4%) and students from the Faculty of Food Science (56.0%) than from the other faculties (18.8–37.7%; Table 4).

Table 4

Indications of correct answers on the application of antioxidants, stabilizers, preservatives and flavourings

Criterion		Respondents [%]			
		antioxidants	stabilizers	preservatives	flavourings
Gender	total	34.9	47.9	66.0	86.0
	women	36.5	47.3	68.9	93.9
	men	31.4	49.3	59.7	68.7
Faculty	Technical sciences	28.1	42.2	53.1	73.4
	Social Sciences	37.7	32.1	79.2	92.5
	Food Science	56.0	66.0	74.0	90.0
	Theology	18.8	54.2	60.4	91.7

Nearly half of the respondents (47.9%) expressed an awareness of the purpose of using stabilizers (Table 4). A slightly higher percentage of the men than of the women indicated “maintaining the physical properties of food products” as the purpose of adding stabilizers (49.3% vs. 47.3%). The highest proportion of the correct answers was recorded among the students from the Faculty of Food Science (66.0%). Among the respondents representing the other faculties, the rate of correct responses ranged from 32.1% (the Faculty of Social Sciences) to 54.2% (the Faculty of Theology).

The knowledge of the purpose of using preservatives and aromatizing substances in food was demonstrated by over a half of the respondents (66.0% and 86.0%, respectively). The students from the Faculty of Social Sciences, Faculty of Food Science and Faculty of Theology showed higher knowledge than the students from the Faculty of Technical Sciences (Table 4). The percentage of women demonstrating this knowledge was higher compared to the men. The studies by KREJCIO et al. (2011) also demonstrated that the students from the Faculty of Food Sciences had higher knowledge of the purpose of using preservatives than the students from the Faculty of Architectural Engineering and Environmental Engineering.

## Conclusions

1. The conducted studies indicate that the respondents were predominantly concerned with the content of additives in food products, which may result from their interest in this issue.
2. The knowledge of the purpose of using preservatives, aromatizing substances and stabilizers was correct for the majority of respondents while a lower knowledge of the objective of using antioxidants may result from the fact that this information is less popularized by the media. This study shows that the knowledge of additives depends to a minor degree on the type of faculty of study. Nevertheless, the students from the Faculty of Food Science had a higher knowledge of this subject.
3. The significant proportion of respondents who expressed a fear of using additives may reflect the need for wider information dissemination among consumers on the use of additives in food production.

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## References

- DZIUBANEK G., ZUŻALEK J. 2008. Świadomość ryzyka zdrowotnego wynikającego z konsumpcji artykułów spożywczych zawierających chemiczne dodatki do żywności w populacji studentów Wydziału Zdrowia Publicznego w Bytomiu. *Ann. Acad. Med. Siles*, 62(3–4): 56–65.
- GERTING H., DUDA G. 2004. *Żywność a zdrowie i prawo*. Wyd. Lekarskie PZWL, Warszawa, pp. 196–207.
- GERTING H. 2008. *Dodatki do żywności*. [In:] *Żywnienie człowieka. Podstawy nauki o żywieniu*. Red. J. Gawęcki, L. Hryniewiecki. Wyd. PWN, Warszawa, pp. 373–383.
- GUTOWSKA K., OZIMEK J. 2005. *Wybrane aspekty zachowań konsumentów na rynku żywności – kryteria różnicowania*. Wyd. SGGW, Warszawa.
- KOSCIOLEK A., HARTMAN M., SPIOLEK K., KANIA J., PAWŁOWSKA-GÓRAL K. 2012. *Ocena stanu wiedzy uczniów szkół policealnych na temat dodatków do żywności*. *Bromat. Chem. Toksykol.*, XLV(3): 1055–1059.
- KREJCIO Z., SULIBORSKA J., HYŻYK A., DYBA S., SKWAREK K. 2011. *Ocena poziomu wiedzy na temat dodatków do żywności oraz ich spożycia w wybranych grupach studentów*. *Bromat. Chem. Toksykol.*, XLIV(3): 404–408.
- OZIMEK I. 2005. *Bezpieczeństwo żywności w aspekcie ochrony konsumenta w Polsce*. Wyd. SGGW, Warszawa.
- OZIMEK I., GUTOWSKA K., ŻAKOWSKA-BIEMAS S. 2004. *Postrzeganie przez konsumentów zagrożeń związanych z żywnością*. *Żywność. Nauka. Technologia. Jakość*, 4(41): 100–111.
- ROGOZIŃSKA I., POBIEREŻNY J. 2008. *Przeciwutleniające stosowane w technologii żywności*. *Inż. Ap. Chem.*, 47(3): 13–15.
- ROGOZIŃSKA I., WICHROWSKA D. 2011. *Najpopularniejsze dodatki utrwalające stosowane w nowoczesnej technologii żywności*. *Inż. Ap. Chem.*, 50(2): 19–21.
- Rozporządzenie Komisji (UE) nr 1129/2011 oraz (UE) nr 1130/2011 z dnia 12 listopada 2011 r. w sprawie dozwolonych substancji dodatkowych. *Dz. Urz.UE L* 295.
- RUTKOWSKI A. 2006. *Dodatki funkcjonalne do żywności. Geneza i perspektywy*. *Przem. Spoż.*, 60(5): 2–8.
- SOON-MI S., SUN H., YOUNHJA L., GUI-IM MOON, MIN-SHIK K., JU-HEE P. 2011. *Consumers' knowledge and safety perceptions of food additives: Evaluation on the effectiveness of transmitting information on preservatives*. *Food Control*, 22: 1054–1060.
- TARKO T., DUDA-CHODAK A., WAJDA D. 2012. *Wzbogacanie żywności w związki polifenolowe*. *Przem. Spoż.*, 66(10): 16–19.
- TARRNAVÖLGYI G., MOLNÁR E. 2004. *Attitudes toward food additives in Hungarian consumers – preliminary results*. *Acta Agriculturae Slovenica*, suppl. 1: 113–120.
- ZIELIŃSKA J., CZERWIONKA-SZAFŁARSKA M. 2008. *Nadwrażliwość na substancje dodatkowe do żywności – niedoceniany problem w praktyce pediatrycznej*. *Przeegl. Pediatr.*, 38: 307–312.
- ZIELIŃSKI H., KOZŁOWSKA H. 2008. *Antioxidant activity and total phenolics in selected cereal grains and their different morphological fractions*. *J. Agric. Food Chem.*, 48(6): 16.