

ANALYSIS OF CONSUMER PREFERENCES FOCUSED ON FOOD ADDITIVES

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Abstract

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This paper is aimed to evaluate the role of additives in food production and to identify how these additives are known and used by consumers in their households. The questionnaire technique was used, the research involved 220 respondents. It was found that the respondents are perceptive to adding of additives into food. Cluster analysis confirmed that the majority of respondents is about the incidence of food additives only partially informed, although 87% of respondents knew what the (E) letter of additive means. The correct answers for each question depended on the age and education of respondents and were not dependent on gender of respondents. We recommend to enhance public knowledge about nutrition, diet and food composition, functions, benefits and safety of food additives.

consumer, additives, application of additives

Current trends, consumer interest in healthy lifestyles as well as their disinterest to spend much time in preparing meals, bring new challenges to food producers. In the food industry additives are intentionally used in processing of raw materials and food production.

The fact that consumers are better educated and more demanding is resulting in growing demand for healthy and nutritious foods (Linneman *et al.*, 1999). In Visegrad countries high proportion of household expenditure (approx. 20%) on food and soft drinks was observed. Similarities, respectively differences in consumer behavior and structure of household expenditure at the time of economic crisis in the years 2007 to 2009 analyzed Skálová and Stávková (2012). Tritscher (2004) states that the worldwide consumer demand led to the produce of healthy and nutritionally balanced food, but also to increase the number of novel foods, novel ingredients and new packaging. This development requires a structured approach for assessing safety of foods and ingredients. The treatment processes can have various effects on foods and their ingredients. Emphasis on improving quality of agricultural production and foods put Gecíková *et al.* (2010), for research on functional foods, nanotechnology,

medical nutrigenomics and food safety Židek *et al.* (2011), Chreneková (2011) and others. Consumer preferences at the market for food commodities, factors of food choice and consumer perception of food quality with an emphasis on health aspects of food in relation to the evaluated price reported Miškolci (2011). In the research and development of new products according to Golian (2007) is important to remove the adverse effects of food additives. Because of safe intake of food additives an estimate of the amount of a substance in food or drinking water, expressed on a body-weight basis, that can be ingested daily over a lifetime without appreciable risk (standard human = 60 kg) is determined. The ADI is listed in units of mg per kg of body weight (JECFA, 2012).

According to the Regulation (EC) No. 1333/2008 of the European Parliament and of the Council, food additive shall mean any substance not normally consumed as a food in itself and not normally used as a characteristic ingredient of food, whether or not it has nutritive value, the intentional addition of which to food for a technological purpose in the manufacture, processing, preparation, treatment, packaging, transport or storage of such food results, or may be reasonably expected to result, in it or

its by-products becoming directly or indirectly a component of such foods.

Regulation (EC) No. 1333/2008 states that food additive may be included in the Community lists only if it meets the following conditions, including environmental factors: (a) it does not, on the basis of the scientific evidence available, pose a safety concern to the health of the consumer at the level of use proposed; (b) there is a reasonable technological need that cannot be achieved by other economically and technologically practicable means; and (c) its use does not mislead the consumer.

According to Magnússon *et al.* (2012) quality and safety of preserved food is usually assessed by the presence of bacterial growth, its spoilage, contamination. However, microorganisms can be not only harmful but also beneficial. A lot of them are component to the various processes of food production, e.g. in production of beer, wine, dairy products. In addition, some microorganisms used in the production of fermented foods can have a positive impact on consumer health.

Colorants are added to the products to compensate the loss of color during its processing and storage in order to strengthen the original natural color. Vijaeeswarri *et al.* (2010) argue that the colorants obtained from natural sources are important alternative to synthetic dyes. According to Danihelová *et al.* (2011) natural dyes are important for antimutagenic, anticarcinogenic, cardiovascular, detoxification effects. Bioactive components for example of flavonoids are attributed to anti-inflammatory effects as well as protective effects against civilization diseases.

For developing of new technologies focused on the activity and bioavailability of natural antioxidants are a key factor according to Sánchez-Moreno *et al.* (2004) technical conditions. To improve the sensory properties and shelf life of foods in recent years, according to Ryan and Mazza (2007) attention is given to the extracts of herbs and spices. These additives may be obtained from various plants with high content of tannins, for example sumac (*Rhus coriaria*). Líšková *et al.* (2011) for example added extracts of herbs into malt drinks and beer and affected sensory and nutritional parameters of final product.

The aim of this paper was to identify how consumers are informed about the importance, labeling and their usage in households.

MATERIAL AND METHODS

Meeting the work objective needed to implement primary research. The primary sources were data and information gathered by research on consumer opinions on additives. Secondary data sources were scientific works of domestic and foreign experts, such as professional and scientific papers published in scientific journals, books and literary sources also from the available electronic databases of the Slovak Agricultural Library. Contribution follows

the work of Dodoková (2011), the input data have been received by the questionnaire technique. The questionnaire consisted of three identifying variables and 6 opinion variables. The research sample consisted of 220 respondents. The research was conducted between November 2010 and February 2011 and respondents involved were from the Slovak Republic.

The main statistical method was cluster analysis, complemented by methods of descriptive statistics. The data were classified according to quality of statistical parameters. Individual respondents obtained three-digit codes. The code consists of data: gender of respondents; education of respondents; age of respondents. Coding of the variables was as follows: Gender: female (1) male (2), Education: secondary (1), university (2), Age: 18 to 25 years (1st age category), 26 to 35 years (2nd age category), 36 to 45 years (3rd age category), 46 to 55 years (4th age category).

The respondents were subjected into 4 questions as follows: what do consumers understand under the term of additives (Q2), which additives are used in their households (Q3), labeling of additives (Q4) and how additives occur in the foods (Q5).

Association tables and graphs were done from data obtained. Respondents' views were divided by the correct and incorrect answers and statistically evaluated using dendrograms. Agglomerative hierarchical clustering on the contingency tables derived from the dataset by the method of Agnes R (Agglomerative Nesting) has been used to highlight the structure (similarities of the responses), R Development Core Team (2011).

RESULTS AND DISCUSSION

Among 220 respondents included, women accounted for 55%, and men 45% of respondents. In the category of 18 to 25 years participated in 31% of respondents, aged 26 to 35 was 29%, 36 to 45 participated in 24% of respondents and 16% were represented in the category of 46 to 55 years. Secondary education was reported in 72% of respondents and university education 28%.

Klescht *et al.* (2006) indicate that the additives are added to food to:

- a) provide the safe, nutritionally valuable foods. As a protection against the effects of microorganisms that cause spoilage and food poisoning are added preservatives,
- b) create a texture and consistency and stability of foods. Gelling, thickening and stabilizing agents are ensuring that the food gets the desired texture and consistency, keeping it for the time of storage. Emulsifiers and stabilizers allow the production of foods containing fats and water,
- c) maintain and improve the organoleptic properties of food. Loss of food color, which occurred as a result of the technological process of production is offset by the addition of food colorings,

- d) food production with specific nutritional requirements. For the production of foods for diabetics are used to replace sugar sweeteners. Thickeners and stabilizers allow the production of foods with reduced fat.

What do consumers understand under the term of additives and their effects has been the subject of the first question (Q2). We found that 19% of respondents shared the view that the additives have a negative effect on food, 35% think that additives negative affect consumers. The largest number of respondents 46% think that additives are added to food to improve its properties (Fig. 1).

The answers of respondents we describe in three clusters. The first cluster consists of women, secondary education and in the first two age groups, whose 34 women answered correctly. The second cluster is represented by women of higher education, the first age group (18 to 25 years) and also men of secondary education in the second age group (26 to 35 years), whose 15 respondents answered correctly. The third most abundant cluster consists of all other respondents, whose 69 respondents answered correctly. Among 220 respondents, correctly answered this question 102 respondents. The correct answer (Q2) depend on education of respondents.

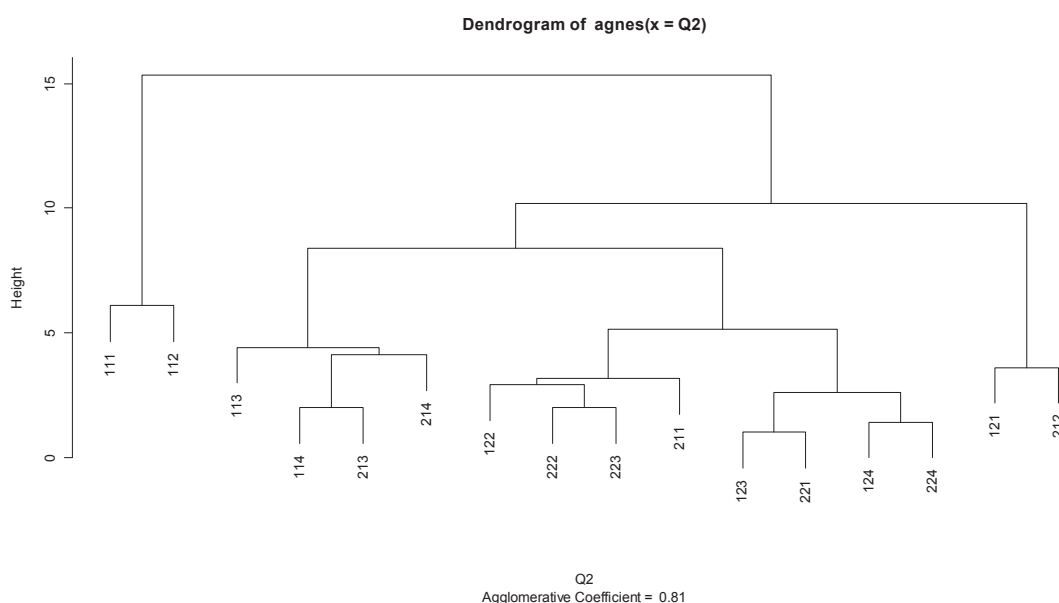
Alto and Elmaci (1995) in a study conducted in the capital of Turkey indicate that the majority of consumers have no knowledge about the functions and benefits of food additives on human health. Some respondents consider them very dangerous, toxic and carcinogenic. Information from that study also showed that consumer education about the functions, benefits, safety issues of food additives is required.

Our research then showed (second question) that the most widely used additives in households are (Fig. 3) texturants (37% of respondents), followed by the colorants (35% of respondents) and the least used are synthetic sweeteners (28% of respondents).

When consumer deciding to purchase foods, important role plays his knowledge. Labeling of additives on food labels, was the next question (Q4). We found that 88% of respondents answered correctly, indicating that additives are referred to the letter E, 11% of respondents thought that the additives are marked A and 1% said that the additives are referred to the letter B. The responses were evaluated according to the correctness on the good and bad, and are shown in the dendrogram (Fig. 2).

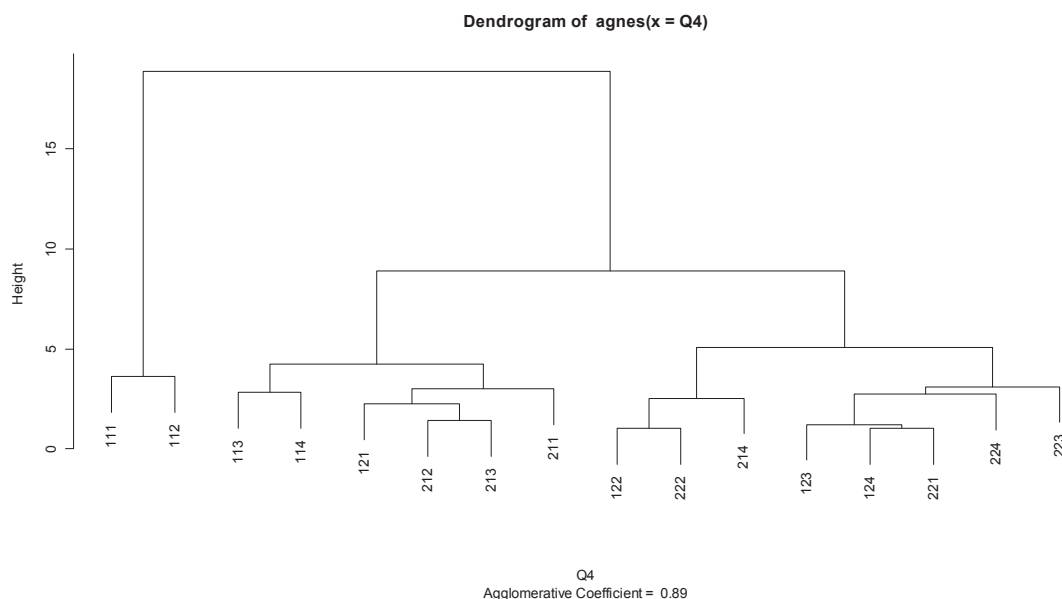
The first cluster included women of secondary education in the first two age groups (aged 18 to 35 years) and 57 of them answered correctly. The second cluster showed 86 correct answers, dominated by women and secondary education in the age groups 3 and 4 (aged more than 36 years) and men of secondary education aged 18 to 45 years. In the third cluster of 48 respondents answered correctly, high education of women aged 26 years and men in high education for all ages as well as secondary education of men aged over 46 years. Of the 220 respondents correctly answered the fourth question 191 respondents. The correct answer (Q4) was depending on age and education of respondents.

Ferruzzi *et al.* (2006) state that many experimental epidemiological studies are dealing with the beneficial effects of phytochemicals and chemical reactions of food of plant origin. Diets rich in fruits and vegetables are associated with the prevention of chronic diseases. Physiologically active food components, such as carotenoids can enhance immunity to protect against various types of



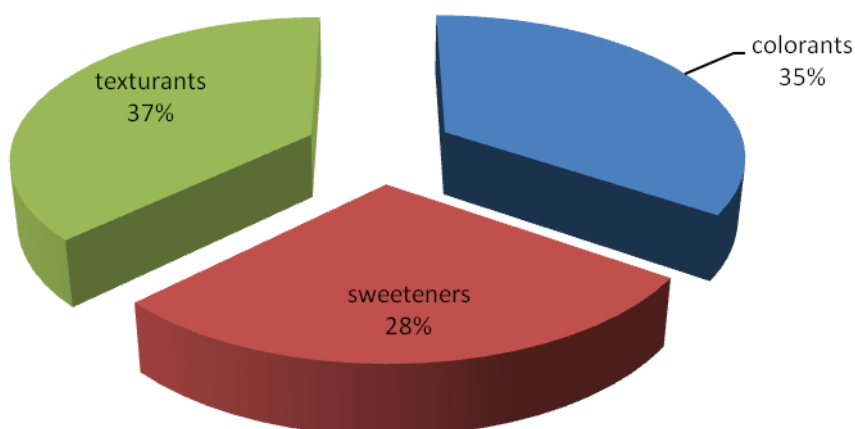
1: Knowledge the term of additive

Source: Own research and processing



2: Labeling of additives

Source: Own research and processing



3: Responses to the question: What additives are used in your household?

Source: Own research and processing

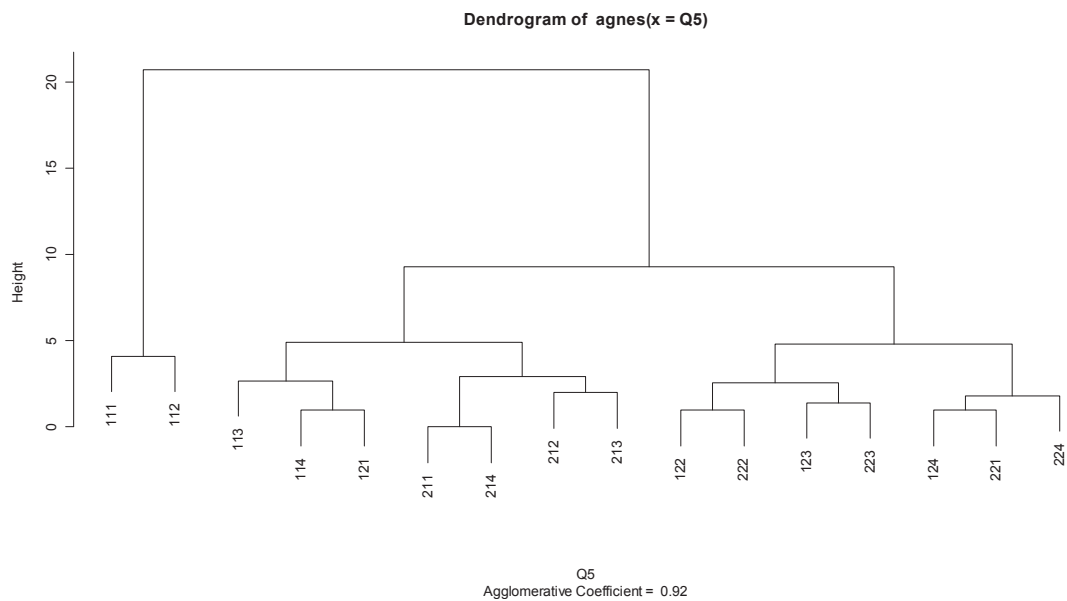
radiation, have antioxidant properties. Chlorophylls exhibit antimutagenic activity.

Carotenoids are commercially used as additives for color improvement and also serve as nutraceuticals, and are also used in the manufacture of cosmetic products (Lee and Schmidt-Danner, 2002). Currently, carotenoids are produced commercially by chemical synthesis, fermentation, or by isolation from several natural sources (Johnson and Schroeder, 1996). Constantly increasing interest in carotenoids in food production is leading to increased effort to develop biotechnology for the production of carotenoids with emphasis on lycopene, β -carotene and other carotenoids (Bhataya *et al.*, 2009; Ye *et al.*, 2002; Lee *et al.*, 2009).

As a source for obtaining the natural red colorant may also be used the fruits of tomato. Mendelová *et al.* (2012) indicate that tomato fruits contain as dominant carotenoid lycopene, whose utility is

increased by heat treatment and hence nutritionally important are tomato products like tomato juice, paste or puree. Heat treatment has a significant positive impact on the utilization of carotenoids in the human body, in the case of lycopene was also confirmed an increase of its contents after processing. The relation among chosen macro- and microelements, total polyphenol content, anthocyanin content and antioxidant capacity in 6 selected cultivars of cranberries was observed by Vollmanová *et al.* (2009).

In our research we examined respondents' opinions on why additives occur in our food (Q5). Respondents should indicate the correct answers of the following: a) are intentionally added during manufacturing, b) there are occurred in agricultural production, c) accidentally come into the food distribution, d) are produced by decomposition of plant products, e) by adding chemicals to food.



4: How can additives access the foods

Source: Own research and processing

Results of analysis of respondents views to the addition of additives in foods are shown in Fig. 4. The first cluster involves women of secondary education aged 18 to 35 years. The second and third clusters are significantly larger. The second cluster is represented by women and men with dominant secondary education for all ages. The third cluster is dominated by a university education for all ages. Among 220 respondents correctly replied the fifth question totally 206 respondents. The correct

answers (Q5) depend on age and education of respondents.

Caballero *et al.* (2003) consider the addition of food additives into foods as a major benefit. Due to the addition of food additives we can find better offer of foods on the market with lower prices, better organoleptic properties of food as well as extending their shelf life. It is important however to improve food safety by using antimicrobial agents to prevent the spread of bacteria and fungi, which can result in alimentary diseases, such as food poisoning.

Shimet *et al.* (2011) investigated how the consumers perceive food additives in Korea. The research involved 430 respondents living in Seoul. The results showed that more than two thirds of respondents have a lack of information about the additives. This disinformation and difficulties in understanding the importance of adding the additives were attributed to the lack of education and a general overview.

I: Summary of correct answers to questions evaluated in relative terms (%)

Code	Q2	Q4	Q5
111	9.09	13.64	15.00
112	6.36	12.27	13.18
113	3.64	8.18	8.64
114	1.36	7.27	7.27
121	6.36	5.91	7.73
122	2.73	3.64	4.09
123	0.45	2.27	2.73
124	0.45	1.82	1.36
211	3.18	5.45	5.45
212	5.00	6.36	6.36
213	2.27	5.91	6.36
214	1.82	4.55	5.45
221	0.00	2.27	1.82
222	2.27	4.09	4.09
223	1.36	2.27	3.18
224	0.00	0.91	0.91
Sum	46.36	86.82	93.64

CONCLUSION

Additives in food production are of great technological importance and they should not present any risk to humans, moreover under current trends they should bring more than just technological functions, e.g. some health benefits. Extending the shelf life of foods is used as a way of expanding safe production offer and thus partially should satisfy the nutritional needs of customers.

Cluster analysis confirmed that the majority of respondents is only partially informed on the incidence and work of food additives. The correct answers for each question depended on the age and education of respondents and were not dependent on gender of respondents. When choosing food we recommend to check the additives content, but it is not necessary completely to avoid them.

We recommend by appropriate ways to enhance public knowledge about nutrition, diet and food composition, their functions, benefits and safety of food additives. Food producers use approved

additives with no adverse effects to human health and in limited quantities, necessary for the individual technologies of safe food production.

SUMMARY

Expenditure on foods and soft drinks represent the largest share of household expenses. Consumers when buying foods are affected by several factors. The paper was aimed to analyze consumer awareness about additives, briefly describe the reasons for the addition of additives into foods during the processing of food, to identify how consumers perceive these additives and analyze consumer preferences, focusing on food additives.

Questionnaire technique was used for data obtaining. The research involved 220 respondents from the Slovak Republic. Cluster analysis confirmed that a lot of respondents is about the addition of additives only partially informed, 87% of respondents knew what letter is used for labeling of additives. Almost half of respondents is aware of the reasons why are during the food production added food additives. More than 90% of respondents correctly indicated how the additives get into the food. The correct answers for each question depended on the age and education of respondents and was not dependent on gender of respondents. We recommend to enhance a public knowledge about nutrition, diet and food composition, the functions, benefits and safety of food additives.

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