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ATTITUDES TOWARDS FOOD ADDITIVES: A PILOT STUDY

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Modern food processing involves the use of different food improvement agents. Among them, consumers are mostly familiar with food additives. Most of them are regarded as being, at least to some extent, the cause of different diseases, even though their use is highly regulated in Europe. This study aims at understanding the knowledge that a sample of people from Bucharest has towards additives and, especially, sweeteners. A total of 232 men and women from Bucharest, randomly selected from the clients of a pharmacy, were asked to complete a 20 item questionnaire regarding food additives. Results showed that most of the people do not know the technological function of sweeteners, being skeptical of buying foods with such ingredients. 76.3% of the consumers disagree with the use of additives and 83.6% consider additives as being dangerous for health, especially preservatives and colourings. More educated and affluent people, as well as elderly, are ready to pay more in order to get additive-free food. Our findings are similar with those from other European countries and underline the need for proper education regarding the necessity of additives in modern food industry and about the process of evaluation of their safety, before they enter the market. The average buyer must feel safe and confident when purchasing food or beverages containing additives.

Keywords: processed food consumption, attitude, information on food additive

Introduction

Additives are food improvement agents widely used in modern food industry (Marin, 2006). Their use is not recent, even though their numbers have risen abruptly in the last few decades. Baking soda or nitrates, citric acid or monosodium glutamate are not new. However, due to popular concern and to some problems with former additives (especially azo-dyes like butter yellow), additives have been closely defined and regulated in most countries, in order to protect consumers' health and avoid unrightfully use. The term "food additive" means in EU "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" (EC no.1333/2008). Some substances that might be associated with the term additive, such as salt, sugar, amino acids, flavorings or gelatin, do not fall within this category. All the additives are requested to be safe (as judged by EFSA on the bases of available information at different moments in time) and are allowed to be used only in certain food categories and in limited quantities. The safety of food additives is assessed periodically in order to tackle changes that might occur, either in exposure, or in toxicity (EC no.257/2010). There is always a need for a technological justification of their use in a certain food product, which, if not met, will lead to its proscription even if the additive is not dangerous *per se*. Consumers are informed of the presence of the additives, which must be inscribed clearly in the list of ingredients on labels (EC No 1169/2011). Unfortunately, even these strict measures controlling for additive use have not raised the confidence of average consumers in additives. These substances are frequently vilified and considered as the cause of a wide array of diseases, from cancer, to allergies and neurological problems. A quick search for the term "food additive" on Google brings back more than 3 million answers, from which the vast majority are negative reviews associating additives with bad health outcomes. Romania has not escaped this "witch hunt". Additives are seen as dangerous, some more than others (like sweeteners, colorings, preservatives). Having a "non-E" product is a marketing incentive for a lot of food producers. Some NGOs even seek the onset of legislative measures coercing the industry to use limited numbers of additives. Even though industry makes efforts to explain the need and the lack of danger of food additives, such opinions are regarded as motivated by sheer greed and financial interest.

In this framework, it is clear that the average citizen is bombarded by conflicting messages and is not always allowed to have a clear image about what means a food additive and the risks connected with its consumption. In the present study, we tried to collect information about the knowledge, perception and acceptance of food additives in a sample of Romanian citizens from the capital town, Bucharest. We selected Bucharest because it is the most important (as regarding the number of inhabitants) for the Romanian market.

Materials and methods

A questionnaire with 20 items was applied on a random sample of costumers of a chain of drugstores over a period of 3 months (January-March 2016). Every costumer entering the pharmacies between 10 am and 6 pm was asked about the availability of completing a questionnaire and, upon their acceptance, they were presented with it. Incentives like ball point pens and free measurement of blood pressure were

offered. The final sample had 232 persons (male and female), with the age between 15 and 66 years.

The questionnaire had multiple choice questions. The items regarded demographics and opinions and knowledge about food additives, and were developed based on previous studies (Borgmeier and Westenhoefer, 2009; Brewer and Rojas, 2008; Sunhee et al., 2014; Wilcock et al., 2004). The completion of the questionnaire was made individually, without surveillance. Questions were designed to be simple and clear, in order to facilitate the process and to obtain answers as accurate as possible. The answers were analyzed with the SPSS 12.0 package. Descriptive and correlation tests, two step cluster analysis and the classification tree method were applied. Results were considered statistically significant if $P \leq 0.05$.

Results and discussion

Demographic characteristics (gender, age, education) of the respondents are in Table 1. Of the 232 respondents, 171 were female (74%) and 61 were male (26%).

Table 1. Demographic characteristics of the sample

Gender	Education	16-25 years	26-35 years	36-45 years	46-55 years	56-65 years
Women	Basic			1	1	
	Arts &crafts	1	2	2	6	1
	High school	36	6	8	4	3
	University	15	46	11	5	1
	Post university	1	11	10		
Total	171	53	65	32	16	5
Men	Basic	2				1
	Arts &crafts	1	2	3	1	
	High school	2	2	1	2	1
	University	2	8	9	5	2
	Post university	1	3	5	7	1
Total	61	8	15	18	15	5

Regarding age, younger consumers were more available to answer than the elderly, some of them being even pleased to do it. The given reason was that generally the impression is that no one takes into consideration consumers` opinions when it comes to designing a food product. Older costumers were less receptive because of eye sight problems and of declared lack of information regarding the subject. In table 1 it is obvious more women than men answered, which can be explained by the fact that women are usually more preoccupied about healthy eating and nutrition problems. Bates et al. (1999) and Zugravu et al. (2009) also reported that women are more receptive to dialog and new information. Studies have shown that women are generally more in charge with health and nutrition aspects in the family, than men. Regarding education, 66.6%% of the answerers had graduated from at least a university, underlining that more educated people are more preoccupied with modern challenges of healthy eating. Kim et al. (2007) found that most of the middle school students were unaware of food additives in processed foods or what means healthy

eating, which raises questions about the necessity of implementation of efficient educational measures in schools.
Some questions and answers are presented in Table 2.

Table 2. Items regarding the attitude towards food additives

Question	Yes (%)	No (%)
Agreement with the use of food additives	23.7	76.3
Considering food additives approved in Romania as safe	16.4	83.6
Looking for additives on food labels	67.2	32,8
Preference for light soft drinks	36.2	63.8
Considering that food with sweeteners have less calories than regular	52.2	47.8
Being ready to pay more for food without additives	75.4	24.6
Having enough information to select food considering the additives	28.4	71.6
Worrying about diseases caused by additives	82.8	17.2
Additives being used for the interest of the consumer	4.7	95.3
Necessity of Governmental programs for information regarding additives	94.8	5.2
Confidence in the authorities when a new additive is approved	11.2	88.8

The questions regarding additives show a very negative attitude. Two thirds of the respondents do not agree with the use of food additives. Most consumers considered food additives as potential hazards and preferred processed foods without additives (Shim et al., 2011). Our study showed that with higher age, comes a lower tolerance for the presence of food additives, seen as artificial, industrial ingredients, in contrast with additive free home-prepared food, seen as clean and healthy (Spearman rho= 0.225, P=0.01).

A two-step cluster analysis using Schwartz`s Bayesian Criterion (BIC) regarding the agreement on food additives use, taking into account variables such as age, gender, education and present occupation, led to three clusters, the second and the third being significant for the agreement variable. Gender had no significance. One of the clusters showed a general more favorable attitude and was formed mainly by adults (26-55 years of age), employed and with a high school education. Borgmeier and Westenhoefer (2009) reported that adults understand better and subsequently comply better with nutritional facts about food additives, resulting in healthier food choices. Another cluster showed a negative attitude regarding the use of additives and was comprised mainly by very young (18-25) students, which comes in some kind of contradiction with our further results, since this age group does not seem highly preoccupied with the side effect of additives on health. The explanation might be that the main sources of information for young people are blogs and sites with rather mixed and frequently inaccurate information regarding additives. More than a half of the respondents (67.2%) assert that they check thoroughly labels in search of food additives. This percent seems rather exaggerated, since the average consumer spends around 5-6 seconds before making the decision to buy or not a certain food product **(**Hamlin, 2015). Label checkers are the same with those ready to pay more for additive free food. It is a clear category of rather wealthy buyers, preoccupied with a healthy lifestyle and nutrition, ready to invest in order to get what they consider to be healthy food (Spearman rho =0.284, P=0.01). Unfortunately, reality shows that this type of buyers are frequently victims of all kind of food fads (like the gluten free

one), without any scientific basis and leading, paradoxically, to nutrition restrictions and deficiencies.

In other studies, even when people were aware of the benefits of the presence of additives added in food, they did not intend to buy those products, considering food additives as a potential hazard (Altu and Elmaci, 1995; Bearth et al., 2014; Civic Science, 2015; Dickson-Spillmann et al., 2014; Food Insight, 2012; Kaptan and Kayısoglu, 2015; Legesse et al., 2016; Mepham, 2014; Szűcs, 2014; Tarnavlgyi, 2003).

Along time the attitude of Romanian consumers has seen little change, as shown in a study carried out in recent years (Szűcs et al., 2015).

Another correlation found in our study is between the age of the respondent and the label checking for food additives. The elderly seem to check more often labels for additives, probably because pre-existing health problems and the presumed association with food additives consumption (Spearman rho =0.183, P=0.01). Even more, 83.6% consider that food additives used in Romania can be dangerous for health, even though the question was formulated in such a way that it discouraged a negative answer ("do you think additives used in Romania are safe for your health?"). Behrens et al. (2010) reported many Brazilians showed suspicion and distrust of processing technologies and food additives in particular. Asian people felt negatively about food additives and processed foods as well (Shim et al., 2011; Sunshee et al. 2014).

A statistically significant correlation exists between age and education, on one hand, and worries about diseases caused by additives. Highly educated (Spearman rho =0.153, P=0.01) and middle age/old people (Spearman rho =-0.141, P=0.05) are more preoccupied than younger, less educated adults. In a classification tree, age has lost its significance, but higher education (university or above) remained a strong influence factor of apprehension towards food additives.

It comes at no wonder that a huge number of the respondents (82.8%) are worried about eventual diseases caused directly by food additives. People strongly believe that what is consumed can reduce (or enhance) the risk of diseases (Nayga, 2000; Smith et al., 2000).

Cancer is one category of diseases which takes its high tall in the contemporary world, being an important cause of morbidity and mortality. Despite the huge advances made in its prophylaxis, screening and treatment, a lot of unknown elements need to be addressed. This might be the cause of the link we frequently see in media between cancer and some additives, even though scientific research does not confirm it. Over 80% of our respondents consider that additives can cause cancer, with the highest percent in highly educated people (97.4% for post university studies). We consider this finding as being an alarming one, a real red flag for the industry and the public health authorities, who need to address false but very popular beliefs regarding additives. In a similar study carried out in Denmark, a majority of respondents agreed (partially or completely) with the affirmation that they worry about the link between additives and cancer, as well as between

additives consumption and allergies or hormone imbalance (Christensen et al., 2011).

Another question addressed the knowledge of the functions additives play in foods. Most of the respondents knew that taste, preservation and coloring were the main ones. The highest percent was noticed for the preservation answer. People are still very preoccupied with the safety of foods and somewhat puzzled about the very long shelf life of modern items. A previous study carried out in Romania 7 years ago showed that the main item searched on food labels was the "best before" one (82.5%) (Zugravu et al., 2011). Indeed, an industrial cake or mayonnaise can be preserved for months, in contrast to their home made equivalents, aspect rather disconcerting for an average consumer.

The most vilified additives are colorings and preservatives (Table 3), followed by taste enhancers.

Table 3. Hierarchy of the most avoided food additives

Which additive do you consider as very unhealthy?!	(%)
Preservatives	31.90
Colorings	28.40
Taste enhancers	13.40
Sweeteners	12.1
Other	11.60
Flavorings	2.60

Consumers do not perceive advantages offered by these additives, such as longer shelf life, avoidance of spoilage, especially of molding, which raises the problem of mycotoxin production, improved safety, or better taste or appearance, even though all of these characteristics are in fact searched when choosing food in supermarkets. The negative preconceptions were enhanced by the media, targeted only on negative studies regarding food additives, even though the European Food Safety Authority guarantees their safety, when used in adequate doses and foodstuff. A similar hierarchy of additives has also been found in other studies (Christensen et al., 2011; Emerton and Choi, 2008; Bearth et al., 2014).

In Figure 1 some differences of perception can be noticed between genders and group ages, but none of them is significant, neither in correlation tests, nor in a multinominal logistic regression model, where age and gender were considered covariates, and additive category, the dependent variable. First places are shared by preservatives and colorings, showing a rather homogenous perception about additives in the population.

Information regarding the proper selection of the optimal type of food is obviously lacking. 71.6% of the respondents, whatever the age, declare not being informed enough in order to choose food while taking into consideration the presence of food additives. This comes in contrast with the conviction that food additives are bad for health. As a matter of fact, a following question addressed the problem of education; over 90% of the respondents feel the need of governmental programs to educate people regarding food additives. The more educated respondents, probably knowing

the importance of proper information, are more interested in such programs carried out by a governmental body (Spearman rho = 0.167, P = 0.01). In other studies(Sunshee et al., 2014), better informed adults had a more positive attitude towards the use of food additives, stressing again the necessity of proper information and education.

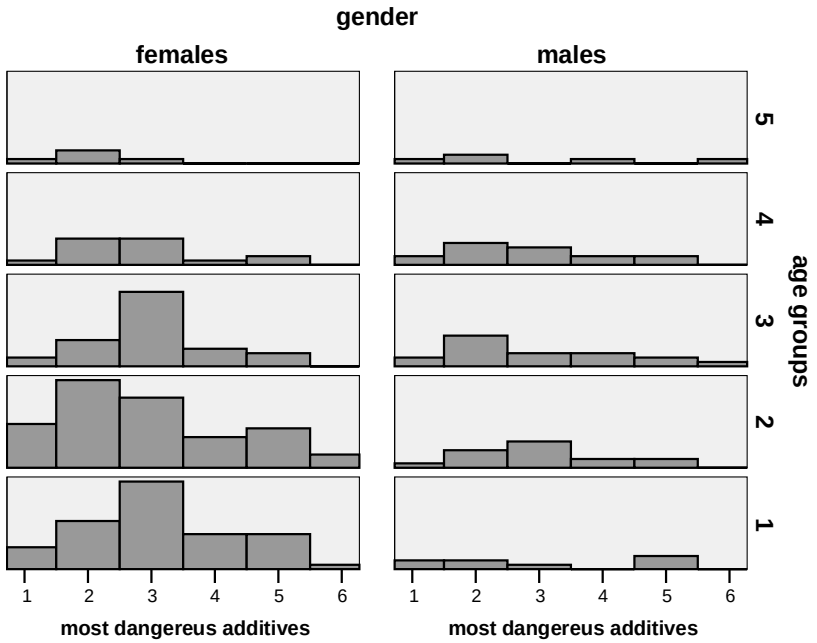

Figure 1. Most avoided category of additives on age and gender groups (frequencies)
For age groups: 1= 16-25 years; 2= 26-35 years; 3= 36-45 years; 4 = 46-55 years; 5= 56-65 years
For groups of additives: 1= other; 2= colorings; 3= preservatives; 4= sweeteners; 5= taste enhancers; 6= flavorings.

It is interesting that the government, namely the Ministry of Health is, after all, seen as a trusted source of information, in spite of the fact that the bulk of information people are getting about additives comes from unreliable sources like sites and blogs, written by unqualified authors. As a matter of fact, the National Institute of Public Health has on its site articles in lay language about food additives, but the impact is far less important, due to the heavier access to the site (Zugravu, 2014).

However, trust was lost to some extent by authorities, national or European. Thus, almost 90% of the respondents do not feel safe when the entitled bodies of authority allow for a new additive to be used on the market. Unfortunately, highly educated people are more convinced than the rest that the additives allowed to be used in Romania are dangerous for health (Spearman rho = 0.253, P = 0.01). Even though additives are closely analyzed before being allowed on the European market and that Romania, as component of the EU, must comply with the same draconian safety restriction as any other European country, there is a local mistrust, probably because of the frequent cases of failure to comply with the laws in force.

Due to the ongoing obesity epidemics, which also stroke Romania (with almost 60% of the population being overweight and obese), the use of artificial sweeteners should be on the rise. However, Romania is a reluctant market when it comes to these additives and sales of "zero calorie" soft drinks are very low. Only 36.2% of the respondents choose light soft drinks, the others opting for sugary ones. Surprisingly, taking into account their reluctance regarding food additives, older people select more frequently sugar free soft drinks (Spearman rho = - 0.132, P = 0.05). The cause might be the well-known association between sugar consumption and some non-communicable diseases.

However, an intriguing answer was obtained at the question "do food and beverages with artificial sweeteners have fewer calories than those with sugar"? Almost a half (47.8%) of the respondents do not consider them as having less calories, which raises big question marks regarding the knowledge regarding additives and sweeteners in particular. Some respondents do not have a clear image about the technological necessity of using additives and see them just as senseless ingredients. They choose, presumably, light drinks just because they do not have sugar, seen as an even worse ingredient.

Asking to choose the healthiest sweetener, the best percent was obtained by Stevia (Table 4).

Table 4. Distribution of preferred sweetener

If you would choose a sweetener, which one might be more healthy?!	**%**
stevia	53
saccharin	21
xylitol	12
aspartame	6
other	5
sorbitol	2
acesulfame	1

The difference between stevia and the next sweetener (saccharin) is statistically significant (P<0.00). Aspartame and acesulfame, widely used in soft drinks, achieve only a very small percent of the answers, maybe because of the recent studies charging them with evil consequences for consumers (Soffritti et al., 2014), even though the European Food Safety Authority did confirm their safety.

Stevia is indeed seen as a sweetener obtained exclusively from natural sources, due to proper marketing campaigns. Since the "natural is healthy" trend is also present in Romania, stevia is selected more than other artificial sweeteners. Figure 2 reveals that saccharin and stevia are considered as preferable, both by men and women. If at younger ages there are no big differences between the two, statistically significant ones are noticed as respondents get older, probably because the knowledge and preoccupation towards healthier options grow. At the extreme age group (56-65 years), differences tend to dwindle, but the number of respondents is too small to allow any conclusion.

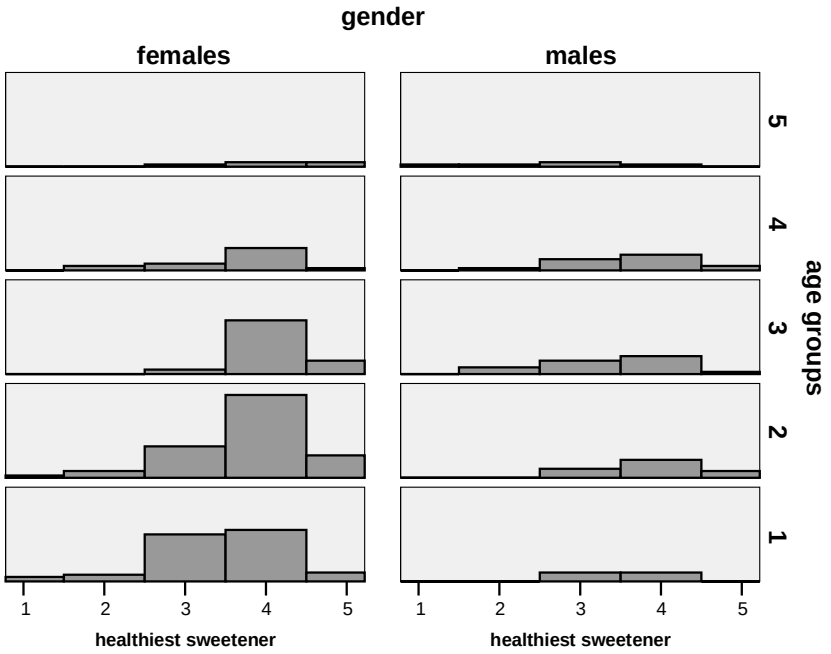

Figure 2. The healthiest sweetener on age and gender groups (frequencies)
For age groups: 1= 16-25 years ; 2= 26-35 years; 3= 36-45 years; 4 = 46-55 years; 5= 56-65 years
For sweeteners; 1= sorbitol; 2= aspartame; 3= saccharin; 4= stevia; 5= xylitol;

In the end, a question dealt with the availability to pay more in order to buy food without food additives. One third of the respondents stated they were ready to pay more. In former studies (Zugravu et al., 2011), people also stated they were ready to pay more for other types of food considered healthy (like natural), but the market figures show that in practice, a lower price tag leads to bigger sales and more expansive products are bought only in small amounts, by a limited and more affluent buyers.

Though we further plan to extend the research, the present study was carried out on a rather small sample of people from the Romanian capital, this being the reason we named it "pilot study" "In fact, this is the explanation for the high number of well-educated respondents, which could be an important bias for the answers. However, we could notice that, even in this group, information on additives is highly distorted and different from reality. We can infer that even worse results could be obtained from a sample from a lower educated group. Another bias is linked with the availability to answer to the questionnaire. As in other studies, people preoccupied with health and nutrition are generally more available, those with a lower level of knowledge being ignored purely because they do not want to answer. Moreover, it has to be stressed that correlation does not mean causality, but can be a useful guide when assessing popular knowledge.

Conclusions

According to scientists, future communications about food additives in food could target attitudes, shifting them away from the perception that "synthetic equals dangerous". Future research might also especially consider the accuracy and/or reliability on information on food additives and how that information affects attitudes and buying intentions.

In Romania there is a high need for nutrition education. If this is a general desiderate not only in our country, food improvement agents can be a peculiar item, since modern food relies on them. In the general frame of abundance of processed foods, it is both the task of industry, and of governmental bodies to communicate adequately with the general public about food additives and to find open channels that reach consumers of all ages and levels of education. Otherwise, additives will further be misunderstood and will play the role of scapegoat in the framework of an unhealthy lifestyle.

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