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## FOOD ADDITIVES AND CONSUMER PREFERENCES: A CROSS-CULTURAL CHOICE-BASED CONJOINT ANALYSIS

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Important differences have been reported in several countries about the level of concern in connection with food additives. In order to better understand the consumer preferences related to foodstuffs containing food additives, five hypotheses were tested with the help of a choice-based conjoint analysis. The study was performed in three European countries (Hungary, Romania, and Spain) having different risk perceptions concerning food additives. Two “model foodstuffs” were involved in the analysis: pre-packed sliced cheese (natural image) and chips (artificial image). For the creation of the conjoint cards, three attributes were selected: “preservatives” (natural/artificial), “packaging gases” (contains/does not contain) and “price” (average based on market data/+10%/+20%). Results were collected via Internet simultaneously and a total of 500 valid questionnaires were received in case of pre-packed cheese and 468 regarding chips. In the analysed countries “preservatives” had an outstanding importance – mainly in Hungary and Romania –, while “packaging gases” got lower importance during the shopping intention. “Natural preservatives” very positively contributed to the choosing of both pre-packed sliced cheese and chips. High level of willingness to pay was not observed, as well as the “price” was less important factor than the additives. Comparison of the data from three countries showed notable differences, which can determine the direction of the product planning and development.

**Keywords:** food additives, preservatives, packaging gases, conjoint analysis

Due to the changing lifestyle, domestic food production is continuously pushed into the background and the importance of food industry is marked up at the same time. In order to fulfil consumers’ multiple demands (foodstuffs have to be convenient, tasty, pleasant, healthy, fresh, safe, and affordable at the same time), and to satisfy the needs of the food industry (like the extended product storage life for the easy to plan and comfortable logistics and the cost effective food production) utilization of food additives became common. However, nowadays there are more and more people who try to avoid foodstuffs containing food additives and try to consume products supposed to be “natural”. Rising popularity of natural components can be due to the fact that food additives are considered as unhealthy (TARNAVÖLGYI, 2003; HONKANEN & VOLDENS, 2006; MCCARTHY et al., 2007; UNUSAN, 2007; MEDIÁN, 2009; OZER et al., 2009; MARIÁN et al., 2011) substances, which can cause cancer (SCHAFER et al., 1993; WARDLE et al., 2001) and allergy reactions (MARIÁN et al., 2011) in humans. At the same time, consumers are sceptic about the utilization of food additives, they are not aware of their advantages. Consumers think that they are just for the process of products, to increase the producers’ profit, they are not safe enough (SHIM et al., 2011), their utilization is too excessive

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(KAJANNE & PIRTTILÄ-BACKMAN, 1999) and unnecessary (KAJANNE & PIRTTILÄ-BACKMAN, 1999). Along with these, the presence of food additives is moderately important factor during the consumers' food choice (FOOD STANDARDS AUSTRALIA NEW ZEALAND, 2003; HONKANEN & VOLDENS, 2006; FARR et al., 2007; UNUSAN, 2007; JEVŠNIK et al., 2008; GRUNERT et al., 2010), near other factors like sensory attributes, price, freshness, date of durability, good quality, and health (LAPPALAINEN et al., 1998; HONKANEN & VOLDENS, 2006; GFK, 2007; JEVŠNIK et al., 2008; SHIM et al., 2011). It is noteworthy, that Hungarian consumers pay higher attention to food additives during their shopping decisions compared to other countries (GFK, 2007; MARIÁN et al., 2011; MARKETING INFO, 2013).

Results of the EUROBAROMETER (2010) survey showed that in Hungary the rate of concern about food additives was high (81%), while in Romania (74%) and Spain (54%) much lower. Furthermore, a high rate of the Hungarian (82%) and Romanian (90%) consumers thought that the foodstuffs and drinks could contain chemicals (EUROBAROMETER, 2013) and for these consumers the avoidance of foodstuffs containing additives is an important element of "eating healthy diet" (EUROBAROMETER, 2006). Less Spanish consumer thought that chemicals can be found in foods and drinks (75%) (EUROBAROMETER, 2013) and for them the avoidance of food additives is not a basic element at all when they are thinking of healthy diet (EUROBAROMETER, 2006b). The latter observations can be due to the fact that Spanish consumers are satisfied with their consumption habits (GUERRERO et al., 2012) and they consider that their Mediterranean diet is healthy enough (CARRILLO et al., 2011).

On the basis of the literature review and the previous studies of the authors, the aim of this study was to test five hypotheses on the preference of foodstuffs from the point of view of food additive content in three European countries: Hungary, Spain, and Romania. The analysed hypotheses were:

1. The factor "preservative" is the most important factor, among those studied, in the shopping intention (*Hypothesis 1*).
2. "Packaging gases" have different importance in the shopping intention in the analysed countries (*Hypothesis 2*).
3. "Natural preservatives" are preferred in the analysed countries and foodstuffs (*Hypothesis 3*).
4. Consumers are willing to pay an "extra" for foodstuffs containing natural preservatives (*Hypothesis 4*).
5. Important differences exist between the studied countries regarding concern about food additives (*Hypothesis 5*).

## 1. Materials and methods

### 1.1. Conjoint analysis design

Steps of the conjoint analysis were designed by taking into consideration the national (LAKNER, 2002) and the international (RYAN & FARRAR, 2000; NORTH & DE VOS, 2002) studies. Considering results of the previous studies (SZÜCS et al., 2012), three factors were chosen for the conjoint study: "preservatives" (artificial/natural), "packaging gases" (contains/does not contain), and "price" (average+10%/average+20%). Average prices were determined on the basis of market data. Conjoint cards of two "model foodstuffs" were created and used to simulate a shopping situation. One foodstuff was expected to have high additive content (chips) and the other was expected to have low additive content (pre-packed sliced cheese)

according to consumers' perception (TARNAVÖLGYI, 2009; SZÜCS & BÁNÁTI, 2010). For the choice-based conjoint study, six cards were chosen (Table 1) according to an orthogonal design. One additional card was added to illustrate a "standard" foodstuff (contains artificial preservatives and packaging gases on average price). In the choice sets each card was always compared to the "standard" card of foodstuffs, and participants had to decide which product they preferred better (the "both" and the "none" answers were also offered). The pairs were set out in a fixed order.

Table 1. Applied conjoint cards for the two-model foodstuffs

Cards	Preservatives		Packaging gases			Price	
	Artificial	Natural	Contains	Does not contain	+10%	+20%	Average
"Standard"	X		X				X
1		X		X	X		
2		X		X		X	
3	X			X	X		
4		X	X		X		
5	X			X		X	
6		X	X			X	

### 1.2. Conjoint analysis data collection and statistical analysis

Results were collected via Internet. A total of 216/210 (pre-packed sliced cheese/chips) valid questionnaires were received in Hungary, 154/157 in Spain, and 130/101 in Romania (in total 500 for pre-packed sliced cheese and 468 for chips). Although – comparing to other quantitative methods – the samples were not representative and the number of the participants were not so high, conjoint analysis can give relatively informative results from the respondents shopping decisions (LAKNER, 2002). Estimation of the utility values and the relative importance that participants gave to the selected attributes during the foodstuff selection was performed with the Conjoint module from the XLSTAT statistical software. Comparison of the utility values within the levels – depending on their number – was carried out with the help of *t*-test and ANOVA (Tukey Post-hoc test) ( $P \leq 0.05$ ), as well as amongst the countries by independent two-sample *t*-test ( $P \leq 0.05$ ).

## 2. Results and discussion

### 2.1. Relative importance and utility values of pre-packed sliced cheese

In all countries "preservatives" was the most important factor in the purchase intention (*Hypothesis 1 is confirmed*) (Fig. 1). "Packaging gases" was more important factor for the Hungarian and Spanish respondents than for the Romanians (*Hypothesis 2 is confirmed*). Furthermore, for the Hungarian and Spanish participants "packaging gases" and "price" had pretty much the same importance when choosing a pre-packed cheese. "Price" appeared to be a less important factor for the Hungarian consumers than for the participants from the other two countries.

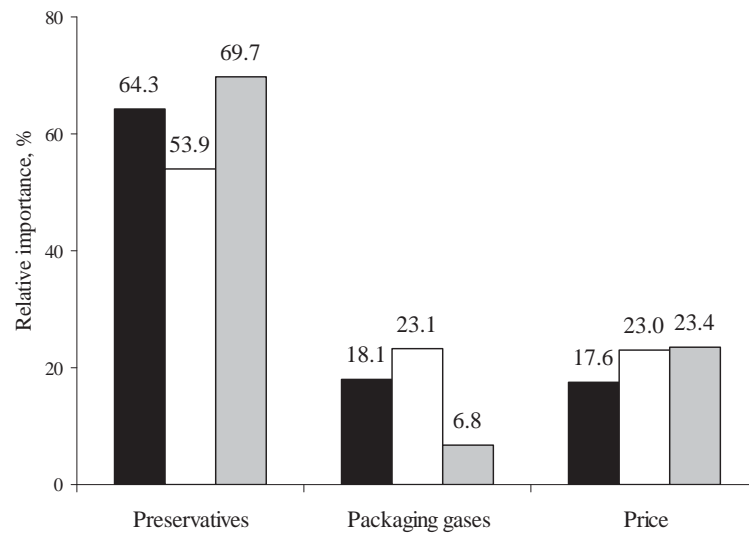


Fig. 1. Relative importance of the attributes for pre-packed sliced cheese choice separated by country. ■: Hungary; □: Romania; □: Spain

“Natural preservatives” had significantly positive impact in the pre-packed sliced cheese choice – mainly in Romania – (*Hypothesis 3* is confirmed), while “artificial” had significantly negative effect in all countries (Table 2). In Spain and in Hungary the presence of the “packaging gases” had high positive impact on the preference of pre-packed cheese. Price with 10% above the average had positive influence on pre-packed cheese choice in Hungary and Spain, while 20% above the average had negative influence in the three analysed countries (*Hypothesis 4* is partly rejected).

Table 2. Utility values and standard error for the contribution of the factors to consumer choice of pre-packed sliced cheese separated by country

Factor	Level	Hungary		Spain		Romania	
		Utility	SD	Utility	SD	Utility	SD
Preservative	Natural	1.390 <sup>ex</sup>	0.147	1.482 <sup>bx</sup>	0.128	1.712 <sup>ax</sup>	0.164
	Artificial	-1.390 <sup>ay</sup>	0.147	-1.482 <sup>by</sup>	0.128	-1.712 <sup>cy</sup>	0.164
Packaging gases	Presence	0.392 <sup>bx</sup>	0.145	0.636 <sup>ax</sup>	0.113	0.168 <sup>cx</sup>	0.176
	Absence	-0.392 <sup>by</sup>	0.145	-0.636 <sup>cy</sup>	0.113	-0.168 <sup>ay</sup>	0.176
Price	Average	-0.152 <sup>by</sup>	0.250	0.583 <sup>ax</sup>	0.208	0.590 <sup>ax</sup>	0.278
	+10%	0.456 <sup>ax</sup>	0.185	0.098 <sup>by</sup>	0.140	-0.030 <sup>cy</sup>	0.192
	+20%	-0.304 <sup>az</sup>	0.169	-0.680 <sup>cz</sup>	0.148	-0.560 <sup>bz</sup>	0.202

Mean utilities with different superscript letters within a row (a, b, c) and with different superscript letters within each factor and country (x, y, z) differ significantly ( $P \leq 0.05$ ).

### 2.2. Relative importance and utility values of chips

“Preservatives” had dominant importance in the choice decisions of chips (*Hypothesis 1 is confirmed*) (Fig. 2). Comparing the relative importance values amongst the countries – as it was perceived from the results of pre-packed sliced cheese and in the findings of Szűcs and co-workers (2012) – it can be noted that “preservatives” had higher importance in Hungary and Romania than in Spain, while “packaging gases” resulted higher importance for the Romanian and the Spanish participants than for the Hungarian ones. Therefore, on the basis of the results of the chips *Hypothesis 2* is confirmed. “Price” was found to be a less important factor for the Romanian than for the Hungarian and the Spanish participants in the studies.

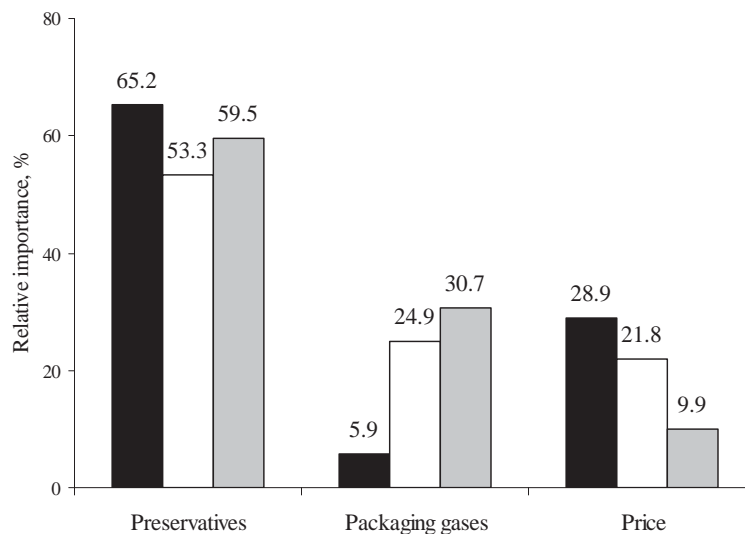


Fig. 2. Relative importance of the attributes for chips choice separated by country  
 ■: Hungary; □: Romania; ▒: Spain

“Natural preservatives” had significantly positive impact on the choice intention of chips, and “artificial preservatives” had significantly negative impact (*Hypothesis 3* is confirmed) (Table 3). Presence of “packaging gases” had highly positive effect in the selection of chips in Spain and Romania. However, it had negative impact on the decision in Hungary. “Price” 10% above the average had positive impact in these three countries, while “price” 20% above the average had significantly negative impact on the choice in Hungary and Spain. The positive willingness to buy presented by a previous study (Szűcs et al., 2012) was perceived just in the case of +10%, thus *Hypothesis 4* is partly rejected.

Table 3. Utility values and standard error for the contribution of the factors to consumer choice of chips separated by country

Factor	Level	Hungary		Spain		Romania	
		Utility	SD	Utility	SD	Utility	SD
Preservative	Natural	1.737 <sup>ax</sup>	0.143	1.498 <sup>bx</sup>	0.128	1.353 <sup>cx</sup>	0.160
	Artificial	-1.737 <sup>cy</sup>	0.143	-1.498 <sup>by</sup>	0.128	-1.353 <sup>ay</sup>	0.160
Packaging gases	Presence	-0.156 <sup>by</sup>	0.146	0.700 <sup>ax</sup>	0.115	0.698 <sup>ax</sup>	0.202
	Absence	0.156 <sup>ax</sup>	0.146	-0.700 <sup>by</sup>	0.115	-0.698 <sup>by</sup>	0.202
Price	Average	0.586 <sup>ax</sup>	0.226	0.533 <sup>bx</sup>	0.209	-0.124 <sup>cy</sup>	0.312
	+10%	0.367 <sup>ay</sup>	0.159	0.161 <sup>cy</sup>	0.142	0.287 <sup>bx</sup>	0.208
	+20%	-0.953 <sup>cz</sup>	0.170	-0.694 <sup>bz</sup>	0.147	-0.163 <sup>ay</sup>	0.219

Mean utilities with different superscript letters within a row (a, b, c) and with different superscript letters within each factor and country (x, y, z) differ significantly ( $P \leq 0.05$ ).

### 3. Conclusions

“Preservatives” had an outstanding importance in both products’ choice decisions in the analysed countries (*Hypothesis 1* is confirmed), mainly in Hungary and Romania. Results point out that judgement of food additives on the basis of their origin (“natural”/“artificial”) show stable and common feature, thus substitution of “artificial” preservatives with “natural” ones can influence the analysed countries consumers’ food choice decisions favourably (*Hypothesis 3* is confirmed).

The importance of “packaging gases” showed differences in these three countries (*Hypothesis 2* is confirmed) and the foodstuffs, too. However, it can be noted that for the Spanish participants it had high importance in case of both foodstuffs. The presence of “packaging gases” had higher utility value for the Hungarian and Spanish participants in case of pre-packed cheese, and in case of chips for Spanish and Romanian respondents. It is noteworthy that Spanish participants rated the presence of “packaging gases” as a positive product characteristic in case of both foodstuffs, which can be due to the fact that in Spain the pre-packed products are common and they are aware of the advantages of these products (e.g. easy to handle, comfortable).

High level of willingness to buy additive-free foodstuffs found during the previous studies (SZÜCS et al., 2012) was not observed in the present study, just in the case of the average +10% price (*Hypothesis 4* is partly rejected). Furthermore – in contrast to some studies (LAPPALAINEN et al., 1998; HONKANEN & VOLDENS, 2006; GFK, 2007) –, the “price” was less important factor in the shopping intentions than food additives, mainly the “preservatives”. However, during the launching of any new product, it is important to take into consideration the “price”, which can result in rejection.

Outstanding importance of food additives in the Hungarian consumers’ shopping decision (GFK, 2007; MARIÁN et al., 2011; MARKETING INFO, 2013) was not observed, as well as consumer judgement of the foodstuffs from the point of view of food additives (pre-packed sliced cheese was more favoured than chips) (TARNAVÖLGYI, 2009; SZÜCS & BÁNÁTI, 2010) did not have relevant influence on the choice decision. However, the comparison of the

countries' data showed notable differences, which can determine the direction of the product planning and development. Differences in the analysed countries' risk perception of food additives (EUROBAROMETER, 2006, 2010; SZÜCS et al., 2012) can be identified in the results of the present study, too. Members of the Hungarian and the Romanian sample showed higher rejection of the "artificial preservatives" and the presence of "packaging gases" than the Spanish participants (*Hypothesis 5* is confirmed).

In the present study, consumer preferences were analysed in case of only two foodstuffs, with the help of three product characteristics, and in three European countries. Extension of the study onto other foodstuffs and factors, as well as involvement of other countries can help to identify the connection between the risk perception of certain foodstuffs and additives, furthermore, can point out new aspects.

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