Original scientific paper
UDC 664.022.3(439)

FACTORS AFFECTING THE AVOIDANCE OF FOOD ADDITIVES IN HUNGARY

Viktória Szűcs[1*], Erzsébet Szabó[1], Diána Bánáti[2]

[1]National Agricultural Research and Innovation Centre - Food Science Research Institute, Herman Ottó út 15, 1022, Budapest, Hungary
[2]International Life Sciences Institute Europe, Av.E. Mounier 83, box 6, 1200 Brussels, Belgium

[*]e-mail: v.szucs@cfri.hu

Abstract

A number of studies show that Hungarian consumers' shopping decisions are strongly affected by the presence of food additives.

In order to get detailed information about the factors affecting the avoidance of food additives in Hungary on the basis of the literature review a theoretical model was developed which was validated by a pathway analysis.

As a first step with the results of a questionnaire survey (N = 437) a factor analysis was done, but the "goodness-of-fit test" did not show significant fitting and the factors were not applicable. So with the help of the factor analysis results, principal components were created. The "avoidance of food additives" (shopping actions in order to reduce the food additive intake) can be strongly explained (51.7%) by the created model and only 48.3% of the variance can be affected by other factors. According to the model the "trust against the utilization" (-0.328), the "risk of food additives" (0.292), the "health risk of food additives" (0.272) and the "self reported knowledge" (0.215) have a direct impact on the "avoidance". The strongest indirect connection in the model is the way between the "trust against the utilization" and the "health risk of food additives" (-0.613). Furthermore it should be noted that the "self reported knowledge" has strong positive impact on the "trust against the utilization" (0.410).

Hungarian consumers' shopping decisions toward the "avoidance of food additives" can be efficiently influenced with the rising of the trust against the producers and the controlling authorities. The level of trust can be incrased with rising of the level of knowledge.

***Key words**: Food additives, Principle component analysis, Pathway analysis, Shopping decision.*

1. Introduction

Due to the lifestyle changing (e.g. spreading of ready-to-eat and conventional foods) domestic food production is continuously surpassed and at the same time importance of food industry is marked up. Food industry launches a huge number of foodstuffs year by year (Lakner *et al*. [1]) and uses different food additives in order to fulfil consumers' multiple demands. Foodstuffs have to be convenient, tasty, pleasant to eat, healthy, fresh, safe and affordable at the same time. However more and more people try to avoid foodstuffs containing food additives and try to consume products containing less food additives or supposed to be "natural" (Pai [2]). According to the consumers food additives are considered as unhealthy components (Altu and Elmaci [3]; Tarnavölgyi [4]; Honkanen and Voldens [5]; McCarthy *et al*. [6]; Unusan [7]; Medián [8]; Ozer *et al*. [9]; Marián *et al*. [10]), which can cause cancer (Pirttilä *et al*. [11]; Schafer *et al*. [12]; Wardle *et al*. [13]) and allergic reactions (Pirttilä *et al*. [11], Marián *et al*. [10]) in humans. At the same time, consumers are sometimes sceptic about the utilization of food additives because they are not aware of their advantages. Consumers think that these components are just for the process of products, to increase the producers profit, and that they are not safe enough (Shim *et al*. [14]) and their utilization is excessive (Pirttilä *et al*. [11]; Kajanne and Pirttilä-Backman [15]) and unnecessary (Kajanne and Pirttilä-Backman [15]).

The recent results of the Eurobarometer [16] survey showed that for example in Hungary the rate of concern about food additives is high (81%). Furthermore, there is a high rate of the Hungarian (82%) consumers think that foodstuffs and drinks can contain chemicals (Eurobarometer [17]) and for the Hungarian consumers the avoidance of foodstuffs containing additives is an important element of "eating healthy diet" (Eurobarometer [18]). Due to the high level of worry against food additives Hungarian consumers pay high attention to food

additives during their shopping decisions (GFK [19]; Marián *et al*. [10]; Marketing Info [20]). It is important to understand how such attitudes are formed. In social psychology there are two classes of theories on attitude formation, which can term bottom-up and top-down approaches. These describe two basic mechanisms, in which people form attitudes. The bottom-up formation implies that the attitude towards an objective is formed according to the knowledge about it. The top-down formation refers an attitude as embedded into a system of general attitudes and values (Grunert *et al*. [21]). These theories were used in many fields like the analysis of consumer acceptance of genetically modified technology (Scholderer and Frewer [22]; Grunert *et al*. [21]), consumer attitudes to enzymes in food production (Søndergaard *et al*. [23]), and consumer perception of new technologies (Nielsen *et al.* [24]).

On the basis of the literature review a theoretical model was developed, which was validated by a pathway analysis, in order to get detailed information about the factors affecting the avoidance of food additives in Hungary.

2. Materials and Methods

2.1. The theoretical model

Based on the models establishing the consumer behaviour (e.g. Pilgrim consumer behaviour model, Stepherd food choice and intake model) and the results of studies conducted in the field of risk perception (mainly about the risk perception of new technologies), a theoretical model was developed (Figure 1). In the model the dependent factor ("avoidance of food additives") is directly influenced by: the judged "risk of food additives" (Mucci *et al*. [25]; Prati *et al*. [26]; Wu *et al.* [27]) - (β1), the "trust against the utilization of food additives" (McCarthy and Vilie [28]) - (β2), the "self reported knowledge" (Stern *et al*. [29]) - (β3) and the perceived "health risk of food additives" (Zhang *et al*. [30]) - (β4). According to the study of Chen and Li [31] and Prati *et al*. [26] direct connection can be assumed between the "trust against the utilization of food additives" and the "risk of food additives" - (β5). Study of Martinez-Poveda and co-workers [32] showed positive correlation between the worry against health and the perceived risk - (β6). Chen and Li [31] found that rising of the knowledge of the consumers can decrease the perceived risk; however, results of Martinez-Poveda *et al*. [32]) showed the opposite connection - (β7). Furthermore, there is a presumably connection between judged "risk factors independent from food additives" (e.g. pesticides, antibiotics, genetically modified foods) and "risk of food additives" analysed in the model - (β8), the "trust" and the "health risk" - (β9), the level of "knowledge" and consumers' "trust" - (β10) as well as between the "knowledge" and the perceived "health risk of food additives" (Miles and Frewer [33] - (β11).

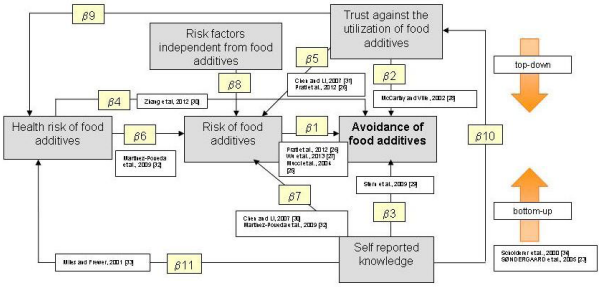

Figure 1. The theoretical model of the avoidance of food additives

2.2. Method

A pathway analysis was done in order to validate the theoretical model with the help of the principal components. As a first step a factor analysis was done to create the factors of the model with the results of a questionnaire survey (N = 437), but the "goodness-of-fit test" did not show significant fitting and the factors were not applicable. So with the help of the factor analysis results, principal components (criterions: communality ≥ 0.25; explained variance > 33%, Székelyi and Barna [35]) were created. The dependent factor was the "avoidance of food additives" and the dependent factors were the "trust against the utilization of food additives", "the self reported knowledge", the "risk of food additives", the risk of factors independent from food additives" and the "health risk of food additives". As the last step by means of these factors a pathway analysis was done which is a causality model for the understanding of the connections between the variables (Babbie [36]). In fact this method is the series of regression models where variables are linked with arrows which showing the direction (way). The intermediate variables can have a direct and an indirect (through other variables) effect on the dependent variable. The ways' β values of the ways (partial regression coefficient) show the strength of the connection, and its sign concerning the direction of the relation. The ways' β values (partial regression coefficient) show the strength of the connection between the two variables, and its' sign the direction of the relation. Product of the intermediate variables' β values results the strength of the independent way (Székelyi and Barna [35]). For the creation of homogenous consumer groups K-means cluster analysis was done.

Data were analysed with the help of the SPSS 17.00 statistical software.

3. Results and Discussion

3.1. Factors affecting the avoidance of food additives

In the validated model the continuous lines show the significant ($p \leq 0.05$) ways, while the dashed lines the non-significant ways (Figure 2).

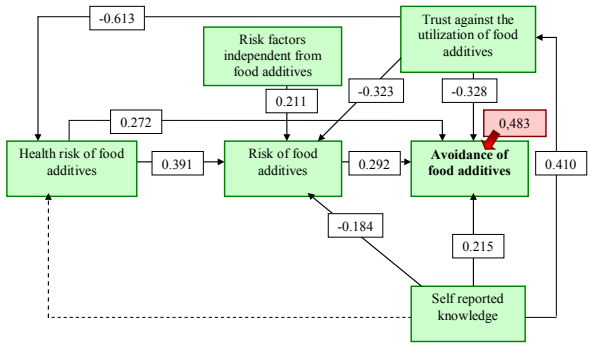

Figure 2. Factors affecting the avoidance of food additives in Hungary

The explanatory power of the created model is high (51.7%), and this means that 48.3% other factors influence the dependent variable ("avoidance of food additives"). According to the model it can be stated that "trust against the utilization" (-0.328), the judged "risk of food additives" (0.292), the perceived "health risk of food additives" (0.272) and the "self reported knowledge" (0.215) have a direct impact on the shopping actions towards the "avoidance of food additives". These results are in line with the conclusions of several of studies (Mucci *et al*. [25]; Stern *et al*. [29]; Prati *et al*. [26]; Wu *et al*. [27]). "Trust against food additives" has the strongest influence on the dependent factor (-0.328), thus by the increasing of the level of "trust" related to producers and controlling authorities, the "avoidance of additives" can be decreased (top-down attitude formation). However it is important to note that the "self reported knowledge" has positive impact on the dependent factor, thus the rising of the level of consumers knowledge with the help of understandable and accurate information can have also effect on the attitude formation (bottom-up way). The strongest indirect connection in the model is the way between the "trust against the utilization" and the perceived "health risk of food additives" (-0.613) (as also published by Chen and Li [31] and Prati *et al*. [26]), hence the high level of trust against the authorities and producers can decrease the perceived "health risk of food additives". Furthermore it should be noted that the "self reported knowledge" has strong positive impact on the "trust against the utilization" (0.410), so with the rising of the level of "knowledge" can be enhanced the level of trust. The "risk of food additives" can be decreased by the rising of the level of the "shelf reported knowledge" (in line with the results of Chen and Li, 2007 [31] and contrary to the results of Martinez-Poveda *et al*. [32]) as well as by the lowering of the risk level of the "factors independent from food additives" and the perceived "health risk" (similarly to the results of Martinez-Poveda *et al*. [32]). There is a positive connection between the "risk factors independent from food additives" and the "risk of food additives", thus consumers treat them as a complex factor. No significant connection between "self reported knowledge" and "health risk of food additives" - verified by the study of Miles and Frewer [33] is demonstrable (Figure 2).

Regarding the comparison of the direct and indirect ways it can be noted that - as it was perceived in case of the direct affects - the "trust against the utilization of food additives" (-0.328) has the strongest influence on the actions for the "avoidance of food additives". Indirect affect of the "self reported knowledge" on the dependent factor is strongest (-0.324) than the direct (0.215). Furthermore the "risk of factors independent from food additives" does not have direct affect on the dependent factor, but it has a weak indirect impact (0.062) (Table 1).

Table 1. Direct and indirect factors affecting the avoidance of food additives in Hungary

Dependent variable	Intermediate variables	Direct effect	Indirect effect	Sum of the direct and indirect effects
Avoidance of food additives	Health risk of food additives	0.272	-	0.272
	Self reported knowledge	0.215	(-0.184)*0.292 = (-0.054) 0.410*(-0.328) = (-0.134) 0.410*(-0.323)*0.292 = (-0.039) 0.410*(-0.613)*0.391*0.292 = (-0.029) 0.410*(-0.613)*0.272 = (-0.068) *Sum:* (-0.054)+(-0.134)+(-0.039)+ +(-0.029)+(-0.068) = (-0.324)	0.215 + (-0.324) = (-0.114)
	Risk of food additives	0.292	-	0.292
	Trust against the utilization of food additives	(-0.328)	-	-0.328
	Risk factors independent from food additives	-	0.211*0.292 = 0.062	0.062

3.2. Cluster analysis

In order to explore the directly not perceptible connections and for the creation of homogenous consumer groups, with the help of the principle components cluster analysis (K-means cluster) was done, which resulted three significantly different groups (Table 2).

Mistrustful risk-avoider

Most of the respondents belong to this cluster. According to their judgement "food additives" and "factors independent from additives" are risky, as well as they perceive a high level of "health risk" against food additives. During their shopping decisions members of this cluster try to avoid foodstuffs containing additives. Participants of this group are mainly ($p \leq 0.05$) females, adults (over 25 years old), households with children as well as middle or lower educated. In case of this cluster the top-down attitude formation can be an efficient tool.

Informed trusting

Self reported knowledge of these members is proper, and on the basis of this they consider food additives as a less hazardous food component. They feel trust against the producers and authorities. Due to these facts the "avoidance of food additives" is not an important factor in their shopping decisions. However they judged the "risk factors independent from additives" as a risky factor. Mainly young adults (18 - 24 years old), households without children and higher educated participants belong to this cluster.

Uninformed optimistic

Members of the smallest cluster have low level of knowledge about food additives. High level of risk was not perceived in case of factors with foodstuffs, thus their shopping decisions are not influenced by the food additive content. In order to make their decisions to be most established and conscious the bottom-up attitude formation can be effective for the participants of this cluster. Regarding the socio-demographic clusters it can be stated that more male belongs to it than female.

4. Conclusions

- Results of the pathway analysis showed that Hungarian consumer' actions towards the "avoidance of food additives can be influenced by the rising of the "trust against their utilization" (top-down attitude formation).

- The high level of mistrust may be due to the fact that media news about the riskiness of food additives are rare in Hungary and consumers can find a number of misbelieving information about these substances in many sources (e.g. Internet, newspaper, books). According to the model the level of "trust" can be effectively increased in parallel with the rising of the "self reported knowledge", thus producers and authorities have to make equally steps towards supplying accurate, reliable and understandable information for the consumers.

Table 2. Cluster created with the help of the values of the principle components

Principle components	Clusters			F	Sig.
	Mistrustful risk-avoider (N = 197)	*Informed trusting (N = 154)*	*Uninformed optimistic (N = 86)*		
Avoidance of food additives	0.76	-0.72	-0.45	204.016	0.000
Self reported knowledge	-0.13	0.64	-0.86	92.492	0.000
Risk of food additives	0.74	-0.71	-0.43	184.975	0.000
Trust against the utilization of food additives	-0.72	0.86	-0.15	162.139	0.000
Health risk of food additives	0.59	-0.83	-0.30	96.509	0.000
Risk factors independent from food additives	0.37	0.21	-1.22	128.893	0.000

- Furthermore this information can decrease the perceived "risk of food additives" too. It is important to take into consideration that consumers treat the risk factors of foodstuffs (food additives and independent factors like pesticides, antibiotics and genetically modified foods) as a complex. Another key point is the decreasing of the "health risk of food additives", and this has direct impact on the shopping decisions as well as on the perceived risk. However, it has to be noted that the perceived "health risk" can be efficiently decreased by rising of the "trust". The developed model verified the findings of several studies conducted on the field of risk-perception.

- With the help of cluster analysis the target groups of the attitude formation were identified. Attitude formation based on the enhancement of "trust" (top-down) can be effective in case of the members of "mistrustful risk-avoider" cluster, while the "knowledge" enlarging way (bottom-up) for the "uninformed optimistic" group.

- The developed model and the showed connections can be effectively utilized in the attitude formation of the Hungarian consumers. In spite of the fact that the explanatory power of the created model was quite high, the other factors can hide important information, thus further analysis of the topic is reasonable.

5. References

[1] Lakner Z., Somogyi S., and Horváth Z. S. (1998). *Food quality and market* (in Hungarian). "Agro 21" Füzetek, 22, pp. 47-64.

[2] Pai J. S. (2011). *Natural Foods*. PFNDAI Bulletin February, pp. 2-4.

[3] Altu T., and Elmaci Y. (1995). *A consumer survey on food additives*. Developments in Food Science 37, pp. 705-719.

[4] Tarnavölgyi G. (2003). *Analysis of consumers' attitudes towards food additives using focus group survey*. Agriculturae Conspectus Scientificus, 68 (3), pp. 193-196.

[5] Honkanen P., and Voldens G. (2006). *Russian consumers' food habits*. Results from a qualitative study in Moscow. pp. 1-13. <URL:http://www.nofima.no/filearchive/Rapport%2027- 2006%20Russian%20consumers%20food%20habits. pdf. Accessed 9 July 2014.

[6] McCarthy M., Brennan M., Kelly A. L., Ritson C. de Boer M., and Thompson N. (2007). *Who is at risk and what do they know? Segmenting a population on their food safety knowledge*. Food Quality and Preference, 18, pp. 205-217.

[7] Unusan N. (2007). *Consumer food safety knowledge and practices in the home in Turkey*. Food Control 18, pp. 45-51.

[8] Medián (2009). *Public opinion about the synthetic substances' health effect* (in Hungarian). <URL:http://www.median.hu/object.7e846e98-f731-4d2c-9fa7-3ec7f89e9836.ivy. Accessed 9 July 2014.

[9] Ozer B. C., Duman G., and Cabuk B. (2009). *Turkish preschool staff's opinions about hormones, additives and genetically modified foods*. Procedia Social and Behavioral Sciences, 1, pp. 1734-1743.

[10] Marián A., Molnár Z. S., Erdey J., Avramucza A., and Palotás G. (2011). *Healthy eating in consumers' consciousness*. The Journal of Food Nutrition and Marketing, 1-2, pp. 25-34.

[11] Pirttilä R., Tourila-Ollikainen H., and Lähteenmäki L. (1985). *Consumer opinions and practices related to food additives in the purchase situation*. Journal of Consumer Studies and Home Economics, 9, pp. 237-245.

[12] Schafer E., Schafer R. B., Bultena G. L., and Hoiberg E. O. (1993). *Safety on the U.S. food supply: consumer concerns and behaviour*. Journal of Consumer Studies and Home Economics, 17, pp. 137-144.

[13] Wardle J., Waller J., Burnswicg N., and Jarvis M. J. (2001). *Awareness of risk factors for cancer among British adults*. Public Health, 115, pp. 173-174.

[14] Shim S. M., Seo S. H., Lee Y., Moon G. I., Kim M. S., and Park J. H. (2011). *Consumers' knowledge and safety perceptions of food additives: Evaluation on the effectiveness of transmitting information on preservatives*. Food Control, 22, pp. 1054-1060.

[15] Kajanne A., and Pirttilä-Backman A. M. (1999). *Laypeople's viewpoints about the reasons for expert controversy regarding food additives*. Public Understanding of Science, 8, pp. 303-315.

[16] Eurobarometer (2010). *Food-related risks*. Special Eurobarometer, 354, pp. 103, 111.

[17] Eurobarometer (2013). *Chemicals*. Flash Eurobarometer, 361, pp. 95.

[18] Eurobarometer (2006). *Health and Food*. Special Eurobarometer, 246, pp. 105.

[19] GFK (2007). *For shoppers the quality of the foodstuffs is the most important* (in Hungarian). Gfk Paci Trend Hírlevél XI, pp. 6.

[20] [20] Marketing Info (2013). *We take more attention on foodstuffs' composition. Instead of nutritional value we worry about preservatives* (in Hungarian). <URL:http://www.marketinginfo.hu/tanulmanyok/essay.php?id=2003. Accessed 9 July 2014.

[21] Grunert K., Sřndergaard H., and Scholderer J. (2004). *How can we know what we like when we don't understand it? Consumer attitude formation towards complex technical issues*. Presented in ICORIA, International Consortia on Research in Advertising, Olso, Norway.

[22] Scholderer J., and Frewer L. (2003). *The biotechnology communication paradox: Experimental evidence and the need for a new strategy*. Journal of consumer policy, 26, pp. 125-157.

[23] Søndergaard H. A., Grunert K. G., and Scholderer J. (2005). *Consumer attitudes to enzymes in food production*. Trends in Food Science & Technology, 16, pp. 466-474.

[24] Nielsen H. B., Sonne A., Grunert K. G., Bánáti D., Pollák-Tóth A., Lakner Z., Olsen N. V., Žontar T. P., and Peterman M. (2009). *Consumer perception of the use of high-pressure processing and pulsed electric field technologies in food production*. Appetite, 52, pp. 115-123.

[25] Mucci A., Hough G., and Ziliani C. (2004). *Factors that influence purchase intent and perceptions of genetically modified foods among Argentine consumers*. Food Quality and Preference, 15(6), pp. 559-567.

[26] Prati G., Pieranoltil L., and Zani B. (2012). *The prediction of intention to consume genetically modified food: Test of an integrated psychosocial model*. Food Quality and Preference, 25, pp. 163-170.

[27] Wu L., Zhong Y., Shan L., and Qin W. (2013). *Public risk perception of food additives and food scares. The case in Suzhou, China*. Appetite, 70, pp. 90-98.

[28] McCharty M., and Vilie S. (2002). *Irish consumer acceptance of the use of gene technology on food production*. In: Trienkens J. H., Omta S. W.F. (eds.), Paradoxes in food chains and networks Proceedings of the Fifth International Conference on Chain and Network Management in Agribusiness and the Food Industry, Noordwijk, Netherlands, pp. 176-188.

[29] Stern T., Haas R., and Meixner O. (2009). *Consumer acceptance of wood-based food additives*. British Food Journal, 111(2), pp. 179-195.

[30] Zhang L., Tan W., Xu Y., and Tan G. (2012). *Dimensions of consumers' perceived risk and their influences on online consumers' purchasing behaviour.* Communications in Information Science and Management Engineering, 2(7), pp. 8-14.

[31] Chen M. F., and Li H. L. (2007). *The consumer's attitude toward genetically modified foods in Taiwan*. Food Quality and Preference, 18, pp. 662-674.

[32] Martinez-Poveda A., Molla Bauza M. B., del Campo Gomis F. J., and Martinez L. M. C. (2009). *Consumer-perceived risk model for the introduction of genetically modified food in Spain*. Food Policy, 34, pp. 519-528.

[33] Miles S., and Frewer L. J. (2001). *Investigating specific concerns about different food hazards*. Food Quality and Preference, 12, pp. 47-61.

[34] Scholderer J., Bredahl L., and Frewer L. (2000). *Ill-founded models of consumer choice in communication about food biotechnology*. In: F. van Raaij (ed.), Marketing communications in the new millennium: New media and new approaches, Erasmus University, Rotterdam, pp. 129-152.

[35] Székelyi M., and Barna M. (2002). *SPSS Survival kit for you. Multivariate analysis techniques for social scientists* (in Hungarian). Typotex Kiadó, Budapest, pp. 18-39, 301-319.

[36] Babbie E. (2001). *The Practice of Social Research* (in Hungarian). Balassai Kiadó, Budapest, pp. 307-308, 507-509.