

THE FOOD SAFETY ISSUE AND THE CONSUMER BEHAVIOUR IN A TRANSITION ECONOMY: A CASE STUDY OF HUNGARY

D. BÁNÁTI^a and Z. LAKNER^b

^a Central Food Research Institute, H-1022 Budapest, Herman Ottó út 15. Hungary

^b Faculty of Food Science, Szent István University, H-1118 Budapest, Villányi út 35–43. Hungary

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The food safety problem is gaining importance not only in developed “welfare” economies, but also in former socialist countries. The article analyses the attitudes and opinions of Hungarian consumers on problems of food safety, based on a direct question survey, consisting mainly of closed questions. For the majority of Hungarian consumers the food safety issue is a top priority problem.

Consumers consider the microbial and hygienic quality of food, food processing and catering as the most important threat for food safety. The elder generations and the women respondents were more worried about food safety problems. In general, respondents with lower qualification level underestimate the importance of food safety problems. In most cases there were no significant differences between the opinion of respondents with at least MSc qualification level in field of human or natural sciences, having no relation to food safety, and the opinion of specialists in food safety.

Combining factor and cluster analysis, five main consumer types can be separated from each other from viewpoint of evaluation of various risk factors threatening food safety. These groups can be matched with the social status of respondents.

Consumers demand a more rigid official control of food safety, even if this could increase the food price. Most of the consumers accept the modern food preservation methods.

Keywords: consumer research, opinion survey, attitudes, food technologies

The food safety issue is one of the most important topics of food industrial development in every industrialised country, because

- food-borne disease is a serious problem even in most developed economies. For example microbial pathogens in food cause an estimated 6.5–33.0 million cases of human illness and up to 9000 deaths in the United States each year (BUZBY et al., 1996)
- liberalisation of the world trade increases public concern on safety of imported products (RAYNER et al., 1993, LEHOTA & ILLÉS, 2001)
- abolishment of trade barriers in regional economic integrations (e.g. in European Union) causes an increase of international turnover of food industrial products, and this fact enhances the public interest in the field of food safety. In case of Norway the food safety problems played an (apparently) decisive role in breaking the integration process to the EU (HALMAI, 1995),
- after serious environmental (e.g. Chernobil, Bhopal, Tisza), malignant health effects of some drugs (e.g. Contergan) and agro-chemicals (e.g. DDT) there is an increasing

public concern about the health effects of new methods of food preservation (JONES & MORGAN, 1997),

- various groups of agricultural producers and processors utilise the food safety problem as a weapon of protection of their domestic market positions (WARLEY, 1990),
- other food safety issues, the recent food scandals (e.g. BSE, dioxin, *Listeria*) underlined the importance of food safety in the whole food chain, as it has been declared in the White Paper of the EU,
- certain food products and new technologies (e.g. GMOs, hormon-treated meat) are of great importance from the EU consumer's point of view as far as an ever-growing number of EU citizens are not willing to consume these products or require more information on these products (EUROBAROMETER, 1999).

In Hungary, the food safety problem is a question of special importance, because

- the Hungarian restructuring of food industry after the collapse of former socialist market and the European harmonisation of food safety regulations proceeded parallel with each other during a rather short time period,
- the never-before experienced freedom of speech opened a wide way for semi-scientific, unreasoned publications,
- for Hungarian consumers the liberalisation of import meant a rapid increasing of choice of imported products (LEHOTA, 1999),
- the deregulation of economy and economic incentives for promotion of small and middle scale food industrial enterprises caused an increasing importance of small scale food industry. These small enterprises often did not meet even the basic hygienic standards. Some branches e.g. in wine, distilling and meat industry the small scale food processors were often an integral part of illegal sector of an economy (SZERDAHELYI, 2000).

1. Methods

1.1. Process of investigation

The basic concept of the study was the direct questioning of consumers regarding their attitudes to food safety issue and consumer behaviour.

There are always limitations of opinion poll surveys, because such a survey can only provide broad indications of attitudes and perceptions, and opinions are subject to change. Nevertheless, information on the structure and underlying determinants for attitudes may be revealed, and this method is the most efficient and practical way to uncover them.

To determine the attitudes of Hungarian consumers to food safety issue, focus group interviews were organised in 1995–1996 and numerous possible statements were formulated concerning food technology and safety, consumer behaviour as well as possible ways and means of food control.

The questions were chosen so as not to influence the respondent, and thus sensitise people to the issues addressed. The order of the questions was also important: more specific questions were given after general questions. To avoid systematic error within the blocks of questions the individual questions were randomly designed. Taking into consideration the heterogeneity of education level of potential respondents, the questions were put as simply as possible.

The items chosen for the questions were condensed so as to be suitable for the purposes of the research. Whenever it was possible, we have utilised 1–5 interval scales to give the respondents a means of expressing their level of agreement with the statements given in the questionnaire. This scale is utilised in the Hungarian education system from elementary school to the university level, so it was quite familiar to the respondents.

Analysing the results of investigations the relative importance of factors, measured on a 1–5 step-scale, were evaluated on the basis of conventional socio-economic categories, using a one-way analysis of variance (ANOVA) of the SPSS® and STATISTICA® integrated program packages. For ANOVA, the Bonferroni method was used to determine the significant differences between various groups of respondents. The level of significant difference was 95%.

The statements concerning possible risk on food safety were refined through factor analysis (NORUSIS, 1998). The adequacy of factor analysis was tested using the Kruskal-Meyer-Olkin test, and the Bartlett test of sphericity. Both methods proved that there is a well-established basis for factor analysis. A combination of the maximum eigenvalue and screening tests were used to determine the number of factors. An orthogonal rotation (VARIMAX) of the initial principal components factor matrix yielded six factors.

These loadings may be considered to be a conservative criterion. Because of a potential instability of factor scores, it was performed five times to $0.7 \times$ number of cases, selected randomly, in order to test whether a changing of sample composition would alter the factor loadings. The results of the analysis were the same as for all similar runs.

In phase two the factor scores obtained from the above analysis were utilised as the input variables to classify the respondents. Ward's hierarchical centroid method, based on squared Euclidean distances, was used to form clusters. This method was preferred to other alternative clustering techniques because it is assumed to achieve more coverage of cases and better handling of outliers. It may also minimise cluster overlap. Ward's method produces a grouping of relatively homogenous groups of firms which have maximum between group distance. There is no absolute criterion for selection of the number of clusters. The decision rule for formation of homogeneous clusters was based on a minimum error sum of squares, inspection of the dendograms displaying the contents at each stage, and examination of the cluster contents in terms of the underlying concepts of interest.

The similarities and dissimilarities between opinion of members of various clusters concerning food safety, food preservation technologies as well as food control and regulation were analysed by analysis of variance. A similar method, based on combination of factor and cluster analysis was utilised for consumer research by KOMÁROMI (1998).

1.2. Sample characteristics

General statistical information was gathered concerning sex, age, marital status, number of children, occupation, education, income and locality. The questions asked included questions regarding gender, age categories, occupation, marital status, children, education and income categories (brackets). The overall features of the samples are summarised in Table 1.

Table 1. The demographic characteristics of Hungarian population and the samples

| Characteristics | Distribution of sexes in 18–X age groups based on the official data of Hungarian Statistical Office (%) | Distribution in sample (%) |
|----------------------------------|---|----------------------------------|
| Gender | | |
| Female | 53.0 | 62.0 |
| Male | 47.0 | 38.0 |
| Marital status | | |
| Single | 16.0 | 18.0 |
| Married | 84.0 | 82.0 |
| Age brackets | | |
| 18–30 | 21.11 | 28.69 |
| 31–40 | 16.53 | 19.89 |
| 41–50 | 36.58 | 35.82 |
| 51–60 | 13.18 | 10.32 |
| 60+ | 12.61 | 5.28 |
| Education level | | |
| Unaccomplished elementary school | 11.12 | 0.0 |
| Elementary school | 18.12 | 10.09 |
| School of professional training | 30.32 | 12.13 |
| Completed secondary school | 25.23 | 55.23 |
| College/university student | 2.82 | 8.42 |
| College/university | 12.3 | 13.32 |
| Place of living | | |
| Budapest | 18.4 | 11.21 |
| Other towns | 45.3 | 50.23 |
| Village | 36.3 | 38.56 |

Sponsored by a popular daily newspaper (Somogyi Hírlap) on the south-western part of Hungary a questionnaire was distributed as a part of the newspaper among

Hungarian consumers. By this way about 300 completed questionnaires were received. After the first round of questioning about 60 questionnaires were filled out by food industrial specialists. By this way we could compile a database, reflecting the representative opinion of “average Hungarian consumers” as well as the opinion of food industrial specialists.

2. Results and discussion

2.1. *The evaluation of importance of food safety issue*

Most of the respondents evaluated the importance of food safety as an important (45.9%) or very important (50.3%) problem. In general, it can be determined that the female respondents considered the food safety problem to be more important, than male respondents. The evaluation of food safety problem is increasing by the age of respondents. Respondents with higher qualification evaluated the food safety problem as more important, than respondents with lower qualification level. It is especially important that the young university or college students evaluated the importance of food safety as a question of the highest priority. In this segment there was not any respondent, who considered the food safety as a problem of secondary importance. Of course, the respondents with a special qualification in field of food hygiene considered the food safety problem more important, than non-professionals. There is no statistical difference between the village or town dweller respondents. It is worth to mention that the respondents, who were ill recently due to consumption of contaminated food, consider the food safety problem not as important as respondents, who have not had a serious illness due to food consumption yet.

Foodborne risk perception of Hungarian consumers

In next phase of investigation we have collected 31 various potential risk factors, threatening the safety of food consumption. The respondents were asked to evaluate the effect of these factors on food safety on a 1–5 interval scale.

The possible risk factors can be divided into two groups according to their grading. It is worth to mention that the first 15 risk-factors have a relatively high grade (higher than 4 score), and the other half of the factor set was evaluated to be much less important. Most of the consumers considered the low hygienic level of processing as a main risk from point of view of food safety. Out of 31 potential risk factors, on the first three places were the problems related to hygiene of processing and catering. The answers were evaluated on the bases of demographic categories. As a general rule, it is obvious that in most cases the elder generations are more concerned about the food borne risks, than the younger consumers (Table 2). This is probably because they have more unfavourable experiences, than members of younger generations. At the same time the elder generations are more reluctant to accept the newer methods of food processing, preservation and packaging.

Tendencies between the evaluation of food risk factors and formal qualification are not easy to explain.

As a general rule, it can be stated that respondents with lower education level overestimated the average risk effect of various components of food. Respondents with accomplished elementary school considered the effect of contamination from packaging material as more important, than other respondents. These consumers are more afraid of utilisation of artificial sweeteners and preservatives. A possible explanation for this phenomenon is the fact that in this qualification category the share of elder respondents is rather high. Another possible explanation is that this group of consumers is one of the primary target of sensation-seeking tabloids and other low quality media communication.

The high cholesterol content got a relatively high grade, this reflects the effect of the media. Ten years ago the knowledge on possible risk of high cholesterol content was marginal.

Analysing the results of investigations by genders it can be determined that the women respondents were more concerned with food safety than men.

In 11 cases significant differences could be detected between men and women on the bases of the evaluation of risk factors. As a general rule, it can be stated that women considered various problems concerning food safety as more serious, than men. It is an important lesson that the proportion of differences between genders in case of nutrition-related potential risk factors was especially high. At the evaluation of every nutrition-related factor the concern of women-respondents was more intensive, than that of men. Analysing the differences between the opinions of respondents with a college or university degree according to their field of qualification, it is interesting that there was a high concordance between the opinion of “amateurs” (respondents, having at least BSc level of qualification, not related to hygiene or food processing) and “professionals” (respondents with at least BSc qualification in field of food processing, medical-related sciences of food hygiene). The coefficient of correlation was rather high, between the two groups of respondents: 0.91.

There were significant differences between the opinion of village and town dwellers only in a few cases. This fact can be explained by the diminishing difference between the way of thinking of various places of living. Hungary is a small state, that's why the village dwellers have practically the same access to new scientific information, like town dwellers.

In next step of investigations we tried to determine the stochastic relations between the evaluation of potential risk factors.

By linear analysis of correlation significant stochastic relationship could only be determined between some factors but this is due to the high number of respondents. The value of linear coefficient of correlation was only in 19 cases higher than 0.5, and only in 5 cases were higher than 0.6:

- Personal hygiene – cleanliness of processing plants,
- personal hygiene – cleanliness of restaurants,
- too high vitamin content – too high energy content,

- hormones in meat – antibiotics in meat,
- contamination from plastic packaging materials – contamination from metallic packaging materials.

These facts underline the importance of utilisation of factor analysis for the determination of common factors behind the evaluation of separate variables. After rotation of factors, 6 factors could be determined. These factors determined more than 70% of the variance (Table 3).

In factor 1 the greatest factor loadings could be assigned to microbiological risks of food processing and consumption. In this factor the the following variables had the greatest values: bacteria in food, mould in food, hormones and antibiotics in food and toxins.

Factor 2 consists mainly of nutritional value related food ingredients: the high content of various food components (e.g. high carbohydrate, cholesterol, sugar, energy as well as salt content).

Factor 3 expresses the risk of food contamination from packaging material and additives. Putting it in another words: this factor compresses the effect of non-microbiological related food contamination.

Factor 4 compresses the risk effects of variables, relating to low level of personal hygiene.

The components of factor 5 emphasise the risk of various processing technologies. In this factor the largest values have the risk from consumption of pasteurised or frozen products.

The most important component in factor 6 is the effect of chemical preservatives.

In the next step the respondents were categorised by their factor-loadings. For every respondent we had six characteristic values, so the complex categorisation by means of cluster analysis was possible. Five characteristic clusters could be determined (Table 4). The most important features of clusters are as follows:

Members of cluster 1 can be characterised by underestimation of food-borne risk hazard. The relatively most frequent problems are concerned with low level of personal hygiene.

For members of cluster 2 the most important problems are the microbial hazards in foods.

Members of cluster 3 considered hygiene as the most important aspect of food safety. For them the various nutritional problems of food consumption does not mean a serious risk factor.

For consumers of this group the food related risks are of extremely high importance. At numerous risk-factors the evaluation of importance of risks were significantly higher, than at other groups. They consider the increasing of rigorousness of official food control as an especially important factor for quality assurance.

Table 2. Evaluation of the risks of some food technological methods and additives on food safety according to their importance on a 1–5 scale as a function of age of respondents, 1: practically not dangerous; 5: very dangerous

| Potential risk factors | Average scores | | | | | Significant differences between various groups at 95% level |
|---|----------------|-----------|-----------|-----------|---------|---|
| | Age categories | | | | | |
| | 18–24 (A) | 25–34 (B) | 35–49 (C) | 50–64 (D) | 65– (E) | |
| Use of artificial flavouring | 2.85 | 3.19 | 3.31 | 3.33 | 3.00 | A-C,D |
| Problematic manufacturing practice | 4.42 | 4.37 | 4.72 | 4.68 | 4.67 | A-C,D,E;B-C,D,E |
| Low-efficient pasteurisation | 2.43 | 2.62 | 3.15 | 3.13 | 3.64 | A-C,D,E;D-C,E |
| Frozen products | 2.77 | 3.47 | 3.65 | 3.55 | 3.36 | A-B,C,D |
| Hygienic conditions of plants | 4.43 | 4.59 | 4.79 | 4.76 | 4.82 | A-C,D |
| Personal hygiene | 4.26 | 4.51 | 4.74 | 4.70 | 4.45 | A-C,D;B-C |
| Hygienic conditions of catering service | 4.32 | 4.51 | 4.62 | 4.46 | 4.55 | A-C |
| Bacteria | 4.09 | 4.59 | 4.67 | 4.70 | 4.55 | A-B,C,D |
| Mould | 4.12 | 4.58 | 4.53 | 4.42 | 4.55 | A-B,C |
| High carbohydrate-content | 2.48 | 2.60 | 2.56 | 2.87 | 2.55 | |
| Vitamins | 2.51 | 3.10 | 2.91 | 3.37 | 3.55 | A-B,C,D;C-D |
| High energy content | 2.55 | 2.83 | 2.69 | 2.94 | 3.00 | |
| Pesticide residues in food | 4.28 | 4.54 | 4.70 | 4.63 | 4.55 | A-C,D |
| Hormone residues in food | 3.78 | 4.41 | 4.28 | 4.34 | 4.09 | A-B,C,D |
| Residues of antibiotics | 3.84 | 4.30 | 4.38 | 4.53 | 4.18 | A-B,C,D |
| Fat content | 2.80 | 2.97 | 2.96 | 3.26 | 3.20 | A-D |

| Potential risk factors | Average scores | | | | | Significant differences between various groups at 95% level |
|---|----------------|-----------|-----------|-----------|---------|---|
| | Age categories | | | | | |
| | 18-24 (A) | 25-34 (B) | 35-49 (C) | 50-64 (D) | 65- (E) | |
| High cholesterol content | 3.03 | 3.35 | 3.36 | 3.77 | 4.36 | A,B,C-D |
| Microbial pollution | 4.05 | 4.32 | 4.59 | 4.57 | 4.82 | A-C,D,E;C-D |
| Sugar content | 2.74 | 2.76 | 2.87 | 3.00 | 3.00 | |
| Chemical preservatives | 3.72 | 4.04 | 4.01 | 4.03 | 4.36 | |
| Nitrate-pollution in water | 4.14 | 4.49 | 4.52 | 4.58 | 4.73 | A-B,C,D |
| Toxins | 4.33 | 4.62 | 4.64 | 4.65 | 4.82 | A-B,C,D |
| Allergens | 4.06 | 4.15 | 4.49 | 4.39 | 4.73 | A-B,C,D |
| Food-additives | 3.12 | 3.27 | 3.33 | 3.38 | 3.27 | C-A,B;A-E |
| Contamination from plastics for packaging | 2.86 | 2.87 | 2.83 | 3.06 | 3.09 | |
| Contamination from metals for packaging | 2.88 | 3.09 | 3.10 | 3.14 | 2.82 | |
| Modified storage (packaging) atmosphere | 2.83 | 2.80 | 3.01 | 3.26 | 2.78 | |
| High salt content | 2.83 | 2.93 | 2.96 | 3.30 | 3.27 | A-D |
| Low-efficiency control of public agencies | 3.51 | 3.93 | 4.16 | 4.22 | 4.36 | A C,D |
| Artificial sweeteners | 3.09 | 3.04 | 3.03 | 3.19 | 3.18 | |

Table 3. The rotated factor pattern matrix of possible food-born risk components (factor loadings higher than 0.5 are signed by boldface characters)

| Risk factor | Factor identification numbers | | | | | |
|---|-------------------------------|-------------|-------------|-------------|-------------|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Use of artificial flavourings | 0.07 | -0.03 | 0.35 | -0.04 | 0.04 | 0.57 |
| Problematic manufacturing practice | 0.35 | 0.22 | 0.11 | 0.47 | -0.12 | 0.08 |
| Low-efficient pasteurisation | 0.00 | 0.20 | 0.10 | 0.10 | 0.78 | 0.02 |
| Frozen products | 0.12 | 0.14 | 0.17 | 0.13 | 0.72 | -0.07 |
| Hygienic conditions of plants | 0.22 | 0.03 | 0.00 | 0.77 | 0.12 | 0.04 |
| Personal hygiene | 0.13 | 0.01 | -0.02 | 0.81 | 0.29 | 0.02 |
| Hygienic conditions of catering service | 0.10 | 0.04 | 0.08 | 0.79 | 0.24 | 0.03 |
| Bacteria | 0.61 | 0.15 | 0.23 | 0.21 | -0.04 | -0.19 |
| Mould | 0.65 | 0.13 | 0.15 | 0.14 | -0.05 | -0.13 |
| High carbohydrate-content | -0.08 | 0.60 | 0.33 | 0.14 | 0.31 | 0.05 |
| Vitamins | -0.07 | 0.54 | 0.11 | 0.11 | 0.60 | 0.14 |
| High energy content | -0.07 | 0.72 | 0.16 | 0.09 | 0.34 | 0.15 |
| Pesticide residues | 0.56 | -0.04 | -0.05 | 0.19 | 0.16 | 0.46 |
| Hormones | 0.66 | -0.03 | 0.08 | -0.06 | 0.16 | 0.08 |
| Antibiotics | 0.76 | -0.06 | 0.09 | -0.09 | 0.13 | 0.11 |
| Fat content | 0.12 | 0.80 | 0.24 | -0.05 | 0.09 | 0.01 |
| Cholesterol content | 0.20 | 0.72 | 0.10 | -0.08 | 0.14 | 0.05 |
| Microbial pollution | 0.69 | -0.08 | 0.00 | 0.20 | 0.07 | 0.10 |
| Sugar content | 0.05 | 0.79 | 0.21 | 0.10 | 0.00 | -0.04 |
| Chemical preservatives | 0.29 | 0.16 | 0.14 | 0.07 | 0.01 | 0.71 |
| Nitrate-pollution in water | 0.58 | 0.13 | -0.03 | 0.15 | -0.03 | 0.44 |
| Toxins | 0.69 | 0.01 | -0.05 | 0.22 | -0.11 | 0.43 |
| Allergens | 0.63 | 0.20 | 0.05 | 0.21 | -0.14 | 0.18 |
| Food-additives | 0.17 | 0.17 | 0.54 | -0.05 | 0.05 | 0.50 |
| Contamination from plastics for packaging | 0.05 | 0.25 | 0.79 | 0.00 | 0.05 | 0.13 |
| Contamination from metals for packaging | 0.11 | 0.19 | 0.76 | 0.00 | 0.07 | 0.11 |
| Modified storage (packaging) atmosphere | 0.18 | 0.20 | 0.66 | 0.11 | 0.19 | -0.01 |
| High salt content | 0.04 | 0.58 | 0.08 | 0.19 | 0.38 | 0.16 |
| Low-efficiency control of public agencies | 0.03 | 0.24 | -0.01 | 0.28 | 0.60 | 0.07 |
| Artificial sweeteners | -0.07 | 0.29 | 0.53 | 0.08 | 0.06 | 0.43 |

Cluster 5: at this group the consumers are afraid of artificial preservatives, residual chemicals and antibiotics.

In the next step of investigations the respondents were asked to evaluate the relative importance of various measures for achievement of safe food industrial products.

The rigour of keeping the production technology and food control was considered a very important factor. This fact in a developed country can be considered as an evidence, necessary precondition of healthy food. It is worth to mention that in Hungary

the “household” animal slaughtering and “private” distilling have great historical traditions. The Hungarian consumer is an increasingly quality-oriented buyer. For example most of the respondents accepted that food safety has a priority over the product price.

Analysing the evaluation of various measures on the bases of age of respondents, it is obvious that the elder generation preferred the rigour of official, legal methods of quality and safety assurance (Table 5).

The women respondents were more concerned with problems of food safety, than men. This is convergent with results of analysis of factors, concerning the issue of food safety.

In the next phase of investigation the consumer opinion was mapped up concerning the utilisation of some methods of preservation. As a general rule it can be stated that heat treatment and cooling were widely accepted for food preservation, but the Hungarian consumers are rather reluctant to utilize artificial preservatives. The evaluation of food irradiation is comparatively favourable, taking into consideration the fact that consumers in Hungary had only a rather limited possibility to get personal experience concerning these products or even to get reliable information on physical, chemical and biochemical effects of this treatment. The relatively high evaluation of smoke curing can easily be explained by long traditions of this method in Hungary.

There were only limited differences between the opinion of various age categories concerning these methods. Interestingly, the elder generations have greater confidence in efficiency of various food preservation methods, than younger respondents. The only exception is deep freezing, where the younger respondents have a more favourable opinion.

Respondents with higher qualification level were significantly more reluctant to utilisation of artificial preservatives and smoke curing, than respondent with elementary school or skilled worker qualification. The evaluation of food irradiation was better in categories of respondents with higher qualification.

The stochastic relations between the evaluation of various ways of increasing food safety were analysed by factor analysis. It became obvious that the estimation of various measures to increase the quality of food industrial products can be divided into three different groups. In the first factor the safe processing and the quality assurance in food processing have the largest loading. In the second factor measures related to consumer protection and quality assurance by all means have the largest loading. In the third factor the most important measure is the official food control.

Table 4. A possible grouping of consumers on the basis of their attitudes to food safety problems

| | Young, unworried consumers (1) | Hygiene centred consumers (2) | Conservative intellectuals (3) | Average Hungarian women (4) | Average Hungarian men (5) |
|---|---|---|--|--|--|
| General evaluation of food safety problem | The food safety is a question of minor importance – 68.5% | The food safety problem is a question of primary importance – 46.0% | The food safety problem is of primary importance 58.0% | The food safety problem is of primary importance 52% | The food safety problem is of primary importance 54.0% |
| Former negative experiences with consumption of unsafe food | Had not food-borne disease problems yet – 69.0% | Sometimes has food-borne disease problems – 68.0% | Often has food-borne disease problems – 25.0% | Sometimes has food-borne disease problems | Sometimes has food-borne disease problems |
| Gender relation (men/women) | 47/53 | 43/57 | 33/67 | 34/66 | 71/29 |
| Age of cluster members | More than 50% younger than 34 years, no member in 65+ bracket | Approximately even distribution between various age brackets | Nearly 50% of cluster members is in age bracket 35–49 | Two – third part of this cluster is between 34–49 | More than 90.0% of members is under 49 |
| Highest qualification level | More than two third of respondents has only a high school degree. In this cluster the rate of persons, having an elementary school degree is higher | Approximately even distribution between various levels of qualification | 2/3 is attending a college or has a college or university degree | Mainly accomplished high school degree | Nearly 60.0% of respondents has a college or university degree |

| | Young, unworried consumers (1) | Hygiene centred consumers (2) | Conservative intellectuals (3) | Average Hungarian women (4) | Average Hungarian men (5) |
|---|---|--|--|--|--|
| Attitude towards various methods of food preservation | Accepts the utilisation of chemicals as preservatives, more reluctant to heating, cooling, and deep freezing | Accepts the utilisation of heat treatment, cooling and deep freezing, accepts the utilisation of smoking | Reluctant to utilisation of chemicals, accepts various methods of food preservation, worries about contamination from packaging material and environment | Accepts the utilisation of drying, heat treatment, cooling and freezing. Reluctant to the utilisation of chemical preservatives and food irradiation and smoking | Reluctant to the utilisation of chemicals and smoking, accepts the physical ways of food preservation |
| Attitude towards various measures to increase food safety | Comparatively the lowest importance is assigned to various measures to increase food safety | High importance assigned practically to every method for increasing food safety | Considers the various methods for increasing food safety as a top-priority goal | Considers the various methods for increasing of food safety as a top-priority goal | Accepts the food safety issue as a very important problem, but takes into consideration another arguments (e.g. cost, quality) |
| Evaluation of importance of various measures | Relatively lesser importance is contributed to various measures, the most important measure is the technical aspects of food safety | Various measures are evaluated as very important | The most important measures are the organisational and behaviour aspects of food safety | The most important factors of food safety are the institutional securities, the food science research is considered as a problem of lesser importance | The most important factors are the institutional and legal means |

Table 5. The evaluation of importance of various measures of insurance of food safety as a function of age of respondents on a 1–5 interval scale 1: absolutely not important 5: very important

| Measure | Importance scores | | | | | Significant difference at 95% level |
|--|-------------------|------------|------------|------------|----------|-------------------------------------|
| | Age brackets | | | | | |
| | 18–24 A | 25–34 B | 35–49 C | 50–64 D | 65– E | |
| Official control of processing | 4.78 | 4.8 | 4.9 | 4.89 | 5 | |
| Official control of food trade | 4.49 | 4.75 | 4.78 | 4.76 | 4.92 | A-B,C,D,E |
| Preservation of original quality properties of raw material | 4.4 | 4.63 | 4.73 | 4.67 | 4.67 | A-B,C,D |
| Food safety must have top priority | 4.37 | 4.58 | 4.75 | 4.71 | 4.83 | A-C,D,E |
| Food labelling must inform consumers in details | 4.17 | 4.48 | 4.45 | 4.4 | 4.33 | A-B,C |
| The most important goal of food preservation is the assurance of food safety | 3.29 | 3.76 | 3.94 | 4.09 | 3.83 | A-B,C,D |
| The food safety is much more important, than product-price | 4.14 | 4.15 | 4.35 | 4.29 | 4.58 | |

We could not detect numerous significant differences from the point of view of evaluation of various measures neither on the basis of qualification, nor the place of living. This is an important fact, because this result emphasises that the Hungarian citizens (put it in another way: taxpayers) are aware of the importance of food safety problem, and they do not consider these steps in the direction of increasing food safety as an unnecessary waste of money.

Besides the opinion research, we have tried to test the effective knowledge of Hungarian consumers on some actual problems, ways and means of food preservation. The picture, got by this way on nutritional and food safety knowledge of Hungarian consumers, is rather heterogenous. It can be considered as a rather positive thing that most of the Hungarian consumers did not accept the popular statement that it is not advisable to consume food with cholesterol content. Moreover, three-quarter of the respondents accepted food irradiation as an effective way of food preservation.

3. Conclusions

On the basis of investigations numerous conclusions and suggestions can be formulated as follows:

- Overwhelming majority of Hungarian consumers consider food safety as a problem of top priority, worth for further sophistication of legislation of regulation and research.
- The consumers consider the microbial condition of food as the most important factor of food safety. This is a positive fact, because in numerous Western-European countries and in the USA the consumers did not see this issue as an especially important one, and this leads to underestimation of this problem.
- There are significant differences between consumers' opinions from point of view of considerations of seriousness of various effects, influencing food safety. The food safety problem is especially important for women respondents, consumers with higher education level and members of elder generations. In marketing communication to these groups the safety of various foods should be more emphasised.
- As a summary of factor analysis, it can be stated that to the factors various food-borne risks can be assigned, and the factor analysis is a useful tool to uncover the hidden relationship between various risk components.
- On the basis of various attitudes to food safety issue, by combination of factor and cluster analysis a grouping of Hungarian consumers can be carried out. The various consumer groups differ from each other not only by their attitudes to food safety issue, but also by various socio-economic factors. This gives a good possibility for differentiated marketing communication strategy.
- The younger generations considerably underestimate the importance of food safety problem, that's why this should be an especially important target group for future food safety communication work in the framework of National Action Plan for Improving Food Safety.
- However, the household food preservation has considerable traditions in Hungarian villages, most of the consumers accept the importance of increasing food safety by more rigorous official control.
- The Hungarian consumers unanimously consider the research and development work for increasing food safety as a very important investment, and are willing to accept and – as taxpayers – support these measures. This should to be taken into consideration in various bargaining over budget and money allocation.
- The food safety and nutritional level of Hungarian consumers is satisfactory, but of course in case of less educated and elder people it needs to be improved, however, generally there is a tendency to accept the new, sophisticated methods of food preservation.

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