Original paper

Evaluation of consumers' purchase behavior by means of mathematical and statistical methods

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ABSTRACT

The objective of this paper was the identification and evaluation of the purchase preferences of the Slovak consumers of small fruits and berries. The evaluation of the consumers' purchase behavior was carried out by methods of mathematical statistics. Data collection for the identification of main preferences in the purchase and consumption of small fruits was conducted by the questionnaire survey. We applied methods of statistical hypotheses testing and finding out dependencies between the determined characters. The existence of a statistically significant relationship was verified by χ^2- test. Calculations were performed by tools of MS Excel, 2013. The statistical hypotheses testing showed that in the process of the purchase of small fruits there is no statistically significant relationship between the gender of respondents and the country of origin of fruits. Similarly, we found out that there is no statistically significant relationship between the respondent's age and the country of origin of small fruits.

KEYWORDS: statistical dependence, χ^2-test, questionnaire survey, purchase behavior, small fruits

JEL CLASSIFICATION: K45, M10, M65

INTRODUCTION

In this paper we deal with the consumers behavior in the purchase of small fruits and berries. The main objective of this contribution is to evaluate data of the exploratory survey, which is concerning the consumers purchase behavior, by appropriate statistical methods. On the basis of obtained answers of the respondents – consumers we want to find out what kinds of small fruits and berries Slovak consumers usually eat, what are the motives of their purchase and whether it is important the information about the country of the product origin.

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Various methods of mathematical statistics are used to the evaluation of the purchasing behavior of consumers. Vietoris et al. [8] applied the hierarchical multiple factor analysis (HMFA) to the evaluation of the marketing exploration of the consumers' preferences. Detection of dietary habits and preferences of consumers is the objective of different investigation and research projects [4]. Gluten-free products are intended for people with celiac disease and they are very important for them. As Nagyová et al. in [7] report, the most important criterion in the purchase of gluten free products is their quality (51.54 % of respondents). Healthy lifestyle, good diet and purchase of organic products are also reflected in consumer preferences as significant factors.

Fruit is an indispensable component of the human food for its high content of vitamins, enzymes, minerals, fiber and other healthful substances. Matošková et al. in [6] report that on the Slovak market the fruit is consumed in the fresh form and also in the form of various products of the food industry. They found out that in the period 2002 - 2011 it has changed the share of the import of the fresh fruit to Slovakia in relation to the domestic consumption (from 41 % in 2002 to 80.5 % in 2011) and in the relation to the domestic production (from 62.3 % in 2002 to 191.7 % in 2011). It follows that in the last year of the observed decade the volume of the fruit import was almost twice the size in the comparison with the domestic production.

MATERIAL AND METHODS

The behavior of consumers during the purchase of small fruits was analyzed from the input data obtained by the questionnaire survey. The survey was conducted from the October 2012 to the January 2013, and we obtained answers of 300 respondents. The characteristic of the respondents by the gender was as follows: 58 % of women and 42 % men. Distribution of the research sample according to the economic activity: 48 % of students, 36 % employed, 6 % unemployed and 9 % pensioners. Distribution into groups according to the age: 49 % of respondents under 25 years, 21 % of respondents from 26 to 40 years, 19 % of respondents from 41 to 55 years and 11 % of respondents over 56 years. The structure of respondents by the education: 5 % with primary education, 56 % with secondary education and 39 % with university education.

From the methodological point of view in this paper there were used statistical methods for the measurement of the dependence, resp. associations of observed variables. We assessed the statistical significance of relations by means of χ^2-test. Calculations were carried out by means of MS Excel 2013.

As the first method we will use χ^2-test of independence [5] for the verification the hypothesis if the examined variables of the statistical sample are dependent or independent. We get the statistical sample of a range *n* and we will investigate two attributes signed *X, Y* which acquire more levels. The primary table for quantitative characteristics is a sequence of ordered pairs $[x, y]$ which are further sorted out into contingency table.

When examining the dependence between the attributes we verify the following hypotheses:
Null hypothesis: Attributes *X* and *Y* are independent.
Alternative hypothesis: Attributes *X* and *Y* are dependent.

The test criterion is expressed by formula:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{s} \frac{\left(a_i \cdot b_j - \left(a_i \cdot b_j\right)_0\right)^2}{\left(a_i \cdot b_j\right)_0},$$

where a_i, b_j are number of frequencies (in our case respondents) in analyzed category. Critical region is interval $W_\alpha = (\chi^2((r-1)(s-1)); \infty)$, where $\chi^2((r-1)(s-1))$ is the critical value of χ^2 – probability distribution. We conclude: If $\chi^2 \in W_\alpha$, so the hypothesis H_0 is refused in favor of the alternative hypothesis; if $\chi^2 \notin W_\alpha$, so the hypothesis H_0 cannot be refused.

RESULTS AND DISCUSSION

We processed answers of conducted questionnaire survey and we identified the opinions and preferences of consumers in relation to the purchase and consumed of small fruits. The results show that strawberries (35 %) and raspberries (22 %) are the most consumed kinds of small fruits. Red currants (11 %), blackberry (10 %) and black currants (9 %) also belong to the often consumed kinds. A minor part of respondents chose gooseberries (6 %) and cranberries (6 %). Other kinds of small fruits accounted for 1 % share.

Suitable organoleptic properties (smell, taste and texture) are the reason for fruit consumption for 51 % of respondents. Part of 27 % of respondents buys small fruits grown organically and products thereof in bio quality. The quality of small fruits is important for 93 % of respondents. Within the examination of the other motifs of consumption of small fruits, we found that 48 % of respondents consume those for the high content of biologically active substances such as vitamins, polyphenols, organic acids and minerals [3].

In the survey the respondents were asked to answer this question:
In what form do you eat small fruits and berries?
In the Fig. 1 there is the graph of the responses (expressed in percentages).
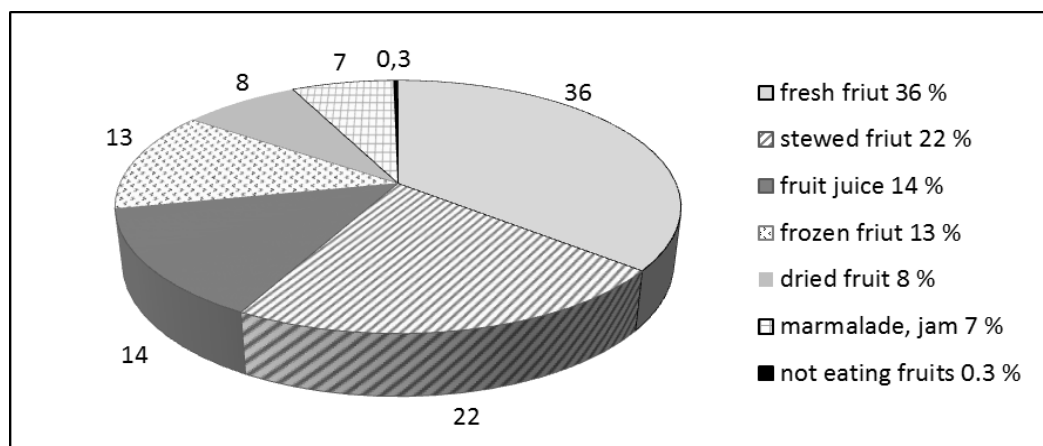

Fig. 1 The distribution of responses according to the form of the fruit consumption

The country of origin of the imported small fruits was studied in the next question:
Is the country of origin important for you when buying small fruits?

We can positively evaluate that 94 % of respondents prefer small fruits grown in Slovakia. The country of origin of fruits is important for 30 % of respondents when buying ones; sometimes it takes into account the 42 % of respondents, and is completely irrelevant for 28 % of respondents. The distribution of responses by the gender: the country of origin when buying small fruits is prefered by 32 % of women and it does not important for 23 % of women. This factor is important for 28 % of men when buying fruits; in reverse, the country of origin is not important for 34 % men. In percentage, the most respondents from women and men said that the country of origin (when buying small fruits) is important only sometimes: exactly 45 % of women and 38 % men. In the Fig. 2 there are graphically shown the answers of respondents in accordance to the gender.
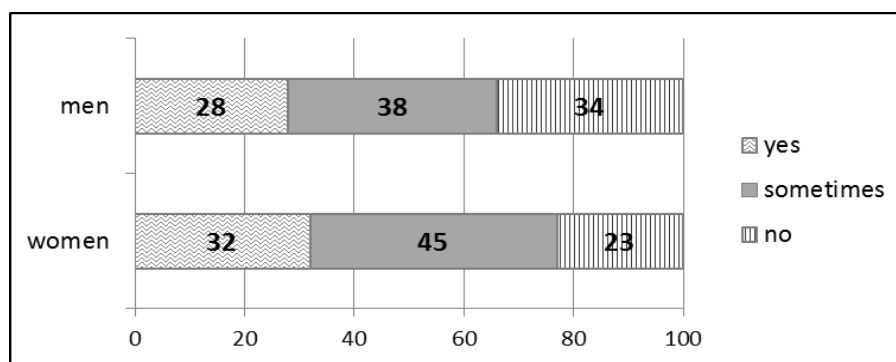

Fig. 2 The preference of respondents: the country of origin in relation to the gender
Expressed in percentages. Source: authors

The age of the respondents was the next classification criterion. When buying small fruits the country of origin is important: for 41 % of respondents aged 41-55 years, for 29 % of respondents under the age of 25 years, for 26 % of respondents aged 23-40 years and for 24 % of respondents older than 56 years. The country of origin has no significant influence on the purchasing decisions of small fruits for 35 % of respondents aged over 56 years, for 29 % of respondents under the age of 25 years, for 26 % of respondents aged 41-55 years and for 23 % of respondents aged 26-40 years. In the Fig. 3 the graph shows the answers of respondents according to their age.
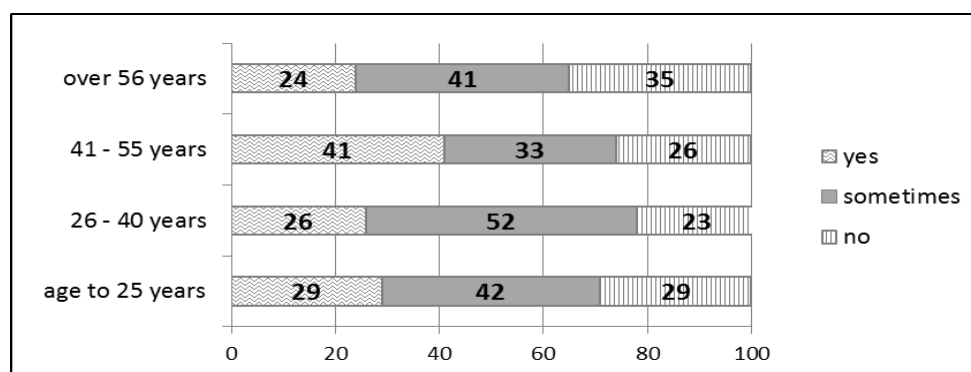

Fig. 3 Respondents preferences of the country of origin in relation to the age
Expressed in percentages. Source: authors

In the research part we tested two null hypotheses and we processed the obtained results.

The first hypothesis H_0: The country of origin of small fruits is not statistically significant factor in the purchase decision of the consumer in relation to the gender.

The second hypothesis H_0: The country of origin of small fruits is not statistically significant factor in the purchase decision of the consumer in relation to the age of the respondent.

In the Tab. 1 we summarized the results to the hypotheses testing.

Tab. 1 Results of the statistical evaluation of responses

Country/criterion	Country of origin/gender	Country of origin/age
Frequency	300	300
χ^2 **characteristics**	4.534	7.286
Critical value	5.991	12.592
Outcome	$\chi^2 \notin (5.991, \infty)$ H_0 not refused	$\chi^2 \notin (12.592, \infty)$ H_0 not refused
Dependence	no	no

Source: authors

The results to the first null hypothesis tested by χ^2-test:

- We have found that when buying small fruits there is no statistically significant relationship between the gender of a respondent and the importance of the country of origin of the fruits. The value of the test criterion is 4.534; therefore it is true $\chi^2 \notin (5.991, \infty)$. On the chosen level of significance ($\alpha = 0.05$) we cannot refuse the null hypothesis about the independence of observed characters. We found that there was no significant relationship between the gender of a respondent and the country of origin when buying small fruits.

The results to the second null hypothesis tested by χ^2-test:

- The results have proved that when buying small fruits there is no statistically significant relationship between the age of a respondent and the importance of the country of origin of the fruits. The value of the test criterion is 7.286; therefore it is true $\chi^2 \notin (12.592, \infty)$. On the chosen level of significance ($\alpha = 0.05$) we cannot refuse the null hypothesis about the independence of observed characters. Thus, the age of the respondent has no importance when deciding on purchasing fruit according to the country of origin.

These results also confirm the fact that foreign products are cheaper in the stores and the consumers are choosing products according to the price and then according to the country of origin. The consumers are the economic and want to maximize their own utility. At the same time, they are trying to determine the quality attributes of the selling products.

The health benefits of eating small fruits are confirmed by the research work of various authors. Habánová et al. [2] state that due to regular consumption of blueberries for three weeks, the total cholesterol level decreased slightly. Research shows that regular consumption of small fruits has a preventive effect against cardiovascular diseases [1], also reduces the risk of cancer, atherosclerosis and tumor diseases [9].

CONCLUSIONS

Consumers' purchase behavior is influenced by many internal and external factors. The objective of this contribution was to identify consumers' opinions and preferences in the purchase of small fruits and berries and assess the impact of the country of origin of small fruits in deciding of the consumer to buy them. In the research part we have tested two hypotheses by χ^2-test. The hypotheses were related to the preferences of consumers in the purchase and consumption of small fruits in relation to the gender and age of respondents. The research sample was composed of 300 respondents. The results of testing hypotheses did not prove the existence of the statistically significant relationship between observed attributes: the country of origin and the gender of a respondent; the country of origin and the age of a respondent.

The conducted survey on the sample of Slovak consumers and its evaluation show interesting and important facts about purchasing and consuming of small fruits and berries. These findings can be useful for both, the Slovak sellers of fruit and producers of small fruits. On the basis that there is no significant relationship between the respondent's gender and the country of origin of small fruit, as well as between the respondent's age and the country of origin of small fruit, it can be assumed that the consumers make decisions based on the price of fruit, or on other factors. This finding may be a topic for further investigation of the process of consumer decision-making.

Acknowledgement

REFERENCES

[1] Basu, A., Rhone, M. & Lyons, T. J. (2010). Berries: emerging impact on cardiovascular health. *Nutr. Rev.,* 68(3), 168-177. doi:http://dx.doi.org/10.1111/j.1753-4887.2010.00273.x

[2] Habánová, M., Habán, M., Chlebo, P. & Schwarzová, M. (2013). Changes of plasma lipids in relation to the regular consumption of bilberries (Vaccinium myrtillus L.). *Potravinarstvo*, 7(1), 1-6. doi:http://dx.doi.org/10.5219/233

[3] Kozelová, D., Chládok, P. & Országhová, D. (2016). Quality of small fruits and its perception by consumers. *Záhradníctvo 2016*: *book of research proceedings*. Nitra: Slovenská poľnohospodárska univerzita, pp. 140-146 (in Slovak)

[4] Kozelová, D., Matejková, E., Fikselová, M. & Dékányová, J. (2014). Analysis of consumer behavior at chocolate purchase. *Potravinárstvo,* 8(1), 61-66. doi: http://dx.doi.org/10.5219/325

[5] Markechová, D., Stehlíková, B. & Tirpáková, A. (2011). *Statistical Methods and Applications*. Nitra: UKF. 534 p. (in Slovak).

[6]   Matošková, D., Meravá, E. & Gálik, J. (2013). Vertikálny reťazec v sektore ovocia (Vertical chain in the fruits sector). *Ekonomika poľnohospodárstva*, 13(2). Retrieved 2016-08-26 from http://www.vuepp.sk/EP2013/2/6Mato.pdf

[7]   Nagyová, Ľ., Košičiarová, I., Rybanská, J. & Holienčinová, M. (2016). Celiac disease: the situation on the Slovak market. *Potravinárstvo,* 10(1), 323-331. doi:http://dx.doi.org/10.5219/582

[8]   Vietoris, V., Kozelová, D., Mellen, M., Chreneková, M., Potclan, J. E., Fikselová, M., Kopkáš, P. & Horská, E. (2016). Analysis of consumer preferences at organic food purchase in Romania. *Polish journal of food and nutrition sciences,* 66(2), 139-146.

[9]   Wibisono, R., Zhang, J. & Saleh, Z. (2009). Optimalisation of accelerated solvent extraction for screening of the health benefits of plant food materials. *Health 1*, 1(3), 220-230. Retrieved 2016-06-24 from http://www.scirp.org/journal/PaperInformation.aspx?paperID=927