

QUANTITATIVE INDICATORS OF FRUIT AND VEGETABLE CONSUMPTION

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ABSTRACT

The quantitative research of the market is often based on surveys and questionnaires which are finding out the behavior of customers in observed areas. Before purchasing process consumers consider where they will buy fruit and vegetables, what kind to choose and in what quantity of goods. Consumers' behavior is affected by the factors as: regional gastronomic traditions, price, product appearance, aroma, place of buying, own experience and knowledge, taste preferences as well as specific health issues of consumers and others. The consumption of fruit and vegetables brings into the human body biological active substances that favorably affect the health of consumers. In the presented research study we were interested in differences of consumers' behavior in the consumption of fruit and vegetables according to the place of residence and gender. In the survey 200 respondents has participated; their place of residence was city or village. The existence of dependences and statistical significance were examined by selected statistical testing methods. Firstly we analyzed the responses via statistical F-test whether observed random samples have the same variance. Then we applied two-sample unpaired t-test with equal variance and χ^2 -test of statistical independence. The statistical significance was tested by corresponding p values. Correlations were proved by the Cramer's V coefficient. We found that place of residence has no impact on the respondents' consumption of fruit. The gender of respondents does not affect their consumption of fruit. Equally, the gender does not affect the respondents' consumption of vegetables. Only in one observed case the significant differences proved that the place of respondent residence has impact on the consumption of vegetables. Higher consumption of vegetables is due to the fact that the majority of citizens, who live in villages, have a possibility to grow their own vegetables and, thus, the demand for it in village shops is low.

Keywords: fruit; vegetable; consumption; consumer; behavior; respondent

INTRODUCTION

In the food market the customers' behavior is affected by different factors. The most important factors, which have an impact on the customers' behavior, are the quality of the products and price of products. Other important factors are: information about the goods, the offer and access to goods, discount, eating habits and rules, national or regional gastronomic traditions, taste preferences as well as specific health issues of consumers. The differences in consumers' behavior in the food market were analyzed by **Rousseau and Vranken (2013)**, **Kutnohorská and Tomšík (2013)**; new trends in eating and impacts on purchasing habits of consumers were examined by **Horská et al., (2012)**, economic and management aspects of the production, sales and demand for food by **Bielik et al., (2014)**, **Kozáková et al., (2014)**, **Tóthová and Prčík (2011)**. Purchasing habits of consumers are also changing by the effects of new information of global character in relation to climate changes. Interesting results were obtained by **Chuanmin et al., (2014)** scenario experimental methodology of carbon labeling on agri-food products, coupled with 873 questionnaires collected from six cities in China; then they made a statistical analysis of different types of consumers' behavior on the low-carbon agri-food purchase.

In regard to the existence of substantial regional disparities at district level, a place of residence has a major impact on customers' behavior when purchasing food. These differences are related to wage levels, purchasing power of people, employment rate, vacancies and job offers as well as land use. The above stated facts demonstrate works of **Fáziková (2012)**, **Chreneková and Jíříček (2013)**, **Kadlečíková et al., (2013)**. Consumers' behavior, when purchasing organic food, dependent on the place of the residence, was examined also by **Müller and Gaus (2015)**. Whereas eating habits are established mainly in the family, in kindergartens and primary schools, the importance of introducing healthy eating habits for children and adolescents are pointed at by **Lesschen et al., (2011)** and others.

The aim of this paper is to analyze consumers' eating habits focusing on fruit and vegetables in relation to the two criteria: the place of residence and the gender of respondent.

MATERIAL AND METHODOLOGY

The partial goal of this paper was to carry out the monitoring of consuming of fruit and vegetable and then to evaluate results in relation to the place of residence and the gender of respondent. The survey was conducted by the method of the questionnaire in February 2015 and 200

respondents were included in the statistical sample. The questionnaire consisted of 16 questions about consumption fruit and vegetables and 4 classificatory issues (in this paper we present 2 of them).

In the survey participated 46% of women and 54% were men. In terms of age the structure was following: 18% were young people from 14 till 19 years; group of 18% of respondents belonged to the age from 20 till 25 years; age group 26 – 35 years accounted for 19% of respondents; age group 36 – 45 years accounted for 15% of respondents; age group 46 – 55 years 19%, and respondents aged 56 years and over were represented in the 13% share. The structure of the respondents according to their economic activity was as follows: 35% students, 30% were employed, 23% unemployed and 13% of retirees. In terms of the place of residence 31% of respondents live in a village and in the city 70% of respondents.

Using a research questionnaire we investigated whether there are significant differences in the level of daily consumption of fruit (resp. of vegetables) in relation to the place of respondent residence and in relation to the gender of the respondent. The term "1 serving" was explained to respondents as the amount of approximately 100 – 150 g of fruit or vegetables. We will analyze the responses by selected methods of mathematical statistics; more precisely we will use two-sample unpaired t -test with equal variance and χ^2 -test of independence. Before running t -test and χ^2 -test we will verify using the F -test whether observed random samples have the same variance. Calculations and graphical interpretation of the results will be realized by MS Excel 2010.

We will describe the main characteristics of the F -test. We assume that there are given two samples with ranges n_1, n_2 with variances s_1^2, s_2^2 that are selected from basic files with normal distribution $N(\mu_1, \sigma_1^2)$ and $N(\mu_2, \sigma_2^2)$. We test the null hypothesis $H_0: \sigma_1^2 = \sigma_2^2$ versus the alternative hypothesis $H_1: \sigma_1^2 \neq \sigma_2^2$. The test criterion has the Fisher-Snedecor distribution $F(n_1 - 1, n_2 - 1)$. If $F > F_{\frac{p}{2}}(n_1 - 1, n_2 - 1)$, we reject the hypothesis H_0

and accept the alternative hypothesis H_1 .

In implementing the unpaired t -test, we assume that the selected samples are independent and justified assumption of equal variances σ_x^2, σ_y^2 . We test the null hypothesis

$H_0: \mu_1 = \mu_2$ versus the alternative hypothesis

$H_1: \mu_1 \neq \mu_2$. As a test criterion we apply

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{S_p^2 \cdot \left(\frac{1}{n} + \frac{1}{m}\right)}}$$

Critical region is the set $W_\alpha = (-\infty, -t_\alpha(n+m-2)) \cup (t_\alpha(n+m-2), \infty)$

where $t_\alpha(n+m-2)$ is the critical value of Student's t -distribution with $n+m-2$ degrees of freedom. If $t \in W_\alpha$ (i.e. if $|t| > t_\alpha(n+m-2)$), we reject hypothesis

H_0 at the significance level α . Otherwise if $t \notin W_\alpha$ we cannot reject null hypothesis H_0 and accept the alternative hypothesis H_1 .

Measurement of dependencies through qualitative characters, i.e. measurement of associations, we will use for verification of the existence of dependence between own questions and classification questions using χ^2 -test of independence. The statistical evidence supporting relationships will be assessed on the basis of the significance of test characteristics (p -value). Dependence of two variables can be either symmetrical (mutual) or asymmetrical (one-sided). The basic test used for the detection of dependence of two categorical characters (without taking into account the direction of statistical dependence) is χ^2 -test of independence. That is based on the consideration that if two characters are independent, then the distribution of frequencies in the pivot table is proportional to the row's and column's marginal frequency (Řezanková, 2011). Using χ^2 -test test we verify the existence of dependence between responses to questions in relation to the classification criteria (in general it can be economic activity, gender, age, place of residence and others). The relationship is considered statistically significant if the p -value is less than the significance level $\alpha = 0.05$.

In research organizing we were in line with formulated targets and suggested following assumptions:

1. We assume that women consume more portions of fruit than men.
2. We assume that people living in the villages consume more fruit than city residents.
3. We assume that women consume more portions of vegetable than men.
4. We assume that people living in the villages consume more vegetable than city residents.

RESULTS AND DISCUSSION

In this part we will verify formulated preconditions through testing of hypotheses. We will apply the F -test to find if observed random samples have the same variance. Then we use the unpaired t -test and χ^2 -test. The aim of the testing is to determine whether:

- There are significant differences in the consumption of fruit in relation to the gender of a respondent,
- There are significant differences in the consumption of fruit in relation to the place of residence of a respondent,
- There are significant differences in the consumption of vegetable in relation to the gender of a respondent,
- There are significant differences in the consumption of vegetable in relation to the place of residence of a respondent.

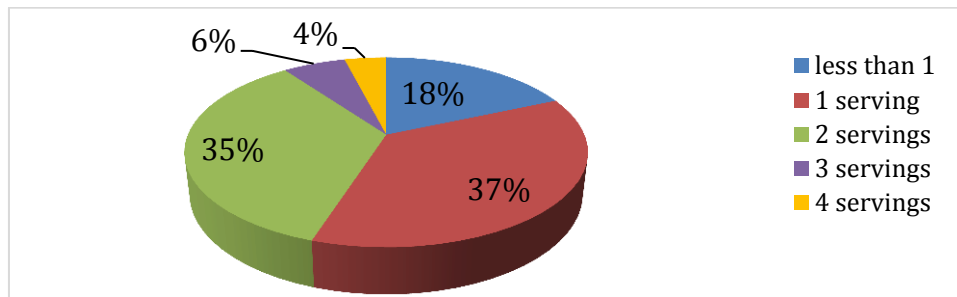


Figure 1 Consumption of fruit per day.

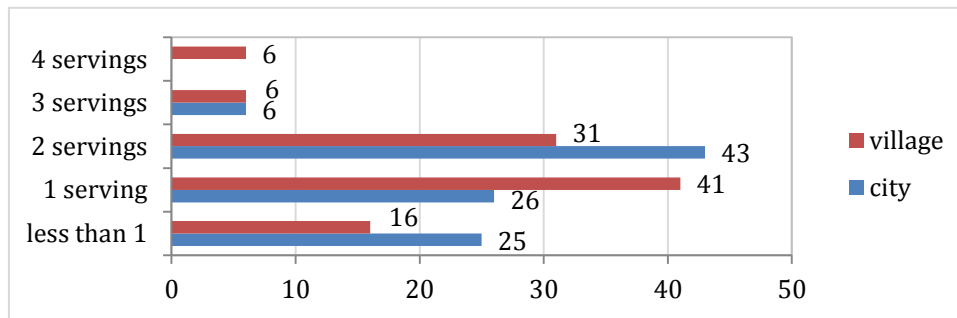


Figure 2 Consumption of fruit in relation to the place of residence (in %).

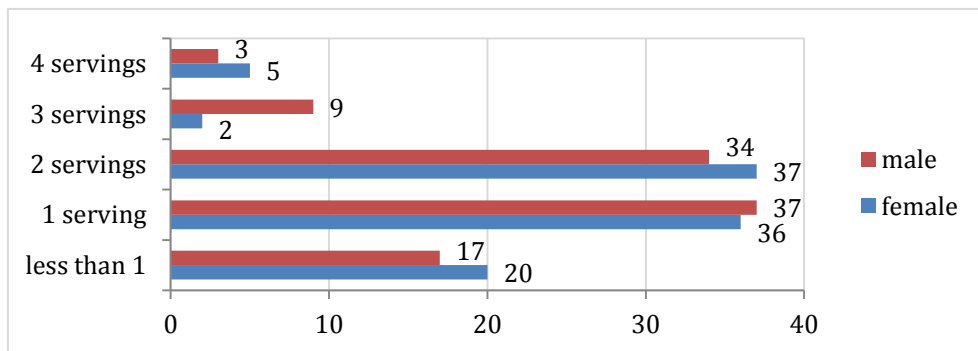


Figure 3 Consumption of fruit in relation to the gender (in %).

Table 1 Consuming fruits by respondents according to the residence place.

Number of servings	City	Village	Testing method	Outcome	Result
Less than 1	15	22	<i>F</i> -test	0.174	$p > 0.05$
1 serving	16	57	<i>t</i> -test	0.189	$p > 0.05$
2 servings	26	44	χ^2 -test	0.409	$p > 0.05$
3 servings	4	8	Cramer's V	0.216	Weak relationship
4 servings	0	8	coefficient		

Source: authors

Table 2 Consuming fruits by respondents according to the gender.

Number of servings	Female	Male	Testing method	Outcome	Result
Less than 1	19	18	<i>F</i> -test	0.897	$p > 0.05$
1 serving	33	40	<i>t</i> -test	0.784	$p > 0.05$
2 servings	34	36	χ^2 -test	0.776	$p > 0.05$
3 servings	2	10	Cramer's V	0.168	Weak relationship
4 servings	5	3	coefficient		

Source: authors

The fruit consumption and habits of respondents

The fruits can be consumed fresh as well as frozen, sterilized or otherwise modified. We were interested how many servings of fruit respondents of the survey eat daily. Majority of respondents (37%) declare that they eat 1 serving of fruit daily. Frequency of daily consumption of fruit is as follows: 18% of respondents eat less than 1 serving; 35% of respondents eat 2 servings; 6% of respondents eat 3 servings daily; 4% of respondents eat 4 servings of fruit. Not one respondent declares that eat 5 servings of fruit per day (Figure 1).

We assumed that people living in the villages consume more servings of fruit than city residents. We formulated and tested the following null hypothesis H_1 : Differences in the consumption of fruit in relation to the place of residence of a respondent are not significant.

In the Table 1 there are results of hypothesis testing to the question about the daily consumption of fruit in relation to the place of residence. From summarized results follows: Based on F -test we can conclude that differences in the variances of the samples are not statistically significant, $p = 0.174 > 0.05$. It is evident from results of two sample un-paired t -test and χ^2 -test that differences in the consumption of fruit in relation to the respondent's place of residence are not statistically significant. At a significance level of $\alpha = 0.05$ we accept the null hypothesis. And further, the value of Cramer's V coefficient proves that the relationship between the city and village in the consumption of fruit is weak. Place of residence has no impact on the consumption of fruit of respondents.

Next we assumed that women consume more servings of fruit than men. We formulated and tested the following null hypothesis H_2 : Differences in the consumption of fruit in relation to the gender of a respondent are not significant.

In the Table 2 there are results of hypothesis testing to the question about the daily consumption of fruit in relation to the gender of a respondent. From results follows: based on F -test we can conclude that differences in the variances of the samples are not statistically significant. From results of two sample un-paired t -test and χ^2 -test is evident that differences in the consumption of fruit in relation to the respondents' gender are not statistically significant. At a significance level of $\alpha = 0.05$ we cannot reject the null hypothesis. The value of Cramer's V coefficient proves that the relationship between the women's and men's consumption of fruit is weak. Gender of respondents has no impact on the consumption of fruit.

Many epidemiological studies examine the health benefits of a diet rich in fruits and vegetables. Increasing individual fruit and vegetable consumption by up to 600 g per day (the baseline of choice) could reduce the total worldwide burden of disease by 1.8% (Lock et al., 2005). During the transition from adolescence to young adulthood, the intake of fruit and vegetables tends to decline (Larson et al., 2008). Studies among young adults, university students, seem to have found a high prevalence of low fruit and vegetable consumption (<5 servings/day), e.g. Brazil 85.2% (Ramalho et al., 2012), Chile 94.8% (Mardones et al., 2009), Germany 95% (Keller et al., 2008), Saudi Arabia 73.6% (Elsoadaa et al., 2013), and UK 70% (Dodd et al., 2010).

Via consumption of fruit and fruit products, the body can receive biologically active substances, such as: total polyphenols, anthocyanins, quercetin, chlorogen acid, pterostilbene and antioxidant activity in bilberry and blueberry analyzed Habánová et al., (2013). In the Slovak Republic in year 2013 the consumption of fruits from temperate zone increased per capita per year, reaching 53.1 kg; fresh fruit consumption was 41.1 kg. Tropical fruit consumption per capita was 25.8 kg (Meravá, 2014a).

The vegetables consumption and habits of respondents

We were interested how many servings of vegetables respondents eat daily. Majority of respondents (29%) declare that they eat two servings of vegetables daily. Frequency of daily consumption of vegetables is as follows: 20% of respondents eat less than 1 serving; 26% of respondents eat 1 serving; 14% of respondents eat 3 servings daily; 11% of respondents eat 4 servings of vegetables. Not one respondent declares that eat 5 servings of vegetables per day (Figure 4).

We were interested whether the gender of the respondents demonstrates the impact on the consumption of vegetables. We assumed that women consume more servings of vegetable than men. We tested the following null hypothesis H_3 : Differences in the consumption of vegetable in relation to the gender of a respondent are not significant.

In the Table 3 there are results of hypothesis testing to the question about the daily consumption of vegetables in relation to the gender of a respondent. From results we can conclude: From the F -test follows that differences in the variances of the samples are not statistically significant. From results of two sample un-paired t -test and χ^2 -test is evident that differences in the consumption of vegetables in relation to the respondents' gender are not statistically significant. At a significance level of $\alpha = 0.05$ we accept the null hypothesis. The value of Cramer's V coefficient proves that the relationship between the women's and men's consumption of vegetables is weak. Gender of respondents has no impact on the consumption of vegetables.

In the last research question we assumed that people living in the villages consume more vegetable than city residents. We tested the null hypothesis H_4 : Differences in the consumption of vegetable in relation to the place of residence of a respondent are not significant.

In the Table 4 there are summarized results of hypothesis testing to the question about the daily consumption of vegetables in relation to the place of residence of a respondent. From results we can formulate conclusions:

From the F -test follows that differences in the variances of the samples are not statistically significant. From results of two sample un-paired t -test and χ^2 -test follow that differences in the consumption of vegetables in relation to the respondents' gender are statistically significant. At a significance level of $\alpha = 0.05$ we reject the null hypothesis and accept the alternative hypothesis that differences in the consumption of vegetable in relation to the residence place of a respondent are significant. The value of Cramer's V coefficient proves that the relationship in the consumption of vegetables is moderately strong between the respondents from the city and village.

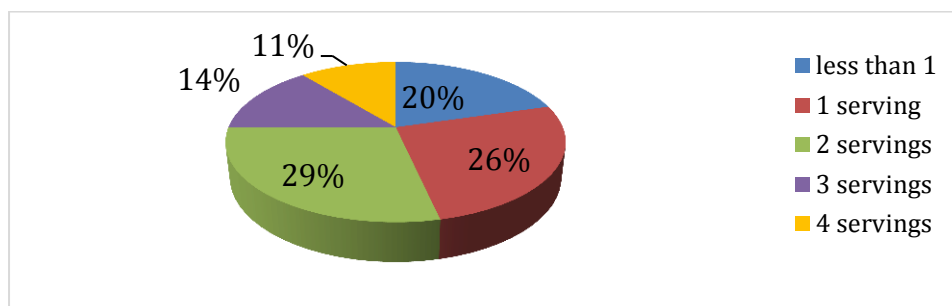


Figure 4 Consumption of vegetable per day.

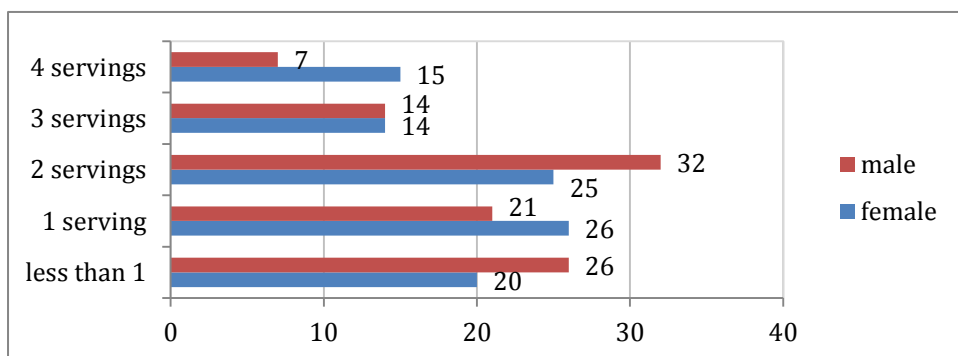


Figure 5 Consumption of vegetable in relation to the gender (in %).

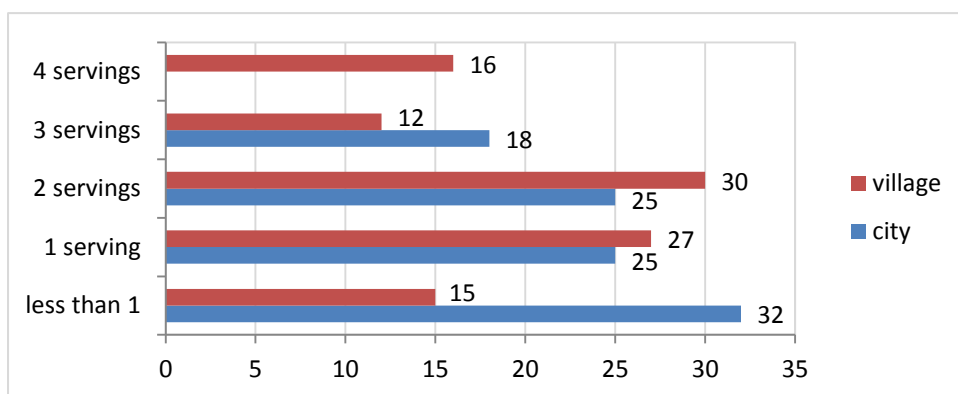


Figure 6 Consumption of vegetable in relation to the place of residence (in %).

Table 3 Consuming vegetables by respondents according to the gender.

Number of servings	Female	Male	Testing method	Outcome	Result
Less than 1	19	28	F-test	0.195	$p > 0.05$
1 serving	24	22	t-test	0.599	$p > 0.05$
2 servings	23	34	χ^2 -test	0.855	$p > 0.05$
3 servings	13	15	Cramer's V		Weak
4 servings	14	8	coefficient	0.154	relationship

Source: authors

Table 4 Consuming vegetables by respondents according to their residence place.

Number of servings	City	Village	Testing method	Outcome	Result
Less than 1	20	21	F-test	0.482	$p > 0.05$
1 serving	15	37	t-test	0.031	* $p < 0.05$
2 servings	15	42	χ^2 -test	0.039	* $p < 0.05$
3 servings	11	17	Cramer's V		Moderately strong
4 servings	0	22	coefficient	0.297	relationship

Source: authors

In this case we found that the place of residence of respondents has impact on the consumption of vegetables. We assume that increased consumption of vegetables is due to the fact that the majority of village citizens have the possibility of growing their own vegetables.

The presence of biological active substances in vegetables is examined by several authors, e.g. in spinach by Mendelová et al., (2014), in garden pea varieties Hegedüsová et al., (2015). It is widely known that healthy diet is a key factor in the prevention of chronic diseases and in maintaining the health throughout one's life. The low consumption of fruit and vegetables was classified as the 5th cause of disability. The high consumption of fruit and vegetables is linked to reduced risk of chronic diseases such as heart disorders, diabetes or cancer. The positive association between the consumption of fruit and vegetables and health improvement was demonstrated also by studies of Takaoka and Kawakami (2013).

The consumption of vegetables and vegetable products (in the case of fresh vegetables) in 2012 rose over the year by 2 408 t (+0.4 %) to 545 454 t, but the consumption of fresh vegetables decreased by 9 026 t less (-2.3%) to 375 156 t, what means that vegetable products had a higher consumption than fresh vegetables. The increase in consumption of vegetables and vegetable products per capita in the year 2013 represented 5.2 kg and consumption of fresh vegetables 5.5 kg. The highest consumption had tomatoes (17.8%), cabbage (15.1%), carrot (11.1%) and onion (8.4%). The lowest consumption had spinach (0.4%), garlic and peas (each 0.8%) and beans (0.7%) (Meravá, 2014b).

CONCLUSION

We assumed that citizens who live in villages consume more portions of fruit and vegetables than those who live in towns. In this case we accept null hypothesis $p = 0.409 > 0.05$, place of residence does not affect the respondents' consumption of fruit. Demand for fruit in the village shops is low, since local citizens grow fruit in their gardens, or they buy it directly from a producer as a sale from a farm yard (Hypothesis 1). We assumed that women consume more fruit than men. This hypothesis was not confirmed because $p = 0.776 > 0.05$. Gender does not affect the respondents' consumption of fruit (Hypothesis 2). We assumed that gender of the respondents has impact on the consumption of vegetables. This hypothesis was not confirmed, $p = 0.855 > 0.05$ and gender does not affect the consumption of vegetables (Hypothesis 3). We assumed that citizens, who live in villages, consume more vegetables than those who live in towns. This hypothesis was confirmed, testing result is $p = 0.039 < 0.05$. Higher consumption is due to the fact that the majority of citizens, who live in villages, have a possibility to grow their own vegetables and, thus, the demand for it in village shops is low (Hypothesis 4).

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