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CONSUMER SENSORY EVALUATION OF HONEY ACROSS AGE COHORTS IN SLOVAKIA

Peter Šedík,Vladimíra Kňazovická, Elena Horská, Miroslava Kačániová

ABSTRACT

The growing popularity of honey among consumers has caused many frauds and cases when honey of high quality is adulterated by cheap imported honey of very low quality. The aim of this research paper was to study consumer perception of honey quality based on sensory attributes such as taste, aroma, colour and consistency. The primary research comprised the sensory blind test conducted as a part of questionnaire survey at selected shopping mall and at university. Research sample reached 400 respondents living in the Nitra region between 18 and 70 years. Respondents tested sensory attributes of two samples. Sample A represented Slovak honey from a local beekeeper and sample B was honey purchased from selected supermarket with country of origin „blend of EU and non – EU honeys“ and represented imported honey. Besides descriptive statistics, the following statistical tests were applied: Fisher's Exact Test, Chi-Square Test of Independence, Cramer´V coefficient and Mann-Whitney U test. Results showed significant differences in perception of honey quality across age cohorts. Respondents older than 40 years (Generation X and Babyboomers) evaluated better the local honey from a beekeeper (sample A) than younger generations (Generation Y and Generation Z). Imported honey from selected supermarket (sample B) obtained the best evaluation in case of colour in both age cohorts while sample A obtained it in terms of aroma. The majority of respondents in both age cohorts mostly decided their preference according to taste, however there exist some differences. While Generation X and Baby boomers took into consideration also aroma, the generations Y and Z considered consistency. More interesting observation appealed in case of aroma where more than 90% of respondents, who decided according to aroma, preferred sample A – local Slovak honey. According to physico-chemical analysis, both samples fulfilled standard of EU legislation, however better parameters were reached in sample A. All in all, better perception of honey quality through sensory attributes in older age cohorts could be caused by the deeper experience in honey consumption as well as due to the fact that younger cohorts consume more semiproducts and industrial food products characterised by intensive, sweet taste which could confuse their assessments.

Keywords: consumer research; sensory evaluation; honey; generations; Slovakia

INTRODUCTION

In recent years, the popularity of honey has been increasing continuously at global level, mainly due to trends in food market connected with healthy eating habits, lifestyle or sustainable consumption **(Kubeláková and Košičiarová, 2016, Paluchová and Prokeinová, 2013; Gálová et al., 2012)**. The increasing consumption of honey can be seen also in Slovakia where according to **Statistical Office of the Slovak Republic (2018)** in the past 10 years the annual consumption of honey per capita has nearly doubled. Nevertheless, younger generations tend to consume less quantities than consumers older than 30 years **(Guziy et al., 2017)** and the similar situation occurs in many other European countries **(Pocol, 2011;Šanová et al., 2015; Vanyi et al., 2010; Pidek, 2001; Pocol and Teselios, 2012)**.

Furthermore, honey is perceived as a sweetener with added value as it contains many vitamins, minerals and enzymes. In many countries, honey is used not only as food, but also in medicine due to its healing properties **(Aparna and Rajalakshmi, 1999; Crittenden, 2011;Martinovski and Gulevska, 2017)**.

Increased popularity of honey among consumers is connected with frequent cases of honey adulteration and quality issues **(Šedík et al., 2018)**. According to **Phipps (2017)**, honey is the third most adulterated food in the world. Despite the fact that the European Union declares, protects, supports, registers and controls certain food and agricultural products according to quality policy and legislation **(Nagyová et al., 2014)**, the legislation allows producers to mix the imported honey from third countries with Eurpean honey and sell it as product with country of origin, formulated as follows: blend of EC honeys, blend of non – EC honeys or blend of EU and non – EU honeys **(Council Directive 2001/110/EC of 20 December 2001 relating to honey)**. The current situation provides opportunities for honey with lower quality or even fake honey, as aproximately 40% of overall consumption in the

European Union is covered by the imported honey **(European Commission, 2016)**. Honey adulteration is mostly proved in sophisticated laboratories therefore the only method for honey consumers how to determine the quality of honey is their sensory evaluation, which involves attributes such as taste, aroma, colour and consistency **(Kaakeh and Gadelhak, 2005)**.

Scientific hypothesis

The aim of this research paper is to identify consumers' perception of honey quality based on intrinsic attributes such as taste, aroma, colour and consistency of imported and local honey between age cohorts.

MATERIAL AND METHODOLOGY

Consumer research was based on questionnaire survey and blind sensory test both conducted at selected shopping mall and the University during the period of November 2017 – February 2018. The research was aimed at honey consumers living in the Nitra region. The research sample comprised 400 respondents between 18 – 70 years.

The socio-demographic profile of respondents is described as follows: 64.75% women and 35.25% men, 54.25% obtained secondary education and 45.75% higher education, 53.50% living in the city and 53.50% in the countryside. Economic activity: 53.00% students, 25.25% employed, 18.25% pensioners and 3.50% other. According to age, respondents were divided into four age cohorts – generations: 26.75% Baby boomers (51 – 70 years), 9.50% Generation X (41 – 50 years), 37.50% Generation Y (25 – 40 years) and 26.25% Generation Z (18 – 24 years).

In the sensory test, respondents tested two samples of honey. Sample A represented Slovak honey from the local beekeeper while sample B was honey purchased from selected supermarket with country of origin marked as a blend of EU and non-EU honeys which represents imported honey. Respondents evaluated sensory attributes such as taste, aroma, colour and consistency of both samples on the 5-point scale (see Tab. 1) from 1 – very good to 5 – very bad. Furthermore, respondents had to decide which sample they prefer more and indicate which sample is from a beekeeper and which from a supermarket.

We formulated several assumptions, same for both investigated countries:

Hypothesis 1: – There exist differences in sensory evaluation of honey between samples.

Hypothesis 2: – There exist differences in sensory evaluation of honey among age cohorts.

Hypothesis 3: – There exists dependence between sample preference and age cohorts.

Hypothesis 4: – There exists dependence between sensory quality criteria and sample preference.

Hypothesis 5: – There exists dependence between sensory quality criteria and age cohorts.

Statistical testing was performed in the statistical program – SAS Enterprise Guide 7.1 and the following non-parametric tests were applied:

- Fisher's Exact Test,
- Chi-Square Test of Independence,
- Cramer'V coefficient,
- Mann-Whitney U test.

The physico-chemical analysis of honey consists of water content, free acidity (FA), electrical conductivity (EC) and hydroxymethylfurfural (HMF) determinations.

Water content was measured according to **IHC (2009)** by laboratory refractometer. Crystallized samples were dissolved in a water bath at 50 °C, then cooled to room temperature. The sample was covered on the surface of the prism of the refractometer and the refractive index was read. Each sample was measured twice and the average value was taken. If the temperature of honey was not 20 °C we did correction: for temperatures above 20 °C we added 0.00023 per °C; for temperatures below 20 °C we subtracted 0.00023 per °C. The corresponding water content was read from the table according to the refractive index.

Free acidity was detected according to **IHC (2009)** by titration with a measure of pH to 8.3. We dissolved 10 g of sample in 75 mL of distilled water in a 250 mL beaker. We mixed it and titrated with 0.1 M NaOH to pH 8.3. Each sample was measured twice and the average value was taken. Free acidity was expressed as milliequivalents acid.kg^{-1} honey (mL of 0.1 M NaOH multiplied by 10).

Electrical conductivity was measured according to **IHC (2009)** by conductometer. Honey, equivalent to 20.0 g anhydrous honey (the amount was calculated according water content), was dissolved in distilled water and transferred to 100 mL volumetric flask and made up to volume with distilled water. The conductivity cell was immersed in the sample solution and the conductance in mS was read. Electrical conductivity (mS/cm) was calculated – conductance was multiplied by cell constant.

Hydroxymethylfurfural (HMF) is a heterocyclic aldehyde which occurrence depends on the heat and period of storage (Kňazovická, 2011). HMF was measured by reflectometer (Merck) and HMF test (Merck). Both reaction zones of test strip were immersed in the honey for 1 s and then we followed the instructions of the producer. The HMF in mg.L-1was found by this way. The HMF in mg.kg^{-1} was calculated - HMF in mg.L^{-1} was divided by the specific gravity of honey (depending on water content).

Results were compared to the EU honey limits – **Council Directive 2001/110/EC** (water content, free acidity, HMF, electrical conductivity) and with standard of SZV (the Slovak Association of Beekeepers) no. 1 (water content – max 18%, HMF content – max 20 mg.kg^{-1}).

RESULTS AND DISCUSSION

Table 1 Sensory blind test.

	Sample A	Sample B
Taste		
Aroma		
Colour		
Consistency		

Results of the sensory blind test showed significant differences in evaluation between age cohorts. Respondents older than 40 years representing Generation X and Baby boomers evaluated sample A (local honey) better than sample B (imported honey) in average (see Figure 1). The best evaluation was obtained by aroma A (1.5), followed by taste A (1.6), consistency A (1.7) and colour A (1.8). The worst evaluation was obtained by aroma B (3.5), followed by taste B (3.1), consistency B (2.8) and colour B (2.7). Respondents younger than 40 years representing Generation Y and Generation Z (Figure 2) evaluated the samples similarly, in average, than previous age cohorts, however differences between the evaluation of the samples are smaller. Even in case of colour, sample B obtained better evaluation. The best evaluation was obtained by consistency A (2.0) followed by taste A (2.1), colour B (2.3) and colour A (2.4). The worst evaluation was obtained by aroma B (3.3), followed by aroma A (3.0), taste B (2.8) and consistency B (2.5).

Furthermore, the differences in evaluation between the samples A and B of each age cohort were statistically tested by applying Mann-Whitney U test. According to the Table 2, statistically significant differences (<0.0001) in case of Generation Y and Babyboomers were proven in all sensory attributes, while in case of younger generations – Generation Y and Generation Z it was proven in taste (<0.0001), aroma (<0.0001) and consistency (<0.0001). The first hypothesis was confirmed and there exist differences in sensory evaluation of honey between samples. The second formulated hypothesis examined whether the evaluation of the samples differs between age cohorts. Based on the same test, the statistically significant differences exist in the evaluation of all sensory attributes besides consistency B (0.0949) therefore hypothesis 2 was confirmed. Different sensory perception between age cohorts is shown by sample preference, where 80% of respondents older than 40 years preferred local honey (sample A) while only 53% of respondents younger than 40 years preferred sample A. These differences (hypothesis 3) were statistically tested by applying Fisher's Exact Test which proved (Table 3) that there exists dependence between sample preference and age cohorts (<0.0001). The similar results were obtained in a study dealing with sensory marketing and its impact on consumer's purchasing behavior. Sensory perception as well as perception of sensory marketing varies across the age cohorts **(Géci et al., 2017)**.

Besides sensory evaluation, respondents indicated according to which sensory attributes they decided their preference (quality of honey). The most decisive attributes regarding the quality of honey (Figure 3) is taste (58.8%) followed by aroma (16.5%), consistency (14.8%). The least important attribute is the colour (7.9%). Moreover, the study examined if there exists the depedence between sensory attributes as quality criteria and sample preference (hypothesis 4). By applying Chi-Square Test of Independence, the statistically significant dependence was proven (<0.0001) with weak strength of dependence where Cramer´s V coefficient = 0.2083 (Table 3). Interesting observation occurred with aroma attribute where the majority of respondents (≥90%) preferred local honey (sample A).

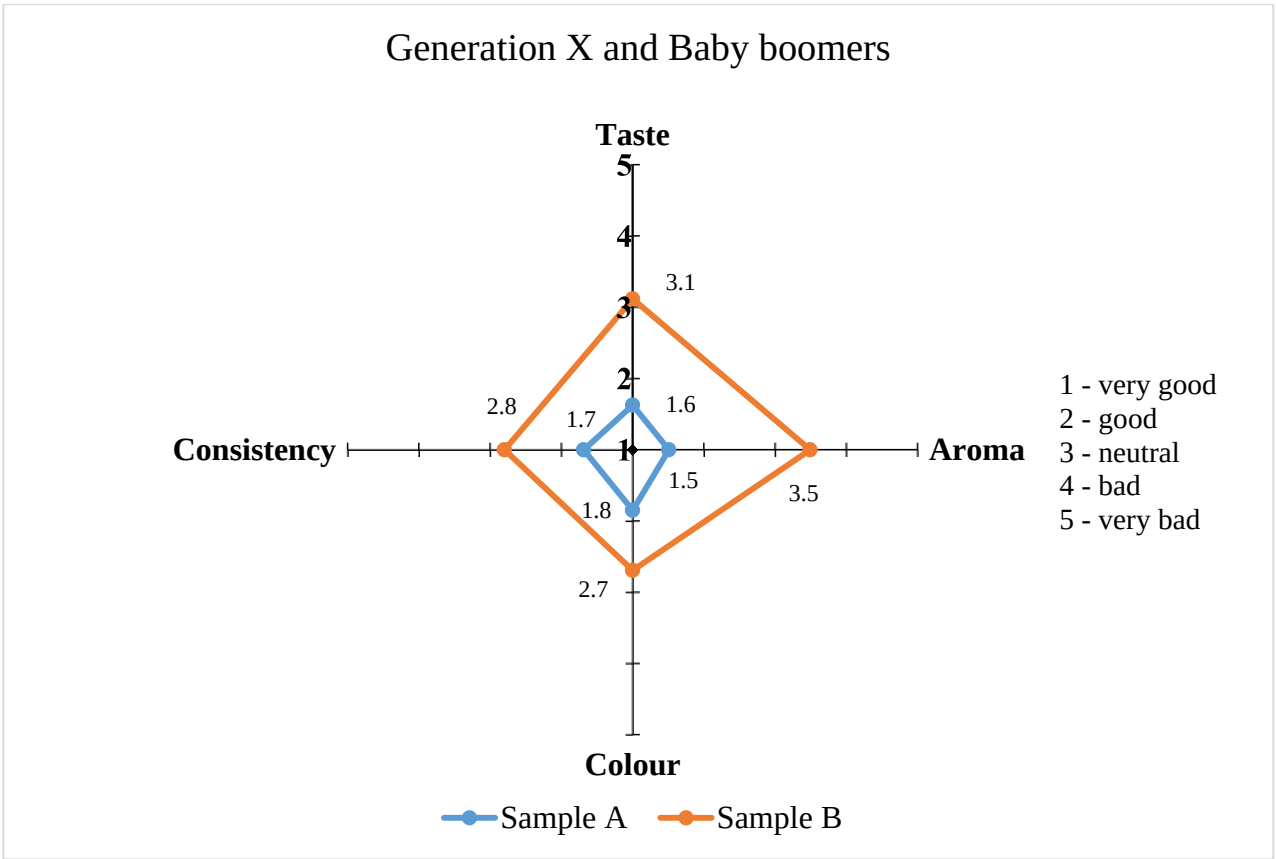

Figure 1 Sensory evaluation of honey samples by Generation X and Baby boomers.

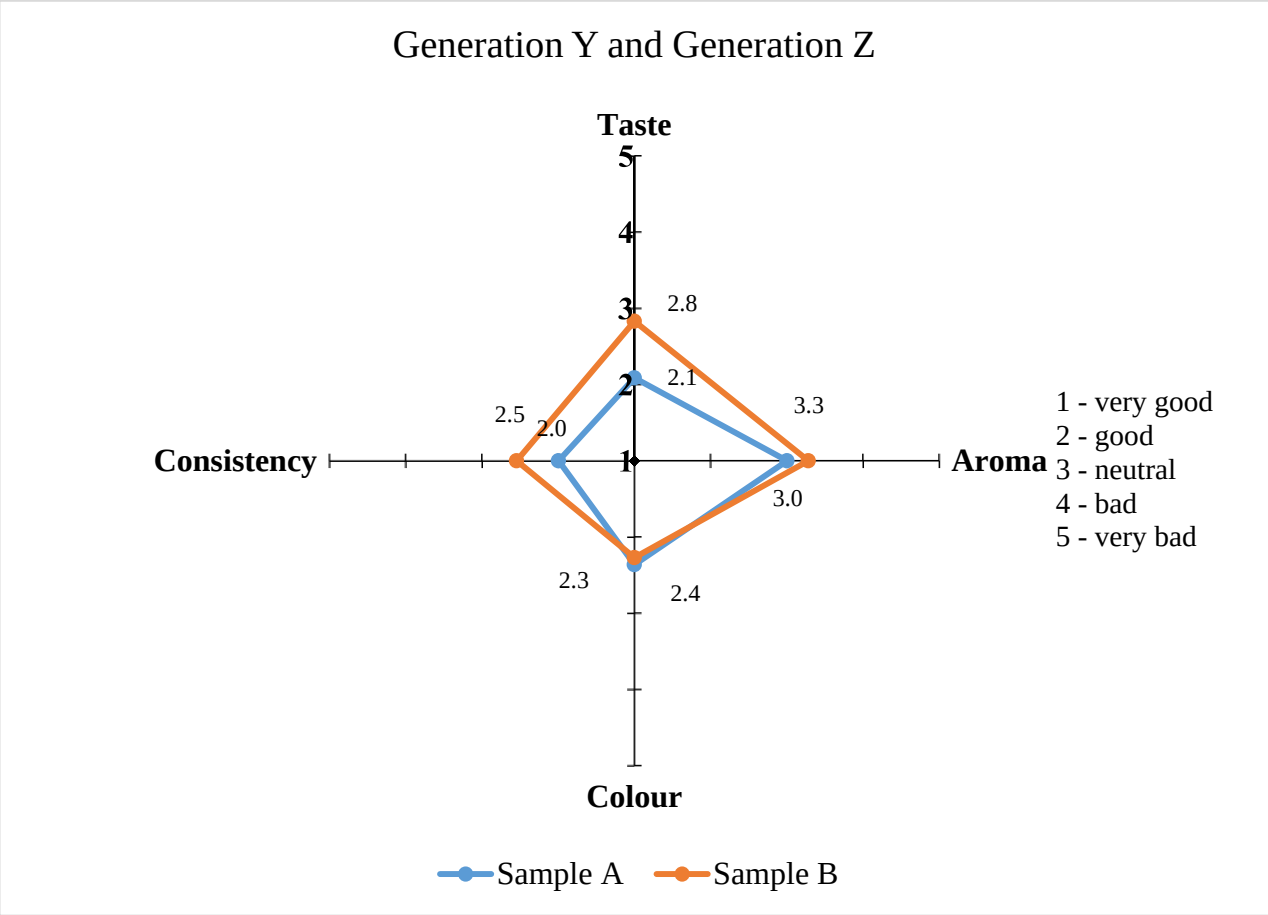

Figure 2 Sensory evaluation of honey samples by Generation Y and Generation Z.

Table 2 Results of Mann-Whitney U test.

Sensory evaluation between samples	Generation X and Baby boomers (*p*-value)	Generation Y and Generation Z (*p*-value)	Sensory evaluation between cohorts	Sample A (*p*-value)	Sample B (*p*-value)
Taste	<0.0001	<0.0001	**Taste**	<0.0001	0.0428
Aroma	<0.0001	<0.0001	**Aroma**	0.0377	0.0321
Colour	<0.0001	0.0921	**Colour**	<0.0001	0.0051
Consistency	<0.0001	<0.0001	**Consistency**	0.0006	0.0949

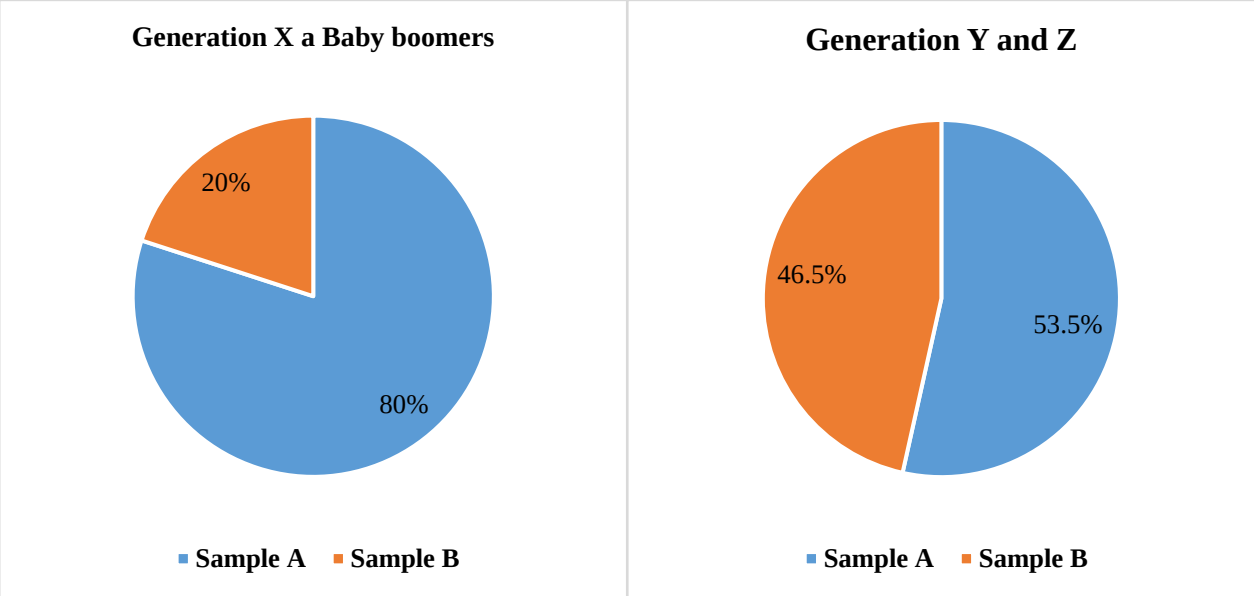

Figure 3 Annual consumption of honey in Slovakia and Russia.

Moreover, decisive criteria – sensory attributes were compared between age cohorts. Chi-Square Test of Independence has proven statistically significant dependence (<0.0001) between sensory attributes and age cohorts (hypothesis 5) with weak strength of dependence where Cramer´s V coefficient = 0.1845 (Table 3). The results illustrated in Figure 4 show differences between age cohorts. Taste is the most frequent decisive factor regarding the honey quality, and the colour is the least frequent for both age cohorts. Nevertheless, for Generation X and Baby boomers the second frequent decisive factor is aroma while for Generation Y and Z it is consistency.

The sensory blind test which represents the consumer point of view on the honey quality was supported by laboratory analyses of physico-chemical parameters of both samples to determine honey quality according to the EU honey legislation – **Council Directive 2001/110/EC**. Physico-chemical parameters included water content, Free acidity, electrical conductivity and HMF. Results showed that both samples fulfilled the selected criteria (Table 4), nevertheless local honey – sample A possesses better

Table 3 Results of Chi-Square Test of Independence and Fisher's Exact Test.

	p-value	correlation	Cramer´s V coefficient
sample preferences and age cohorts	<0.0001	yes	-
sensory attributes and sample preferences	<0.0001	yes	0.2083
sensory attributes and age cohorts	0.0001	yes	0.1845

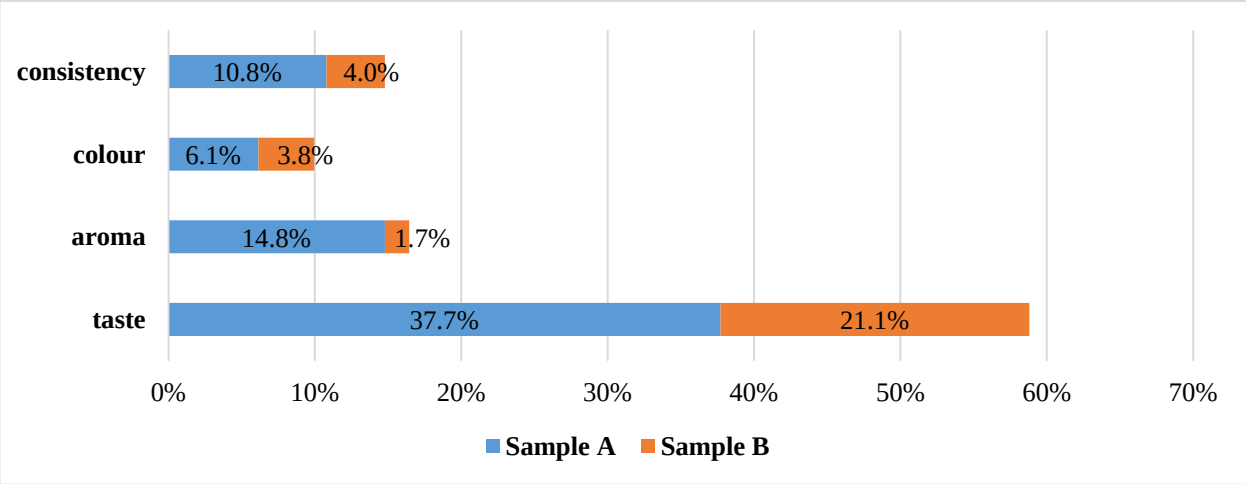

Figure 3 Respondents' sensory quality criteria according to sample preference.

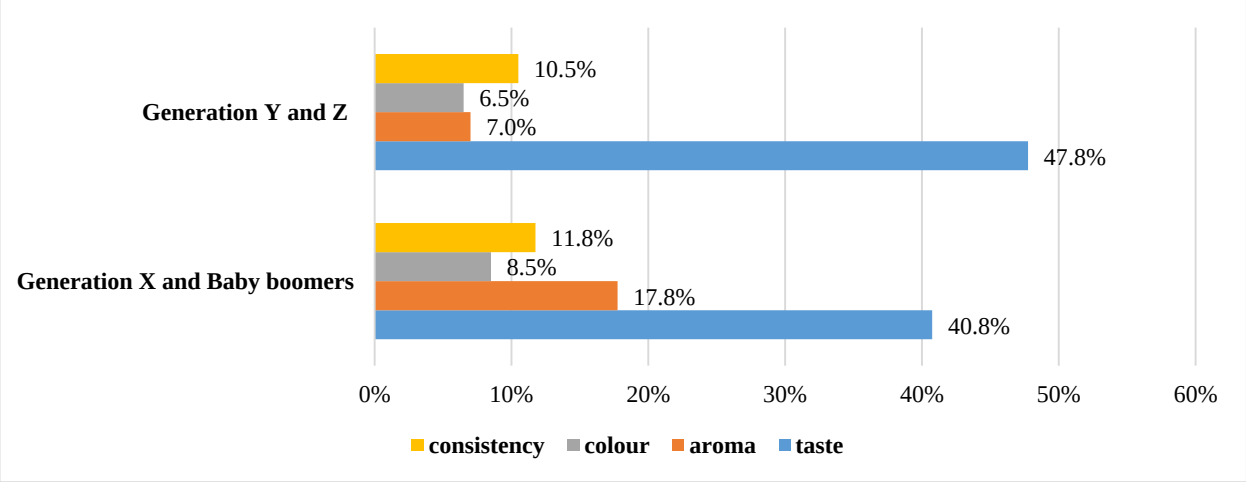

Figure 4 Respondents' sensory quality criteria according to age cohorts.

Table 4 Results of physico-chemical parameters.

	Water content (%)	**Free acidity** (meq kg^{-1})	**Electrical conductivity** (mS cm^{-1})	**HMF** (mg.kg^{-1})
EU Standard (SZV standard)	max 20 (18)	max 50	blossom - max 0.8	40 (20)
Sample A	15.4	15.8	0.37	11.9
Sample B	18.8	6.3	0.22	22.7

parameters and therefore has higher quality than imported honey – sample B. Moreover, the results of physico-chemical parameters were compared with standard of Slovak Association of Beekeepers (SZV standard) which was created as trademark „Slovak honey“ and as a variant which is more strict than EU legislation mainly due to frequent scandals in food industry and as consumer dissatisfaction with food safety **(Golian et al., 2018)**. According to this standard in terms of water content and HMF the only sample which has fulfilled the requirements was the sample A – local Slovak honey. Customers should be more aware of the uniqueness and the quality of domestic products and prefer them rather than products from abroad **(Nagyová et al., 2018)**.

Sensory test is an esential tools in determining the quality of honey, however, it has been mostly used for determining botanical origin, regions or sensory profile **(Kaakeh and Gadelhak, 2005)**. The most commonly used method to identify the botanical and geographical origin of honey is to apply the physicochemical parameters **(Popek, 2002)** as well as sensory analyses to differentiate and declare honey quality and profile **(Piana et al., 2004; Castro-Vazquez et al., 2009; Lorente et al., 2008; Oddo and Piro 2004)**. Sensory perspective of honey was studied in several countries such as Spain **(Galán-Soldevilla et al., 2005; González-Vinas et al., 2003)**, Italy **(Esti, 1997)** or India **(Anupama et al., 2003)**, Denmark **(Stolzenbach et al., 2012)**, Hungary **(Szabó et al., 2016)**, and Serbia **(Popov-Raljic et al., 2015)**, and all studies implemented ratings of colour, texture, taste, flavour or aftertaste. Nevertheless, sensory test provides information about perception of product quality **(Stolzenbach et al. 2011)**.

Understanding the consumer's expectations and how they perceive product attributes can be applied in the development of product strategy **(Stolzenbach et al. 2012)**.

CONCLUSION

Consumer research has proven different sensory perception among consumer based on sensory blind test involved in the questionnaire survey realised in Slovakia.

Quality perception of honey based on sensory attributes showed significant differences between age cohorts.It could be concluded that different perception among age cohorts could be caused by several reasons. Respondents older than 40 years – Generation X and Baby boomers preferred more local honey (sample A) due to their deeper experience in honey consumption and the ability to recognise honey of Slovak origin. Respondents younger than 40 years – Generation Y and Generation Z were more confused in sensory blind test and only 53.5% preferred local honey. It could be caused by the fact that younger consumers consume less quantity and therefore do not have many experience with Slovak honey. Furthermore, taste perception among age cohorts could be influenced by different eating habits and structure of the diet. Younger generations are more used to intensive, sweet taste by consuming semiproducts and industrial food products than older consumers. In conclusion, consumers should consider the fact that in many cases natural products do not have an intensive taste or colour as commercialised products. Moreover, in sensory evaluation they should decide not only according to taste, but also aroma as honey from beekeeper should have at least some aroma.

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Contact address:

Ing. Peter Šedík, Slovak University of Agriculture, Faculty of Economics and Management, Department of Marketing and Trade, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, E-mail: sedik.peter@gmail.com

Ing. Vladimíra Kňazovická, PhD., Slovak University of Agriculture, Faculty of Biotechnology and Food Sciences, Department of Evaluation and Processing of Animal Products, Trieda A. Hlinku 2, 949 76 Nitra, Slovakia, E-mail: vladimira.knazovicka@uniag.sk

prof. Dr. Ing. Elena Horská, Slovak University of Agriculture, Faculty of Economics and Management, Department of Marketing and Trade, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, E-mail: elena.horska@gmail.com

prof. Ing. Miroslava Kačániová, PhD., Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Sciences, Department of Microbiology, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, E-mail: Miroslava.kacaniova@gmail.com