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RESEARCH REPORT

Flavour and identification threshold detection overview of Slovak adepts for certified testing

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Abstract

OBJECTIVES: During certification process of sensory assessors of Slovak certification body we obtained results for basic taste thresholds and lifestyle habits.
MATERIALS AND METHODS: 500 adult people were screened during experiment with food industry background. For analysis of basic and non basic tastes, we used standardized procedure of ISO 8586-1:1993.
RESULTS: In flavour test experiment, group of (26–35 y.o) produced the lowest error ratio (1.438), highest is (56+ y.o.) group with result (2.0). Average error value based on gender for women was (1.510) in comparison to men (1.477). People with allergies have the average error ratio (1.437) in comparison to people without allergies (1.511). Non-smokers produced less errors (1.484) against the smokers (1.576). Another flavour threshold identification test detected differences among age groups (by age are values increased). The highest number of errors made by men in metallic taste was (24%) the same as made by women (22%). Higher error ratio made by men occurred in salty taste (19%) against women (10%). Analysis detected some differences between allergic/non-allergic, smokers/non-smokers groups.

INTRODUCTION

Losing one of the human senses, whether partial or complete, temporary or permanent, decreases a quality of human life. Despite the fact that the most important human sense is considered to be sight, losing any other human sense comes to worse perception of environment we live in and decreases a quality of life. Loss of taste does not allow us enjoying a meal, or even properly prepare it. Loss of smell does not allow us to perceive odour which belongs to our life and evokes different emotions or even warn us of danger, e.g. the smell of smoke. Smell is also closely related with the taste, so the loss of smell may cause food less appetizing (Horčin 2002; Vietoris *et al.* 2008).

Loss of sense may have many causes. It can be caused by certain diseases, as a side effect of using certain drugs, head trauma, may be congenital (such as colour blindness) or even may occur due to aging (Kopec & Horčin 1997). There is lot of studies comparing influence of aging in food taste

perception (Kramer *et al.* 2007; Mojet *et al.* 2003), even relations between taste and smell (Mojet *et al.* 2005).

In addition to everyday use of the senses for perception of environment we live in, senses can also be used in sensory analysis. Sensory analysis is a scientific discipline that uses human senses for the purposes of sensory evaluation of quality of food (Khodaeva *et al.* 2013). We use senses to evaluate the characteristics of food as smell, taste and their intensity, consistency, appearance, total palatability and acceptability of food. The objectivity of the results of sensory analysis is discussed, but using the appropriate and objective conditions for assessment and the selection of appropriate assessors, it is possible to achieve objective results. Very important is choosing the correct methodology. Selection of assessors consists in teaching and training people, checking and testing their knowledge of sensitivity of the senses, and retraining later. Methods for testing of the senses are specifically designed to check the sensitivity of taste, smell, colour vision, to provide the information about the threshold of sensitivity on basic tastes of individuals, flavour memory, recognition of basic tastes and odours. Very important role during stimuli recognition play cognitive functions.

Tab 1. The concentration of the substance in $g.l^{-1}$ reference substance for the test resolution tastes.

Reference substance	Concentration of stock solution ($g.l^{-1}$)
Citric acid	0.43
Caffeine	0.195
Sodium chloride	1.19
Sucrose	5.76
Monosodium glutamate	0.595
Tannic acid	0.50
Ferrous sulphate heptahydrate	0.00475

MATERIAL AND METHODS:

During the experiment, we evaluate the results of the 500 people who participated in the sensory tests in 2006–2011. The group consists of 391 women and 109 men divided into 5 age categories: under 25 years, 26–35 years, 36–45 years, 46–55 years, 56 years and older. In the group of people, there were 99 smokers and 401 were non-smokers. The number of people with allergies was 64, while people without allergies were 436. Taste solutions were prepared to demineralized water in day of experiment and stored in ISO EN 8586-1:1993 conditions. Taste solutions were served in one minute intervals to avoid lingering of former taste concentrations. All facilities and equipment during experiment were done by ISO EN 8589:2007 ISO standard.

Flavour test

Flavour test is based on the determination of the character in 10 different flavours, with possibility of repeating the same taste. Used solutions were sweet, salty, sour, bitter, metallic, astringent, umami taste and clear water. Concentrations are given in Table 1.

Flavour threshold identification test

The role of the flavour threshold identification test is gradually tasting samples with a rising intensity of taste until the determination the character of the taste. For taste detection is important physiology function. Even cognitive functions have important role during taste recognition. Concentrations of individual tastes are given in Table 2.

RESULTS AND DISCUSSION

Sweet and umami taste occurs twice in 360 tests, in the remaining 140 tests metallic and salty taste occurs twice. The average number of errors per person is 1,502. The average number of errors depending on age shows the highest average number (2.00) in the age category

Tab. 2. Concentration of the diluted samples of each flavour with increasing concentrations for the flavour threshold test.

Order of samples	Sour $g.l^{-1}$	Bitter $g.l^{-1}$	Salty $g.l^{-1}$	Sweet $g.l^{-1}$	Umami $g.l^{-1}$	Astringent $g.l^{-1}$	Metallic $g.l^{-1}$
1	0.13	0.06	0.16	0.34	0.08	0.105	0.0007
2	0.16	0.07	0.24	0.55	0.12	0.131	0.0009
3	0.20	0.09	0.34	0.94	0.17	0.164	0.0013
4	0.25	0.11	0.48	1.56	0.24	0.205	0.0019
5	0.31	0.14	0.69	2.59	0.34	0.256	0.0027
6	0.38	0.17	0.98	4.32	0.49	0.320	0.0039
7	0.48	0.22	1.40	7.20	0.70	0.400	0.0056
8	0.60	0.27	2.00	12.00	1.00	0.500	0.0080

56 years and older. The second highest average number (1.863) was in the age group under 25 years. The age group 26–35 years was with the lowest average number of errors (1.438), the age category 36 to 45 years had an average number of 1.477 errors and the age category 46–55 years is slightly lower on 1.447.

Average number of errors based on gender was only slightly higher among women (1.510) than men (1.477). People with allergies have the average number of errors made in the flavour threshold test lower (1.437) than people without allergies (1.511). The average number of errors in the flavour threshold test between smokers (1.576) is only slightly higher than non-smokers (1.484).

In the individual age groups were people often wrong in recognizing metallic and umami tastes. People were very good in recognizing sour and astringent taste. There were 22 people in the age group up to 25 years, the highest total errors (11) was taken at a metallic taste, 10 errors were made in bitter taste and 9 errors in umami taste. On the contrary, no error was made in the astringent taste in this age group (Figure 1).

There were 146 people in the age group 26–35 years. The most errors occur in umami taste (49) and metallic taste (43). Less errors occurred in bitter taste (36), in water and salty taste (26) and 20 errors occurred in sweet taste. At least only 6 errors occurred in sour and astringent taste.

The age category 36–45 years consisted of 153 people with the highest sum of errors in metallic taste (52), bitter and umami taste (46) and in water it was 40 errors. Few mistakes were made in astringent taste (3) and no error occurred in sour taste. The age category 46–55 years consisted of 152 people. They also made the most mistakes in metallic taste (49). Fewer mistakes were made in bitter taste (46), umami taste (35) and water (32). Only 3 errors were made in sour taste and 5 errors in astringent taste.

In the age group 56 years and older, 27 people participated in the test. They made 14 errors in metallic taste and 11 errors with water. 8 errors occurred in salty taste, 6 errors in sweet, bitter and umami taste. Only 3 errors occurred in sour taste, in astringent taste people of this age group did not make any mistake (Table 3).

The highest number of errors in each age category, except the category 26–35 years, was in metallic taste. In the age category 26–35 years, the highest number

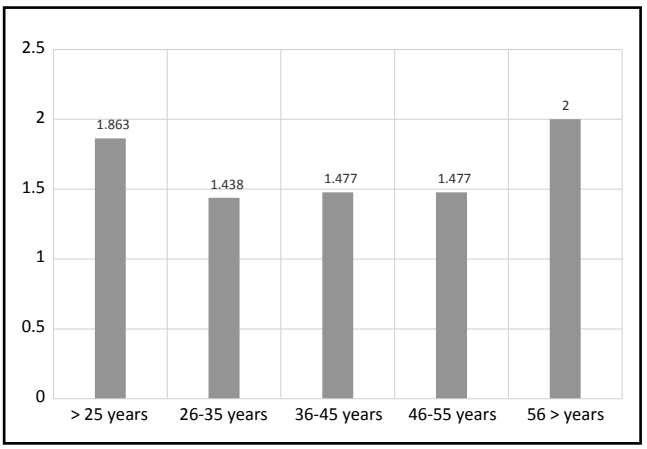

Fig. 1. Average number of errors in the flavour threshold test depending on the age.

Tab. 3. Errors in different age groups in the perception of basic tastes.

Age category	Errors made in identification of tastes:	Wrong identification of taste for:							
		water	sweet	salty	sour	bitter	metallic	astringent	umami
Under 25 years	Metallic (26.83%)	64%	0	0	0	36%	0	0	0
	Bitter (24.39%)	30%	0	0	10%	0	60%	0	0
	Umami (21.95%)	0	0	45%	0	33%	22%	0	0
26–35 years	Umami (23.11%)	10%	4%	42%	6%	19%	13%	6%	0
	Metallic (20.28%)	54%	2%	0	2%	21%	0	12%	9%
	Bitter (16.98%)	56%	0	0	3%	0	33%	3%	5%
36–45 years	Metallic (23.00%)	46%	6%	2%	2%	33%	0	9%	2%
	Bitter (20.35)	50%	2%	2%	4%	0	28%	7%	7%
	Umami (20.35%)	4%	0	52%	0	22%	11%	11%	
46–55 years	Metallic (22.27%)	31%	2%	4%	4%	39%	0	14%	6%
	Bitter (20.91%)	43%	4%	9%	7%	0	26%	9%	2%
	Umami (15.91%)	14%	6%	23%	3%	23%	26%	5%	
56 years and older	Metallic (25.93%)	36%	7%	7%	7%	14%	0	29%	0
	Water (20.37%)	0	0	18%	9%	37%	36%	0	0
	Salty (14.81%)	25%	0	0	37%	0	13%	0	25%

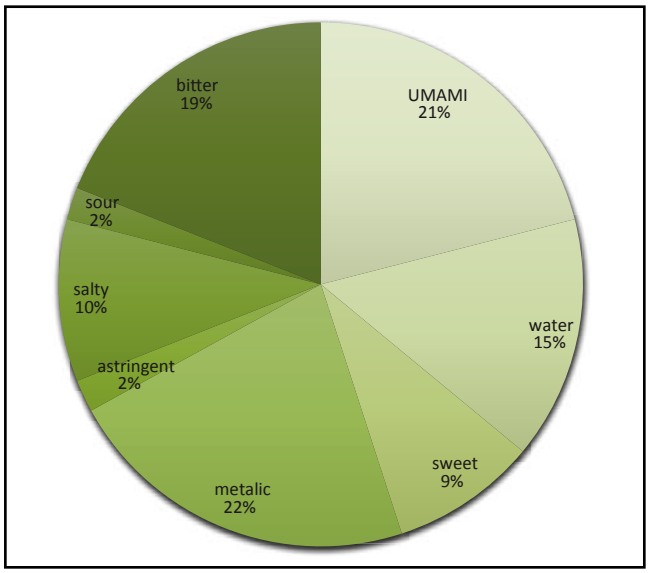

Fig. 2. Errors made by women in individual tastes in flavour test.

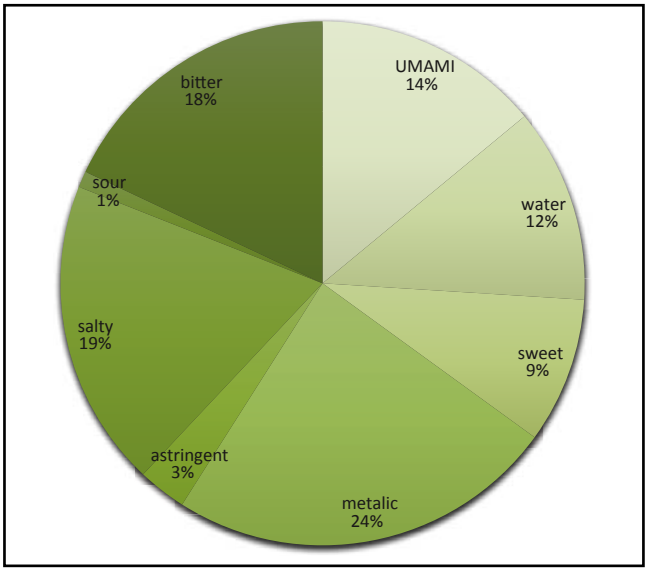

Fig. 3. Errors made by men in individual tastes in flavour test.

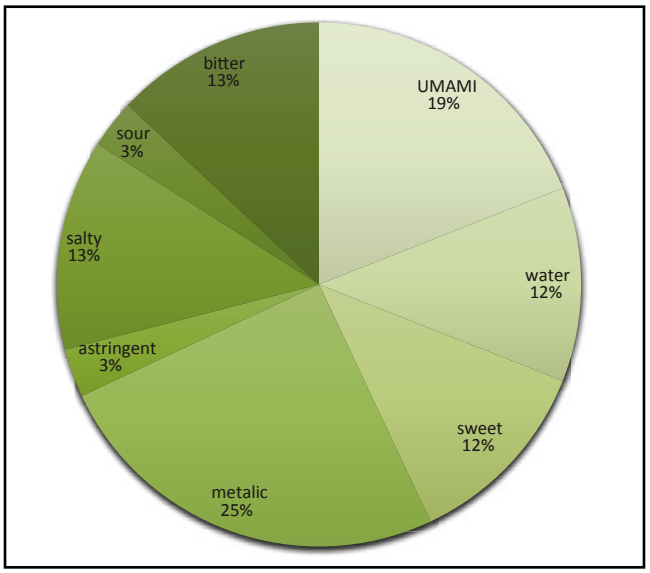

Fig. 4. Errors made by allergics in individual tastes in flavour test.

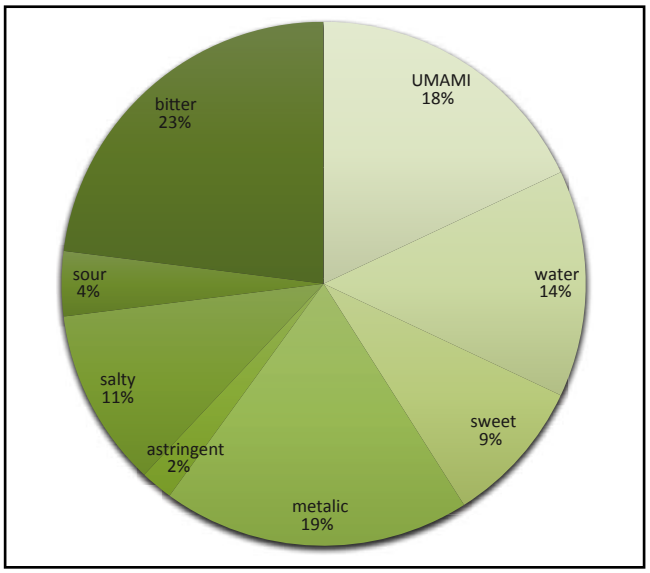

Fig. 5. Errors made by smokers in individual tastes in flavour test.

of errors was in umami taste. Then, in age categories under 25 years, 36–45 years and 46–55 years, the wrong identificated taste was bitter. In the age category 26–35 years it was the metallic taste and in the age category of 56 years and older it was water. Then the errors occurred in umami taste in the age categories under 25 years, 36–45 years and 46–55 years. In the age category 26–35 years, it was a bitter taste and in the age category 56 years and older it was a salty taste.

The metallic taste was mostly wrong identificated as a bitter, water or astringent taste. The umami taste was often wrong identificated as a salty, bitter or metallic taste. The bitter taste was wrong identificated as a metallic taste or water. The salty taste was mostly wrong identificated as umami, sour taste or water and finally water was wrong identificated as a metallic taste (Figures 2 and 3).

The highest number of errors made by men was the same as made by women in metallic taste (24%). Less errors made by men occurred in salty taste (19%), bitter taste (18%) and umami taste (14%). With the identification of the water it was 12% and in the sweet taste it was 9% (Barborová *et al.* 2013)

(Bartoshiuk 1994) declares that the differences between men and women are given by the concentration of papillae. The correlation between the number of taste papillae and the taste perception was confirmed by Miller (1990).

Both women and men made the least errors in astringent taste (3%) and sour taste (1%).

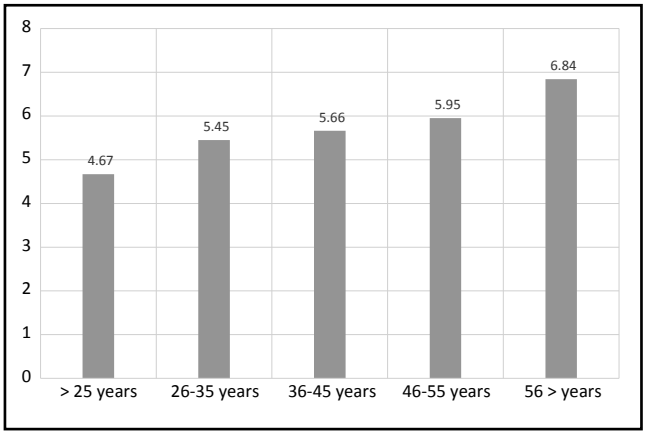

Fig. 6. An average number of sample in order of increasing concentrations in which the sour taste was identified according to the age group.

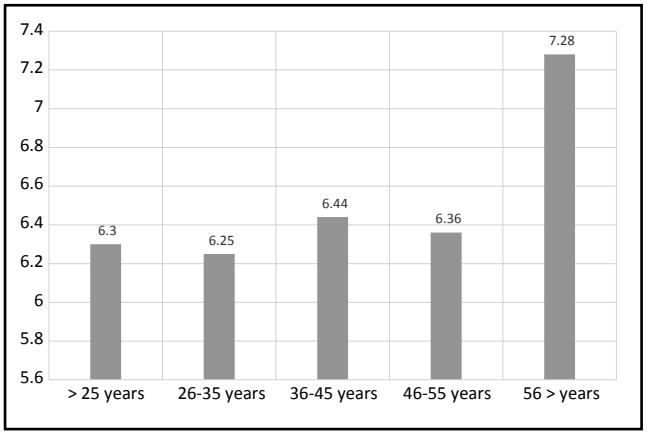

Fig. 7. An average number of sample in order of increasing concentrations in which the sweet taste was identified according to the age group.

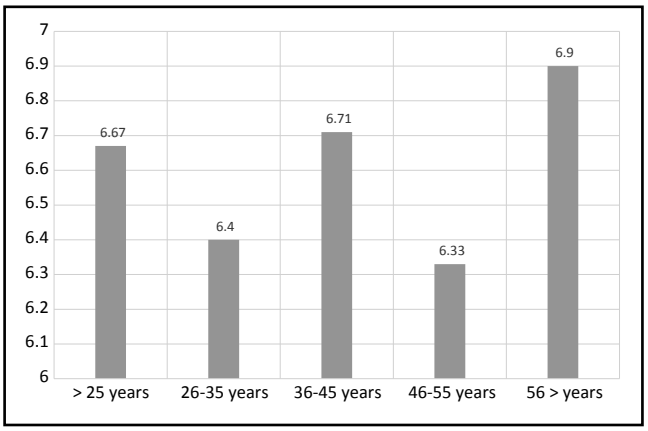

Fig. 8. An average number of sample in order of increasing concentrations in which the astringent taste was identified according to the age group.

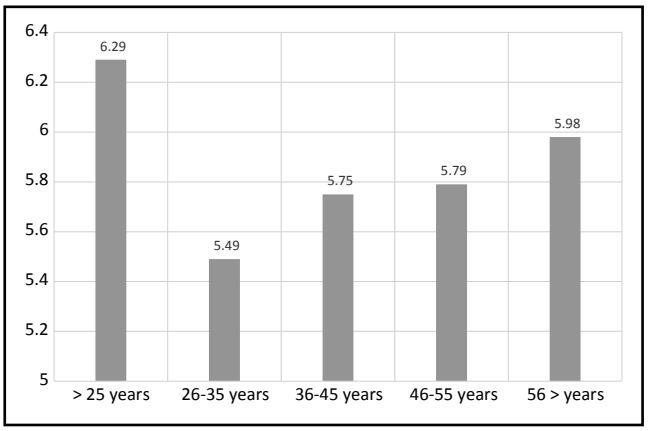

Fig. 9. An average number of sample in order of increasing concentrations in which the bitter taste was identified according to the age group.

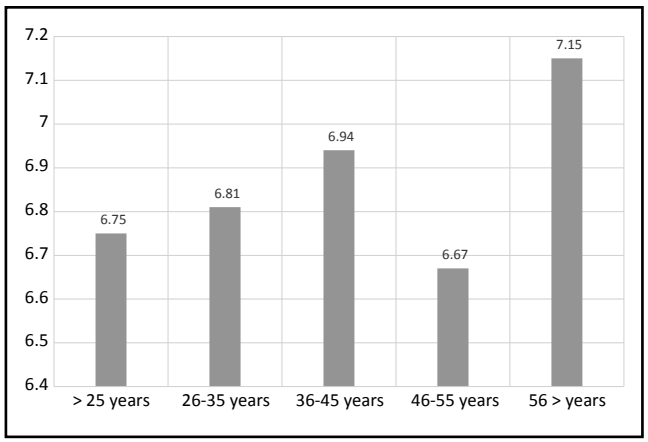

Fig. 10. An average number of sample in order of increasing concentrations in which the umami taste was identified according to the age group

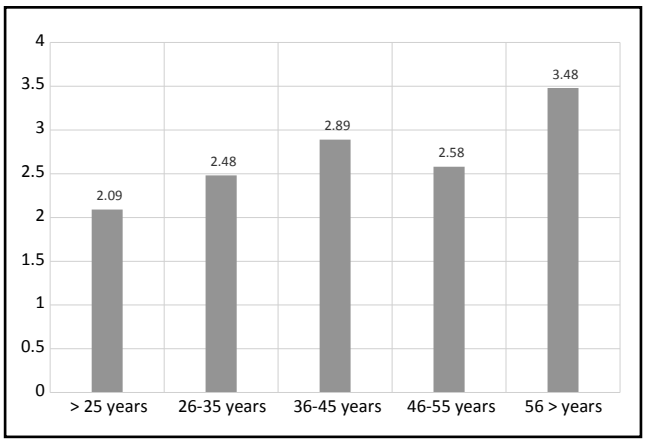

Fig. 11. An average number of sample in order of increasing concentrations in which the salty taste was identified according to the age group.

The average number of errors made by people with allergies (1.44) is lower than by non-allergic (1,511). The highest number of errors in group of allergics was similar between women and men in a metallic taste (25%), then in umami taste (19%), in bitter taste (13%), in salty taste (13%), then with the same number of errors (12%) in sweet taste and water. The fewest mistakes made by allergics were in sour taste (3%) and in astringent taste (3%).

Tab. 4. Errors made by smokers in individual tastes and their wrong identification in %.

Taste	Number of errors in individual tastes in flavour threshold test	Wrong identification of taste in %						
		Sweet	Salty	Sour	Bitter	Metallic	Astringent	Umami
Sweet	8%	–	–	17%	–	67%	16%	–
Salty	11%	11%	–	11%	22%	11%	–	45%
Sour	9%	29%	–	–	29%	28%	–	14%
Bitter	20%	6%	12%	–	–	44%	19%	19%
Metallic	29%	9%	9%	4%	48%	–	26%	4%
Astringent	10%	–	–	–	37%	50%	–	13%
Umami	13%	–	30%	10%	30%	20%	10%	–

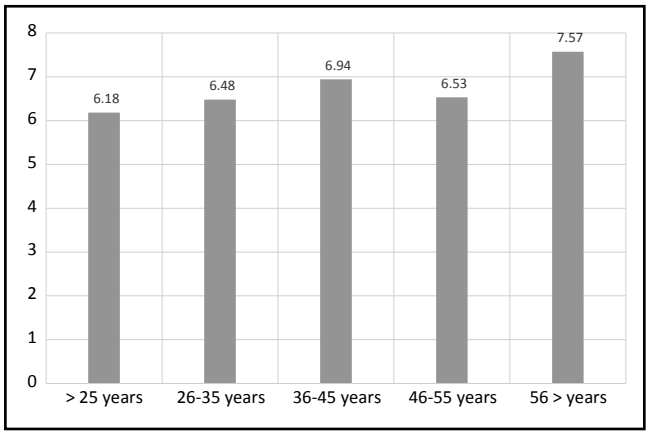

Fig. 12. An average number of sample in order of increasing concentrations in which the metallic taste was identified according to the age group.

The average number of errors in group of smokers (1.59) is higher than in group of non-smokers (1.48). In comparison with allergics, smokers made the highest number of errors in a bitter taste (23%) and then in a metallic taste (19%). Then in umami taste (18%), water (14%), salty taste (11%), sweet taste (9%) and sour taste (4%). The fewest errors made by smokers was in an astringent taste (2%). The similar results have already been found in the study (Hong 2005), in addition, he has also analysed the correlation between the perception of the basic tastes in interaction with PTC, or PROP (Pasquet 2002). Another study of bitter flavonoids was published by (Karvaj *et al.* 2007; Karvaj 2007) (Figures 4 and 5).

While evaluating the flavour threshold test we have divided the assessors into age groups and analysed in which concentration of solution they would identify the wanted taste (Figures 6–12). The concentration of solutions is given in Table 2. The results are summarized in Table 4.

CONCLUSIONS

Variability of taste perception is different across age groups and allergies. Lot of the experiments concluded diversity of taste perception by even genetic factor – perception genetics. One of the main intention of the study was to select subjects for future studies. Interaction between cognitive functions, genetics and taste perception will be promising field of evaluation for the future. During experiments of perception genetics should be even interesting to analyse interaction between taste and aroma losing by age and life style.

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