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Taste disorders in the elderly

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Introduction: Disorders of the sense of taste mainly affect the elderly. There are many factors that contribute to their development, including various types of chronic diseases, polypharmacy, and the use of stimulants. Taste impairments lead to improper nutritional behaviour in the elderly, which may cause deterioration of their health and reduce their quality of life.

Goal: The aim of the study was to estimate taste deficits in the elderly.

Method: The participants were 24 persons aged 70–86. Sample size was limited by the number of available professional taste test kits (for identification of the four basic gustatory qualities: sweet, salty, sour, and bitter). The respondents were assisted by a researcher to fill in a survey about their health status, eating habits, and subjective assessment of their taste function.

Results: Most of the elderly persons assessed their taste function as being good, and the rating increased with the age of the participants. However, the organoleptic test showed that taste identification became less accurate with age. The participants had the greatest trouble recognizing the salty (58%) and sour (79%) tastes and had much less difficulty identifying the sweet (96%) and bitter (92%) tastes. The subjects' perception of taste became less and less intense with age.

Conclusions:

1. The seniors were the least likely to accurately recognize the salty taste.
2. With age, the accuracy of identification of sweet, sour, bitter and salty gustatory qualities became lower.
3. The positive subjective assessment of the taste function in the elderly did not go hand in hand with their actual taste perception, which declined with age.
4. The use of stimulants such as alcohol and tobacco, pharmacological treatment of chronic diseases, and use dental prostheses reduced the perceived intensity of taste.
5. The taste disorders observed among the elderly can lead to dietary mistakes and thus negatively affect their health.

Key words: dysgeusia, seniors, eating habits, health risks

Introduction

The sense of taste is one of the least investigated senses. It provides taste sensations, but also has a protective function as a barrier that warns one against the danger of eating spoiled food or poison. The sense of taste also participates in the digestive process, stimulating the secretion of digestive enzymes [3]. The perception of taste depends on taste buds, the sensory organs located in different parts of the tongue. With age, the size and number of taste buds decreases, which is why disorders of the sense of taste mainly affect the elderly. However, in addition to age-related changes, there are many other factors that impact the perception of taste. These primarily include neurological disorders and mental and metabolic diseases. Changes in taste perception can also be triggered by medications, as well as stimulants such as alcohol or tobacco. Also the use of dentures or presence of amalgam fillings in teeth can cause changes in the perception of gustatory stimuli [1,4]. The perception of the intensity of the sweet taste is lost first, followed by salty, sour and bitter. Disturbances in the taste function negatively affect the general health of elderly people. They cause the weakening of appetite, and, in consequence, malnutrition and deficiencies of vitamins and macro- and micronutrients. Taste impairments lead to improper food choices. Disturbances in the perception of the salty taste make people use excessive amounts of salt with their food, which may increase the risk of hypertension or aggravate the existing symptoms. In turn, impaired perception of sweetness often leads to increased sugar (sucrose) intake, contributing to the development of type II diabetes. Disorders of the sense of taste indirectly reduce the quality of life. Elderly people suffering from taste deficiencies take no pleasure in preparing and consuming food and do not feel the need to look for variety in their meals [1].

Participants and method

The aim of the study was to estimate taste deficits in the elderly. The study group consisted of senior citizens participating in a senior activation programme run at a day support centre (Zespół Ośrodków Wsparcia, Lwowska 28, Lublin). The participants were asked to fill out a survey questionnaire (most often with the assistance of a researcher) and took a taste test, which was conducted using disposable taste strips. The organoleptic tests were carried out using a professional taste test kit consisting of taste strips (Burghart Messtechnik GmbH, Germany; distributed in Poland by NaturFarm Piotr Wojciechowski). The test had been approved for use in Primary Health Care. Four taste tests (sweet, sour, salty and bitter) were

available for each of the senior participants. The number of subjects was limited by the number of taste tests available. Apart from a taste identification test, the participants were also tested for intensity of taste perception. The study had been approved by the Bioethics Committee. Consent had also been obtained from the Head of the support centre and individually from each senior citizen participating in the study.

Overall, 24 elderly persons were examined; the average age of the subjects was 78.33 ± 3.48 years; the youngest participant was 70 and the oldest was 86 years old. Four participants were aged 70–75, eleven belonged to the age group of 76–79 year-olds, and nine were 80 and over. There were 21 women and 3 men among the participants. Twenty three persons had at least one chronic disease: 16 patients had cardiovascular diseases, 9 suffered from diabetes, 6 had gastro-oesophageal reflux, and 5 had diseases of the nervous system (including Parkinson's disease). Two participants were active smokers and four had smoked tobacco in the past; the others were non-smokers. More than a half of the respondents (fourteen, 58%) declared that they did not consume alcohol at all, and out of the 10 seniors who reported consuming alcohol, 9 used it occasionally, several times a year. Four of the subjects had their own teeth (did not have a denture), six had a partial (top or bottom) prosthesis, and the remaining fourteen had complete prostheses.

Results

Nutritional behaviours associated with gustatory perception

A vast majority of the respondents (88%, $n = 21$ out of 24) declared that they had not increased the amount of sugar they took in their tea in the previous few years. Most of the respondents (83%, $n = 20$ out of 24) also declared that they had not increased the frequency of adding salt to their dishes in the previous few years. The major part of the elderly who took part in the study declared a good or very good perception of sour taste in a sauerkraut tasting task (88%, $n = 21$ out of 24). A similar result was obtained with regard to bitter taste in a test in which the participants were asked to taste bitter medicine; a vast majority of the respondents ($n = 20$ out of 24) claimed that they felt the bitter taste "strongly" ($n = 8$) and "rather strongly" ($n = 12$).

Table 1. Percent of participants declaring very good perception of the four gustatory qualities by age group

Very good taste perception:		Age [years]			Whole group
		70-75.	76-79.	80 and>	
sweet	n	1	4	6	11
	%	25%	36%	67%	46%
sour	n	1	5	7	13
	%	25%	45%	78%	54%
salty	n	1	6	5	12
	%	25%	55%	56%	50%
bitter	n	2	5	5	12
	%	50%	45%	56%	50%

Subjective evaluation of the taste function

The subjects evaluated their subjectively-viewed level of taste perception. Almost half of the respondents (46%, n = 11) declared that they perceived the sweet taste very well, the same number of respondents evaluated their perception of sweetness as being good, and two seniors believed they had a reduced ability to sense sweetness. The self-evaluated perception of sour taste was very good in over half of the participants (54%, n = 13), good in ten seniors, and poor in one elderly person. Half of the respondents (50%, n = 12) declared they had a very good ability to taste salty things, nine subjects reported a good perception of saltiness, and three stated they had a reduced perception of the salty taste. The self-evaluated perception of bitter taste was very good in half of the seniors (50%, n = 12), good in ten elderly participants, and poor in two subjects. None of the respondents reported a complete loss of taste perception for any of the evaluated gustatory qualities. It was observed that the older the subjects were, the more likely they were to give a better evaluation of their taste function with regard to the four types of taste receptors (Table 1).

The organoleptic taste perception test

Prior to testing, one set of taste strips was tested by the researcher to check how well the strips represented the four gustatory qualities. In the researcher's opinion, each taste was well represented and each was also felt very strongly. The elderly participants had not consumed any food or flavoured beverages and had not used stimulants (coffee, cigarettes, alcohol) for at least one hour before taking the test.

The sweet taste presented on the test strips was accurately recognized by 23 out of the 24 subjects (96%). One of the female respondents misidentified that taste as sour. The woman was a non-smoker, consumed alcohol only occasionally and was the only participant who did not suffer from any chronic disease.

The participants had the greatest difficulty recognizing the salty quality. Only 14 out of the 24 respondents (58%) recognized it accurately. Two of the respondents described the strip impregnated with salty taste as bitter-sweet, four as sour, the others did not feel any particular taste.

The sour taste was correctly recognized by 19 out of the 24 subjects (79%). Two of the subjects described the taste of the strip impregnated with the sour taste as being bitter, two other participants recognized the taste as salty, and one as sweet.

The bitter quality was the most accurately recognized taste (22 of the 24 respondents, 92%). One participant recognized the taste of the bitter strip as sour and another one as salty.

Taste perception and age

Among the seniors who participated in the study, the frequency of accurate taste identification in the organoleptic test decreased with age. The greatest difficulties in accurately recognizing the salty taste quality were observed in individuals aged 80 and over, as less than half of them (44%, $n = 4$ out of 9) recognized it correctly. Also, only half of the respondents aged 70–75 (50%, $n = 2$ out of 2) were correct in their identification of the salty taste. The only participant who incorrectly identified the sweet taste was in the group of senior citizens aged 80 and over. All subjects aged 70–75 performed correctly on the sour taste identification task; sour taste was accurately recognized by 73% ($n = 8$ out of 11) of the participants aged 76–79 and 78% ($n = 7$ out of 9) of those aged 80 and over. Identification of bitter taste was also slightly poorer in subjects at a more advanced age: this gustatory quality

was correctly identified by 89% (n = 8 out of 9) of the subjects aged 80 and over and 91% (n = 10 out of 11) of the subjects aged 76–79 [Table 2].

Table 2. Participants' performance on the taste identification test by age

Accurate identification of taste quality		Age [years]			Whole group
		70–75.	76–79.	80 and>	
sweet	N	4	11	8	23
	%	100%	100%	89%	96%
sour	n	4	8	7	19
	%	100%	73%	78%	79%
salty	n	2	8	4	14
	%	50%	73%	44%	58%
bitter	n	4	10	8	22
	%	100%	91%	89%	92%

Medications and taste perception

Among the subjects who took oral anti-diabetic medications, there were individuals who incorrectly recognized salty and sour taste during the identification test. Two out of the five diabetic participants (40%) failed to identify correctly the salty taste and one – the sour taste. Two of the diabetic participants were treated with insulin and none of them accurately identified the salty taste. The subjects who were treated pharmacologically for cardiovascular diseases also most often had problems with proper identification of the salty (n = 7 out of 16, 44%) and sour (n = 4 from 16.25%) tastes. Moreover, one female participant did not recognize sweetness and another failed to identify bitterness. Taste perception impairments were also present among pharmacologically-treated neurological patients, including Parkinsonian patients. They most often misidentified the sour (60%, n = 3 out of 5) and salty (40%, n = 2 out of 5) tastes and one participant failed to recognize the sweet taste. Of the six subjects with gastroesophageal reflux, half (50%, n = 3 out of 6) misidentified the salty quality and one failed to recognize the bitter taste (17%, n = 1 out of 6). One of the three subjects suffering from peptic ulcer disease did not properly recognize the bitter taste (33%, n = 1 out of 3). One subject who was treated for cancer, incorrectly recognized the salty taste.

Stimulants and taste perception

The prevalence of tobacco smoking, similarly to alcohol consumption, was small in the study sample. Nonetheless, several relationships were observed. One (out of two) active smokers failed to recognize the salty taste (50%, $n = 1$ out of 2), but identified all the other tastes accurately on the taste identification test. Among the four ex-smokers, one failed to identify the sweet (25%, $n = 1$ out of 4) and sour tastes (25%, $n = 1$ out of 4). Among the individuals who had never smoked tobacco, all correctly identified the sweet taste in the organoleptic test, half misidentified the salty taste (50%, $n = 9$ out of 18), four failed to recognize the sour taste (22%, $n = 4$ out of 18) and two – the bitter taste (11% , $n = 2$ from 18).

Alcohol intake in the studied population was low, and people who reported using alcohol did so sporadically, several times a year. It was observed that the perception of saltiness depended on the use of alcohol and the frequency of alcohol intake. The salty taste was not recognized by 31% of those who did not drink alcohol ($n = 4$ out of 13), 44% of those who drank alcohol occasionally ($n = 4$ out of 9) and all those who reported regular consumption of small amounts of alcohol ($n = 2$ out of 2).

Taste perception and denture wearing

Participants wearing a (partial or complete) denture were more likely to misidentify the salty taste. Two thirds of the subjects with a partial denture (67%, $n = 4$ out of 6) and one third with a complete tooth prosthesis (36%, $n = 5$ out of 14) failed to accurately identify the taste of the salty test strip. Among the respondents who had their own teeth, one person incorrectly identified the salty taste (25%, $n = 1$ out of 4). In the case of perception of the other gustatory qualities, the results for people with and without dentures were comparable.

Adding extra salt and sugar to meals

Inaccurate perception of the specific tastes may be accompanied by inappropriate eating habits, for example, adding extra salt or sugar to food products and beverages so that their perceived taste is sufficiently intensive. In this connection, the relationship between the accuracy of the participants' perception of the salty taste (tested in the organoleptic strip test) and the frequency of adding salt to dishes was analysed. The participants who incorrectly identified the salty taste were more likely to have the habit of adding extra salt to their meals.

Among the respondents who often added salt to their meals, 67% (n = 2 out of 3) misidentified the salty taste in the organoleptic test (for details, see Table 3).

Only one subject failed to accurately identify sweetness in the organoleptic test. The same person declared that he/she decidedly had not sweetened drinks or dishes in the previous few years.

Table 3. Adding extra salt to meals and accuracy of taste perception

The salty taste was identified		Use of extra salt compared with past use				Whole group	
		more frequent	less frequent	decidedly less frequent	undefined		
incorrectly	n	2	5	3	0	10	
	%	67%	45%	33%	0%	42%	
correctly	N	1	6	6	1	14	
	%	33%	55%	67%	100%	58%	
Total		n	3	11	9	1	24

Intensity of perceived taste

In addition to testing whether the participants perceived or did not perceive a given taste during the organoleptic test, observations were also made regarding the intensity of taste perception rated on a scale from 1 to 5 (1–very weak, 5–very intense).

With age, the intensity of perception of taste decreased, especially for the sweet gustatory quality: the mean intensity rating was 4.5 in the group of 75 year-olds and younger, 4.3 in the group aged 76–79 years, and 3.8 in the group of subjects aged 80 and over. Furthermore, the oldest age group also had the lowest mean values of intensity of perceived taste for the remaining gustatory qualities (Fig. 1).

In subjects with peptic ulcer disease, each of the tastes was more often felt by those suffering from it. A similar relationship with regard to the sour and salty tastes was observed in patients with gastroesophageal reflux.

Interesting findings were obtained when the intensity of perceived taste was studied in relation to smoking. The intensity of perception of each of the four tastes was the lowest in active smokers (Fig. 2). Also, for all of the studied gustatory qualities, the intensity of perception was higher in the subjects who did not use alcohol at all: the largest difference was observed for the salty taste (Fig. 3).

A lower intensity of perception of the sour, sweet and bitter tastes was noted in diabetic patients treated with insulin (Fig. 4). Also, a reduced perceived intensity of each of the four tastes was observed in persons who took medication for neurological disorders (including levodopa) (Fig. 5).

The subjects who had their own teeth and did not use dentures assessed their perception of each of the tastes as being more intense than did those with a partial or complete denture (who perceived the sweet and salty tastes as being the least intense) (Fig.6).

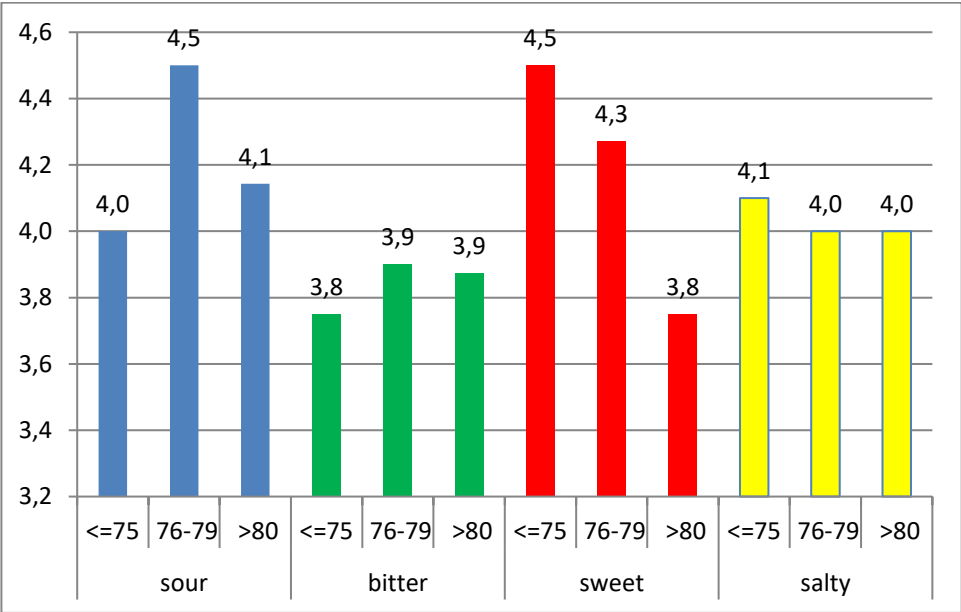


Fig. 1. Intensity of taste and the age of the subjects

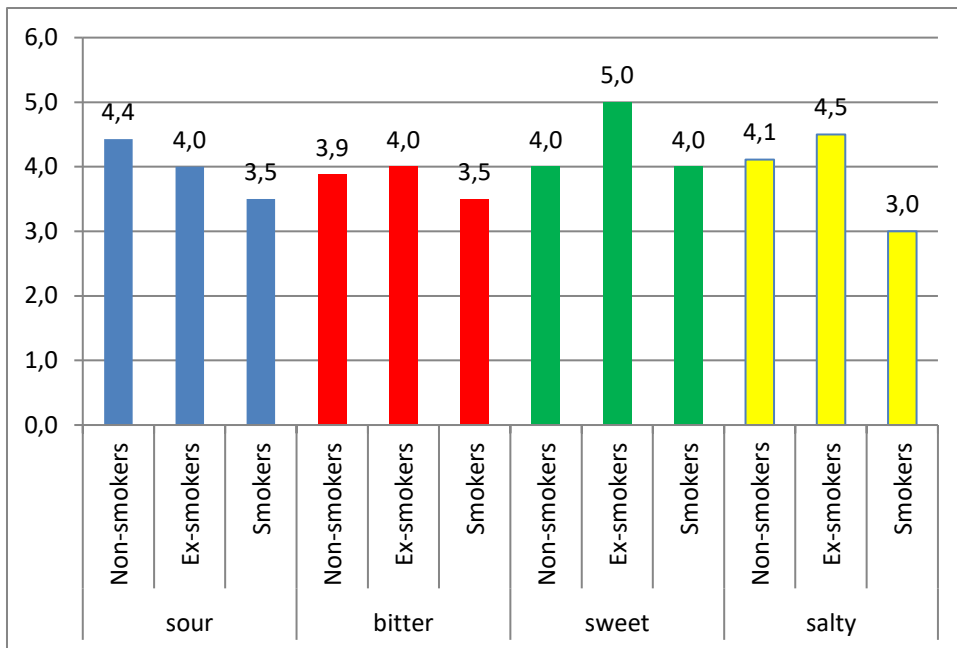


Fig. 2). Intensity of taste perception and smoking habits in the senior citizens

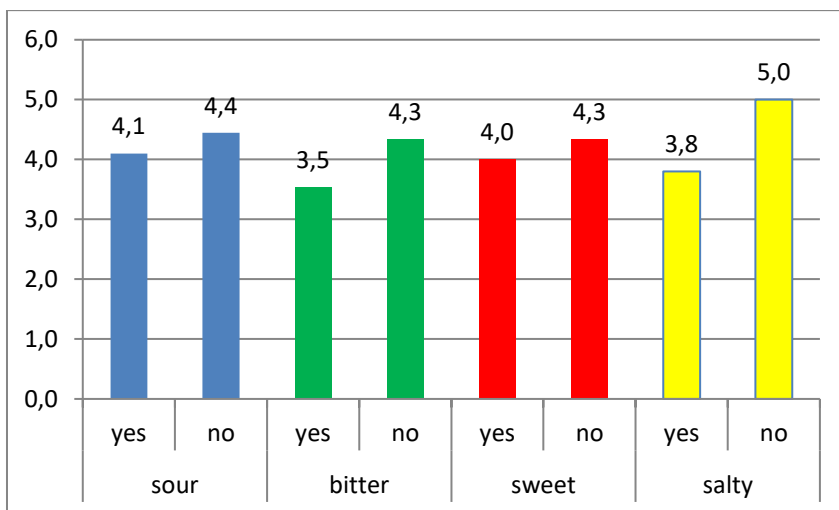


Fig. 3). Alcohol use and the intensity of taste perception

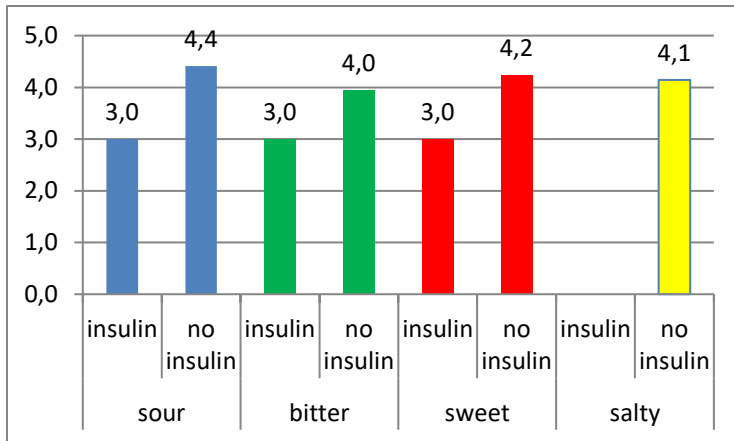


Fig. 4). Intensity of taste and use of insulin as part of anti-diabetic therapy

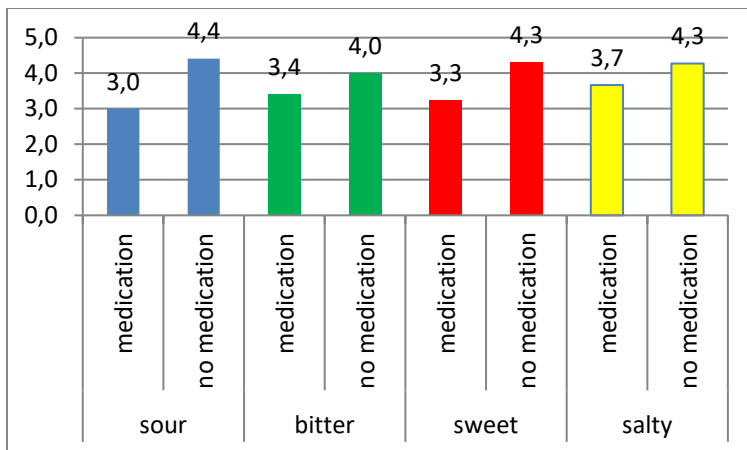


Fig.5. The use of pharmacotherapy for neurological diseases and the intensity of perceived tastes

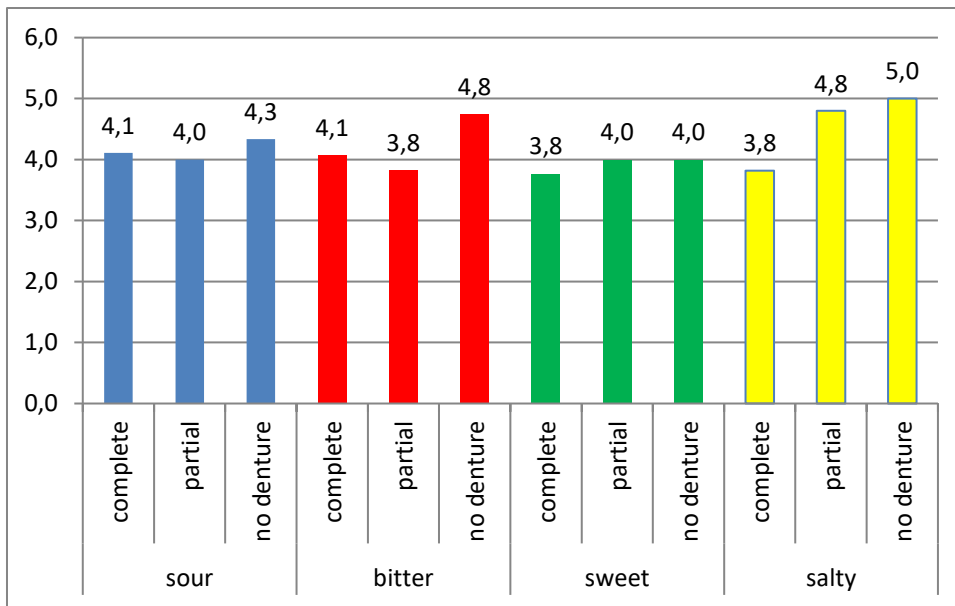


Fig. 6 The use of dentures and the intensity of taste perception

Discussion

There exist many factors that cause alterations in taste perception in the elderly. They depend on both anatomical changes associated with ageing and environmental factors. An analysis of the results obtained in the study showed that the older the participants were, the more likely they were to assess the subjectively-viewed function of the sense of taste as very good. However, organoleptic (strip) tests demonstrated that more subjects had problems with accurate identification of tastes than declared in the questionnaire administered prior to the test. The present study also indicated that accurate taste perception deteriorates with age. This finding is in line with the observations of Konopka et al. and Balczewska et al., who have also drawn attention to the relationship between the patient's age and the occurrence of taste disorders [4,5]. Along with aging, atrophic changes occur within the mucous membrane of the tongue and the number of taste buds decreases, which results in weaker transmission of taste sensations [7]. This may be the reason why the threshold of taste perception becomes higher in the elderly population [1].

Changes in taste perception are also influenced by pharmacotherapy. There are many drugs that have side effects which manifest as deficiencies in taste perception and changes in the intensity of that perception. In the present study, subjects who used anti-diabetic medications had problems recognizing the salty and sour tastes. The situation was similar for

the individuals who were treated for diabetes with insulin, because these persons perceived the tastes as being much less intense than did the seniors who did not use insulin. Balczewska and Nowak have found in their study that taste impairments occur in people with diabetes and are dependent on the degree of metabolic control [1]. In this present study, the participants who reported using medications for cardiovascular diseases also had problems accurately recognizing tastes, especially saltiness. Borakowska-Siennicka et al. has observed that pharmacotherapy used in cardiac diseases exerts a negative effect on taste perception [9]. Similar dependencies were observed in our study in neurological, gastroesophageal reflux, and cancer patients (the cancer patient did not receive chemotherapy).

Some authors report that taste perception is negatively affected by the use of stimulants such as alcohol and tobacco [5]. In the study group, the prevalence of smoking and alcohol consumption was low. Nevertheless, it was observed that people who were active smokers at the time of the study perceived the tastes as being less intense than did ex-smokers and non-smokers. One exception was the bitter taste, for which the intensity of perception was similar for non-smokers, former smokers, and active smokers. The results of the present investigation are confirmed by a study by Kasperski and colleagues, who have established that smokers feel the bitter taste better than do non-smokers [5]. Our study also shows that the accuracy of taste perception is reduced in people who drink alcohol occasionally or regularly. None of our participants was addicted to alcohol, however, it is worth noting that, according to a study by Niedzielska, a high percentage of dysgeusia is observed in alcohol addicts [8].

Taste disorders in the elderly may also occur due to the use of dentures. An inappropriate design of the prosthesis may accelerate the disappearance of lingual warts [4]. The analysis of the present results showed that people who did not have any dentures were better at recognizing the intensity of tastes than the participants who wore dental prostheses. In addition, it can be noted that people with complete (top and bottom) dentures perceived sweet and salty tastes less intensely than persons who wore partial dentures (top or bottom) or had no dental prosthesis. Kasperski and colleagues believe that sensitivity to all four tastes decreases in the first stage of use of removable dentures. As the patient gets used to wearing the denture, the threshold of sensitivity is reduced, but no return to the baseline values has been observed. [5]

Conclusions:

1. The seniors were the least likely to accurately recognize the salty taste.
2. With age, the accuracy of recognition of sweet, sour, bitter and salty gustatory qualities became lower.
3. The positive subjective assessment of the taste function in the elderly did not go hand in hand with their actual taste perception, which declined with age.
4. The use of stimulants, such as alcohol and tobacco, pharmacological treatment of chronic diseases and use of dental prostheses reduced the perceived intensity of taste.
5. The taste disorders observed among the elderly can lead to dietary mistakes and thus negatively affect their health.

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