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Scientific articles

La quimiopercepción de las sensaciones gustativas primarias del sabor en estudiantes adultos de la especialidad en gerontología

Chemoperception of the primary taste sensations of taste in the adult students of Specialty in Gerontology

Quimiopercepção das sensações gustativas primárias do sabor em estudantes adultos especializados em gerontologia

Juan Carlos López Barajas

Universidad de Guadalajara, México

Juan.lbarajas@academicos.udg.mx

<https://orcid.org/0000-0002-0503-2824>

Adolfo-Yakov Castañeda-Navarrete

Universidad de Guadalajara, México

yakov.cnavarrete@academicos.udg.mx

<https://orcid.org/0000-0002-7212-9335>

José Luis Cabrera González

Universidad de Guadalajara, México

luis.cabrera@academicos.udg.mx

<https://orcid.org/0000-0001-8635-8449>

Jessica Lizet Bautista Hernández

Universidad de Guadalajara, México

jessica.bautistah@academicos.udg.mx

<https://orcid.org/0000-0002-4543-3593>

Roberto Carlos López Barajas

Universidad de Guadalajara, México

robertocarlos_99@hotmail.com

<https://orcid.org/0000-0003-0484-9792>



Resumen

Mejorar los hábitos alimenticios en la edad adulta evita perder la percepción de los sabores, entre otros beneficios, lo cual fue notorio en esta investigación. El abuso de alimentos procesados genera cambios en las papilas gustativas, que puede resultar en una pérdida de apetito, dando como consecuencia una inadecuada alimentación y disminución en la calidad de vida. Los distintos sabores percibidos, como el sabor básico de los alimentos, son detectados por las papilas de la lengua, evaluando dos aspectos: percepción gustativa e intensidad de sabores, mismos que fueron probados por las personas que se sometieron, previo consentimiento, a la identificación de pruebas discriminativas de cuatro diferentes sabores. La comparación por ordenamiento consistió en que las personas enumeren una serie de muestras en forma decreciente de los sabores básicos.

De los principales resultados se destaca que el 25% de las personas manifiesta tener dificultad por apreciar el sabor ácido, mientras que el 25% manifiesta tener afinidad por percibir más fácilmente los sabores amargo y dulce; así pues, la comparación de las pruebas sensoriales aplicadas muestran que no todos los adultos perciben y detectan los sabores de manera igualitaria.

Palabras clave: quimiosensoriales, estímulos, sensoriales, percepción sensorial.

Abstract

Improving eating habits in adulthood avoids losing the perception of flavors, which was notable in this research, among other benefits. The abuse of processed foods generates changes in the taste buds, which can result in a loss of appetite, resulting in inadequate nutrition and a decrease in quality of life. The different flavors perceived, such as the basic flavor of food, are detected by the papillae of the tongue, evaluating two aspects: a) taste perception and b) intensity of flavors, which were tested by the people who submitted, with prior consent, to the identification of discriminative tests of four different flavors; The ranking comparison consisted of people listing a series of samples in descending order of the basic flavors.

From the main results, it stands out that 25% of people report having difficulty appreciating the sour taste and, while another 25% report having an affinity for perceiving bitter and sweet flavors more easily; Thus, the comparison of the sensory tests applied shows that not all adults perceive and detect flavors equally.

Keywords: chemosensory; stimuli; sensory, sensory perception.

Resumo

Melhorar os hábitos alimentares na idade adulta evita a perda da percepção dos sabores, entre outros benefícios, o que foi notável nesta pesquisa. O abuso de alimentos industrializados gera alterações nas papilas gustativas, que podem resultar na perda de apetite, resultando em alimentação inadequada e diminuição da qualidade de vida. Os diferentes sabores percebidos, como o sabor básico dos alimentos, são detectados pelas papilas da língua, avaliando dois aspectos: percepção gustativa e intensidade dos sabores, que foram testados pelas pessoas que passaram, com prévio consentimento, à identificação dos sabores. testes discriminativos de quatro sabores diferentes. A comparação do ranking consistiu em pessoas listando uma série de amostras em ordem decrescente dos sabores básicos.

Dos principais resultados destaca-se que 25% das pessoas relatam ter dificuldade em apreciar o sabor ácido, enquanto 25% relatam ter afinidade em perceber com mais facilidade sabores amargos e doces; Assim, a comparação dos testes sensoriais aplicados mostra que nem todos os adultos percebem e detectam sabores de forma igual.

Palavras-chave: quimiossensorial, estímulos, sensorial, percepção sensorial.

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Introduction

The concept of age refers to the set of periods into which a person's life is considered to be divided, without depending on external factors, and is generally located in years. It is also classified into stages of life, where people are commonly called babies, children (infancy stage), adolescents, young people, adults and the elderly (Cascales, 2020). Likewise, age is associated with a series of roles, responsibilities, activities and interpersonal and group interactions within society (Osorio, 2010).

Etymologically, adult comes from the verb *adoleceré*, which means to grow, so an adult is understood to be a person who has completed their growth and is between adolescence and old age (Monreal, 2001). Chronologically, adulthood ranges from twenty to sixty years; there are no fixed limits, since they can vary depending on the culture, that is, adulthood lasts approximately 40 years, making it the longest period of life, reaching between the ages of twenty-five and thirty years the maximum development in physical performance,

organic functioning, reaction times, motor skills and other physical capacities. After these ages, capacities decrease slowly but significantly (Cavavaugh., 2020) .

In adulthood, a group of conditions manifest that establish the degeneration of the sensory system, such as the loss of teeth and the use of prostheses, atrophy of the maxillary and mandibular tissues, changes in the neuromuscular system, etc. In the mouth, the fungiform papillae are especially reduced and the remaining papillae atrophy. Clinically, a loss or reduction of the salty taste has been observed, which may explain the bad taste of some foods, as well as the retention of sweetness. However, these taste modifications vary according to the person (González et al., 2002).

In ancient times, man and societies perceived food through their senses, expressing their relationship based on the criteria of liking and disliking, evaluating the taste and other characteristics, which influence the acceptance or rejection of a food product (Manfugás, 2007). Due to the development of human society, methods have been established and specified to describe the complex interaction between humans and their perception of the properties of food, its preparation and consumption (Manfugás, 2007).

The senses are the means by which humans perceive and discover the world around them. Humans have five senses: sight, hearing, touch, smell and taste. All of them are very important for human beings. The lack of any of them seriously affects human life and can even endanger it (Enriquez, 2008).

According to the Institute of Food Technologists (IFT) of the United States, sensory evaluation is a scientific discipline used to remember, measure, analyze and interpret responses to the visually perceived organoleptic characteristics of foods; as well as other substances, using smell, taste, touch and hearing (Baños, 2014).

Baños (2014) defines perception as the mind's ability to attribute sensory information to external objects. Therefore, the evaluation of food is perceived through multiple senses, which means that the appreciation of any physical or chemical stimulus is attributed to the interaction between the signal received by the sense organs. These systematize the information and give a response or feeling based on the intensity, duration and quality of the stimulus, distinguishing acceptance or rejection.

The perception of food flavors occurs through the sense of taste or smell , because these senses are mediated by chemosensory nerve endings that respond to different stimuli, so that their alteration can affect the ability to ingest food and, in turn, directly influences the quality of life (Rico, 2011) . Taste is one of the most important senses that It is derived from

taste receptors in combination with smell, touch, pressure and temperature; it is also called the “basic taste” of food and is detected by the papillae of the tongue, in which four flavors are manifested: sweet, salty, sour and bitter (Juárez, 2015).

Taste buds can detect these four tastes, but they have some sensitivity to one or two. The filamentous papillae are located on both sides of the tongue and perceive salty and sour tastes. The circumflex papillae are located at the back of the tongue and perceive bitter tastes. Therefore, the brain detects the type of taste based on the proportion of stimulation of the different taste buds (González et al., 2002). The sour taste is considered as an alarm by the brain, since some poisonous and harmful substances have sour tastes; this The taste slightly irritates the mucous membranes and produces a large amount of saliva (Enríquez, 2008). The salty taste is generated by salts such as sodium chloride. It is important to consider that salts activate taste cells: when sodium passes through ion channels and penetrates the microvilli, the taste afferent neurons receive the message and transmit the signal to the brain (Barriga, 2019). According to Barriga (2019), the sweet taste is detected through the heteromer formed by T1R2 (type 1 taste receptor) and natural flavors, such as glucose and sucrose, sweeteners such as saccharin and acesulfame potassium, or amino acids such as glycine, peptides, L-aspartyl-L-phenylalanine (aspartame) and thaumanthine, among others. Therefore, sweet substances bind to their receptors causing changes.

Finally, the bitter taste is the one that is difficult to get used to, since it is probably the most unpleasant taste, and according to evolutionary biology, this taste has manifested itself as unpleasant in many cultures due to its sensory memory mechanism, which indicates the need to develop defense criteria for survival, due to the fact that most poisons have a bitter taste (Enríquez, 2008).

Descriptive tests refer to the procedure in which the judge establishes the descriptors that define the sensory characteristics of a product and thus quantify the differences between various products. They consist of describing the color and overall flavor of a product, as well as its individual attributes. These criteria define the order of appearance of each attribute, the degree of intensity, residual flavor and amplitude or general impression of the flavor and smell (Cárdenas, 2018).

Sensory analysis (SA) involves carrying out various tests to evaluate different characteristics or attributes of a product using the senses. It is carried out through tests following a series of rigorous, reliable and consistent procedures with perfectly defined goals (Reglero, 2011). Sensory tests refer to the methods of sensory evaluation of foods, being

indispensable in the quality control process, classified as affective, discriminative and descriptive; however, in this article only the discriminative ones will be referred to (Elida et al., 2018).

According to Del Ángel (2013), in discriminative tests the panel is expected to decide how much a product differs from a control, and this test includes the order comparison, the triangular test and the duo-trio test. It is important to consider that several samples must be presented at the beginning, of which some are repeated in the triangular test and in the duo-trio test, and the taster is the one who detects the difference. Therefore, the classification test implies that the judges classify a series of samples in ascending or descending order for each characteristic or sensory attribute that is evaluated. Only when the flavor is evaluated by certain outstanding or intense characteristics, it is better to ask the judges to classify the characteristics from least to greatest intensity (Cedeño, 2015). A detection threshold test, on the other hand, must present the judge with a series of samples or solutions containing different dilutions of each base flavor, the judge must certify each sample until he or she detects or perceives a specific flavor, and the test must proceed to the level at least three times, and always from low to high concentrations (Cedeño, 2015).

Materials and methods

A quantitative research was developed with a descriptive, transversal design. This research was carried out in the city of Guadalajara, Jalisco, at the facilities of the Jalisco AC Educational Center. The work universe was made up of the 2022A generation of the gerontology specialty of this university.

The following inclusion criteria were taken into account in the selection process: 1) being a student of the specialty in gerontology at the Centro Educativo Jalisco AC; 2) being present on the day of the survey application. The exclusion criterion was not having located the student, and the elimination criteria considered students who did not wish to participate in the survey or did not complete the survey responses.

A survey applied in September 2022 was used as a measurement and data acquisition instrument. It consisted of 21 items, providing information through the virtual application of the survey, evaluating two aspects: taste perception and intensity of flavors. The response time of the questionnaire was approximately 20 minutes and, in relation to the ease, it was

possible to complete it from a computer or mobile device. Later, the Excel program was used to analyze the data.

To obtain the data, authorization was requested from the corresponding authorities of the academic institution, with the legal name Centro Educativo Jalisco AC, in which the objectives and ethical considerations of the study were specified, all with the aim of having access to the 2022A generation of the gerontology specialty of this university. Thus, an explanation was given on ethical and confidentiality issues. Subsequently, there was an approach with the students, who agreed to participate in the research. Then, the questionnaires were applied through the Google forms application, and in a second moment, the data analysis was carried out through the Excel program.

The evaluation of the basic flavors was based on a 21-question survey, including two discriminative tests for each student. The first discriminative test was an ordering test to detect the perception of each of the flavors, which consisted of comparing samples in three different concentrations in solution: sweet, bitter, salty and acid, to be ordered from highest to lowest intensity; the concentration measurements for the samples were as follows:

- Sweet: Sugar was used. A1 was weighed at 1 gr, A2 at 2 gr, A3 at 4 gr.
- Acid: Lemon was used. B1 at 1 gr, B2 at 2 gr, and B3 at 4 gr.
- Salty: Salt was used. C1 at 1 gr, C2 at 2 gr, and C3 at 4 gr.
- Bitter: Coffee was used. D1 at 1 gr, D2 at 2 gr, and D3 at 4 gr.

The second discriminative test of detection or recognition threshold was then continued, to identify the different flavors and the area of the tongue where the flavor was perceived. This test was based on providing 10 disordered samples with the four basic flavors, classifying them as follows:

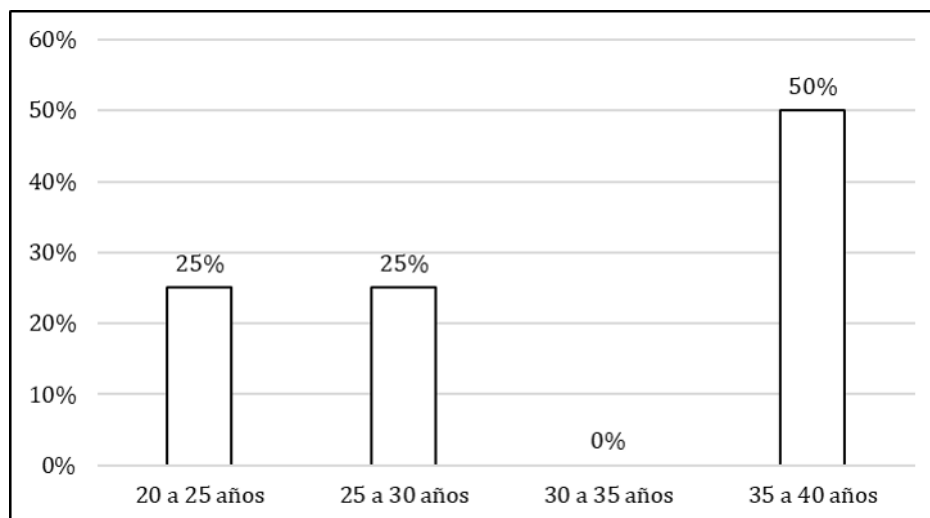
- Sample 1, 2, 3 were sweet
- Sample 4, 5, 6 acidic
- Sample 7 and 8 salty
- Sample 9 and 10 bitter

Results

Based on the data obtained, the following findings were made:

Figure 1 shows that the 2022A generation of the gerontology specialty, belonging to the Jalisco AC Educational Center, is made up of young adults, concentrating mainly on the age group between 35 years and a maximum of 40 years, which is important for this research, because this indicates that it is within the appropriate category for the classification of young adults.

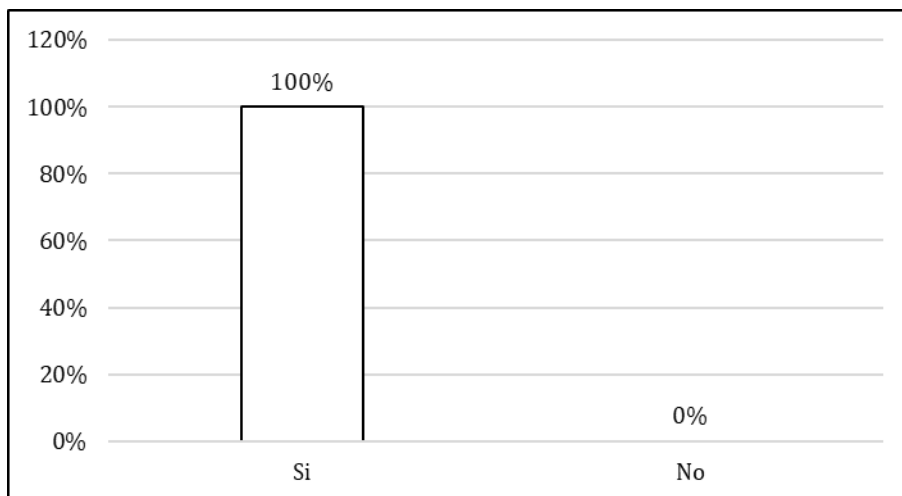
Figure 1. Age of the students who make up the 2022A generation of the Gerontology Specialty of the Jalisco AC Educational Center



Source: Own elaboration

In figure number two, in which students are questioned about their knowledge of basic flavors, it is observed that 100% of the students surveyed state that they do know the four basic flavors.

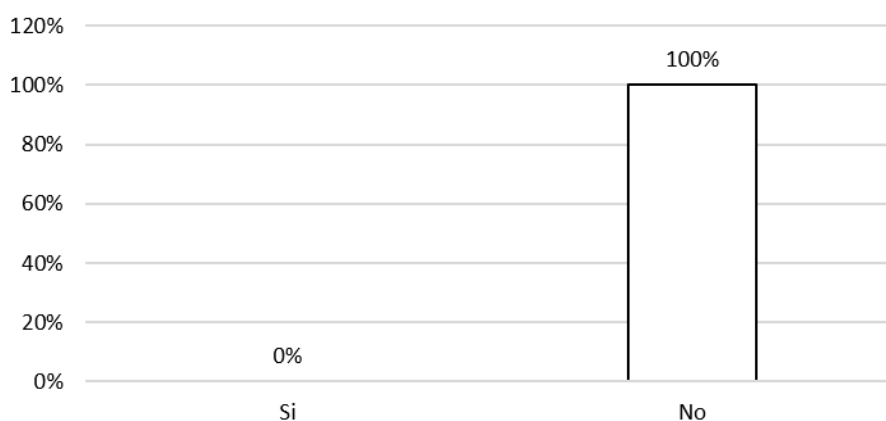
Figure 2. Knowledge of basic flavors, by the 2022A generation of the Gerontology Specialty of the Jalisco AC Educational Center



Source: Own elaboration

The results of the questioning carried out on the students about changes in the sensory perception of flavours during the last month are shown in figure 3 and it can be observed that 100% of the students state that they have not perceived any change in the perception of flavour, thus, this graph is important because it can be assured that this factor can significantly intervene in the information and result of this research.

Figure 3. Changes in taste perception

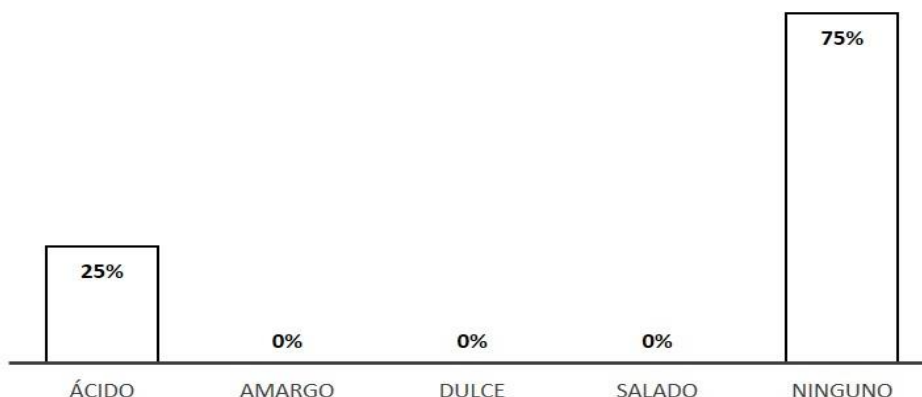


Source: Own elaboration

The questions asked in item four about having some difficulty in being able to appreciate any of the four basic flavours, obtained some results. In Figure 4 it can be observed that 75% of the specialist students surveyed stated that they had no difficulty in

perceiving any of the four basic flavours; however, 25% of the students surveyed indicated that they had difficulty in appreciating the acidic flavour.

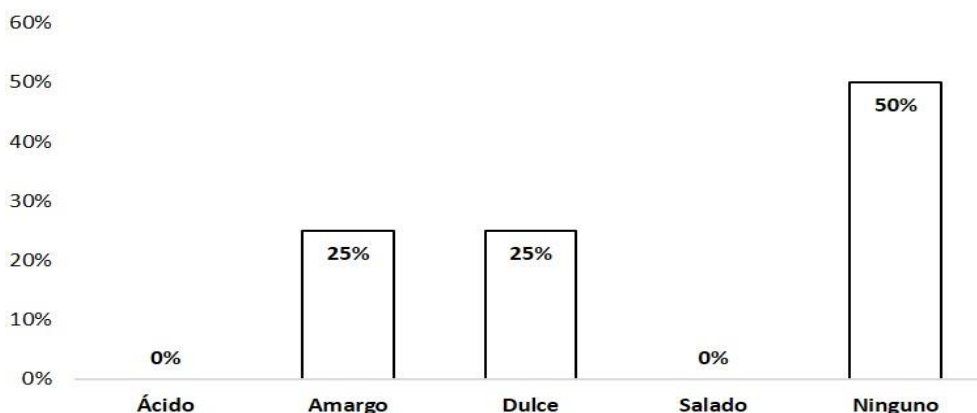
Figure 4. Difficulty perceiving any flavor



Source: Own elaboration

According to the question "Which flavor can you perceive most easily?", it can be seen in Figure 5 that 50% of the students say they can perceive all flavors without difficulty, while 25% of the students surveyed say they have an affinity for perceiving and recognizing bitter and sweet flavors more easily.

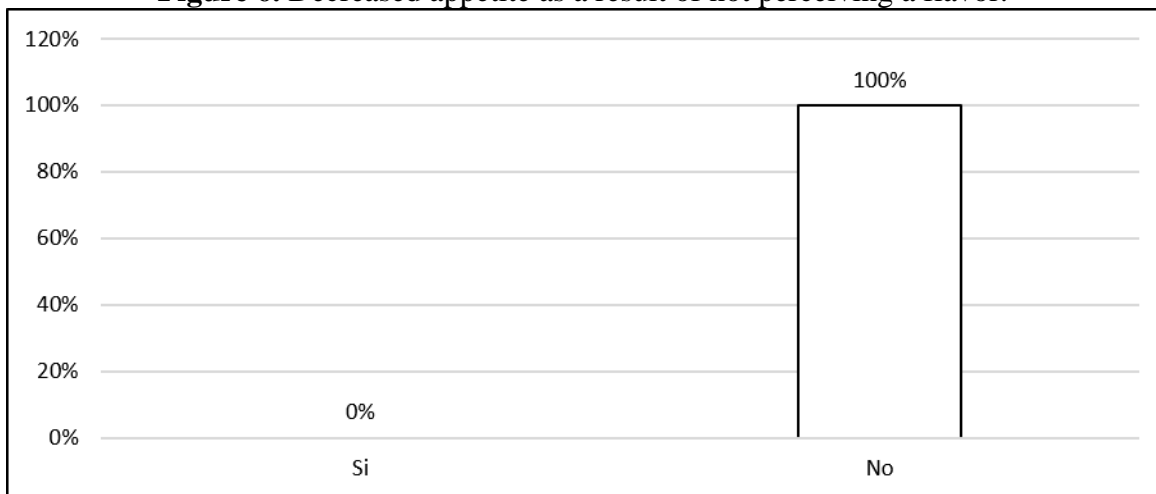
Figure 5. Ease of perceiving a flavor



Source: Own elaboration

Figure 6 shows the results of the question about whether their appetite has decreased due to a lack of perception of flavors. It can be seen that 100% of respondents stated that they had not experienced this consequence of decreased appetite due to not detecting flavors.

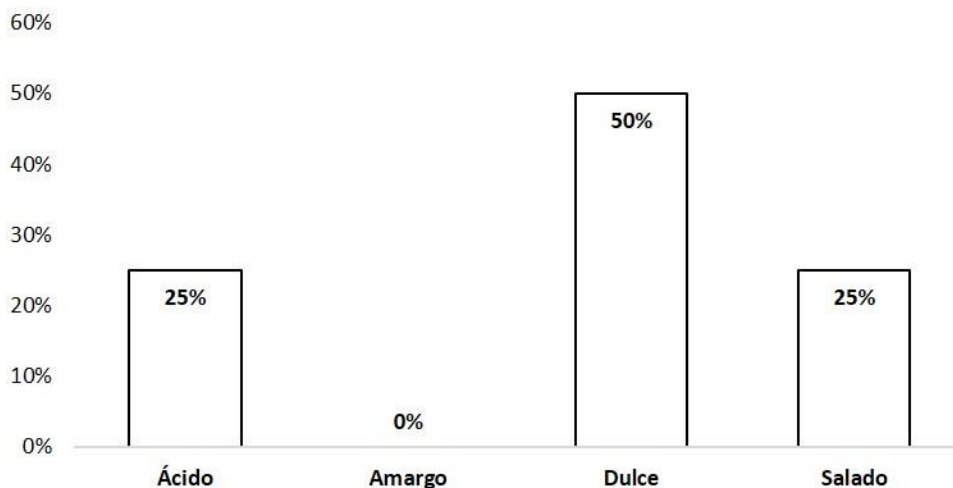
Figure 6. Decreased appetite as a result of not perceiving a flavor.



Source: Own elaboration

Figure 7 shows that 50% of the students surveyed stated that they had an affinity for sweet flavours, while an equal preference of 25% opted for sour and salty flavours.

Figure 7. Preference for one of the four basic flavors

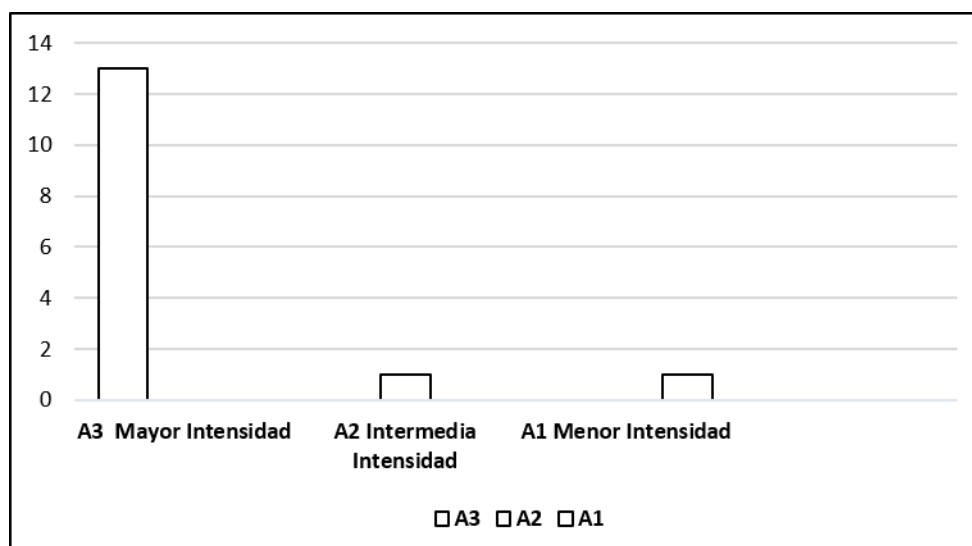


Source: Own elaboration

With the results of graphs 8, 9, 10 and 11, the sensory sorting test begins.

In the graph in Figure 8, a sensory taste test is performed. The students were asked to organize the samples from highest to lowest intensity, offering the students three samples of each of them with coding A1, A2 and A3, finding in said coding samples of sweet flavor, prepared in the following way: A1 (prepared with 1 gram of sugar in 10 ml of water), A2 (prepared with 2 grams of sugar in 10 ml of water) and A3 (prepared with 4 grams of sugar in 10 ml of water). It can be seen that there was unanimity in the ordering test, since the entire generation agreed that the one with the highest concentration of intensity was the sample coded with A3, as it contained more sugar, and the one with the lowest intensity was the sample coded with A1. Consequently, it can be assured that the elements generated from this evaluation show that the students have fine and adequate taste sensory endings to perceive flavor intensities, after correctly ordering the samples with the highest presence of sugars.

Figure 8. Ordering of the sweet taste samples.

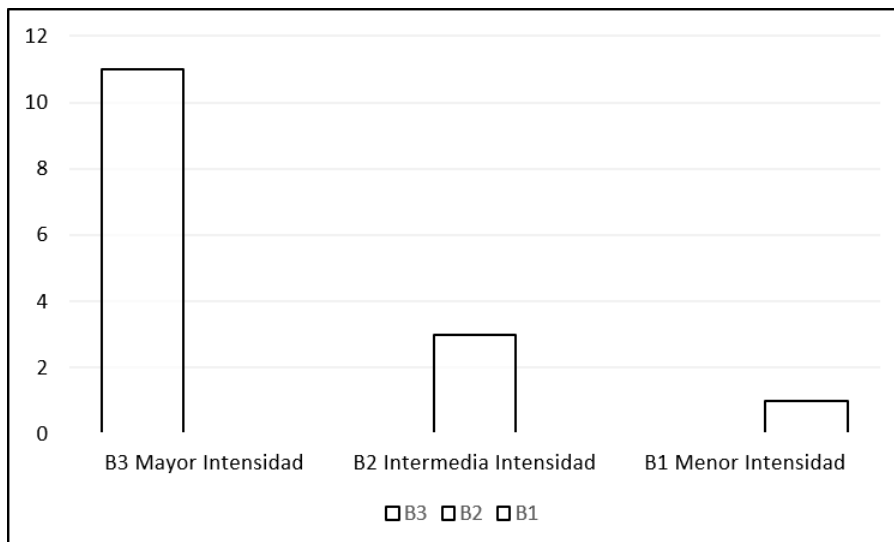


Source: Own elaboration

Figure 9 shows the sensory test for acidic taste. In the test, students were asked to arrange the samples from highest to lowest intensity. Three samples unknown to them were offered to the students with coding B1, B2 and B3, and in said coding there were samples of acidic taste, prepared in the following way: B1 (prepared with 1 gram of vitamin C in 10 ml of water), B2 (prepared with 2 grams of vitamin C in 10 ml of water), and B3 (prepared with 4 grams of vitamin C in 10 ml of water). In this way, a variation in the degree of ordering in terms of acidic perception is observed, where 11 of the 15 participants perceive sample B3 as the most intense, while B1 is the lowest intensity; consequently, it can be assured that the elements generated in this evaluation show that students have their gustatory sensorial

endings to perceive acidic taste intensities a little different among themselves. After ordering the samples differently with higher and lower acidity intensity, it can be deduced that there is no such alarm on the part of the brain, as mentioned by Colorado (2014), which would be present when perceiving an acidic taste, being important to identify poisonous and harmful substances for the body.

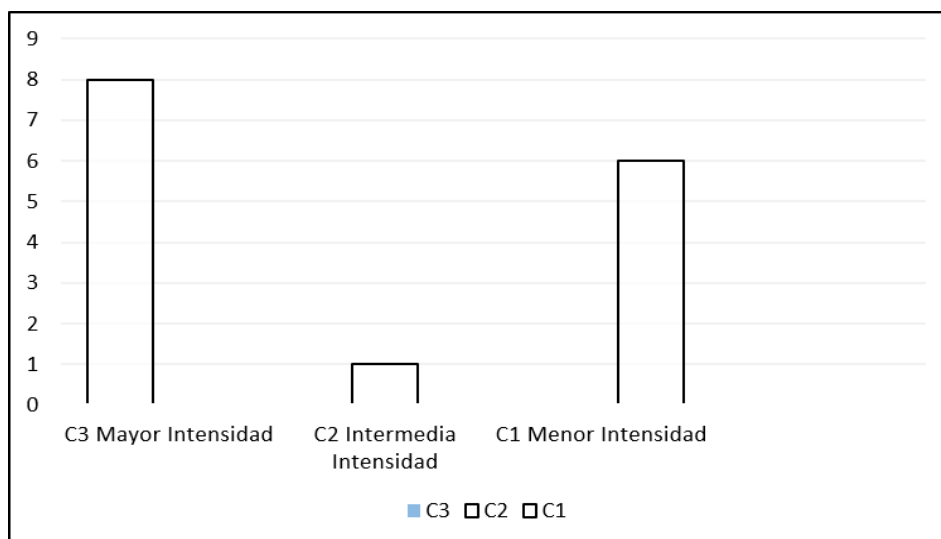
Figure 9. Ordering of the acid taste samples.



Source: Own elaboration

Figure 10 shows the result of a sensory test of salty taste. In this test, students were asked to rank samples from highest to lowest intensity. To do this, students were offered three unknown samples with coding C1, C2 and C3, with samples of salty taste being found in this coding, prepared as follows: C1 (prepared with 1 gram of salt in 10 ml of water), C2 (prepared with 2 grams of salt in 10 ml of water), C3 (prepared with 4 grams of salt in 10 ml of water). In this way, it is observed in the degree of ordering in terms of salty perception that 8 of the 15 participants perceive sample C3 as the one with the highest intensity, while one student considers sample C2 to be of Intermediate density, while C 1 is of lower intensity. Consequently , it can be assured that the elements generated in this evaluation show that the students have their gustatory sensory endings to perceive salty flavor intensities a little variable between them, after ordering differently the samples with greater and lesser intensity of salty flavor, therefore it can be deduced that the gustatory afferent neurons receive the message and transmit the signal to the brain in a different way in each one of them (Hernández and Barriga, 2019)

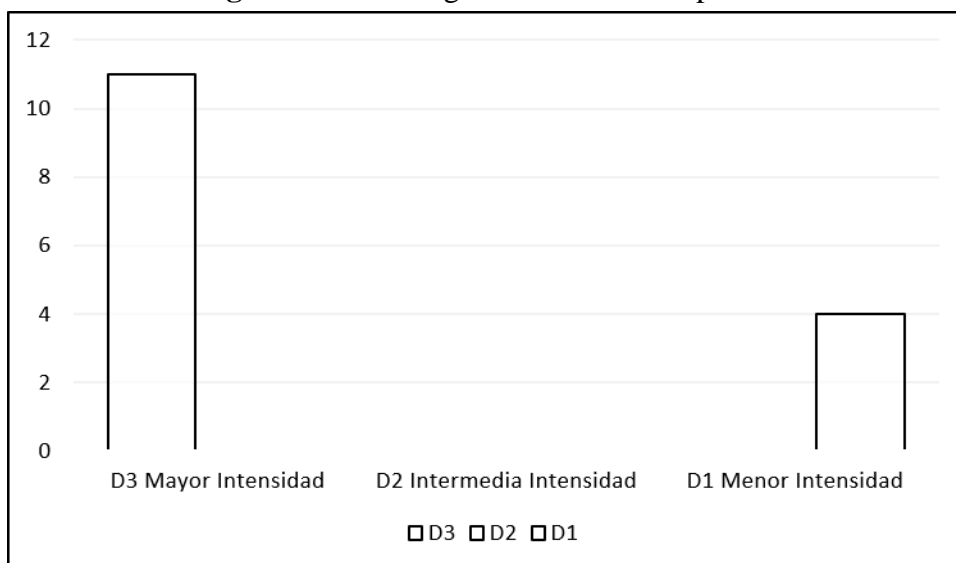
Figure 10. Ordering of salty taste samples



Source: Own elaboration

Figure 11 shows the result of the sensory test for bitter taste. In this test, students were asked to arrange the samples from highest to lowest intensity. Students were offered three unknown samples with coding D1, D2 and D3, finding in said coding samples of bitter taste, prepared in the following way: D1 (prepared with 1 gram of coffee in 10 ml of water), D2 (prepared with 2 grams of coffee in 10 ml of water), D3 (prepared with 4 grams of coffee in 10 ml of water), in such a way that it is observed in the degree of ordering in terms of bitter perception that 11 of the 15 participants perceive sample D3 as the most intense, followed by 4 students who consider that it is sample D1, while D2 is the least intense. From the above it follows that students have their ideal sensory endings to be able to survive in case of perceiving this flavor, which is interpreted as unpleasant in many cultures due to the defense mechanism against poisoning, this is because most poisons are bitter (Vera, 2008).

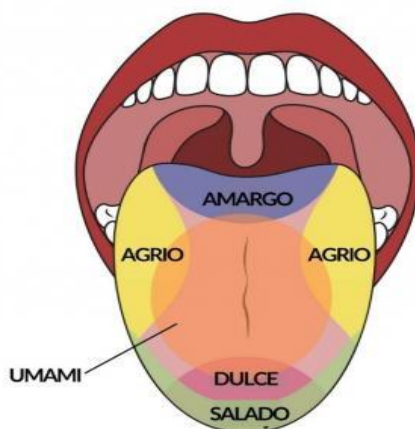
Figure 11. Ordering of bitter taste samples



Source: Own elaboration

Figure 12 shows the discriminative test of appreciation or recognition. It is worth mentioning that it is a graph with different samples that will divide the images.

Figure 12. Anatomical areas with flavor sensations



Source: Martinez, 2019.

In Figure 13, after providing the subjects with a series of samples to taste, it can be observed that they perceived the sweet flavours in the centre of the tongue with the greatest presence, followed by the sour and bitter ones; likewise, the identification of the sweet flavours at the tip of the tongue, on the other hand, they identified the salty and sour flavours on the sides of the tongue and finally the sweet and bitter flavours at the back of the tongue. It is important to highlight that a variation in the perception of flavours in adults is identified

(González, 2002); thus, it would be expected that sweet flavours could be appreciated through the fungiform papillae found at the tip of the tongue. The area of the filiform papillae would have to perceive the salty and sour flavours located on the sides and, finally, the caliciform papillae located at the back of the tongue perceive the bitter flavour.

Figure 13. Appreciation of flavors in areas of the lingual papillae.



Source: Own elaboration

Discussion

Based on all of the above, what Pinilla (2021) stated is confirmed: “aging can be defined as the decrease in the organism's ability to adapt to its environment, requiring special care. This stage of the life cycle includes a wide range of conditions related to the biological, psychological, and social processes of adulthood” (p. 493). There is no doubt that biological and physiological changes in people are one of the most complex scenarios, since they have a significant impact on the quality of life, which often leads to loss of appetite and malnutrition, and sometimes to the onset of depression. One of the limitations of this study is the analysis of the literature, because it was not possible to cover all the information that currently exists and a specific selection was used.

Another limitation was the selection of the appropriate educational offer, which had to have enough older adults, because the institution handles more young adults. Therefore, it is necessary to enrich the search by other more academic means. One of the strong points

of this article is the integration of chemoreceptor sensations expressed by the respondents, when expressing the deterioration of sensory perception over the years. Likewise, the main strength of this document is that it brings together important elements developed individually by other authors, such as analysis and reflection on the processes of biological degradation due to age and the description of the processes of degradation of taste perception in older people.

Conclusions

In the present investigation, it was possible to analyze the perception of flavors and their variations in students from the Jalisco AC Educational Center. The perception of some flavors with greater presence stood out, which leads to deducing that lifestyles, consumption of technologically manipulated foods and the decrease in salivary flow (especially in the reduction of fungiform papillae and in the atrophy of the rest of the papillae, among other elements) generate changes in sensory perceptions.

In this research it was observed that not all adults perceive and detect flavors equally, this is evident in the comparison of the sensory tests applied to each of the students. When each of the samples and each of their codes are analyzed separately, it is observed that there are differences in terms of flavor identification.

The intensity detection test did not detect the flavours according to the three samples provided, which contained different concentrations. As a result, the flavours were not detected in this way, but there were variations in the organisation and arrangement of intensities; a greater variety was also observed in terms of the perception of flavours by areas of the tongue, the most contradictory being the bitter taste. This result can be seen in the graphs: it was detected by some of the respondents on the tip of the tongue, something contradictory to related research and studies that mention that the bitter taste is detected on the back of the tongue.

Therefore, it is essential to improve lifestyles in order to maintain the perception of flavors. It was evident in this research that as age increases, changes occur in taste buds, which will undoubtedly lead to a loss of appetite that will interfere with an inadequate diet and a decrease in quality of life.

Future lines of research

1. Gustatory sensory perception in older adults.
2. Quantification and comparison of the taste threshold of older adults and young adults.
3. Influence of sensory distortions on the nutritional status of the elderly.

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Contribution Role	Author(s)
Conceptualization	Juan Carlos Lopez Barajas
Methodology	Juan Carlos Lopez Barajas.
Software	Adolfo-Yakov Castaneda-Navarrete
Validation	Adolfo-Yakov Castaneda-Navarrete
Formal Analysis	Juan Carlos Lopez Barajas (50%) Jose Luis Cabrera Gonzalez (25%) Jessica Lizet Bautista Hernández (25%)
Investigation	Juan Carlos Lopez Barajas
Resources	Roberto Carlos Lopez Barajas
Data curation	Juan Carlos Lopez Barajas
Writing - Preparing the original draft	Juan Carlos Lopez Barajas
Writing - Review and editing	Jessica Lizet Bautista Hernandez
Display	Jose Luis Cabrera Gonzalez
Supervision	Juan Carlos Lopez Barajas (50%) Jose Luis Cabrera Gonzalez (25%) Jessica Lizet Bautista Hernández (25%)
Project Management	Roberto Carlos Lopez Barajas
Acquisition of funds	Roberto Carlos Lopez Barajas