Using food comfortability to compare food's sensory characteristics expectations of elderly people with or without oral health problems

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Abstract

Food consumption is by far the most important point where food's organoleptic properties can be perceived and can elicit sensory pleasure. Ageing is often accompanied by oral impairments. Those impairments may impact food perception by changing texture perception and the release of flavour components, which have a significant impact on food acceptability. The present study aimed at evaluating the impact of oral health on the perception of food comfortability in an elderly population. This was achieved by asking elderly people with a good oral health and elderly people with poor oral health to rate six cereal products and six meat products using a food comfortability questionnaire. Thirty-seven and 35 elderly people (65-87 years old) underwent either a cereal or meat session, respectively. The present study showed very few effects of dental and saliva status on food perception. For the cereal products, a significant effect of dental status was observed for one texture descriptor and one flavour descriptor, and a significant effect of salivary status was observed for two texture

descriptors and one flavour descriptor. For the meat products, a significant effect of dental status and a significant effect of salivary status were observed on one flavour descriptor. For both products, no significant impact of dental or salivary status was observed on the general perception of food oral comfort nor on food bolus formation. Future studies exploring the impact of a broader set of oral parameters and potential adapting factors are needed to further explore the results of the present study.

Practical applications

During oral food consumption, mastication, salivation and swallowing play a key role in the acceptance of food and beverages by modulating the perception of texture, taste and aroma, as well as providing eating comfort by assisting the food breakdown process into a bolus that can be safely swallowed. The age-related oral impairments such as loss of teeth, decrease in salivary flow or dysphagia are known to have an impact on food consumption. However, very few products are developed to skirt those impairments. Therefore, in the context of an ageing population, there is a need to develop functional foods that meet the specific nutritional needs of the elderly population, as well as a well-balanced flavour and texture framework. Considering the large inter-individual variability observed on the elderly people, developing adapted functional foods is a major challenge for the food industry and society.

INTRODUCTION

When a food is put in the mouth, oral processes, namely, mastication, salivation and swallowing, play a key role in texture and flavour perception, which have a significant impact on food acceptability (Yven *et al.*, 2006). As ageing is often accompanied by oral impairments, it is often assumed that age-related changes in oral health may therefore impact food perception by changing texture perception (Mioche *et al.*, 2002) (Veyrune and Mioche, 2000) and the release of flavour components (Duffy *et al.*, 1999)

First, each tooth is connected to periodontal mechanoreceptors (up to 2000 mechanoreceptors per tooth) that signal information about tooth loads in a temporal, spatial and intensive aspect. Those mechanoreceptors are located in the ligaments that attach the tooth root to the alveolar bone, among the collagen fibres (Trulsson, 2006). When teeth are extracted, the remnants of the periodontal ligament break down. According to data from animal studies, this leads to changes in the neuro-muscular pattern and in periodontal sensitivity (Veyrune and Mioche, 2000); (Braud and Boucher, 2015). For instance, a study in cats has shown that after teeth extraction, the periodontal mechanoreceptor neurones no longer responded to mechanic stimulation (Linden and Scott, 1989). Those observations are also done in humans, and Devezeaux de Lavergne *et al.* (2015) highlighted the fact that passive tactile sensitivity depends largely on the presence of the periodontal ligament receptors. Indeed, in a denture wearing elderly population, the texture perception is altered compared to an elderly population with natural dentition (Mojet *et al.*, 2005). Consequently, it may be assumed that age-related tooth loss could have an impact on periodontal sensitivity and thus on texture perception in the elderly population. Second, ageing is also often accompanied by a decrease in muscle strength (Fontijn-Tekamp *et al.*, 2004). It has been demonstrated that reduced strength in the jaw masticatory muscles and an alteration of dental status can have an impact on biting and chewing behaviour (Mioche *et al.*, 2004). It may be assumed that these changes could have an impact on the perception of food rheological properties such as tenderness, elasticity, firmness, and melting, among others. Third, ageing may often be accompanied by a decrease in salivary flow (Vandenberghe-Descamps *et al.*, 2016) or changes in salivary composition (Vissink *et al.*, 1996), which in turn may have an impact on taste and texture perception. Indeed, it may be considered that an age-related decrease in salivary flow could modulate the perception of oral sensations such as viscosity, smoothness, juiciness, and astringency, among others (Neyraud, 2014). Furthermore, Engelen *et al.* (2007) demonstrated that subjects with high α-amylase activity had a decreased thickness perception of starch-based custard. Finally, mastication and saliva transform a food sample into a bolus that can be safely swallowed (Prinz and Lucas, 1997) (Shaw and Martino, 2013). These food breakdown processes also lead to the release of chemical compounds responsible for taste and aroma perception. Age-related impairments have been demonstrated to have a significant impact on food bolus formation (Bessadet *et al.*, 2013); (Veyrune and Mioche, 2000). For instance, Bessadet *et al.* (2013) showed that denture wearers presented a decrease in the median particle size of food boluses in comparison to elderly people without removable denture prosthesis. In parallel, it may also be hypothesized that a decrease in food breakdown efficiency could lead to changes in flavour release.

In a recent study, we have explored the concept of "oral comfort" when eating a food in the elderly population (Vandenberghe-Descamps *et al.*, in prep.). Three focus groups were conducted with elderly people. Each group included volunteers with poor oral health and volunteers with good oral health, in regards to dental status and salivary flow rate. The results of the focus groups, which included brainstorming (What is oral comfort for you?) and food tasting, revealed four dimensions underlying the concept of "oral comfort": the ability to form a food bolus, pain perception, texture perception, and flavour perception. The results were used to create a "food comfortability" questionnaire that included items on these four dimensions. This questionnaire was used in the present study to evaluate the impact of oral health status on food perception in elderly participants. Among the three identified oral health parameters (*i.e.*, salivary status, dental health and muscle strength), the first two were studied in the present experiment. Specifically, we asked elderly people with a good oral health and elderly people with poor oral health (poor dental status and/or low salivary flow) to rate six cereal products and six meat products using the food comfortability questionnaire.

MATERIALS AND METHODS

Participants

The data were collected as part of a programme that aimed at studying the relationship between oral health and eating behaviour (AlimaSSenS project: towards an adapted and healthy food supply for elderly people). Among the 50 AlimaSSenS project's volunteers recruited at that time, 37 and 34 subjects were available for the cereal-based products and the meat-based products sessions, respectively. The recruitment criteria were as follows: older than 65 years old, living at home, no acute pathological episodes neither at the time of the experiment nor in the recent past, a score of at least 24 on the mini mental state evaluation (MMSE) (Folstein *et al.*, 1975), and a number of functional units equal to 7 or more (for non-oral health problems) and equal to 4 or less (for oral health problems). The thresholds of 7 and 4 functional units to define good and bad dental status, respectively, were defined according to Leake *et al.* (1994). A functional unit was defined as a pair of posterior antagonist teeth that had at least one contact area during chewing. An interview and a dental examination were carried out with each volunteer to ensure that they met the inclusion criteria. In parallel, the resting salivary flow of every volunteer was measured by instructing the participant to spit out the saliva into a pre-weighed screw-cap cup every time they felt like swallowing over a period of 10 min. Salivary flow rate was expressed in ml/min, assuming that 1 g of saliva corresponds to 1 ml. As with the number of functional units, the participants were categorized into two groups depending on their salivary flow. The cut-off value corresponds to the median resting salivary flow observed in 180 AlimaSSenS project's volunteers (65-92 years-old) and is equal to 0.26 ml/min. Therefore, elderly people with a salivary flow below 0.26 ml/min were considered as having a low salivary flow, and elderly people with a salivary flow over 0.26 ml/min were considered as having a high salivary flow.

Products

Six cereal-based products and six meat-based products were chosen in order to have contrasted textures. The cereal-based products included a crispbread, a financier, a madeleine, a sponge cake, a milk roll and a protein enriched milk roll. The meat-based products included stewed cheek, beefsteak, ground beef, chicken meatballs, chicken aiguillette and ground chicken reconstituted in an aiguillette shape.

Procedure

The volunteers were invited to take part in one session where they had to taste 6 products, either the cereal-based products or the meat-based products. For each product, the volunteers were asked to answer the "food comfortability" questionnaire (Figure 1). At the beginning of each session, the questionnaire was presented to the volunteers by the experimenter. No specific training was performed before the sessions. The questionnaire included five sections (Vandenberghe-Descamps *et al.*, in prep.).

- A first general question on food comfort that the participants answered using a 5-point scale ranging from "Very uncomfortable" to "Very comfortable."
- A second section on bolus formation included five items: the ability to cut the food with incisors, the ability to cut the food with premolars, the ability to masticate the food, the ability to humidify the food with saliva, and the ability to swallow the food. For each item, participants answered on 6-point scale ranging from "Impossible" to "Very easy." This section also included an item on the time needed to form the food bolus; participants answered using a 6-point scale ranging from "Impossible" to "Very brief."

- A third section on pain perception included five items: burning or spicy sensation, muscular pain, articular pain, dental pain and gum pain. For each item, participants answered on a 4-point scale ranging from “Extremely” to “Not at all.”
- A fourth section on texture perception included eight items that were evaluated on their intensity: sticky, stringy, greasy, dry, doughy, melting, firm and hard. The items were rated on a 4-point scale ranging from “Extremely” to “Not at all.”
- A fifth section on flavour perception included five items: taste intensity and the salty, sugary, acidic and bitter perceptions. For each item, participants answered on a 4-point scale ranging from “Extremely” to “Not at all.”

Figure 1 about here

During the sessions, the volunteers were free to bite the products as many times as they wanted in order to answer the questions on the “food comfortability” questionnaire. The participants were given a 3-min rest time between samples, and they were free to drink as much water as they needed during the session. Meat-based products were cooked right before serving according to the recipes provided by the supplier. They were served when the temperature in the heart of the product reached at least +65°C. The sessions were conducted in a sensory room equipped with individual booths according to the AFNOR standard (AFNOR, 1987) and under white light. The room temperature was 20.5±0.5°C. The products were presented in an order determined by a William Latin square design; they were coded with a three digit number.

Data analysis

Separate analyses were conducted for the cereal products and for the meat products. For each item of the “food comfortability” questionnaire, scores were submitted to an analysis of variance (ANOVA) with three fixed factors (*i.e.*, product, dental status (poor or good), salivary status (low or high)) and one random factor (participant). Post hoc comparisons were performed using the Student Newman Keuls test. Means (M) were associated with their standard errors (SEM). The threshold for significance was set at 5%. Statistical analyses were conducted using R-studio software version 3.3.1 with the "nlme" package for linear mixed models and the "agricolae" package for post hoc analyses (R Development Core Team, 2006).

RESULTS

Panel description

The general characteristics of participants recruited from the cereal testing and the meat testing are described in Table 1. Regarding dental status, we distinguished elderly people with good dental status (7 or more functional units) from elderly people with poor dental status (4 or less functional units, possibly wearing denture). For both product categories the number of functional units of the elderly participants in the poor dental status group was significantly lower than that of the elderly participants in the good dental status group (cereal-based products: $t(36)=13.17$; $P < 0.001$; meat-based products: $t(33)=13.04$; $P < 0.001$). Regarding salivary status, we distinguished elderly people with a high salivary flow (higher than 0.26 ml/min) from elderly people with a low salivary flow (lower than 0.26 ml/min). The salivary flow of the elderly participants in the low salivary flow group was significantly lower than that of the elderly participants in the high salivary flow group (cereal-based products: $t(36)=10.13$; $P < 0.001$; meat-based products: $t(33)=10.54$; $P < 0.001$).

Table 1 about here

Results on cereal-based products

The results on the dentition effect reveal that there was no effect of dental status on the general question of food comfortability (Table 2). Few effects were observed in the sub-dimensions of food comfortability. A significant dentition effect was observed on muscle pain and dental pain. Elderly people with a poor dentition reported feeling more muscle and dental pain while eating the food than elderly people with a good dentition. A dentition effect was also observed on the perception of a stringy texture. Elderly people with a poor dentition found the cereal-based products less stringy than elderly people with a good dentition.

The results on the saliva effect reveal that there was no effect of salivary status on the general question of food comfortability (Table 2). A significant salivary effect was observed on muscle and dental pain and on the stringiness and hardness of the food. The results showed that elderly people with a low salivary flow felt more muscle and dental pain and found the cereal-based products harder but less stringy than elderly people with a high salivary flow.

Moreover, a significant *dental status*×*saliva status* interaction was observed for muscle pain, articular pain, dental pain, greasiness and acidic items; the volunteers with poor dental status and a low salivary flow found that eating the products resulted in more muscle, articular and dental pain and considered the products less greasy but more acidic than the other groups.

Results on meat-based products

The results on the dentition effect reveal that there was no effect of dental status on the general question of food comfortability (Table 2). Few effects were observed in the sub-dimensions of food comfortability. A significant dentition effect is observed on muscle pain. Elderly people with a poor dentition reported feeling more muscle pain during food consumption than elderly people with a good dentition. A dentition effect was also observed on the acidic perception. Elderly people with a poor dentition found the products more acidic than elderly people with a good dentition.

The results on saliva effect reveal that there was no effect of salivary status on the general question of food comfortability (Table 2). A significant effect was observed on the perception of sweetness. Elderly people with a poor dentition found the products less sweet than elderly people with a good dentition.

Moreover, a significant *dental status*×*saliva status* interaction was observed for the burning sensation; the elderly people with a poor dentition and a low salivary flow felt more burning sensations while eating than the other groups.

Table 2 about here

DISCUSSION

Contrary to what was expected, we observed only few effects of dental or salivary status on cereal and meat products perception. For the cereal products, poor oral status induced slightly more muscular and dental pain. However, a significant effect of dental status was observed for only one texture descriptor and one flavour descriptor, and a significant effect of salivary status was observed for only two texture descriptors. A significant effect of the interaction *saliva*×*dental* status was also observed on three pain descriptors and one flavour descriptor. For the meat-based products, poor oral status induced slightly more muscular pain. A significant effect of dental status and a significant effect of salivary status were observed on one flavour descriptor. No significant impact of dental or salivary status was observed on the general perception of food oral comfort nor on food bolus formation.

Several methodological limitations can be initially considered to explain these inconclusive results.

First, the number of volunteers was relatively small. Therefore, the results need to be carefully considered, in particular those on saliva-dental status interaction, and studies with a higher number of volunteers are recommended. However, it is challenging to recruit elderly people with poor oral health at a good cognitive level to carry out the sensory tests. In fact, elderly people with poor oral health are usually frail and dependent, and therefore, they are less willing to take part in this type of study (Maître *et al.*, 2015).

Second, the recruited volunteers were naive in terms of sensory analysis and were therefore not used to rating food on sensory descriptors. Their inexperience might have led to a misunderstanding of the items and/or the misusing of the scales. These points were evaluated during the creation of the food comfortability questionnaire (Vandenberghe-Descamps *et al.*, in prep.). To check rating repeatability, participants from the cereal panel were invited to come back to the laboratory three months later for a second session. During this session, they were asked to rate the same cereal products using the same "food comfortability" questionnaire under similar experimental conditions. The data from the first and the second session were submitted to an ANOVA with product and session as fixed factors. The results showed a significant *session* effect for five descriptors: ability to masticate the food, ability to swallow the food, stringy, greasy, and doughy. For all these descriptors, participants gave higher scores during the first session than during the second one. However, a significant *product×session* interaction was observed for only the descriptor doughy; the financier belonged to the 'doughy' products in the first session (with the madeleine, the milk roll and the protein-enriched milk roll), while it belonged to the "not doughy" products in the second session (with the crispbread). None of the other questionnaire items were associated with a significant *product×session* interaction, providing that the participants were quite repeatable when scoring the products for food comfortability.

Third, only two oral health parameters were used in the present study for assessing the oral status of the participant: the number of functional units and the resting salivary flow. Indeed, the number of functional units is known to be a key determinant of masticatory performance

(Hatch *et al.*, 2001), and the resting salivary flow reflects an individual's basic physiological status rather than his/her immediate reflex response to stimulation. However, other oral parameters could have been taken into account. Regarding mastication, muscle mass and bite force are known to decrease with age and thus decrease masticatory performance (Hatch *et al.*, 2001); (Woda *et al.*, 2006). However, Kohyama *et al.* (2003) demonstrated that elderly people cope relatively well with muscular weakness by extending the time cycle of mastication. Regarding salivation, previous studies have concluded that a value of 0.1 ml/min defines hyposalivation. However, most of these studies were conducted with frail, dependent and highly medicated elderly people (Muñoz-González *et al.*, in prep.). In the present study conducted with healthy elderly people living at home, only 6% of the participants displayed a resting salivary flow below 0.1 ml/min. Furthermore, the present study compared elderly people with low salivary flow *versus* high salivary flow, not necessarily elderly people with hyposalivation *versus* elderly without hyposalivation. Indeed, a person with hyposalivation can be defined as having a resting salivary flow rate below 0.1 ml/min; meanwhile, we limited our subjects having a resting salivary flow that was based on the median resting salivary flow observed in a large sample of healthy and autonomous elderly people (*i.e.*, AlimaSSenS sample, n=180). Furthermore, it could be argued that measuring *stimulated* salivary flow rather than *resting* salivary flow would be better representative of the saliva flow induced by the consumption of a food. Measuring stimulated salivary flow consists in collecting saliva either during a mechanical stimulation (chewing a piece of paraffin wax during collection) or a gustatory stimulation (application of citric acid on the anterior surface of the tongue). However, those two stimulations are a reduced representation of stimulated saliva during food eating, which involves a much more complex stimulation (Ekström *et al.*, 2012). Indeed, it has been shown in cereal products (toast and cake) that stimulated salivary flow during food consumption is significantly higher than mechanically stimulated salivary flow (Gavião *et al.*,

2004) Moreover, the authors observed a significant correlation between resting salivary flow and food-stimulated salivary flow, which suggested that resting salivary flow can be an indicator of the amount of saliva secreted during eating. Furthermore, the measure of stimulated salivary flow was associated with a large variability, whether between the different stimulations or even inside one stimulation but with different methods to collect saliva (Navazesh and Christensen, 1982).

To the best of our knowledge, the present experiment is the very first one that studied the impact of dental status and salivary flow on food perception, particularly texture and taste perception, in the elderly population. However, the absence of conclusive results observed in the present study is consistent with the results of the very few studies that investigated texture perception in older people. In fact, the research studies on meat texture produced by Mioche and collaborators showed no aged-related effects in terms of tenderness and juiciness perception when comparing young subjects and old adults with good dental health (Mioche, 2004). Veyrune and Mioche (2000) noticed that subjects with complete dentures were more sensitive to changes in juiciness of meat samples compared to dentate subjects, but the toughness perception of meat was similar between the two groups. Several hypotheses can be proposed to explain this lack of strong impact of age-related oral impairment on texture perception.

First, it may be assumed that the few remaining teeth of the elderly people with poor dental status are sufficient to discriminate the products, in particular, products that present large differences in terms of texture and/or flavour, as was the case in the present experiment. In fact, texture perception does not exclusively rely on periodontal mechanoreceptors. There are also mechanoreceptors in the other oral mucosa (tongue, palate, cheek) which may be sufficient to perceive food texture when the periodontal sensitivity is impaired due to tooth loss. Second, it is also possible that low saliva flow subjects had low saliva flow for a long time or that saliva flow had decreased progressively in time. In this case, they do not realize that it takes them longer to humidify the food with their saliva, and do not consider the food drier than elderly people with a high salivary flow. They probably adapted their food oral processing to this low saliva flow without any consequence in dry perception and food comfortability. Third, elderly people with poor oral health may have adapted their eating behaviour, such as mouthful size, chewing time or the amount of water drunk. Regarding mouthful size, Goto *et al.* (2015) suggested that a decrease in the mouthful size might assist with the formation of a bolus to cope with poor oral health. In the present experiment, we measured spontaneous mouthfuls of the cereal products during the second session that was organized to measure rating repeatability. For each product, five samples were served to the participants. Participants were asked to bite one time in each sample, and mouthful sizes were weighted by the experimenters. The results showed no difference between participants, whether they had oral impairments (poor dental status or low salivary flow rate) or not. They did not adapt the size of their mouthful according to their oral health. Regarding chewing time, it may be assumed that elderly people with oral impairment spend more time chewing food, particularly uncomfortable food, but they would not consciously realize it as it resulted from a progressive decline in oral health. The chewing time should be measured in further studies in order to confirm or infirm this hypothesis. Regarding the amount of water drunk, Shiozawa and Kohyama (2011) demonstrated that the addition of water in the mouth during mastication would facilitate the formation of a food bolus suitable for swallowing, regardless of the type of food. It may be assumed that elderly people with a low salivary flow drink a larger amount of water during food consumption. Measuring the amount of water drunk during the sessions in future studies will help in better understanding the eating behaviour of this specific population.

CONCLUSION

In conclusion, we observed very few effects of dental and saliva status on food perception for cereal-based and meat-based products. This is consistent with the results of the very few studies that investigated texture perception in older people. However, before drawing definitive conclusions, future studies should explore the impact of a broader set of oral parameters including muscle strength and measure potential adapting factors (mouthful size, chewing time, and water drunk…). Furthermore, it could be interesting to consider the impact of age-related impairment on the perception of food products, which displayed a smaller sensory difference than in the present experiment.

Ethical Statements

The authors declare that they do not have any conflicts of interest. The experimental protocol was approved by the French Ethics Committee for Research (CPP Est III, Nancy, #15.04.04, ANSM #2015-A00279-40). In accordance with ethical standards, all participants received written and oral information on the study before signing a consent form.

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Figure 1. Food comfortability questionnaire

General question

This food is…

Very uncomfortable	Uncomfortable	Moderately comfortable	Comfortable	Very comfortable
□	□	□	□	□

Bolus formation

To cut this food with your incisor is…

Impossible	Very difficult	Difficult	Moderately easy	Easy	Very easy
□	□	□	□	□	□

Same scale for cutting with premolars, masticating, humidification with saliva, swallowing and time needed to form the food bolus

Mouth pain

Does eating the food bring a burning or spicy sensation?

Extremely	A lot	Little	Not at all
□	□	□	□

Same scale for muscular pain, articular pain, dental pain and gum pain

Texture

Is this food sticky?

Extremely	A lot	Little	Not at all
□	□	□	□

Same scale for stringy, greasy, dry, doughy, melting, firm and hard

Flavour

Is this food intense in taste?

Extremely	A lot	Little	Not at all
□	□	□	□

Same scale for salty, sugary, acidic and bitter

Table 1. General characteristics of participants

		Cereal panel	Meat panel
Number of participants		37	34
Gender (% female)		54.05%	52.94%
Age	m (SEM)	73.49 (1.04)	72.15 (1.07)
	Range	65-87 years old	65-87 years old
Dental status	**Good dental status**		
	n	23	22
	m (SEM)	8.09 FU (0.53)	8.27 FU (0.64)
	Poor dental status		
	n	14	12
	m (SEM)	3.36 FU (0.69)	2.58 FU (0.84)
Saliva status	**High salivary flow**		
	n	17	18
	m (SEM)	0.53 ml/min (0.05)	0.51 ml/min (0.05)
	Low salivary flow		
	n	20	16
	m (SEM)	0.14 ml/min (0.05)	0.16 ml/min (0.05)

FU: Functional Units

(SEM): Standard Error of the Mean

Table 2. Results of the Anova on the dentition and saliva effect for both cereal-based and meat-based products

		Cereal-based products			**Meat-based products**		
	Variables	Dentition effect	Saliva effect	Interaction	Dentition effect	Saliva effect	Interaction
General perception	Comfort	0.490	0.856	0.641	0.569	0.872	0.815
Bolus formation	Incisor	0.894	0.379	0.716	0.270	0.949	0.840
	Molar	0.279	0.130	0.704	0.358	0.899	0.961
	Masticate	0.656	0.675	0.545	0.866	0.812	0.424
	Humidify	0.831	0.609	0.948	0.938	0.334	0.479
	Swallow	0.794	0.228	0.878	0.685	0.475	0.406
	Time	0.425	0.419	0.749	0.944	0.100	0.757
Pain	Burn	0.354	0.610	0.224	0.165	0.278	**0.001***
	Muscle	**0.015***	**0.053***	**0.013***	**0.012***	0.280	0.105
	Articular	0.134	0.680	**0.038***	0.607	0.709	0.175
	Dental	**0.012***	**0.046***	**0.006***	0.343	0.716	0.834
	Gum	0.565	0.150	0.916	0.839	0.797	0.416
Texture	Sticky	0.095	0.192	0.059	0.143	0.121	0.931
	Stringy	**0.045***	**0.048***	0.206	0.766	0.707	0.828
	Greasy	0.603	0.609	**0.052***	0.204	0.277	0.585
	Dry	0.341	0.469	0.711	0.603	0.714	0.901
	Doughy	0.793	0.106	0.101	0.300	0.306	0.531
	Melting	0.391	0.206	0.660	0.730	0.474	0.540
	Firm	0.312	0.945	0.208	0.236	0.528	0.300
	Hard	0.784	**0.046***	0.443	0.949	0.159	0.928
Flavour	Taste intense	0.547	0.316	0.565	0.478	0.876	0.877
	Salty	0.450	0.870	0.473	0.338	0.938	0.340
	Sweet	0.659	0.981	0.170	0.549	**0.044***	0.464
	Acidic	0.712	0.211	**0.034***	**0.016***	0.610	0.648
	Bitter	0.871	0.313	0.078	0.455	0.505	0.805

Presentation of the p-value and significance levels (*P < 0.05; **P < 0.01;***P < 0.001)