Paper 12

Sensory profile of Cooked Rice and Consumer Preferences

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Abstract

240 consumers from 3 French towns were invited to the laboratory. Three raw-milled and 3 parboiled rices were presented simultaneously. The consumers were asked about their preference and invited to mention the weak and strong points of each rice. Four distinct clusters of consumers were formed from differences in their preferences : for the aromatic rice, for the raw-milled rices, for the parboiled rices or for the most conventional rices. The weak and strong points gave the information we required to know the sensory salient characteristics which were liked and the defects of rices.

Keywords

- Preference, flavour, texture, appearance, rice
- France

Acknowledgements

Introduction

Previous work (Pons et al., 1996, DGAL, 1997) on the sensory profile of 26 rice varieties and rice products including raw-milled rices and parboiled rices has shown that it was possible by cluster analysis to identify 6 groups of rice. In each group of specific sensory profile, one rice was selected as representative of the sensory characteristic of the group.

The aim of this work is to ask consumers about their preference for these 6 rices and to relate their preferences to the sensory characteristics described by the trained panel. Moreover, they were asked about the strong and weak points of these products to compare their perception with the description of a trained panel.

Material and Methods

Rices

125-g portion of milled rices were put in a perforated bag for accurately timed periods in 1 L of boiling natural spring water (Volvic, France) containing 7 g of NaCl. The type of rice, the time of cooking and dominant sensory characteristics of the rices are listed in Table 1.

The 6 rices selected were : Ariete Camargue (ariet13) for its bright and aggregated appearance, sticky and mealy texture and its starch flavour, Thaïbonnet Camargue (tbc15) for its swollen, aggregated and damaged grains, its melting and sticky texture and its starch and milk flavour, Basmati (basma12) for its long grains and its milk and brioche flavour, a parboiled Thaïbonnet (TB10) characterised by firmness, a crunchy texture, and bouillon flavour, another parboiled Thaïbonnet (TB17) described by a brown colour, presence of foreign matter, swollen grains and bouillon flavour, and a commercial rice (Z10) which was brown, bright, firm elastic and had a bouillon flavour.

Consumer panel

240 consumers from 3 towns in France - Clermont-Ferrand, Montpellier and Nantes - were invited to the laboratory and asked about their preference for the 6 rice samples. They did not receive any information about the rice samples. The sex ratio is balanced and their age varies between 18-65 with an average of 37. They received simultaneously the 6 samples in hot glasses and assessed the overall acceptability of rices on non structured scales. Moreover, they were asked about the strong and weak points of each sample. Their comments were grouped into strong (+) or weak (-) points.

Statistical analyse :

A cluster analysis was performed on the correlation matrix computed with the acceptability scores of the 239 consumers for the 6 products. This analysis enabled us to divide the set of consumers into clusters in such a way that each cluster can be interpreted as essentially unidimensional. The preferences of the consumers belonging to a cluster are the same. An analysis of variance by cluster and the means comparison test of 6 rices showed the difference in preference of the consumers.

An internal preference mapping was carried out with the overall acceptability scores to show the directions of preference vectors of the consumers, the location of each rice in the preferences space and the correlations between sensory variables superimposed and the preferences.

The correspondence analysis computed with the frequencies of strong and weak points attributed to each rice shows the correspondence between the rice samples and attributes.

Results

Preference mapping

The first plan of the internal preference mapping accounted for 57% of the variation of overall acceptability scores (Figure 1). The majority of the increasing preference vectors was located on the right of the figure. The position of basma12 in the right part of the plot indicates that this sample was preferred by a majority of the consumers. Basma12 was described by the sensory attributes : long grains and brioche flavour. TB17 is in the middle of the first axis and at the top of the third

axis. It is liked a lot but less than basma12. These main sensory characteristics were brown colour, swollen grains, presence of foreign matter and bouillon flavour. The rice Z10 is close to TB17 on the first axis but far on the third axis. It was also described by the brown colour and bouillon flavour but distinguished from TB17 by its bright appearance, firmness and elasticity. TB10, ariet13 and tbc 15 are on the left and were less appreciated than the other rices. TB10 looked like Z10 but it was firmer and crunchy. Ariet13 and tbc15 are close to one another. A few consumers liked these rices. They were characterised by a sticky and mealy texture, swollen aggregated damaged grains.

Analyses of variance by cluster and for all the consumers

The cluster analysis performed 4 distinct clusters of consumers. The first cluster is composed of 64 consumers, the second one of 63, the third one of 52 and the last one of 60. The analysis of variance by cluster shows that the rice factor was very significant in all the consumer clusters. The means comparison test shows that the consumers of the first cluster preferred basma12, then Z10, TB10 and TB17, and finally tbc15 and ariet13 (Figure 2). They preferred the white aromatic rice with long grains, then the parboiled rices and they liked much less the 2 raw-milled rices whose scores were under the average (5 out of 10). They were sticky with aggregated and swollen grains.

Cluster 2 preferred the raw-milled rices and the parboiled rice TB17. The 6 means were significantly different. Basma12 was preferred, then tbc15, TB17, ariet13, Z10 and finally TB10. The last 3 rices were scored under the average.

Cluster 3 distinguished 4 groups of rices : the parboiled rices ranked the best, then Z10, TB10 and tbc15, then tbc15 and arietec and finally basma12.The last cluster preferred TB17, and basma12, then all others. The consumers belonging to this cluster preferred the rices well-cooked with swollen and thick grains. Three clusters out of four preferred basma12 and the last one ranked basma12 in last position. This analysis proved that the preference was variable from one consumer to another. All the rices were ranked first at least once, except ariet13. They were also ranked last except TB17. TB17 will be a conventional rice which has a classic appearance and a common taste without defect nor salient characteristic.

The analysis of variance computed with all the consumer data shows that the rice effect was very significant while there was no effect of town factor nor significant interaction rice*town. Basma12 was ranked first, then TB17, then Z10, tbc15 and TB10, and finally ariet13. This global analysis gave reduced information compared to those performed by cluster and masked the differences in consumer preferences. However, it reflected the overall tendency.

Correspondence analysis

18 categories were conceived from the 1577 strong points written by consumers to characterise the traits of the 6 rices they like : 'beautiful appearance', 'beautiful colour', 'nice shape', 'good', 'nice taste', 'aromatic', 'nice texture', 'well-cooked', 'light' (the opposite of 'heavy'), 'white colour', 'long grain', 'thick grain', 'crunchy', 'firm', 'soft', 'tender', 'not sticky' and 'sticky'. The most often quoted descriptions were concerned with taste (330), then 'not sticky' (168), 'aromatic' (164), 'firm' (147), 'good' (105) and 'long grains' (103). Basma12 and TB17 received the largest number of descriptions concerning 'nice taste' and 'aromatic'. Z10, TB10, TB17 and basma12 had as a strong point to be 'not sticky'. Z10, TB10 and basma12 distinguished by an appreciated firmness. Descriptions regarding long/thin grains were mentioned for basma12, Z10 and TB10. Moreover, basma12 was appreciated for its impression of lightness (easily digested, dietetic, natural ...).

21 categories were created to classify 1599 weak points or descriptions open to criticism : 'bad appearance', 'bad colour', 'bad taste', 'unpleasant odour', 'bad texture', 'undercooked', 'heavy', 'too white', 'yellow', 'long grain', 'thick grain', 'tasteless', 'odourless', 'dry', 'crunchy', 'tough', 'elastic', 'overcooked', 'mealy', 'too soft' and 'sticky-pasty'. The most common defect of rice was 'sticky' (334), then 'tasteless' (251), 'bad taste' (190) and 'tough' (176). The 'sticky-pasty' and 'mealy' defects were imputed to ariet13 and tbc15. 'Tasteless' was frequently mentioned for Z10, ariet13, tbc15 and TB10. 'Bad taste' was mentioned between 21 and 44 times for each rice. 'Tough' was used to characterise TB10. TB10 and ariet13 were perceived as 'undercooked'.

The first plan of the correspondence analysis explains 82% of the variations (Figure 3). A majority of strong points (descriptions finishing by +) were on the right and at the bottom of the figure and a lot of weak points (descriptions finishing by -) are at the top and on the left. According to the third axis, the weak and strong points are scattered. Basma12 had a high correspondence or association with 'aromatic', nice 'texture', 'white' colour, 'long' grain and 'light'. It was sometimes perceived as too 'long' by 10 consumers and 'undercooked' by 9 consumers. So its defects remained minimal. TB17 had also more correspondence with strong points than with weak points. It received high frequency values for 'tender', 'good' and 'well-cooked'. It had association with bad 'texture' and bad 'colour'. However, these defects were minor because they were mentioned only by 6 and 7 consumers. TB10 and Z10 were close to one other because they had similar profiles : they were described as 'firm'; 'crunchy', 'not sticky', 'beauty', and having a nice 'texture' and a nice 'shape'. Their main defects were 'tough' (79 and 41 times, respectively) and 'tasteless' (42 and 62 times, respectively). Their minor weak points were 'dry' (22 and 16 times), 'elastic' (14 and 13 times), 'undercooked' (27 and 12 times) and 'yellow' (13 and 11 times). TB10 could have been liked more if its cooking time had been longer than 10 minutes. Ariet13 and tbc15 were also close and had a high correspondence wit : 'sticky-pasty' (145 and 135 times), 'mealy' (22 and 19 times), 'overcooked' (5 and 15 times), 'too soft' (8 and 25 times) and 'heavy' (9 and 10 times). A few consumers (13 and 10, respectively) liked the sticky texture of both rices.

Conclusion

The analyses of variance by cluster pointed out that the preferences in matter of appearance, taste and texture were very variable from one consumer to another. Some of them preferred the aromatic rice and the raw-milled rices, others liked the parboiled rices, and others the most conventional rices.

The comparison of the figures derived from preference mapping and correspondence analysis showed similar result : basma12 was preferred by a majority of consumers. The trained panel described this rice using 'long grains' appearance and 'brioche' flavour. The correspondence analysis revealed that the higher number of strong points was imputed to basma12. Among those, 'aromatic', 'long grains', 'white' colour and nice 'texture' were mentioned. Ariet13 was the less liked rice. The trained panel characterised this sample as 'sticky', 'swollen grains', 'milk' and 'starch' flavour. The consumer panel mentioned 'sticky', 'mealy', 'thick grains', 'bad appearance', 'too soft', 'white' and 'overcooked'. The vocabulary of the consumers was more involved with their preference while that of the trained panel was more descriptive in term of differences among samples.

Table 1. List of the rices, cooking times and main sensory characteristics

Rice variety	Code	Cooking time (min)	Main sensory characteristics		
			Appearance	Texture	Flavour
Raw-milled rices					
Thaï-Bonnet Camargue	tbc15	15	swollen grains	melting-sticky	starch-milk
Ariète Camargue	ariet13	13	swollen grains	sticky-mealy-crunchy	starch-milk
Basmati	basma12	12	long grains-bright	-	milk-brioche
Parboiled rices					
Thaï-Bonnet	TB17	17	brown colour	-	bouillon
Thaï-Bonnet	TB10	10	-	firm-crunchy	bouillon
not identified	Z10	10	brown colour	firm-crunchy	bouillon

Fig.1 Preference mapping

Figure 1.Preference mapping
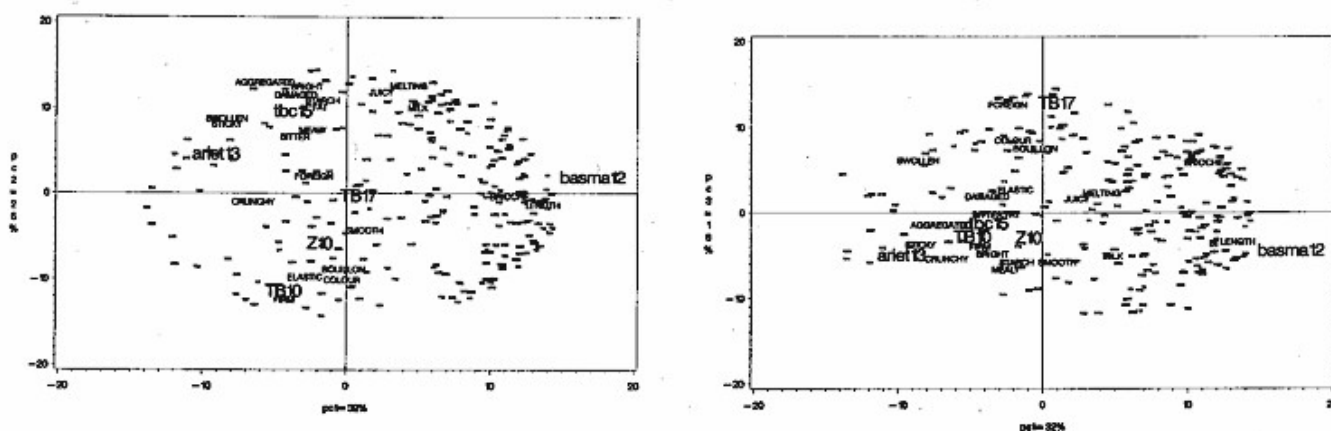
6 rices — 240 consumers from Montpellier, Clermont—Ferrand and Nantes

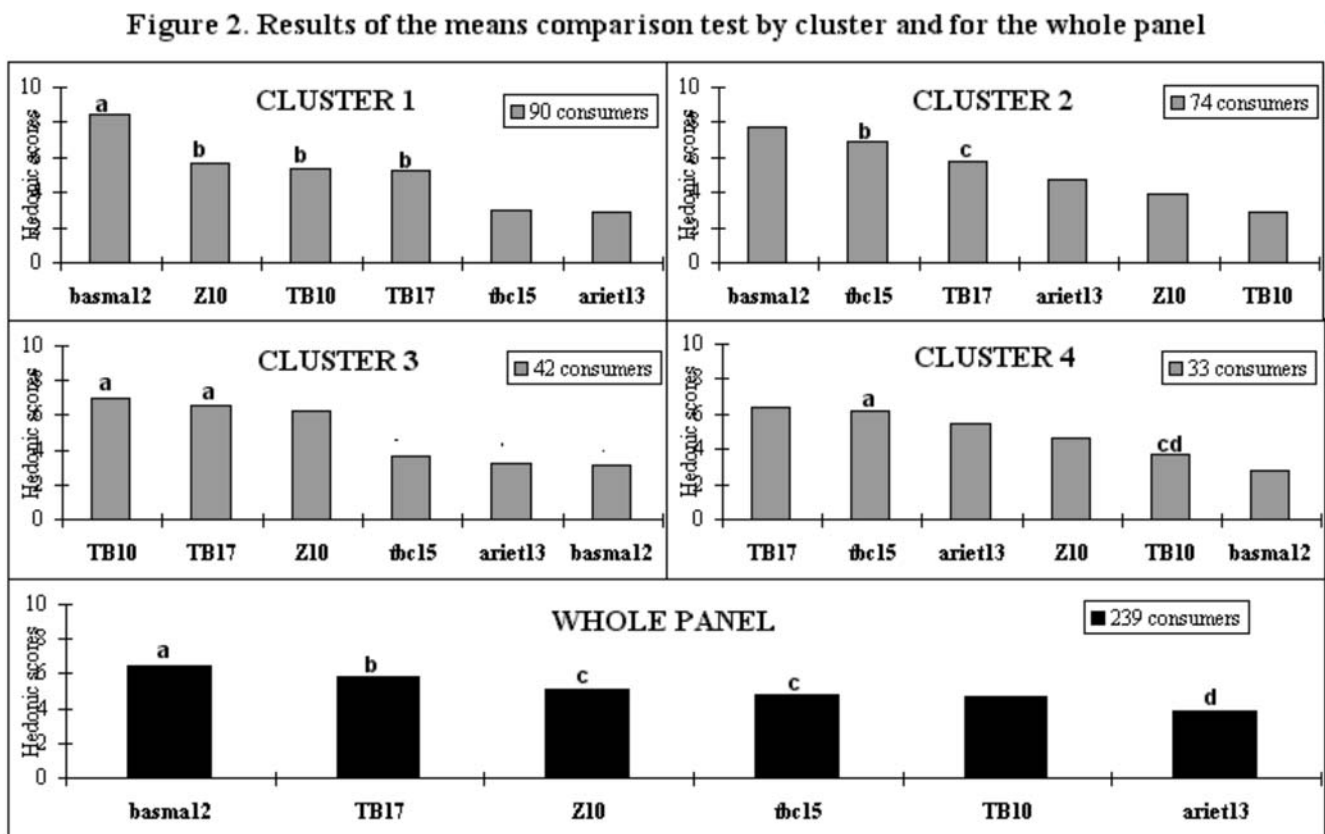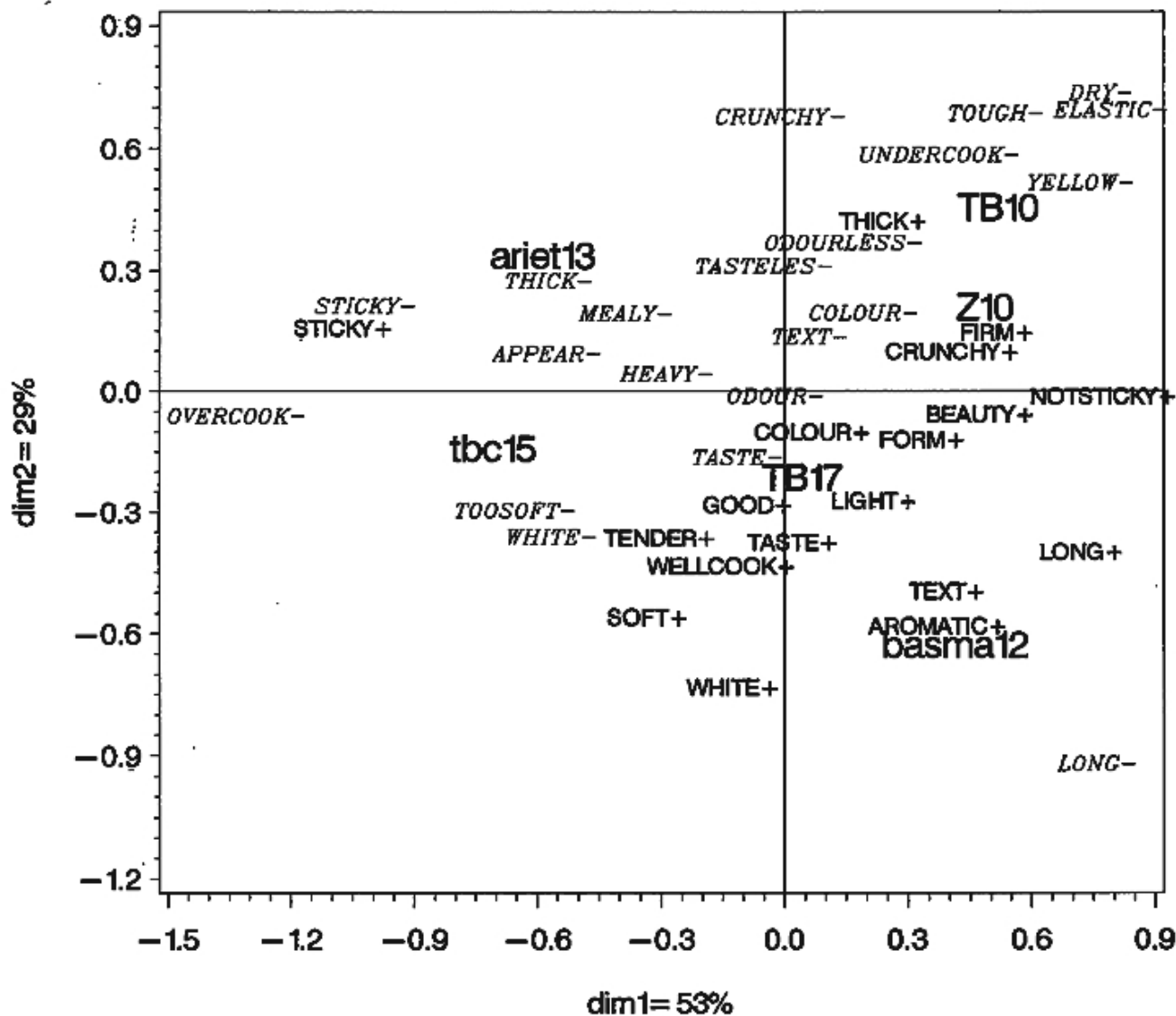Fig.2 Results of the means comparison test by cluster and for the whole panel

Figure 2. Results of the means comparison test by cluster and for the whole panel

Means with the same transcript do not differ (p<0.05)

Fig.3 Correspondence analysis of strong and weak points

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Figures summary

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