S7P08.WP

RELATIONSHIP BETWEEN FAT LEVEL AND FLAVOUR IN MINCED BEEF

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INTRODUCTION

Low fat level in beef meat is becoming a request of consumers. At the same time, they deplore a lack of taste in meat. In fact, a very wide range of fat content in meat is available through different kinds of carcasses and different kinds of muscle from each carcass. It should be therefore possible to satisfy consumers who seek either low fat meat or tasty meat. To do this, it is first necessary to determine the lowest fat level required in beef to provide it with a satisfactory flavour. The aim of this study is to contribute in this regard.

MATERIALS AND METHODS

Sensory analysis

Six sessions were conducted. Each session involved six plates, three plates with intramuscular fat and three plates with intermuscular fat. Each plate included two samples of minced meat with different fat levels. Ovrall, 18 unique plates were made up, as shown in Table 1. These plates were distributed among the different session as outlined in Table 2. For each session, the order of the distribution of plates was randomly pre-established.

Preparation of minced meat samples

Minced meat with intramuscular fat was prepared from three kinds of muscles (*m.infraspinatus, m.serratus ventralis, m.longissimus dorsi*) collected from young bulls and cow carcasses. These muscles after a careful trimming were vacuum-packaged and stored at 0-2°C for ageing for a period of eight days. After storage, batches of about 500g were prepared from each muscle. Fat content of each batch was determined by chemical analysis (Sohxlet 55) and three patties of 120g were prepared from each batch.

Minced meat with intermuscular fat was prepared by mixing different proportion of two batches, one used for preparation of commercial minced meat with 15% fat content, the other prepared only with very low fat content muscle. Fat level of each different batch obtained was determined by chemical analysis (Sohxlet 55). Three patties of 120g were prepared from each batch.

Cooking method

Frozen patties wrapped with grease-proof paper were cooked on an electrical hotplate made of chrome at 210°C for seven minutes.

Sensory panel evaluation

A trained 12-member sensory panel was used to analyze cooked patties for palatability characteristics. Flavour intensity,

flavour appreciation, and juiciness during the first bite were evaluated on a scale from 1 (least) to 100 (greatest). Slices of apple and water were given between each sample.

Statistical analysis

First, a descriptive analysis of data was made showing the relationship between the different scores and fat level.

In the second step, the differences between scores for two fat levels were calculated and analyzed by covariance analysis (SAS 82). In the covariance analysis, the effects of "session", panel-member", "difference of fat level compared", "fat level x difference of fat level compared" and "session x panel-member" were tested. Fat level was used as the co-variable.

RESULTS AND DISCUSSION

The average flavour intensity scores for each of the compared fat levels are given in Table 3.

The evolution of scores was quite the same for intramuscular or intermuscular fat: the average scores increased slightly until about 10% of fat content and then decreased; however, flavour intensity scores were rather the same regardless of fat level.

The average differences between scores adjusted by covariance analysis are given in Tables 4 and 5.

Differences between scores are close to 0 when differences between compared fat level are from 2 or 4 points. For a difference of 6 points between fat content, the flavour intensity score increased by 8.66 and -0.98 points (on scale from 1 to 100), the appreciation of flavour score by 4.28 and 4.96 points and juiciness by 5.24 and 4.76 respectively for intra and intermuscular fat.

The slopes characterizing the evolution of differences between scores according to fat level are given in Tables 4 and 5. The few slopes that are significantly different from 0 are negative. Thus, the difference between scores decrease as fat level increased. According to the descriptive data, the increase in the scores is more important for fat content below 10% than beyond.

Results of the covariance analysis are given in Tables 8 and 9.

CONCLUSION

Only low fat levels in the range from 1 to 15% were investigated in this study taking the common fat level in meat of French cattle into account. Very small differences between fat levels were also compared because the practical problem is to know if increasing the intramuscular fat level of some points is able to improve the meat flavour, especially for meat from heifers and young bulls.

Our results are in agreement with papers which indicate either no or slight improvement of flavour with intermuscular fat level (Berry 84, Cross 80, Mc Keith 85, Kregel 86, Troutt 92). However, the intramuscular fat level effect was well defined, and the particular effect of intramuscular fat on flavour intensity observed in this research should be interesting to confirm.

In Summary, the results show that:

(1) The flavour intensity increases with the intramuscular fat level but not with the intermuscular fat level.

(2) The flavour appreciation and the juiciness increase with

the intramuscular or intermuscular fat level.
(3) The difference between all sensory scores decreases as the fat level increases.
(4) These increases seem to stop at a fat level of about 10%.
(5) These increases are detected by the panel member only if the difference between fat levels compared is 6 points.

It is necessary to confirm these results with unminced cooked meat.

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ACKNOWLEDGEMENT

This work is supported by the Ministry of Research and Space and INTERBEV.

Table 1. Samples plates.

Plate	Sample1	Sample2	Plate	Sample1	Sample2
A	1%	7%	J	9%	13%
B	3%	9%	K	11%	15%
C	5%	11%	L	1%	3%
D	7%	13%	M	3%	5%
E	9%	15%	N	5%	7%
F	1%	5%	O	7%	9%
G	3%	7%	P	9%	11%
H	5%	9%	Q	11%	13%
I	7%	11%	R	13%	15%

Table 2. Distribution of sample plates.

Session #	Plate 1	Plate 2	Plate 3
1	A	I	Q
2	B	J	R
3	C	F	L
4	D	G	M
5	E	H	N
6	K	P	O

Table 3. Average score of flavour intensity for different fat levels.

Fat level compared: Level 1(%)	Level 2(%)	Intramuscular fat Score level 1 Mean±s.d.	Score level 2 Mean±s.d.	Intermuscular fat Score level 1 Mean±s.d.	Score level 2 Mean±s.d.
1	3	63.25 ± 6.63	64.00 ± 8.74	62.41 ± 10.07	67.00 ± 8.21
1	5	61.83 ± 9.52	69.25 ± 5.69	69.17 ± 6.75	68.00 ± 8.81
1	7	62.25 ± 8.91	72.58 ± 74.28	73.36 ± 6.93	64.58 ± 10.05
3	5	65.75 ± 8.02	74.83 ± 7.98	74.00 ± 5.89	67.92 ± 9.59
3	7	67.00 ± 10.50	71.42 ± 8.23	69.16 ± 9.46	65.17 ± 9.74
3	9	60.08 ± 8.28	72.08 ± 7.14	65.08 ± 11.31	63.50 ± 12.63
5	7	69.42 ± 10.62	66.83 ± 8.88	67.08 ± 10.05	65.17 ± 13.88
5	9	65.83 ± 10.55	71.17 ± 8.56	64.00 ± 10.26	67.08 ± 6.99
5	11	67.75 ± 8.76	73.92 ± 7.55	73.17 ± 9.92	68.42 ± 6.71
7	9	63.92 ± 8.38	71.75 ± 7.46	63.33 ± 9.02	58.50 ± 9.78
7	11	62.33 ± 12.50	70.33 ± 11.16	65.42 ± 7.20	68.09 ± 9.63
7	13	70.42 ± 10.69	72.92 ± 6.94	65.83 ± 8.21	74.08 ± 7.52
9	11	68.08 ± 10.79	70.25 ± 7.09	64.33 ± 7.54	66.42 ± 8.65
9	13	75.33 ± 6.27	70.00 ± 11.58	66.92 ± 11.36	60.42 ± 12.25
9	15	69.25 ± 7.52	75.41 ± 9.76	64.00 ± 8.48	71.00 ± 11.38
11	13	71.58 ± 9.20	66.50 ± 10.31	67.42 ± 6.42	69.17 ± 8.59
11	15	70.58 ± 8.91	68.08 ± 6.46	65.08 ± 7.44	66.33 ± 9.07

13	15	68.25 ± 8.59	68.92 ± 8.07	67.5- ± 11.99	58.66 ± 11.03

Table 4. Average adjusted difference between scores for the different intramuscular fat levels compared.

Difference between fat levels:	Flavour intensity	Flavour appreciation	Juiciness
2 points	-2.77	-3.53	-1.66
4 points	-0.46	0.58	0.40
6 points	-0.98	4.96	4.76

Table 5. Average adjusted difference between scores for the different intermuscular fat levels compared.

Difference between fat levels	Flavour intensity	Flavour appreciation	Juiciness
2 points	-2.77	-3.53	-1.66
4 points	-0.46	0.58	0.40
6 points	-0.98	4.96	4.76

Table 6. Test of slopes characterizing evolution of differences of score according to intramuscular fat level.

Palatability characteristic	Difference between fat level	Estimated level of the slope	Significance
Flavour intensity	2 points 4 points 6 points	-1.12 -2.07 -0.21	NS P<0.01 NS
Flavour appreciation	2 points 4 points 6 points	-0.03 0.49 -1.32	NS NS NS
Juiciness	2 points 4 points 6 points	-0.03 -1.32 -0.55	NS NS NS

Table 7. Test of slopes characterizing evolution of differences of score according to intermuscular fat level.

Palatability characteristic	Difference between fat level	Estimated level of the slope	Significance
Flavour intensity	2 points	-0.66	NS
	4 points	-0.28	NS
	6 points	2.13	P<0.03
Flavour appreciation	2 points	0.91	NS
	4 points	-0.49	NS
	6 points	-3.32	P<0.01
Juiciness	2 points	-0.50	NS
	4 points	-1.15	NS
	6 points	-1.49	NS

Table 8. Covariance analysis on differences between sensory scores for intramuscular fat.

Effect tested	Flavour intensity	Flavour appreciation	Juiciness
Difference between fat level	NS	NS	P<0.05
Session	NS	NS	NS
Difference between fat level x fat level	P<0.03	NS	NS
Panel member	NS	NS	NS
Session x panel member	NS	NS	NS

Table 9. Covariance analysis on differences between sensory scores for intermuscular fat.

Effect tested	Flavour intensity	Flavour appreciation	Juiciness
Difference between fat level	NS	P<0.01	NS
Session	NS	NS	NS
Difference between fat level x fat level	NS	P<0.03	NS
Panel member	NS	NS	P<0.02
Session x panel member	NS	NS	NS