DAS VORKOMMEN EINES ABNORMALEN GERUCHS IM FETTE VON SCHWEINEKÖRPERN

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ZUSAMMENFASSUNG

Die Untersuchung vom Fettgeruch in den Schlachtkörpern von Fleischschweinen (63,50-72,57 kg) durch zwei ausgebildeten Prüfungsausschüsse während eines Zeitdauers von 10-12 Wochen zeigte, dass das Eberfett einen signifikant grösseren Anteil an abnormalem Geruch als das Fett von kastrierten oder weiblichen Schweinen ($P < 0.001$) enthielt. Die vorwiegende Art abnormales Geruchs im Eberfett wurde auf 5α-androst-16-ene-3-one (männlichem Geschlechtsgeruch) zurückgeführt; die im Fette der Kastraten und weiblichen Schlachtschweinen vorkommenden Anteile waren signifikant niedriger ($P < 0.001$). In bezug auf das Verhalten der Beurteiler gegen dem Geschlechtsgeruch während der Untersuchung gab es (a) persönliche Konsistenz in den Noten (b) ein grosser Unterschied zwischen einzelnen Noten (c) häufige Wechselwirkung mit Geschlechtern, jedoch mit höheren Noten für Eber als für Kastraten und weibliche Tiere. Diese Faktoren sind wichtig für die Erklärung von Ausschussmittelwerten.

THE OCCURRENCE OF ABNORMAL ODOUR IN PIG CARCASE FAT

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SUMMARY

The examination of fat odour in bacon weight carcases (63.50-72.57 kg) by two trained panels over a period of 10-12 weeks showed that boar fat contained significantly more abnormal odour than either hog or gilt fat ($P < 0.001$). The predominant type of abnormal odour found in boar fat was attributed to 5α-androst-16-ene-3-one (boar taint) with significantly lower levels occurring in hog and gilt fat ($P < 0.001$). Regarding the behaviour of judges to boar taint during the testing period, there was (a) individual consistency in scoring (b) wide variation between individual scores (c) frequent interaction with sexes, but with boars scored higher than hogs and gilts. These factors are important in the interpretation of panel means.

LA PRESENCE DE L'ODEUR ANORMALE DANS LA GRAISSE DES CARCASSES DE PORC

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RESUME

L'examen de l'odeur de la graisse des carcasses de porc (63.50 - 72.57 kg) par deux jurys de juges expérimentés pendant une période de 10-12 semaines a démontré que le tissu adipeux des porcs mâles entiers contenait un niveau significativement plus élevé d'odeur anormale que celui des mâles castrés ou des femelles ($P < 0.001$). Le type prédominant d'odeur anormale rencontré dans la graisse des mâles entiers a été attribué au 5α-androst-16-ene-3-one (odeur sexuelle), les niveaux étant significativement inférieurs dans la graisse des mâles castrés et des femelles ($P < 0.001$). En ce qui concerne la réaction des juges à l'odeur sexuelle pendant l'examen, il se trouvait (a) une consistance individuelle dans les points marqués (b) une grande variation entre les points individuels (c) une action réciproque fréquente avec les sexes, mais avec des points plus hauts pour les mâles entiers que pour les mâles castrés et les femelles. Ces facteurs sont d'importance pour l'interprétation des moyennes des jurys.

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INTRODUCTION

Boar taint, the most common type of abnormal odour associated with pig carcase fat, is attributed largely to the presence of 5 α-androst-16-ene-3-one, a compound with an intense urine-like odour (1). Detectable amounts of the taint are thought to occur in a small percentage of hogs and gilts, but this has never been fully verified. Very little is known about the extent of occurrence of other possible types of abnormal odour variously described as skatole, musty, spicy, sweet, soapy and fishy. Using a heated soldering iron (160-180°C) for the testing of carcase fat samples by two trained panels, we have studied (a) the relative occurrence of abnormal odour (all unusual odours including boar taint) in boars, hogs and gilts, and (b) the usefulness of trained panels as a reliable means of assessing abnormal odour.

MATERIALS AND METHODS

Selection and Training of Panel Judges

Judges were selected on their ability to detect with ease 5 α-androst-16-ene-3-one adhering to the tip of a glass rod previously dipped in a diethyl ether solution of the standard compound. Subsequently the panel was trained with standard solutions of different concentration (0.16-3.00 µg/ml) and, despite the inevitable wide variation in nose sensitivity, each judge was able to form his or her personal scale of taint corresponding to:- 0 (absent or uncertain), 1 (slight, just detectable), 2 (medium, firmly positive), 3 (strong, violent reaction). A thorough check was made to ensure that judges could clearly recognise the characteristic odour of skatole, which the untrained nose frequently confuses with boar taint.

Carcase Fat Sample Preparation

Samples were removed from the shoulder area of carcases, vacuum packed and stored at -18°C until required. Before testing, samples stored for equal periods of time were allowed to reach room temperature, cut to expose a fresh surface, and trimmed to a uniform size. In order to reduce the possibility of extraneous odours due to oxidation products, a fresh surface was cut, if necessary, every two hours.

Sample Testing

Judges conformed to the following code of practice:-

(1) Ensure that the temperature of the soldering iron is in the range 160-180°C.

(2) Apply iron lightly to the surface of sample for a period of 3-5 seconds and smell without hesitation.

(3) Between tests clear nose by taking 5 inhalations.

(4) Between tests wipe iron on paper towelling and check for any residual odour.

In the recording of results judges were asked to:-

(1) State whether or not abnormal odour was present (Yes = 1, No = 0).

(2) Assess the type of abnormal odour.

(3) If boar taint, allocate a score of 1, 2 or 3.

Experimental Design

The total numbers of boar, hog and gilt carcases examined by two panels over a period of 10-12 weeks are shown in Table 1.

TABLE 1. Numbers of carcases tested from each factory.

	Factory 1 (Panel A)	Factory 2 (Panel A)	Factory 3 (Panel B)	Breeds*	Age (days)	Carcase Wt. (kg)
Boars	100	95	120	LR, LW, LRxLW	150-180	63.50-72.57
Hogs	100	95	120	LRxLW	Approx. 180	63.50-72.57
Gilts	100	95	120	LRxLW	Approx. 180	63.50-72.57

* LR = Landrace (Elite herds); LW = Large White (Elite herds); LRxLW = Landrace×Large White cross (commercial herds).

Panel A: 5-7 judges; Panel B: 4-6 judges.

At each factory fat samples were taken weekly from ten boar, ten hog and ten gilt carcases selected at random. These were tested in two sessions held, when possible, on the morning and afternoon of the same day; a session consisted of five boar, five hog and five gilt samples distributed at random.

Statistical Treatment of Data from each Weekly Test (1 or 2 sessions)

For abnormal odour the numbers out of 5 samples presented giving positive responses were analysed with respect to:-

(a) the main factor, sexes;

(b) secondary factors associated with the experimental design - times (a.m. and p.m.), judges, and sexes x judges interaction.

In the case of boar taint, scores (0, 1, 2 and 3) were analysed to determine the effects of sexes (main factor), times, judges and the interactions of times x sexes, sexes x judges, times x judges and times x judges x sexes.

RESULTS AND DISCUSSION

The results of 33 weekly tests (63 sessions) are summarised in Table 2 (abnormal odour) and Table 3 (boar taint).

Boars had significantly more abnormal odour than hogs and gilts ($P < 0.001$), there being no significant difference between the latter. Times and in general judges and the interaction sexes x judges were not significant. The percentage distribution of judge responses (see Table 4) shows that the predominant type of abnormal odour in boar fat is decidedly boar taint. Panel A (Factories 1 and 2) returned a significantly higher proportion of abnormal odour (not boar taint) responses (boars, hogs and gilts) than Panel B (Factory 3) ($P < 0.001$); skatole, musty, faeces and sweet odours were the most common, but in very few cases was there overall panel agreement as to a particular type. There was no significant difference in the amounts of abnormal odour (not boar taint) for the three sexes, within each panel with the exception of Factory 1, where boars > gilts ($P < 0.05$). It is indeed interesting that both panels found a significant amount of boar taint associated with hog and gilt fat. Quantitative studies by Patterson (1) have indicated that 5 α-androst-16-ene-3-one is not present in hogs and gilts.

In the actual scoring of boar taint, boars were again significantly higher than hogs and gilts ($P < 0.001$) with no significant difference between the latter. Each boar sample tested received a mean panel score >0, suggesting that no carcase in the bacon weight range is completely free of some level of recognisable taint. This contrasts with the results of a recent factory survey in Holland, which indicated that 93% of 2200 boars examined had no recognisable taint (2). Times and the interactions times x sexes, times x judges, times x sexes x judges were not significant, showing that judge response did not appreciably vary from morning to afternoon. The usually highly significant differences in judge scoring undoubtedly reflect the very real and important problem of variation in nose sensitivity. It is possible that a sensitivity obtained in the presence of a given level of standard 5 α-androst-16-ene-3-one could be reduced or even enhanced in the presence of natural fat odours and the sensation of heat from the iron. Furthermore this change in sensitivity could vary from nose to nose, thus leading to the observed differences in individual scoring. In view of this situation and the initial problem of natural variation in response to the standard compound, it is probable that the usefulness of odour panel testing lies more in the comparison of groups and not in the attempt at accurate estimation of odour strength. As would be expected, judges frequently showed significant interaction with sexes, but nevertheless scoring was consistently higher for the boar samples. The mean boar taint values for all boar, hog and gilt samples taken at each factory are shown in Table 5. Boars had significantly higher levels than hogs and gilts ($P < 0.001$) with no significant difference between weekly tests, showing that panel means were not adversely affected by the addition, withdrawal or substitution of judges. The mean level for boars scored by Panel B (Factory 3) was significantly higher than the corresponding scores obtained by Panel A (Factories 1 and 2) ($P < 0.001$) and may be due to (1) a greater sensitivity in Panel B, (2) a genuinely higher level of taint in the animals killed at Factory 3, or (3) a combination of both these factors; this illustrates the need for caution in the interpretation of strengths of boar taint obtained by different panels. Both panels did not significantly differ in the amounts of taint obtained for hogs and gilts.

REFERENCES

(1) PATTERSON, R.L.S. J. Sci. Fd. Agric. (1968) 19, 31.

(2) WALSTRA, P. Livestock Production Science Vol. I, p.187 (1974).

TABLE 2. Mean Abnormal Odour Values (numbers out of 5 samples tested).
NS not significant; * 0.01<P<0.05; ** 0.001<P<0.01; *** P<0.001

Week	Boars	Hogs	Gilts	Standard Error	Significances Sexes	Judges	Sexes/Judges
Factory 1							
1	3.600	2.800	1.200	0.476	*	NS	+
2	4.000	0.900	1.000	0.224	***	NS	NS
3	4.250	1.917	1.750	0.382	***	NS	NS
4	3.429	0.714	1.286	0.280	***	*	NS
5	3.583	2.000	2.000	0.373	*	*	NS
6	4.164	1.417	0.404	0.265	***	NS	NS
7	3.100	0.600	0.100	0.216	***	NS	NS
8	2.833	0.500	0.833	0.180	***	***	NS
9	3.600	0.600	0.600	0.440	***	NS	+
10	3.857	0.927	0.857	0.261	***	NS	NS
11	2.583	0.917	0.750	0.198	***	*	NS
Factory 2							
1	4.286	1.000	0.857	0.154	***	***	+
2	3.643	1.643	1.357	0.170	***	NS	*
3	3.286	0.929	1.143	0.184	***	*	NS
4	3.900	0.400	0.800	0.153	***	NS	**
5	2.300	1.400	2.300	0.252	*	NS	*
6	4.357	0.429	0.571	0.247	***	NS	NS
7	4.083	0.833	0.417	0.231	***	NS	NS
8	3.429	0.929	0.286	0.294	***	**	NS
9	3.417	0.667	0.500	0.245	***	NS	NS
10	3.583	1.250	0.667	0.167	***	NS	**
Factory 3							
1							
2	4.000	2.500	1.667	0.280	***	NS	NS
3	3.000	2.000	1.167	0.340	**	NS	NS
4	4.000	1.000	1.000	0.447	***	NS	NS
5	3.833	1.500	0.750	0.289	***	*	NS
6	2.875	1.250	0.250	0.382	**	NS	NS
7	4.100	0.600	0.000	0.208	***	NS	**
8	3.600	0.300	0.400	0.173	***	*	**
9	4.750	0.000	0.000	0.144	***	NS	NS
10	4.800	0.000	0.000	0.082	***	NS	NS
11	4.375	0.125	0.125	0.204	***	NS	NS
12	4.500	0.500	0.200	0.216	***	NS	NS
	4.000	0.125	0.375	0.125	***	NS	*

+ One session analysed; judges x sexes interaction used as error.

TABLE 3. Mean Boar Taint Values.
NS not significant; * 0.01 < P < 0.05; ** 0.001 < P < 0.01; *** P < 0.001

Week	Boars	Hogs	Gilts	Standard Error	Significances Sexes	Judges	Sexes x Judges
Factory 1							
1+	1.200	0.320	0.280	0.207	*	***	NS
2	1.280	0.100	0.200	0.102	***	***	***
3	1.367	0.367	0.183	0.153	***	***	***
4	0.871	0.100	0.100	0.108	***	**	*
5	0.817	0.133	0.167	0.111	***	NS	NS
6	0.850	0.150	0.033	0.140	***	*	NS
7+	1.167	0.233	0.000	0.268	*	*	NS
7+	1.080	0.000	0.000	0.181	**	**	**
8	0.667	0.067	0.050	0.140	**	NS	NS
9+	1.000	0.040	0.080	0.200	**	NS	NS
10	0.914	0.057	0.057	0.082	***	NS	NS
11+	0.486	0.114	0.029	0.118	*	NS	NS
11+	0.300	0.033	0.067	0.056	*	NS	NS
Factory 2							
1+	1.400	0.114	0.114	0.095	***	***	***
2	1.000	0.243	0.129	0.121	***	**	***
3	0.929	0.043	0.100	0.138	***	**	NS
4+	0.960	0.000	0.000	0.223	*	NS	*
4+	1.200	0.167	0.067	0.192	**	*	**
5+	0.600	0.333	0.100	0.122	*	NS	**
5+	0.640	0.000	0.240	0.236	NS	NS	*
6	1.271	0.071	0.129	0.097	***	***	***
7	1.050	0.000	0.033	0.093	***	NS	NS
8	1.029	0.143	0.029	0.123	***	NS	NS
9+	0.686	0.057	0.057	0.151	*	NS	**
9+	0.567	0.000	0.033	0.122	*	NS	*
10+	0.829	0.029	0.029	0.152	**	*	**
10+	0.633	0.100	0.100	0.170	*	NS	NS
Factory 3							
1	1.467	0.667	0.533	0.154	***	*	*
2	1.283	0.500	0.283	0.189	**	NS	***
3	1.600	0.240	0.240	0.138	***	**	***
4	1.580	0.480	0.120	0.186	***	***	*
5	0.950	0.300	0.050	0.104	***	NS	NS
6	1.560	0.180	0.000	0.084	***	NS	***
7	1.360	0.060	0.080	0.118	***	***	***
8	2.150	0.000	0.075	0.115	***	NS	NS
9	1.440	0.000	0.000	0.057	***	NS	NS
10	1.600	0.025	0.025	0.115	***	*	***
11	1.525	0.025	0.050	0.136	***	**	***
12	0.925	0.400	0.025	0.125	***	NS	NS

+ Analysis of 1 session.

TABLE 4. Abnormal Odour (percentage distribution of responses).

Factory	Panel	Total no. responses per sex	Abnormal odour Boars	Hogs	Gilts	Abnormal odour not boar taint Boars	Hogs	Gilts
1								
2	A	590	70.85	23.05	20.17	15.42	12.20	10.85
	A	595	72.44	18.99	17.31	15.46	11.60	11.09
3	B	590	79.32	18.31	11.02	1.20	1.86	0.85

TABLE 5. Mean Boar Taint Values for all Boar, Hog and Gilt Samples Tested from each Factory.

Factory	Panel	Total no. responses per sex	Boars	Hogs	Gilts	Standard error	Significances Treatments	Weeks
1								
2	A	600	0.938	0.134	0.102	0.042	***	NS
	A	615	0.966	0.103	0.089	0.043	***	NS
3	B	590	1.453	0.240	0.123	0.060	***	NS

*** P < 0.001; NS not significant.