

THE EFFECT OF BOAR ODOR LEVEL, MEAT BLOCK DILUTION AND THE ADDITION OF FENNEL SPICE ON THE ACCEPTABILITY OF COOKED FRANKFURTERS PROCESSED FROM BOAR PORK

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Frankfurters were processed from selected boar and barrow lean cuts to determine: (Phase I) the acceptable level of odor in boar carcasses to be incorporated in frankfurters; (Phase II) the extent of dilution necessary when boar pork containing a very strong odor was added to the meat block; and (Phase III) the effect of levels of fennel spice on the acceptability of frankfurters containing boar pork.

In Phase I of the study, carcasses were selected by panel evaluation (hot iron and sensory methods) to represent five levels of boar odor. For Phase II processing, carcasses characterized by the strongest level of boar odor were mixed with barrow pork to obtain five dilution levels: 0%, 25%, 50%, 75%, and 100% of the meat block. For Phase III, at each odor and dilution level, fennel spice was added as 0, 0.075%, and 0.15% of the meat block. This design was replicated three times. All frankfurter batches were evaluated by a trained sensory panel as to: color, texture, frankfurter odor and flavor, boar odor and flavor, and general acceptability.

Results showed a significant ( $P < .01$ ) and negative relationship ( $r = -.75$ ) between boar flavor and frankfurter acceptability. In Phase I pork rated as Medium or less in boar odor was acceptable for use in franks. Dilution of pork rated Very Strong in boar odor (Phase II) resulted in a significant quadratic reduction of boar odor in the processed franks. Products containing no more than 50-75% of Very Strong boar were acceptable. There was a significant ( $P < .01$ ) linear reduction in boar odor in franks processed with increasing quantities of fennel spice, but dilution was as effective as fennel spice in reducing the problem. The hot iron method for boar odor detection in frankfurters proved most useful.

LES EFFETS DU NIVEAU D'ODEUR DE VERRAT, DE LA DILUTION DE LA TRANCHE DE VIANDE ET DE L'ADDITION DE L'ÉPICE DE FENOUIL SUR L'ACCEPTABILITÉ DE "FRANKFURTERS" (SAUCISSES VIENNOISES À HOT DOG) CUISTS FABRIQUÉS AVEC DE LA VIANDE DE VERRAT

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On a tiré des "frankfurters" à partir de tranches de verrat choisi et de viande maigre de porc châtré pour déterminer: (Phase I) le niveau acceptable d'odeur dans les carcasses de verrat qui doivent être incorporées dans les "frankfurters"; (Phase II) la dilution nécessaire lorsqu'on ajoute du verrat à odeur très forte à la tranche de viande; et (Phase III) l'effet de l'ajout de différents taux de fenouil sur l'acceptabilité de "frankfurters" contenant de la viande de verrat.

Au cours de la Phase I, les carcasses ont été choisies par un panneau (employant des méthodes sensorielles et au fer chaud) qui les a classées d'après 5 niveaux d'odeur de verrat. Pour la fabrication de la Phase II, on a mélangé les carcasses ayant le niveau le plus élevé d'odeur de verrat avec du porc pour obtenir 5 taux de dilution: 0%, 25%, 50%, 75% et 100% de la tranche totale de viande employée. Au cours de la Phase III, à chaque niveau d'odeur et de dilution, on a ajouté de l'épice de fenouil en quantité de 0, 0,075% et 0,15% de la viande totale. Le même procédé a été répété 3 fois. Toutes les fournées de "frankfurters" ont été évaluées par un panneau spécialement entraîné pour déterminer: la couleur, la texture, l'odeur et le goût de "frankfurter", l'odeur et le goût de verrat, et l'acceptabilité générale.

Les résultats ont montré un rapport remarquable ( $P < .01$ ) et négatif ( $R = -.75$ ) entre le goût de verrat et l'acceptabilité des "frankfurters". Au cours de la Phase I, l'usage, dans des "frankfurters", de porc estimé moyen ou inférieur en odeur de verrat était considéré acceptable. La dilution de porc estimé très fort en odeur de verrat (Phase II) a entraîné une remarquable réduction carrée en odeur de verrat dans les "frankfurters" finis. Les produits ne contenant pas plus de 50-75% de verrat à odeur très forte étaient acceptables. On a constaté une remarquable réduction linéaire ( $P < .01$ ) en odeur de verrat dans les "frankfurters" fabriqués avec un taux toujours plus élevé d'épice de fenouil, mais la dilution s'est montrée une méthode aussi efficace que le fenouil dans la réduction du problème. La méthode du fer chaud s'est montrée la plus efficace pour la détection d'odeur de verrat dans les "frankfurters".

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### DER EFFEKT VON EBERGERUCH, VERDÜNNUNG DER FLEISCHMISCHUNG UND ZUGABE VON FENNEL AUF DIE ANNEHMBARKEIT VON MIT EBERFLEISCH HERGESTELLTEN GEKOCHTEN FRANKFURTER WURSTCHEN

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Frankfurter Würstchen wurden aus ausgewählten mageren Fleischstücken von kastrierten und nicht-kastrierten Ebern hergestellt, um folgendes festzustellen: (Phase I) den annehmbaren Grad von Geruch von für Würstchen bestimmtes Eberfleisch; (Phase II) den notwendigen Grad von Verdünnung der Fleischmischung, wenn Fleisch von nicht-kastrierten Ebern, das einen starken Geruch besitzt, der Fleischmischung beigegeben wird; und (Phase III) den Effekt von verschiedenen Mengen von Fenchel auf die Annehmbarkeit von Würstchen, die Fleisch von nicht-kastrierten Ebern enthalten. In Phase I der Untersuchung wurden die Tierleichen von einer Bewertungsgruppe geprüft ("hot iron" und "sensory" Methode) und fünf Stufen von Geruchsstärke wurden festgelegt. Im Verlauf der zweiten Phase wurde Fleisch, das den höchsten Grad von Geruch aufwies, mit Fleisch von nicht-kastrierten Ebern gemischt. Fünf Mischungsstufen wurden erzeugt: 0%, 25%, 50%, 75% und 100%. In Phase III wurde jeder dieser Mischungen Fenchel als 0%, 0.075% und 0.15% der Gesamtmasse beigegeben. Dies wurde dreimal nachgebildet. Eine erfahrene Bewertungsgruppe prüfte alle Würstchen mit Hinsicht auf: Farbe, Gewebe, Geruch und Geschmack, Ebergeruch und Geschmack und allgemeiner Annehmbarkeit. Die Resultate zeigten ein bedeutsames ( $P < .01$ ) und negatives ( $r = -.75$ ) Verhältnis zwischen dem Ebergeruch und der Annehmbarkeit der Würstchen. In Phase I war das Fleisch, das als durchschnittlich oder weniger geruchsstark eingeschätzt wurde, für Würstchen geeignet. Mischungsverdünnung des Fleisches, dessen Geruch als "sehr stark" eingeschätzt wurde (Phase II), führte zu einer bedeutsamen vierfachen Verringerung des Ebergeruchs in den Würstchen. Würstchen die nicht mehr als 50-75% von "sehr starkem" Eberfleisch enthielten waren annehmbar. Eine bedeutsame ( $P < .01$ ) lineare Reduktion des Ebergeruchs wurde in den Würstchen, die mit zunehmenden Mengen von Fenchel hergestellt wurden, festgestellt; aber Verdünnung der Fleischmischung war ebenso wirksam wie die Zugabe von Fenchel. Die "hot iron" Methode erwies sich als die brauchbarste um Ebergeruch in Würstchen festzustellen.

### ВЛИЯНИЕ УРОВНЯ ЗАПАХА СВИНИНЫ ОТ ХРЯКОВ, РАЗБАВЛЕНИЯ МЯСОВОГО БЛОКА И ДОБАВЛЕНИЯ ФЕНХЕЛЯ НА ПРИЕМЛЕМОСТЬ ВАРЕНЫХ СОСИСОК, ИЗГОТОВЛЕННЫХ ИЗ СВИНИНЫ ОТ ХРЯКОВ

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Сосиски были изготовлены из отборных кусков туш свинины от хряков и боровов для того, чтобы определить: (Фаза I) приемлемый запах в тушах свинины от хряков, идущий на изготовление сосисок; (Фаза II) требующуюся степень разбавления, когда к мясовому блоку добавляется свинина от хряков с очень сильным запахом; и (Фаза III) влияние добавления различных количеств фенхеля на приемлемость сосисок, содержащих свинину от хряков.

В Фазе I настоящего изыскания группой специалистов были отобраны (методом прикосновения на каленой железной пластинки к мясу и чувственного восприятия) туши, которые представляли пять уровней запаха свинины от хряков. В Фазе II обработки, туши с самым сильным уровнем запаха свинины от хряков были смешаны со свининой от боровов, чтобы получить пять уровней разбавления: 0%, 25%, 50%, 75% и 100% мясового блока. В Фазе III, для каждого уровня запаха и разбавления добавлялся фенхель в количестве 0, 0,075% и 0,15% от мясового блока. Этот процесс был повторен три раза. Все партии сосисок были оценены группой тренированных специалистов на предмет: цвета, консистенции, запаха и вкуса сосисок, запаха и вкуса свинины от хряков и общей приемлемости.

Результаты показали значительную ( $P$ -вероятность  $< 0,01$ ) и отрицательную ("коэффициент соотношения"  $= -0,75$ ) между запахом свинины от хряков и приемлемостью сосисок. В Фазе I свинина с установленным Средним или нижесредним запахом свинины от хряков была приемлема для употребления в сосисках. Разбавление свинины с установленным Очень сильным запахом свинины от хряков (Фаза II) привело к существенному квадратному уменьшению запаха свинины от хряков в изготовленных сосисках. Изделия, содержащие не больше 50% - 75% свинины от хряков с Очень сильным запахом были приемлемы. В сосисках, обработанных увеличенным количеством фенхеля, происходило значительное ( $P < 0,01$ ) линейное уменьшение запаха свинины от хряков, но разбавление было таким же эффективным средством как и фенхель в уменьшении этой проблемы. Метод прикосновения к мясу накаленной железной пластинкой оказался наиболее полезным для нахождения в сосисках запаха свинины от хряков.

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INTRODUCTION

Although boars are more efficient producers of leaner carcasses (Cahill, 1960; Charrete, 1961; Prescott, 1964; Plimpton, 1972) their use as a fresh meat source is greatly limited by a most offensive boar or sex odor and flavor (Lerche, 1936; Plimpton, 1965; Plimpton and Teague, 1972; and Patterson, 1968). Even though the boar's use is limited as a fresh product, its possible use in processed pork items has been explored (Williams et al., 1963; Pearson et al., 1971; and Walstra, 1974). Greene (1973) recommended that boar meat, which had a strong boar odor, could be used up to 50 percent of the meat block in bologna consumed cold. Greene (1973) also observed that spice, namely fennel spice, has a masking effect on boar odor when boar meat is incorporated into a bologna to be consumed cold.

PROCEDURE

Boar and barrow carcasses selected as a source of pork for this research were pre-evaluated for boar odor and flavor using both the taste panel method (Plimpton, 1961) and the modified hot iron method (Greene, 1973). In Phase I, carcasses were rated as to the level of boar odor intensity with odors ranging: none, slight, medium, strong, and very strong. Carcasses exhibiting this range of odors were the sole meat components of frankfurters made to determine the acceptable level of intensity of boar used. In Phase II, boar pork rated as very strong boar odor was then diluted with pork from barrows rated as having no boar odor so as to formulate frankfurters representing five boar odor levels (0%, 25%, 50%, 75%, and 100%). For Phase III, to observe the effect which fennel spice might have on boar odor reduction, three levels (0%, .05% and .15% of the meat block) were incorporated into each level of dilution and intensity. This experimental design was replicated three times. The taste panel (Plimpton, 1961) and the modified hot iron method (Greene, 1973) were used to evaluate the frankfurters. All frankfurter blocks were adjusted to 30% fat, received the same spice mix (except for added fennel), chopped, stuffed and then heated to an internal temperature of 65.5°C. After a 24 hour chill at 2°C, taste panel evaluation was conducted on frankfurters simmered to an internal temperature of 65.5°C. Samples were then evaluated by a trained sensory panel for: color, texture, frankfurter odor and flavor, boar odor and flavor and general acceptability. A second sensory evaluation was conducted for boar odor using the modified hot iron technique of Greene (1973), using the heated tip of an Ungar #6939 electric desolderer equipped with an Ungar #5948 tip. In both panel evaluations, members were statistically screened for repeatability and reliability. All data were subjected to least squares analysis of variance according to Harvey, 1968.

RESULTS

Phase I: Odor Intensity. Table 1 presents the sensory panel data for Phase I. There was a significant ( $P < .01$ ) and negative relationship ( $r = -.75$ ) between boar flavor and frankfurter acceptability. Increased intensity level did result in an increase in boar flavor in cooked frankfurters and a corresponding decrease in general acceptability of product. The data suggest, however, that an acceptable frankfurter can be processed from boar pork rated as high as medium in intensity. The major factor affecting general acceptability of the frankfurter was boar flavor ( $r = -.75$ ) but it is of interest to note that appearance was adversely affected in the frankfurters processed from the Strong and Very strong raw pork. No quality differences were noted in the fresh pork.

Phase II: Boar Dilution. In Phase II the effects of diluting boar pork (selected for possessing a very strong boar odor) with barrow pork are summarized in Table 2. Increasing the percentage of boar meat had a significant ( $P < .01$ ) quadratic effect on boar odor scores. This would indicate that the amount of odor causing substance acts in a logarithmic fashion. Boar flavor scores showed a significant ( $P < .01$ ) cubic effect. This switch from quadratic to cubic response was caused by a significant increase in boar flavor at the 25% level. The correlation between boar odor and boar flavor in these frankfurters was  $r = .78$ . The frankfurter odor and flavor scores along with general acceptability decreased ( $P < .01$ ) with increasing levels of boar pork. The correlation between boar flavor and general acceptability was  $r = -.69$ . Increasing the amount of boar pork in the formulation did not significantly ( $P < .05$ ) affect the color or texture of the frankfurters.

Phase III: Masking Effects of Fennel Spice. In Phase III the effects of fennel spice as a boar odor or flavor masking device were examined. Table 3 presents the data for the "intensity - Phase I" experiment. The addition of fennel spice at the 0.15% level of the meat block did cause the greatest masking of boar odor. For boar flavor there was a significant ( $P < .01$ ) interaction between fennel spice level and intensity level. From the mean scores it was determined that only at the strong and very strong intensity level did the 0.15% fennel spice level significantly ( $P < .05$ ) decrease boar flavor scores. Contrary to the results observed in the intensity phase of this experiment, in the dilution Phase II there was no significant ( $P < .05$ ) effect of fennel spice on boar flavor, frankfurter odor or flavor, or general acceptability. Table 4 exhibits these mean scores. Examination of the data indicated that only at the 100% boar level was boar odor significantly ( $P < .01$ ) reduced by the addition of 0.15% fennel spice. It is of interest to note that this highly aromatic spice did not adversely affect normal frankfurter odor and flavor. But, since fennel spice did not affect general acceptability in spite of its slight effect on boar odor and flavor, one would question the practicality of using this method of overcoming the problem.

Method of Odor Detection. A comparison of the trained taste panel and the hot iron method was observed over both the intensity and dilution phases of this experiment. In both phases the hot iron method yielded higher scores for boar odor. The following table shows that for various levels of boar odor intensity there was no

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significant difference between the two methods. However, there was a significant ( $P < .05$ ) difference in the dilution phase.

## LEAST SQUARES MEANS AND STANDARD ERRORS OF TASTE PANEL AND HOT IRON SCORES<sup>1/</sup> OF BOAR ODOR AS INFLUENCED BY FENNEL SPICE

Fennel Level	Intensity Phase <sup>2/</sup>		Dilution Phase <sup>3/</sup>	
	Taste Panel	Hot Iron	Taste Panel	Hot Iron
0	2.78 ± .17	3.52 ± .17	4.20 ± .20	4.50 ± .20
0.075	3.09 ± .17	3.44 ± .17	3.53 ± .20	4.68 ± .20
0.15	2.85 ± .17	3.15 ± .17	3.54 ± .20	3.65 ± .20

<sup>1/</sup> Scoring system: 1 = no boar odor  
10 = very strong boar odor

<sup>2/</sup> No significant difference ( $P < .05$ )

<sup>3/</sup> Significant difference ( $P < .05$ )

The hot iron method would seem a better evaluation technique based on the assumption that a method which yields a higher score would result in less chance of missing a boar with a low odor level.

### CONCLUSION

Two possible methods for utilization of boar pork were explored. Boar pork with a medium level of boar odor could possibly be used as the sole meat component of frankfurters. Dilution of the higher levels appears necessary. Dilution of boar pork containing a very strong boar odor level is limited to 75% of the meat block to result in a satisfactory frankfurter. Both of these recommendations are based upon the fact that both taste panel scores at these points are below the score (four) suggested by Patterson (1971) to be objectionable to consumers. The use of fennel spice is questionable even though there was a slight masking of boar odor and flavor in the intensity phase. There was no increase in general acceptability in either phase. Detection of boar odor in frankfurters could be done with the hot iron method. The hot iron yielded higher scores in all phases of this experiment.

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TABLE 1

LEAST SQUARES MEANS AND STANDARD ERRORS OF PANEL SCORES<sup>5</sup>  
 FOR FRANKFURTER EVALUATION - VARIOUS LEVELS  
 OF BOAR ODOR INTENSITY

Sensory panel	Boar odor intensity				
	None	Slight	Medium	Strong	Very strong
Boar odor <sup>1,3</sup>	2.71±.25	2.79±.30	2.47±.26	7.24±.30	3.60±.30
Boar flavor <sup>1,3</sup>	3.00±.25	3.24±.34	2.67±.27	6.69±.33	5.08±.33
Frank odor <sup>2,3</sup>	6.25±.15	6.65±.21	6.35±.17	3.97±.21	5.56±.20
Frank flavor <sup>2,3</sup>	5.53±.18	6.64±.26	5.84±.20	4.07±.25	4.62±.25
Gen. acceptability <sup>2,3</sup>	5.99±.21	6.23±.29	6.27±.23	3.50±.28	4.41±.28
Color <sup>2,3</sup>	5.68±.15	6.61±.21	6.38±.17	4.30±.20	6.19±.20
Texture <sup>2,4</sup>	6.88±.14	7.08±.20	6.81±.16	6.14±.19	6.18±.19
Hot iron					
Boar odor <sup>1,3</sup>	3.09±.25	3.73±.30	2.72±.26	7.21±.30	4.64±.30

<sup>1</sup>Scoring system: 1 = no boar odor, flavor; 10 = very strong boar odor, flavor

<sup>2</sup>Scoring system: 1 = unacceptable; 10 = acceptable

<sup>3</sup>Quadratic effect of boar intensity significant ( $P < .01$ )

<sup>4</sup>Linear effect of boar intensity significant ( $P < .05$ )

<sup>5</sup>Regressed for fat and protein

TABLE 2

LEAST SQUARES MEANS AND STANDARD ERRORS OF PANEL SCORES<sup>6</sup>  
 FOR FRANKFURTER EVALUATION-DILUTION OF VERY STRONG BOAR

Taste panel	Level of boar dilution				
	0	25	50	75	100
Boar odor <sup>1,3</sup>	2.41±.24	2.70±.22	2.91±.21	3.02±.21	3.49±.22
Boar flavor <sup>1,4</sup>	2.42±.26	3.05±.22	2.83±.22	3.12±.23	4.49±.24
Frank odor <sup>2,4</sup>	6.26±.18	5.94±.15	6.20±.15	6.30±.16	5.71±.17
Frank flavor <sup>2,4</sup>	5.90±.21	5.57±.17	5.82±.17	6.15±.18	4.87±.19
Gen. acceptability <sup>2,4</sup>	6.34±.22	5.71±.18	5.72±.18	6.17±.19	4.70±.20
Color <sup>2,5</sup>	6.20±.18	6.23±.15	6.20±.15	6.14±.15	6.23±.16
Texture <sup>2,5</sup>	6.89±.18	6.69±.15	6.90±.15	6.84±.15	6.29±.16
Hot iron					
Boar odor <sup>1,3</sup>	3.24±.24	2.88±.22	2.80±.21	3.42±.21	4.53±.22

<sup>1</sup> Scoring system: 1 = no boar odor, flavor; 10 = very strong boar odor flavor

<sup>2</sup> Scoring system: 1 = unacceptable; 10 = acceptable

<sup>3</sup> Quadratic effect of dilution level significant ( $P < .01$ )

<sup>4</sup> Cubic effect of dilution level significant ( $P < .01$ )

<sup>5</sup> No significant ( $P < .05$ ) effect

<sup>6</sup> Regressed for fat and protein

TABLE 3

LEAST SQUARES MEANS AND STANDARD ERRORS OF PANEL SCORES<sup>5</sup>  
 FOR FRANKFURTER EVALUATION - VARIOUS LEVELS  
 OF FENNEL SPICE (INTENSITY)

		Fennel level	
	0	.075	.15
<b>Taste panel</b>			
Boar odor <sup>1,3</sup>	4.20 ± .20	3.84 ± .20	3.55 ± .20
Boar flavor <sup>1,3</sup>	4.68 ± .19	4.00 ± .19	3.72 ± .19
Frank odor <sup>2,4</sup>	5.70 ± .12	5.89 ± .12	5.68 ± .12
Frank flavor <sup>2,4</sup>	5.33 ± .14	5.46 ± .14	5.03 ± .14
Gen. acceptability <sup>2,4</sup>	5.09 ± .16	5.49 ± .16	5.25 ± .16
Color <sup>2,4</sup>	5.80 ± .11	5.73 ± .11	5.96 ± .11
Texture <sup>2,4</sup>	6.57 ± .11	6.52 ± .11	6.76 ± .11
<b>Hot iron</b>			
Boar odor <sup>1,3</sup>	5.50 ± .20	4.68 ± .20	3.65 ± .20

<sup>1</sup> Scoring system: 1 = no boar odor, flavor; 10 = very strong boar odor, flavor

<sup>2</sup> Scoring system: 1 = unacceptable; 10 = acceptable

<sup>3</sup> Linear effect of fennel spice significant ( $P < .01$ )

<sup>4</sup> No significant ( $P < .05$ ) effect

<sup>5</sup> Regressed for fat & protein

TABLE 4

LEAST SQUARES MEANS AND STANDARD ERRORS OF PANEL SCORES<sup>4</sup>  
 FOR FRANKFURTER EVALUATION - VARIOUS LEVELS  
 OF FENNEL SPICE (DILUTION)

		Fennel level	
	0	.075	.15
<b>Taste panel</b>			
Boar odor <sup>1,3</sup>	2.78 ± .17	3.09 ± .17	2.85 ± .17
Boar flavor <sup>1,3</sup>	3.18 ± .17	3.39 ± .17	2.98 ± .17
Frank odor <sup>2,3</sup>	6.09 ± .12	6.13 ± .12	6.03 ± .12
Frank flavor <sup>2,3</sup>	5.93 ± .13	5.44 ± .13	5.61 ± .13
Gen. acceptability <sup>2,3</sup>	5.81 ± .14	5.62 ± .14	5.76 ± .14
Color <sup>2,3</sup>	6.28 ± .11	6.12 ± .11	6.20 ± .11
Texture <sup>2,3</sup>	6.75 ± .11	6.83 ± .11	6.58 ± .11
<b>Hot iron</b>			
Boar odor <sup>1,3</sup>	3.53 ± .17	3.43 ± .17	3.15 ± .17

<sup>1</sup> Scoring system: 1 = no boar odor, flavor; 10 = very strong boar odor, flavor

<sup>2</sup> Scoring system: 1 = unacceptable; 10 = acceptable

<sup>3</sup> No significant ( $P < .05$ ) effect

<sup>4</sup> Regressed for fat and protein