



# Catalogue of applications of meat from entire male pigs with boar taint





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## Introduction

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In the production of male pigs without castration, some of the carcasses will be rejected due to their high levels of skatole and androstenone. To ensure optimum financial efficiency, it is important that these carcasses are used in the production of alternative products where the boar taint and flavour cannot be detected by the consumer.

This is a catalogue of the strategies that have been identified as effective in masking boar taint and flavour. Some of the strategies are optimal for certain cuts, while other strategies would be more appropriate for other cuts. Generally speaking, it is recommended to combine different strategies, for example dilution and smoke, to ensure complete masking of the boar taint and flavour.

The catalogue begins by describing the following strategies: dilution, smoking, masking, serving in complex contexts, fermentation, curing and drying, and temperature. This is followed by a list of recommended applications for fore-ends, middles and hams.

The strategies were identified in the project entitled "Industrial application of meat from entire male pigs", which was financed by the Pig Levy Fund.

Further information on the results can be found on the following website:  
[www.boartaint.dk](http://www.boartaint.dk)



## Dilution

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Dilution is an effective strategy for using meat and fat from rejected carcasses. The meat and fat can be used in meat mixes and emulsified products, where they can be mixed thoroughly with meat and fat from carcasses that have not been rejected. In emulsified products, such as sausages, there is less need for dilution due to the masking effect of the spices and smoke.

To ensure an effective dilution, a dilution factor has been calculated based on the fact that all rejected carcasses have a very high level of skatole (0.9 µg/g) and androstenone (9 µg/g). In practice, a lower level of dilution would therefore be acceptable.

### RECOMMENDATION

The following general guidelines are recommended, depending on the product:

- Minced meat for pork patties should be diluted at least 18 times.
- Meat mixes for boiling sausages should be diluted at least ten times if the trimmings and meat come from rejected carcasses.
- Meat mixes for boiling sausages should be diluted at least one time if the meat (though not the trimmings) comes from rejected carcasses.

If the product is also smoked or seasoned with spices, a lower dilution factor can be used.





## Smoking

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Smoke is an effective method for masking boar taint and flavour. Since it gives the products a very distinctive flavour, odour and appearance, it can only be used for products that are usually characterised as being smoked, e.g. bacon, Bayonne ham or sausages. The masking effect of smoke is not dependent on the fat content of the product, and therefore smoke is recommended for both lean and fatty meat products.

Liquid smoke did not prove to be effective in the dosage rates recommended by the producer. It is therefore recommended to use traditional surface smoke.

In whole muscle products, the boar taint and flavour decrease with increasing levels of smoke intensity. However, with some of the tested smoke programmes (up to 60 min. for bacon), a sensory panel assessed that boar taint and flavour were still present in the products.

In wiener sausages, the boar taint and flavour were completely masked if the sausages were smoked for at least 40 min., corresponding to a total phenol content of at least 1-1.2 mg/g. The sausages were made from meat and trimmings from entire male pigs with an average skatole content of 0.57 µg/g and androstenone content of 2.4 µg/g.

### RECOMMENDATION

- Traditional smoke should be used rather than liquid smoke.
- Can be used for all products regardless of fat content.
- The more intense the smoke flavour, the better the masking effect.
- Boar taint and flavour in whole muscle products cannot be completely masked.
- Boar taint and flavour in wiener sausages can be completely masked.
- It is recommended to combine smoke with other strategies, e.g. serving in a complex context.



## Masking

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Spices add flavour and aroma to the meat and can be used to mask boar taint and flavour. Several spices, in their pure form, were shown to have a masking effect in meatballs. By combining different spices, it was possible to achieve a masking effect in a stew containing diced pork and in pulled pork.

In a stew, it was possible to achieve complete masking of boar taint in meat with a skatole content of up to 0.83  $\mu\text{g/g}$  and an androstenone content of up to 6.3  $\mu\text{g/g}$ , although the effect on boar flavour was less pronounced and complete masking was not achieved. The stew was made from pork shoulder and had a spice concentration of 11%.

In pulled pork, using the tested spice amounts, it was possible to achieve masking of boar taint and flavour in meat with an androstenone content of up to approx. 3.8  $\mu\text{g/g}$ , but no higher. The spices were not effective at masking skatole. The pulled pork was made from pork collar and had a spice concentration of 3%.

### RECOMMENDATION

- Use recipes with high spice concentrations.
- Use spices such as cinnamon, chilli, oregano, thyme, rosemary, mint, ginger and paprika.
- Use spices in combination with other strategies, such as complex servings (e.g. pulled pork sandwich).





## Serving in complex contexts

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Meat is seldom eaten alone, and the more complex the meal served together with the meat is, the less pronounced the boar taint and flavour will be.

Smoked ham (in Danish: ålerøget skinke) is a whole boiled muscle product that has been surface-treated with smoke spices and then surface-smoked. Since the ham was tasted cold, the boar taint and flavour were masked to a certain extent. However, concentrations of skatole and androstenone above approx. 0.4 µg/g and 4 µg/g respectively could still be tasted by a trained panel. When the ham was served as part of a hot cheese and ham toasted sandwich, even very high concentrations of skatole and androstenone could not be tasted. Therefore, the more sensorially complex serving, together with the smoke, masked the boar taint and flavour.

### RECOMMENDATION

- It is recommended to use boar meat in food products consisting of several components, e.g. cheese and ham toasted sandwich.



## Fermentation

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Several meat products are fermented, especially various types of salami and bacon. The literature mentions fermentation as a potential method for masking boar taint and flavour in meat containing medium levels of skatole and androstenone. However, a systematic comparison of five different starter cultures and fungi for salamis showed that a reduction in boar taint and flavour did not occur. During the drying process, the concentration of skatole and androstenone increased and no reduction occurred due to degradation during fermentation. When pepperoni was served hot on pizza, there was a slight but clear boar taint and flavour, although the consumers did not necessarily react to it.

### RECOMMENDATION

- Fermentation is not recommended as a strategy for reducing boar taint and flavour.
- When producing fermented products with meat from rejected carcasses, additional strategies, such as dilution or smoke, should be used.





## Curing and drying

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When meat is cured and then dried, for example during the production of dried hams, different aromatic compounds are produced. The process time is relatively long, and it is therefore important that the product can be sold at a higher price. Trials showed that a trained sensory panel was able to detect boar taint and flavour in dried hams from rejected entire male pigs. However, when the hams were served to consumers together with melon, the consumers were not able to taste the difference between hams from an entire male pig and hams from a castrate. This could be due to the complex aromatic structure of these types of hams, which makes it difficult for the consumers to distinguish between boar taint and flavour and other aromas in the hams.

### RECOMMENDATION

- It is not recommended to make cured and dried products with meat from rejected entire male pigs, since the boar taint and flavour are not masked.



## Temperature

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Skatole and androstenone are volatile compounds that can be easily smelled during the cooking process. This must mean that some of the compounds disappear during cooking. However, trials showed that neither cooking for a long time at a low temperature (58-75 °C for six hours) nor cooking at a high temperature (pork crackling cooked at up to 250 °C) reduced the concentration of skatole and androstenone. The amount of skatole was reduced to a degree corresponding to that of cooking loss, whereas the amount of androstenone remained the same. There was no reduction in boar taint and flavour. The reduction in the concentration of skatole and androstenone due to evaporation was so small that it could not be detected analytically.

It is not possible to reduce the concentration of skatole and androstenone and thereby avoid boar taint and flavour through cooking.

### RECOMMENDATION

- Cooking temperature is not recommended as a strategy for reducing boar taint and flavour.



## Fore-end

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Dilution	✓
Smoke	✓
Masking	✓
Complexity	
Fermentation	
Temperature	

### SHOULDER

Can be minced and diluted.  
For greater effectiveness, the products (e.g. sausages) can be smoked.

### PORK COLLAR

Can be used for products in which masking can be achieved using spices, e.g. pulled pork.

## Middle

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Dilution	
Smoke	✓
Masking	✓
Complexity	✓
Fermentation	
Temperature	

### PORK LOIN

Can be used for marinated products, e.g. ready-marinated pork cutlets.

### BACON

Can be used for products with intense smoke flavour, or can be served in burgers or salads.

## Ham

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Dilution	
Smoke	✓
Masking	✓
Complexity	✓
Fermentation	
Temperature	

### HAM

Can be smoked, e.g. smoked ham.

Can be served as part of a complex dish, e.g. cheese and ham toasted sandwich.

Can be masked, e.g. in a stew.