ESSMENT OF BACKBACON QUALITY

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MARY: Backbacon quality is highly related to the size and distribution of meat and fat areas in the backbacon slice. The aim of this riment was to investigate the variation in meat and fat distribution and quality of backbacon slices along the back. 45 female and male of Danish Landrace and Duroc breed were slaughtered at 100 kg live weight and prepared for backbacon production. Each back was ed into 230 slices with a thickness of 2 mm. The slices were recorded on video, and then devided into a dorsal (DPS) and a ventral P) part, of which the areas of meat and fat were measured. The areas were obtained using an image analysing programme. A sification model was developed from the ratio between meat and fat in 169 test backbacon slices and the results from a subjective sification of these slices into four quality groups. The model was tested by cross-validation.

ulation of the lean : fat ratio (L/F) in the two parts of the slices showed, that the mean L/F of the DPS was significantly higher than mean L/F of the VPS. The breed and sex of the animals did not affect the mean L/F of the slices, but the mean L/F of both the DPS the VPS increased with increasing lean percentage of the carcass. Especially the L/F of the VPS varied systematically with the tomical origin of the slices. Consequently the L/F was high in the VPS from the caudal and cranial parts of the back and low in slices the medial part. The mean quality of the backbacon slices did not differ significantly between four groups of pigs. According to the st slices of the best quality were from the medial part of the back. Thus the L/F of the VPS was less important than expected to the ective classifiers.

RODUCTION:

The Danish export of backbacon depends i.a. on the quality of the product, it is therefore important for the backbacon ducers to know how to assess, manage and control the quality of the product. Backbacon is produced by slicing loins (backs) into slices a thickness of 1 to 3 mm. Some producers use the lean to fat ratio in the ventral part of the slices as a quality parameter. Other ducers assess the quality subjectively from the visual impression of meat and fat distribution in the slices, obtained by trained classifiers. aim of this project was to investigate the variation in meat and fat distribution in backbacon slices from the entire back. Furthermore, ain was to develop a model for estimation of backbacon quality.

TERIALS AND METHODS:

The experiment included 45 female and male pigs of Danish Landrace and Duroc breed. All the pigs e reared at a breeding test station, fed a standard diet ad libitum and slaughtered at 100 kg live weight. The lean pecentage of the ass was measured in the Danish Classification Centre. The day after slaughter the carcass was devided into the three main joints: ulder, middle and leg. The middles were then deskinned and deboned i.e. the ribs were removed one by one. 18 cm from the spinal the loin (back) was seperated from the belly and flank. Finally the backs were cured, drained and dryed. At the National Institute of mal Science in Denmark the backs were sliced into approximately 230 backbacon slices with a thickness of 2 mm. All the slices were ced starting at the caudal end of the back and then recorded on video. The video recordings were made with constant illumination 'Super VHS' video camera. The meat and fat area of the recorded backbacon slices were analysed using an image analysing gramme. Initially the user of the programme defined a range of colours, representing either background, meat or fat. The analysing gramme disolved the video picture into 570 pixels (picture elements), wich were categorised as either background, meat or fat according ir colour. From this information the area of fat and meat in the backbacon slices were measured, and the ratio between lean and fat) was calculated for the total slice (TS), the dorsal part (DPS) and the ventral part (VPS). The devision of the slices into VPS and DPS done according to a tangent of the ventral side of m. longissimus dorsi, as shown in figure 1.

tical methods

<u>ods for analysing the mean lean : fat ratio of all the slices in a back</u>

mean L/F of the two parts of the slices was calculated for the entire back and then analysed with a linear regression model (model ng the procedure GLM in the statistical programme SAS (SAS, 1988).

Model I: $Y_{ijk} = \mu + b_i + s_j + (bs)_{ij} + \beta X + \varepsilon_{ijk}$

Where: Y_{ijk} is the the mean L/F of DPS or the VPS from anaimal k, k = (1,..,45); μ is the sample mean; b_i is the fixed effect of bree = (1,2); s_j is the fixed effect of sex, j = (1,2); $(bs)_{ij}$ is the interaction between breed and sex; X is the lean percentage of the carcass; the regression coefficient and ε_{ijk} is the random error.

Methods for analysing the lean : fat ratio of the ventral part of the slices

The L/F in the VPS of slice number 50 to 200 from each animal was analysed in detail with model II, a multifasic regression model three fases, using the procedure NLIN in SAS (SAS, 1988).

Model II: $Y_{lk} = a + \beta_1 X_l - (\beta_1 - \beta_2)\, r \ln(1 + e^{(Xl - c)/r}) + \varepsilon_{lk}$

Where: Y_{lk} is the L/F of the VPS of slice l from animal k, l = (50,..,200) and k = (1,..,45); a is the intercept; β_1 is the regression coeffic of the left part of the function; X is the number of the slice l; β_2 is the regression coefficient of the right part of the function; r is smoothening parameter; ln is the natural logarithm; e is the exponential function; c is the minimum of the function and ε_{lk} is the rand error.

Methods for estimation of the quality group of the backbacon slices

To develop a classification model another 169 test backbacon slices were classified in quality group 1 to 4 according to their qua assessed by two trained classifiers. Quality group 1 included backbacon slices of excellent quality and group 4 included slices of p quality. The mean coefficient of repetability was 0.93 and the correlation between the two classifiers was 0.88 calculated with the proced CORR in SAS (SAS, 1988). A classification model (model III) was developed by relating common information on the L/F of TS, D and VPS from backbacon slices placed in the same quality group, using quadratic discriminant analysis (Conradsen, 1984; Møndel et 1986). Assuming the a priori probability to be equal for the four quality groups, the general model can be written as follows:

Model III: $D^2_{lm} = (\mathbf{X}_l - \mathbf{X}_m)' \, \mathbf{C}_m^{-1} \, (\mathbf{X}_l - \mathbf{X}_m) + \ln(\det \mathbf{C}_m)$

Where: D^2_{lm} is the discrimination value of backbacon slice l placed in quality group m, l = (1,..,169) and m = (1,..,4); $\mathbf{X}_l$ is a matrix values of the explaining variables for slice l; $\mathbf{X}_m$ is the matrix of means of the explaining variables, measured on the slices that belong quality group m; $\mathbf{C}_m$ is the covarians matrix for quality group m; ln is the natural logarithm; det $\mathbf{C}_m$ is the determinant of the covari matrix for quality group m.

The model was tested by cross-validation and placed 87% of the backbacon slices in the same quality group as did the subjective classifi Thus the classification model identified a relatively big part of the slices of excellent/poor quality. Calculating the value 'Jeffrey-Matusit distance' (Ersbøll, 1989) for each of the three explaining variables in the classification model showed that L/F of the TS was m important to the classification than the L/F of the VPS. The L/F of the DPS was also of greater importance than the L/F of the VPS. quality of all the recorded backbacon slices from the 45 pigs was then estimated by the classification model, the procedure DISCRIM SAS (SAS, 1988) was used in the calculations.

RESULTS AND DISCUSSION:

Mean lean : fat ratio of all the slices from a back

Table 1 includes the mean L/F of the four groups of pigs. It appears, that the L/F of the DPS was significantly higher than the L/F of VPS. Neither the breed, sex or the interaction between them affected the mean L/F of the slices. The L/F of the VPS of the slices va more than the L/F of the DPS of the slices. The anatomical origin of the slices influenced the variation in the L/F of the VPS, as illustrat i figure 2a and 2b. Consequently the L/F of the VPS was high in slices from the caudal and cranial end of the back and low in slices fr the medial part of the back. The mean L/F of both the DPS and the VPS for the whole back increased with increasing lean percentage the carcass, also illustrated in figure 2, where figure 2a shows the mean L/F of the VPS for 11 carcasses with a lean percentage hig than 61.0% and figure 2b the mean L/F of the VPS for 11 carcasses with a lean percentage lower than 58.5%. It appears, that the V-sh of the VPS-function was deeper in b than in a. Therefore, the back from carcasses with a low lean percentage had more slices with a l L/F in the VPS than had carcasses with a high lean percentage.

Lean : fat ratio of the ventral parts of the slices

The L/F of the VPS is often used as a quality parameter, therefore the L/F of the VPS was analysed in detail with model II. Especial

ameter 'c' of the model was of interest, since it refers to a predicted minimum of the function. Because model II allows for not more ree fases, only slices in the interval from 50 to 200 were analysed.

parison of 'c' from the four groups of pigs shows, that 'c' occured more caudial in backs from Duroc pigs than in backs from Danish ce pigs (table 2). By calculating the L/F in the VPS of the slice at 'c' it appeared, that male pigs had a lower minimum L/F in the compared to female pigs. The calculated L/F of the VPS of the slice at 'c' was also lower in the Duroc pigs than in the Danish ce pigs. Since the L/F of the VPS varied systematically with the anatomic origin of the backbacon slices, one way of controlling ality of backbacon could be to exclude a part of the back with a low expected L/F of the VPS from the production. Therefore, an al of slices with a L/F of the VPS lower than 50% was calculated from the estimated parameters in model II. The interval generally ented the area between the 10th and the last rib. The proportion of backbacon slices in the interval with an observed L/F of the VPS than 50% varied from 57 to 69% for the four groups of pigs, as shown in table 2. The standard deviation of the values was high, cluding a part of the back, based on the expected L/F of the VPS, did not lead to a complete exclusion of backbacon slices with L/F in the VPS.

sion of the quality group of the backbacon slices

ean frequencies of the four quality groups are shown in table 3. It appears, that only one slice was placed in quality group 4. fore, the overall quality of the slices from the 45 backs must have been higher than the overall quality of the 169 test backbacon used for developing the classifcation model. Table 3 also shows a tendency towards a higher proportion of the backbacon slices from Landrace pigs placed in quality group 1 compared to Duroc pigs. On average all the slices from a back were placed in quality group = 0.2). The breed and sex of the pigs did not affect the mean quality of the backs. The lean percentage of the carcasses affected ality significantly, since increasing lean percentage of the carcass increased the mean quality of the back.

ssification model in general classified backbacon slices from the medial part of the back in quality group 1 and 2, while the quality ces from the caudal and cranial parts were classified as low. Comparing the quality assessments achieved from the classification model e the L/F of the VPS shows, that the classification model did not place backbacon slices with a L/F of the VPS lower than 50% in ow quality groups. Thus the L/F of the VPS was less important than expected for the visual impression obtained by the subjective ifiers.

CLUSION: This investigation showed, that the mean L/F of the DPS of backbacon slices generally was higher than the mean L/F e VPS. The mean L/F of the DPS and VPS was neither affected by the breed or the sex of the pigs. There was a significant relation ween the L/F of the slices and as well the lean percentage of the carcass as the anatomical origin of the slices. Evaluating backbacon a from this experiment in intervals where the L/F of the VPS was estimated to be lower than 50%, showed that only from 57 to 69% ese slices had a L/F in the VPS lower than 50%. Therefore, this method did not lead to a complete exclusion of backbacon slices with w L/F in the VPS. Analysing the quality of the backbacon slices assessed from a classification model revealed no differences in the quality of the backs because of the breed and sex of the pigs. The mean quality depended on the lean percentage of the carcass, since ean quality of the backs increased significantly with increasing lean percentage of the carcasses.

paring the quality of the backbacon slices assessed by the classification model to the L/F of the VPS shows, that the classification el did not place backbacon slices with a L/F of the VPS lower than 50% in the low quality groups. Thus the L/F of the VPS was less ortant than expected for the visual impression obtained by the subjective classifiers.

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Table 1. L/F of the two parts of the backbacon slices. Means and standard errors (SE) for male and female pigs of Danish Landrace and Duroc breeds.

	Danish Landrace		Duroc	
	Male	Female	Male	Female
Number of slices	3516	3036	2010	1840
L/F in DPS %	83.2	83.9	83.4	83.6
(SE)	0.6	0.6	0.8	0.8
L/F in VPS %	59.5	61.9	62.0	63.6
(SE)	1.2	1.2	1.5	1.6

Table 2. Slice number for the 'c'-points and L/F of VPS of point slice with approksimated standard errors (SE). Percentage of slices with a VPS lower than 50% in timated interval with standard deviation (SD).

	Danish Landrace		Duroc	
	Male	Female	Male	Female
'C'	120.5	127.5	110.1	113.8
(SE)	2.1	1.6	1.5	2.1
L/F in 'c' (%)	45.9	48.3	42.0	46.2
(SE)	0.2	0.2	0.2	0.2
L/F < 50% (%)	60	69	57	63
(SD)	24	27	24	26

Table 3. Mean frequences (%) of slices in the four quality groups for male and female pigs of Danish Landrace and Duroc breeds.

	Danish Landrace		Duroc	
Quality group	Male	Female	Male	Female
1	39.2	44.5	25.9	35.9
2	35.0	24.6	40.9	26.8
3	25.8	30.9	33.2	37.2
4	0.0	0.0	0.0	0.1

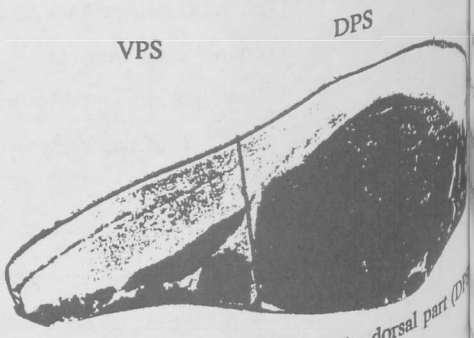

Figure 1. Backbacon slice devided into the dorsal part (DPS) and the ventral part (VPS).

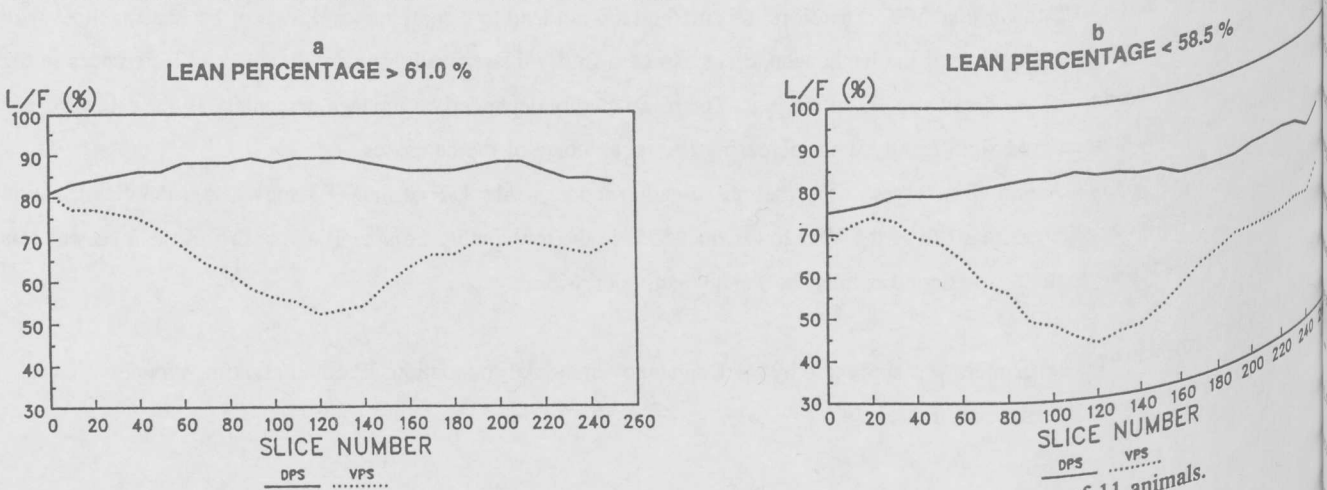

Figure 2. Mean L/F in DPS and VPS in relation to the anatomical origin of the slices from two groups of 11 animals.