

TOWARDS A PAN-EUROPEAN COMPUTED TOMOGRAPHY PROCEDURE FOR DETERMINING THE NEW EU LEAN MEAT CONTENT OF PIGS

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I. INTRODUCTION

A new EU regulation on carcass classification applies from July 2018. The new reference to calibrate the pig classification methods is a lean meat percentage based on total dissection (LMPtd) of a half-carcass. Manual dissection can be replaced by an unbiased computed tomography (CT) procedure. Daumas *et al.* [1] developed a simple and accurate CT method first on cuts and then on carcasses [2]. If the national pig population to be sampled has the same characteristics as the population for which a CT procedure has been previously corrected, no additional dissection is required. In most of the national applications for authorisation of classification methods the population characteristics are managed via a stratification on a fat depth, mimicking the LMP variation. The aim of this paper is to propose a pan-European CT procedure to calibrate the pig classification methods without any additional manual dissection.

II. MATERIALS AND METHODS

A sample of 29 half-carcasses was CT scanned with 3 mm slice thickness (Fig. 1) and then fully dissected according to the EU regulation. The CT muscle volume was calculated by thresholding in the Hounsfield range 0-120 (Fig. 2 and 3). It was converted into muscle weight by applying a density of 1.04. The weight was divided by the carcass weight to obtain the lean meat percentage from CT (LMPct), in the same way as done for the LMPtd. LMPtd was regressed on LMPct. Fatness effect was tested as a covariable.

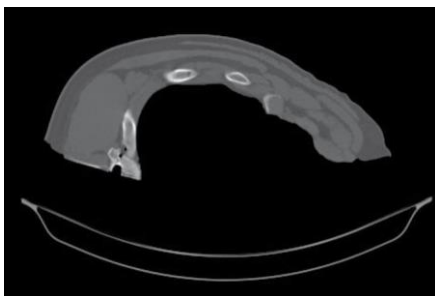


Figure 1. Raw image of a transversal slice in the middle

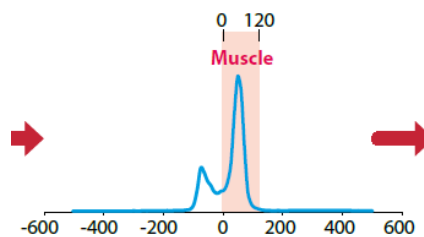


Figure 2. Automatic thresholding on grey level histogram

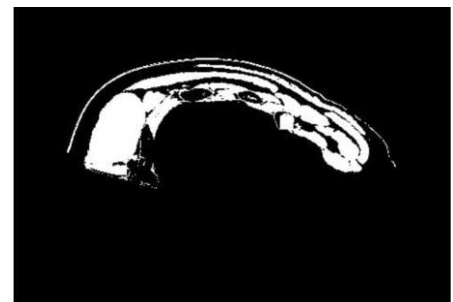


Figure 3. Processed image of a transversal slice in the middle

III. RESULTS AND DISCUSSION

As expected, fat depth was not significant. Only the slope of the regression (Fig. 3) was significant and was estimated at 0.965 (s.e.=0.002). The RMSE was 0.81. The plot of residuals against fitted values showed no pattern and no heterogeneity of variances.

The main source of measurement error is the thresholding of the rind. As the thickness of the rind is very thin (2-3 mm), most of the voxels including rind are mixed voxels, either with air or with fat. Their Hounsfield values are therefore less than 0 and these voxels are classified in non-muscle. Only a few rind voxels have a Hounsfield value in the range [0-120 HU] and are thus misclassified in muscle. This is taken into account by the slope value which is slightly less than 1.

In the sample the ranges of LMPct, fitted LMPtd and LMPtd were respectively 54-68, 52-65 and 53-65. The range of fitted LMPtd covers the S+E classes (≥ 55) and a part of U class (50-54) which gather about 95% of the EU pigs (Fig. 4). It covers too more than 80% of all the national populations, excepted Italy because of its specific heavy subpopulation.

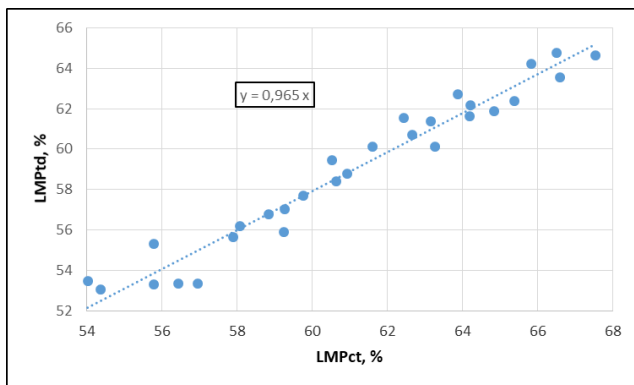


Figure 3. Regression line of LMP from dissection (LMPtd) on LMP from CT (LMPct)

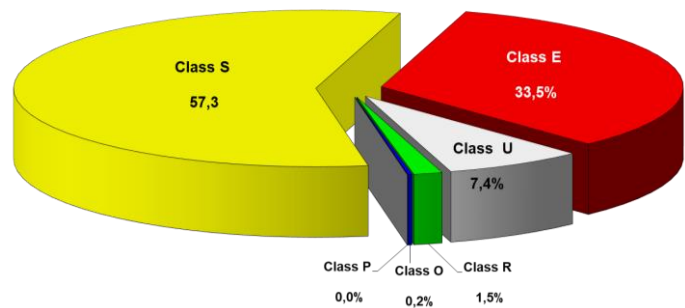


Figure 4. Distribution of SEUROP classes in EU 28 in 2016 (Source: EC)

A few of national experts were not fully convinced by the representativeness of the used sample. They asked for 10 national dissections or more to assess a national coefficient. This would not be an efficient way for two reasons: the lack of reproducibility of manual dissection and the huge confidence interval due to the very small sample size. Nissen *et al.* [3] assessed the reproducibility standard deviation of the LMP from partial dissection at 1.10 in an experiment involving 8 countries. This indicated a maximum difference (95% probability) between two trials of 3.1 ($= 1.96 \times \sqrt{2} \times 1.10$). Such a difference should be higher between the present 28 Member States. On the contrary, the reproducibility of the LMP in the French trial was much better, thanks to the introduction of a specific procedure ensuring the control of an anatomical dissection [4, 5].

IV. CONCLUSION

The proposed CT procedure can be used in the EU to calibrate the national classification methods. The LMP of a carcass should be multiplied by 0.965 to be scaled with the manual dissection. As this coefficient is robust against variation in fatness, it could be applied in almost all of the EU Member States, without any additional national dissection. This procedure can therefore be qualified as a pan-European CT procedure to determine the lean content of pig carcasses.

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