Use of X-ray computed tomography for predicting an industrial lamb carcass lean meat yield

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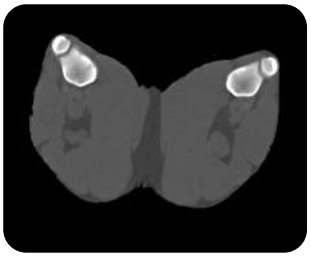
Objectives

Interbev Ovins, (the French ovine interprofession) is prospectively interested in the ability of the video image analysis system VIAscan® to estimate the lean meat yield of lamb carcasses. To calibrate this system, it is necessary to bone a large number of carcasses following some specifications closed to the anatomical dissection. But carcass dissection to fat, muscles and bones is a destructive, time-consuming, and therefore a costly method. Recent studies on pig carcasses showed that X-ray computed tomography (CT), a non-invasive method, can replace dissection with the following advantages: repeatability, reproducibility and standardization of the measuring protocol. Thus, the potential of CT to predict an industrial lean meat yield was investigated on lamb.

Materials and methods

• 158 lamb carcasses representative of carcasses usually cut in the French sheep industry
  – conformation: R and O
  – fat score: 2, 3 and 4
  – carcass weight: 14-25 kg
• After 24 hours of refrigeration at 4°C, carcass composition was determined by:
  – X-ray computed tomography (Siemens Somatom Emotion Duo – 130 kV, 40 mAs, thickness of the cross-sectionnal image: 3 mm)
  – industrial cutting, following some specifications closed to an anatomical cut (separating muscles from fat and bones)

▼ *The separation of muscles, fat and bones of the leg with the industrial cutting*



The leg composition with CT: bones in white, muscles in light gray, fat in dark gray ◀

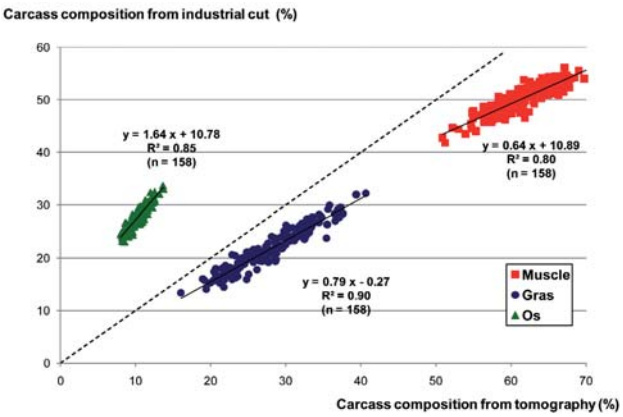
Results

• Compared to industrial cutting (Table 1 – Figure 1), CT overestimates the muscles (+11.5 points on average) and fat yields (+6.2 points) and underestimates the percentage of bones (-17.4 points)
• However, the difference between industrial cutting and CT yields remains quite constant among carcasses, as evidenced by the R^2 ranged from 0.8 to 0.9
• In 61% of cases, the muscle yield predicted by CT is outside a tolerance threshold set at ± 2%

> Table 1. Composition of lamb carcasses (n = 158)

	% muscles	% fat	% bones
Mean cutting	50.48	21.62	27.61
Standard deviation cutting	2.87	3.93	2.08
Mean CT	61.94	27.82	10.24
Standard deviation CT	4.03	4.72	1.17
Average bias	11.46	6.20	-17.37
Average relative bias	22.70	28.69	-62.90
RSD	1.28	1.27	0.81
RSD / Standard deviation	44.69	32.38	38.93
RSD / Mean	2.54	5.88	2.94
R^2	0.80	0.90	0.85

> Fig. 1. Composition of lamb carcasses



Conclusions

CT prediction is currently not accurate enough to be used by the sheep industry. The determination of carcass composition by anatomical cutting in an industrial context is probably the origin of the prediction error because, in this context, the cutting is quite difficult to standardize and not repeatable.

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