An investigation into the use of video image analysis (VIA) and visible-near infrared (NIR) spectroscopy for carcase evaluation

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Cameron Ross Craigie

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Abstract

In order for the meat industry to move towards a carcase payment system that is more consumer-focused, there is a need to identify carcases that have a higher yield of superior eating quality meat. Through a series of experiments, this thesis investigates the relationships between video image analysis (VIA) variables and saleable meat yield (SMY%) of high-value cuts in beef carcases, and also the relationships between visible-near infrared (NIR) spectra and instrumental meat quality parameters in beef, lamb and venison of various breeds and genders.

Results showed that VIA could effectively replace the visual classifier for classifying beef carcases according to the EUROP carcase classification system, and that both visual and VIA systems showed some promise for predicting the yield of high-value sirloin yield through the EUROP-grid information. Both VIA and visual systems could only account for approximately 57% of the variation in sirloin SMY%, but the relationship between SMY% and other possible VIA outputs such as lengths, widths and volumes remains largely uncharacterized.

Instrumental measures of meat quality (shear force, pH and colour) of *M. longissimus thoracis et lumborum* (LTL) from 234 beef carcases and 208 Texel lambs showed that gender had a larger effect on meat quality than breed. Data from these two experiments was used to determine the relationship between NIR spectra and instrumental meat quality parameters in beef and lamb LTL. NIR showed promise for identifying beef with high ultimate pH values and lamb with high intramuscular fat percentages, but the prediction of shear force using NIR spectra in both beef and lamb was less accurate.

The effects on meat quality of sex, breed, chilled aging and location within venison *M. Longissimus lumborum*, for samples from 79 farmed deer showed that all factors influenced venison meat quality, with aging time and gender having the largest effects. The relationships between NIR spectra and venison meat quality indicated that NIR spectra could be used to identify samples with high ultimate pH and high shear force values.

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List of abbreviations

Abbreviation	Explanation
AHDB	Agriculture and Horticulture development board
ASD	Analytical Spectral Devices
AU	Australia
AYPG	Adjusted preliminary yield grade
BBSRC	Biotechnology and Biological Sciences Research Council
BCC	Beef classification centre
BF	*M. biceps femoris*
BIOSS	Biomathematics and Statistics Scotland
BON	Bone weight
BONE%	Bone percentage
CAS	Chiller assessment system
CEO	Chief executive officer
CH	Charolais heifer
CL	Cooking loss
CS	Charolais steer
CSL	Complete sirloin
CT	Computer aided tomography
CV	Coefficient of variation
CVS	Computer vision system
DB	Dairy bull
DE	Germany
DFD	Dry, firm and dark
DK	Denmark
DMRI	Danish Meat Research Institute
DO%	Dressing out percentage
DS	Dairy steer
EAAP	European Association of Animal Production
EBLEX	English Beef and Lamb Executive
EC	European Community
EEC	European Economic Community
EJ	Expressed juice
ES	Spain
EU	European Union
F	France
FAT%	Fat percentage
FIL	Fillet weight
GB	Great Britain
GLM	General linear model
HCS	Hot carcase system
HCW	Hot carcase weight
HU	Hungary
IF	Intermuscular fat
IQR	Inter-quartile Range
IYF	Initial yield force
KgF	Kilograms of force

Abbreviation	Explanation
KKCF	Kidney, knob and channel fat
LH	Limousin heifer
LL	*M. longissimus lumborum*
LMCNI	Livestock and Meat Commission Northern Ireland
LMY%	Lean meat yield percentage
LT	*M. longissimus thoracis*
LTL	*M. longissimus thoracis et lumborum*
LS	Limousin steer
MAC	Machine à classer
MANOVA	Multivariate analysis of variance
MARC	Meat Animal Research Centre
MEQ	Meat eating quality
MIRINZ	Meat Research Institute of New Zealand
MLA	Meat and livestock Australia
MLC	Meat and livestock commercial
MSA	Meat standards Australia
MSC	Multiplicative scatter correction
NIR	Near infrared spectroscopy
NO	Norway
NZ	New Zealand
PLSR	Partial least squares regression
QMS	Quality Meat Scotland
REML	Restricted maximum likelihood
RMS	Research Management Systems
RMSE	Root mean square error
RPD	Ratio performance deviation
RSD	Residual standard deviation
SAC	Scottish Agricultural College
SD	Standard deviation
SE	Standard error
SED	Standard error of the difference
SF	Subcutaneous fat
SL	Sarcomere length
SM	*M. semimembranosus*
SMY%	Saleable meat yield
SNV	Standard normal variate
SS	Saleable sirloin
SZ	Switzerland
TM-QTL	Texel muscling quantitative trait locus
UK	United Kingdom
USA	United States of America
USDA	United States department of agriculture
UY	Uruguay
VBM	Value-based marketing
WBSF	Warner-Bratzler shear force
WD	Work done
WHC	Water holding capacity
WTP	Willingness to pay
VHVC	Very high value cuts

Abbreviation	Explanation
VIA	Video image analysis
VL	*M. vastus lateralis*
XSF	Excess fat
YB	Young bull

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