RIKILT
WAGENINGEN UR

Control of water content in poultry meat by NIRS: an alternative approach

Rob Frankhuizen, Jan Kiers and Saskia van Ruth

Aim

The aim of the study was to evaluate the fitness for purpose of the FOSS FoodScan near-infrared spectrophotometer with a FOSS Artificial Neural Network calibration model (ANN) and associated database for the prediction of the water and protein content in chicken breast.

Materials and Methods

Regular poultry meat samples (176) as part of an EU regulatory control scheme (EC Regulation No. 543/2008) and 10 chicken breast samples prepared with added water and retaining agents were analyzed. After grounding and homogenizing, the samples were analyzed for their moisture and protein contents according to the classical wet chemistry methods (ISO 1442 and ISO 937 standards), respectively. For NIRS analysis samples were packed into a circular large sample cup (140 mm Ø by 14 mm depth) and placed into the FoodScan. The samples were scanned in transmission in the low near infrared region (from 850-1050 nm). The NIR spectra of 151 chicken breast samples were then compared to those in a database which included over 20.000 sample spectra of different sample types and associated reference values and included poultry meat. The moisture and protein contents were calculated using the mathematical algorithms of the ANN model. ANN model predictions and wet chemistry results were compared. In addition, the NIR spectra of the total test set (186 samples of poultry meat) were subjected to Principal Component Analysis (PCA).

Table 1. Comparison of results of 151 samples chicken breast measured by wet chemistry reference methods and the NIRS FoodScan technique.

Constituent	N	r^{ref}	r^{ANN}	R^{ref}	R^{ANN}	SEP^{RIKILT}	SEP^{RIKILT}_{bc}	SEP^{ANN}
Water	151	0.593 +0.0017.W	0.53	0.79 +0.00471.W	0.90	1.02	0.52	0.72
Protein	151	0.638	0.25	-	0.50	0.63	0.46	0.62

N	Number of chicken breast samples
r^{ref}	Repeatability reference method (ISO 1442, ISO 937)
r^{ANN}	Repeatability FoodScan method[1]
R^{ref}	Reproducibility reference method (ISO1442, ISO 937)
R^{ANN}	Reproducibility FoodScan method[1]
SEP^{RIKILT}	Accuracy expressed as Standard Error of Prediction
SEP^{RIKILT}_{bc}	Accuracy expressed as Standard Error of Prediction bias corrected
SEP^{ANN}	Accuracy expressed as Standard Error of Prediction based of the ANN calibration for meat and meat products[1]

Results and Discussion

The NIRS results were quite reproducible and correlated well with the wet chemistry results (Table 1).The accuracy of the NIR results was similar to the accuracy of the wet chemistry methods. Some aging of the samples during frozen storage between the wet chemistry and NIR analysis occurred. Combined with the fact that the performance of the NIR technique is strongly dependent on sample preparation and homogeneity, as well as the accuracy and precision of the reference method(s), accuracy is expected to improve with simultaneous wet chemistry/NIRS analysis of fresh samples.

Principal Component Analysis (PCA) of the data revealed that all prepared samples were well separated from the regular samples (Fig. 1). A center group composed of chicken breasts was separated from the group consisting of poultry cuts (chicken and turkey thighs, drumsticks, legs, etc.) with bones (circled).

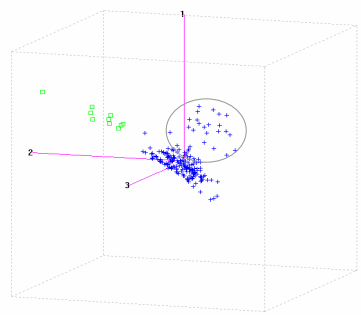

Fig. 1. Plot of the first three dimensions of a Principal Component Analysis on 151 samples chicken breast and 25 samples poultry cuts originating from regulatory control schemes (+) and 10 additional samples prepared with additional water and retaining agents (□) .

Conclusions

In the present study NIRS analyses replaced classical moisture and protein analyses in poultry meat accurately. NIRS may also be able to detect deviating samples in general and may be explored as an 'early warning' tool.

References

1. S. Anderson et al., (2007). Determination of fat, moisture and protein in meat and meat products by using the FOSS FoodScan Near-Infrared Spectrophotometer with FOSS Artificial Neural Network calibration model and associated database: Collaborative study. J. AOAC Int. 90, 4, p. 1073-1083.

101631

[1] **RIKILT – Institute of Food Safety**
P.O. Box 230
NL-6700 AE Wageningen, The Netherlands
Phone: +31 317 48 02 56 • Fax: +31 317 41 77 17
Internet: www.rikilt.wur.nl
* Corresponding author: rob.frankhuizen@wur.nl