Quality of poultry feeds in East Africa. Interest of near infrared spectroscopy (NIRS) for the estimation of their composition

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A study on the quality of poultry feeds was performed on approximately 200 samples from 8 East African countries. The objective was to obtain reliable data on the chemical composition and nutritional value of feeds available, in order to promote discussions between breeders and feed manufacturers and to propose solutions for technical improvement of poultry production. This study also evaluated Near Infrared Spectroscopy (NIRS) as a simple, cheap and transferable analytical technique since it is not always possible to perform reference analyses locally.

A total of 195 poultry feeds (129 broiler feeds, 66 layer feeds) was collected in 8 countries in East Africa. Sampling procedures allowed the representation of the main sources of quality variation: regions, feed manufacturers, feed categories. About 150 samples were analysed for reference methods. The main parameters measured were Crude Protein (CP), crude fat, crude fibre, Starch, LYS, MET, CYS, TRY and Ca. Metabolizable energy (ME) was estimated according to an equation based on chemical composition. Near Infrared Spectroscopy analyses were performed on a FOSS NIRSystem 6500 spectrometer in reflectance mode. Spectra were pretreated (SNV and detrend) before being used in partial least square regression (PLS) for development of calibrations. The R^2 and SECV (standard error of cross-validation) of calibration are shown in table 1. The precision level of predictions for proximate composition is satisfactory. The SECV values are coherent with the repeatability of chemical analyses, and the ratio performance to deviation (RPD = SD/SECV) is greater than 4 for all criteria. Equations for AA prediction were satisfactory given the known difficulty of AA NIRS calibrations. Only the equation for TRY was poorer, which had no consequence in this study since TRY levels were not limiting in analysed feeds. ME was predicted with SECV=0.34MJ/kg; which is fairly good. However the ME value has to be considered as an indication only because it is not measured, as in Valdes and Leeson (1992) but calculated.

Table 1 Mean characteristics of broiler feeds (129) and layer feeds (66) analysed, and precision of NIRS calibrations obtained.

Constituent	Broiler feeds		Layer Feeds		NIRS calibrations	
	Mean.	S.D.	Mean	S.D.	R^2	SECV[1]
CP (%)	17.8	2.7	16.2	2.20	0.97	0.61
Crude Fat (%)	6.3	2.1	5.9	2.5	0.98	0.39
Crude Fibre (%)	7.0	2.4	6.3	2.4	0.98	0.43
Starch (%)	33.1	7.4	32.9	7.9	0.98	1.30
ME[2] (MJ/kg)	10.9	1.1	10.4	1.0	0.94	0.34
LYS (g/kg)	8.3	2.4	7.3	1.7	0.96	1.02
MET+CYS (g/kg)	6.8	1.3	6.2	0.9	0.95	0.86
TRY (g/kg)	2.2	0.3	2.0	0.3	0.82	0.28
Ca (%)	1.9	1.1	3.5	1.3	-	-

[1] SECV = Standard Error of Cross-Validation. [2] ME calculated from chemical composition.

The nutritional value of feeds analysed was in general low to very low. The ME values were very low, with means lower than 11MJ/kg and extreme values as low as 8.5 MJ/kg. A possible explanation is that mineral content of many samples was extremely high: more than 14% on average and some values as high as 25% even in broilers (not shown in table 1). In some feeds high levels of acid insoluble ash were recorded, which suggests contamination of feeds by sand or earth. Crude fibre content was also very high, due to the use of high fibre cottonseed cake and sunflower cake. Crude protein content was low, especially for broilers in which some of the feeds had less than 16% CP. AA content is also very low. The limiting factor was generally LYS, and sometimes sulphur AA (MET+CYS). The tryptophane level was almost always sufficient. One sample had a LYS content of 21.8g/kg, obviously due to a manufacturing problem. Protein and AA were low even when they were related to the energy content, with insufficient CP/ME (on average 16.3g/MJ for broilers and 15.6g/MJ for Layers) or AA/ME (on average 0.76gLYS/MJ for broilers and 0.70gLYS/MJ for Layers) contents. Another problem linked with protein supply is that the raw materials used have generally a low protein (and AA) digestibility. Digestible CP (and AA) levels are therefore obviously even more deficient than total CP and AA content suggest.

The mean values discussed above hide a wide diversity of samples as suggested by the variability (standard deviations) shown in table 1. Indeed the quality of feeds within countries was very variable, and there were also big differences between countries. Feeds from Sudan and Eritrea were fairly good, with the obvious use of a high proportion of maize (high starch levels in feeds). On the contrary, countries such as Kenya, Tanzania, Uganda had low quality feeds, with the common characteristics: high minerals and fibre, very low energy and CP. These countries have in fact more or less the same raw material resources and the same technical level in the production sector.

This survey, which was done with the same conditions in several countries on a large number of samples, is one of the most important done so far on the quality of feeds in Africa. It showed that in most cases the feeds available in the local markets do not allow sufficient technical performance. This information is extremely important for producers and technical advisers, because it means that technical progress must include either discussions with feed manufacturers to improve their products or promotion of home feed mixing.

The quality of NIRS calibrations produced in this project allows them to be used in practice. Use of NIRS in animal feed industry is now common in developed countries (Van Kempen, 2001), but the equations are not publicly available and they are not always adapted to "atypical" feeds as the ones studied here. The local feed manufacturers do not possess NIRS equipment but it is available in research centres in most countries. They now have a possibility to check the quality of their. Unfortunately AA analysis is very seldom available locally.

References

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