

## Comparison of Energy Utilisation and Nitrogen Digestibility of rapeseed meals in roosters, broilers and young turkeys.

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**ABSTRACT:** As a result of the development of biodiesel, rapeseed meal (RSM) production has considerably increased in the European Union and in particular in France where around 2.3 millions tons have been included in animal diets in 2010.

Nevertheless, RSM is not enough promoted in poultry nutrition due to the lack of nutritional references available for the different species and ages of birds.

The aim of the study was to measure the variability of the nutritional value of RSM currently available in France in 2009. 8 RSM were collected in the 9 main crushing plants located all over France and they were compared for metabolizable energy (ME) and nitrogen digestibility (DN) values on three models of bird: ISABROWN rooster, 4 weeks broiler ROSS chicken and BUT turkeys. RSM was introduced at 30% in a basal diet including wheat, maize and soybean oil. All the birds were fed *ad libitum* with the same experimental diets and 12 birds were used for each diet. The measurements of apparent metabolizable energy corrected with nitrogen (AMEn) and Nitrogen apparent digestibility were made for each diet, then values of RSM were calculated by difference.

Total lipid and protein contents of RSM varied from 2.0 to 3.6 % and 35.7 to 38.4 % of dry matter (DM), respectively. Glucosinolates (GLS) content varied from 4.2 to 20.6 micromoles/ g of DM. Mean AMEn values were 1857, 1421 and 1672 kcal/ kg DM respectively for rooster, broiler and turkey and protein digestibility values were 69.1, 62.2 and 68.8%. AMEn values obtained for roosters were higher than INRA-AFZ tabulated values (+ 200 kcal/kg DM) while values for broilers were lower. Nitrogen digestibility values determined on broiler were lower than those observed on other birds.

As a consequence, current data obtained on roosters cannot be used for formulating diets for growing birds.

**KEYWORDS:** rapeseed meal, metabolizable energy, nitrogen digestibility, rooster, broiler, turkey

### INTRODUCTION

In parallel to the development of biodiesel, rapeseed meal (RSM) production has increased in the European Union and in France, utilization in feed has reached 2.3 millions tons in 2010.

Even if RSM is mainly used in ruminants (about 60%) and pigs (30%) formula, its potential utilization by poultry exists and is currently increasing. Nevertheless, nutritional values are not well known and seem to vary between crushing plants and for the different ages and species of birds. Since 2003, the chemical composition of RSM produced in France was monitored by CETIOM and ONIDOL (DAUGUET et al., 2011) and the study of the nutritional values for poultry is completing this multi-year survey.

First of all, bibliography shows that oil extraction highly decreases apparent metabolizable energy (AMEn) of rape seed (NEWKIRK *et al.*, 2003) and conditions of heating stages like desolvantization and toasting influence solubility of proteins and digestibility of amino acids (ANDERSON-HAFERMANN *et al.*, 1993). On the other hand, many data and in particular the study of LESSIRE *et*

*al.*, 2009 indicate that the digestibility values of RSM measured on adult birds are higher than on younger ones.

## MATERIAL AND METHOD

Rapeseed meals (RSM): 8 different batches of RSM were collected in 8 of the main 9 french crushing plants and were tested for AME and apparent digestibility of nitrogen (DN) values.

Animals: Digestibility trials were done with 144 Isabrown 12 months' old roosters, 132 Ross 4 weeks' old male broilers and 132 But 4 weeks' old male turkeys in individual cages.

Feeding: Roosters were used to eat a diet containing 20% of RSM for two weeks before the balance trial. Young animals were fed from D0 to D20 with a classical starter diet. Three diets containing soybean meal (15, 30 and 45%) and a basal diet (corn, wheat, oil, minerals and vitamins mix) were tested and allowed to obtain the digestibility value of soybean meal and basal diet. Eight experimental diets were also used; they were composed of one of the eight RSM (30%) and the basal diet. All the diets were pelletised and prepared from the same delivery. Digestibility trials were performed according to BOURDILLON *et al.*, 1990a, b, with at least 10 birds per diet. All the birds were fed ad libitum and total collection of excreta was performed.

Analysis: Experimental diets and raw materials were analyzed for dry matter, crude proteins, total lipids, water insoluble wall cells (WICW), minerals and gross energy. Feces were freeze dried and crushed (0.5 mm) and then analyzed for total nitrogen, uric acid, amino acids and gross energy. These analyses allowed the calculation of AMEn and DN of diets and by difference values of each RSM batch. The eight RSM batches were also analysed by CETIOM for glucosinolates (GLS), proteins and lipid contents and for protein solubility in caustic soda.

## RESULTS AND DISCUSSION

The average composition of the 8 RSM indicated in Table 1 was quite the same than those given in the INRA AFZ Tables (SAUVANT *et al.*, 2004). However, individual values were varying. For instance, protein content varied from 35.7 to 38.4% of dry matter (DM), GLS from 4.2 to 20.6  $\mu\text{mol/g}$  of DM and protein solubility from 40.6 to 63.1% of protein.

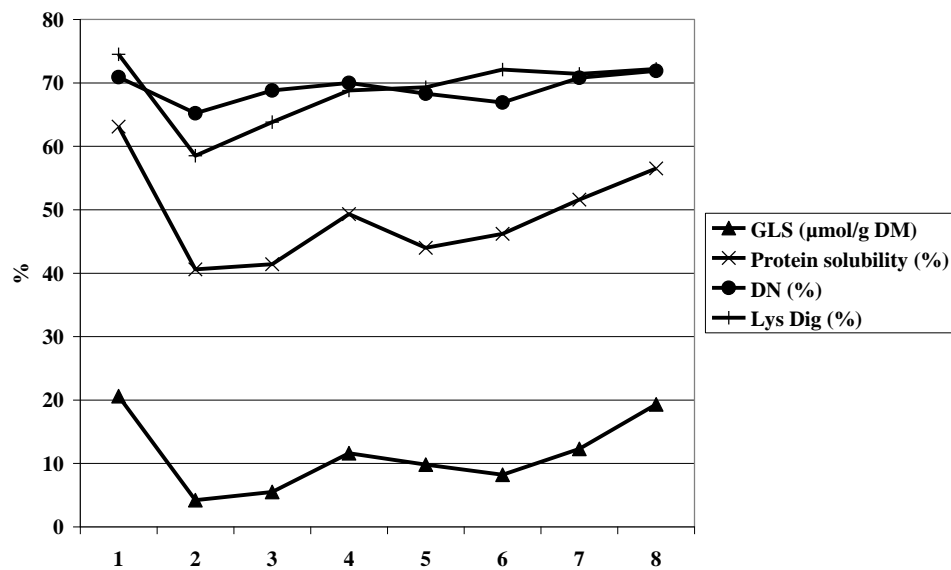
Table 1: Composition and nutritional values of rapeseed meals for poultry (DM basis)

Rapeseed meals	Protein (%)	Lipids (%)	GLS ( $\mu\text{mol/g}$ )	Protein solubility (%)	Rooster			Broiler		Turkey	
					AMEn (Kcal/kg)	DN (%)	Lys Dig (%)	AMEn (Kcal/kg)	DN (%)	AMEn (Kcal/kg)	DN (%)
1	36,9	3,5	20,6	63,1	1760	70,9	74,5	1180	64,9	1658	74,4
2	38,2	2,8	4,2	40,6	1860	65,2	58,5	1494	59,9	1707	65,4
3	37	3,6	5,5	41,4	1893	68,8	63,8	1438	60,6	1802	67,5
4	36,7	2,9	11,6	49,3	1775	70	68,8	1366	63,4	1572	66,5
5	35,7	3	9,8	44	1850	68,3	69,3	1404	62,4	1647	65,3
6	38,3	3,6	8,2	46,2	2023	66,9	72,1	1561	59,7	1834	69,4
7	38,4	2	12,3	51,6	1771	70,8	71,4	1620	64,6	1509	70
8	37,5	3	19,3	56,5	1922	71,9	72,2	1306	62	1646	71,6
<b>Mean</b>	<b>37,3</b>	<b>3,1</b>	<b>11,4</b>	<b>49,1</b>	<b>1857</b>	<b>69,1</b>	<b>68,8</b>	<b>1421</b>	<b>62</b>	<b>1672</b>	<b>68,8</b>
<b>INRA(2004)</b>	<b>38</b>	<b>2.6</b>			<b>1645</b>		<b>78</b>	<b>1590</b>			

The calculate values for the eight RSM mentioned in Table 1 show tendencies that suggest a large variability of nutritional values between "processing plant" (for instance: a difference of 440 kcal/kg DM between RSM number 1 and 7 for broiler) and an important species effect showing that rooster mean AME value (1857 Kcal/kg DM) is higher than turkey (1672) and broiler ones (1421).

Protein and lysine digestibility of the 8 RSM measured on rooster (and mentioned in figure 1) seems to indicate that a quite close relation exists between GLS and protein solubility such as mentioned by DAUGUET *et al.*, 2011, and digestibility of protein and lysine measured in adult birds. Indeed, the higher protein solubility of RSM number 1 is associated with the higher lysine digestibility and the higher residual GLS content.

**Figure 1: Digestibility of protein and lysine in relation with glucosinolates and protein solubility on rooster**



## CONCLUSION

The AMEn values of the 8 RSM collected in France in 2009 are quite variable and mean rooster values are 200 kcal higher than those mentioned in INRA AFZ Tables (SAUVANT *et al.*, 2004).

Furthermore, AMEn values are higher for rooster than young turkey and broiler. These differences indicate that more accurate studies have to be done to understand the respective effects of the composition of RSM and the specie and age of the birds.

Moreover lysine digestibility seems to be connected to residual GLS content and in vitro solubility of proteins. That indicates that further investigations on crushing process conditions are absolutely essential to improve the prediction of nutritional value of RSM for poultry.

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