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# RESEARCH ON DETERMINING THE NUTRITIONAL VALUE OF LUPINE GRAIN AND RAPESEED MEALS FREE OF ANTI-NUTRITIVE SUBSTANCES

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***Abstract***

*The objective of this study is to determine the chemical composition and nutritive value calculation lupine grain and rapeseed meals as an alternative to conventional protein from soy products and by-products. Were used white lupine seeds (variety Energy) free of alkaloids and rape groats results after oil extraction by cold pressing the seeds free of erucic acid and glucozizi (variety Helga). These macrocomponents feed (grain lupine and canola-type rapeseed) were obtained from cultures performed in specific climatic conditions Cris Plain. Besides good productions performed at unit area, these new resources turkey chicks forage for food, they noticed the special nutritional qualities. The crude protein content (N x 6.25) was 38.6% for white lupine seeds and 35.3% for rapeseed cakes while the energy was 2658 kcal ME/kg and that 1893 kcal ME/kg. These nutritional values are similar to those that characterize soybean cakes (mean 46% Pb and 2,150 kcal ME/kg), which is the main source of protein for feeding broiler turkeys. The results substantiate the need and opportunity to cultivate and use free alkaloid lupine beans and spring rapeseed and erucic acid free glucozizi as an important alternative source of protein and energy in poultry feed.*

**Key words:** lupine seed, rapeseed meals, protein, net energy, turkey.

## INTRODUCTION

In the context of the prohibition of animal meal in diet and the high price of poultry products and by-products of soybean, lupine beans and rapeseed meals can be a promising alternative for the provision of own production plant protein in feed birds in our country. Data from the literature mentions that new varieties of lupine alkaloids and the pool free of erucic acid rapeseed and glucozizi (canola type rapeseed) makes good productions, but highlighted the need to improve the biological value of protein by adding synthetic amino acids. Climatic conditions of our country provides the prerequisites for obtaining a production of lupine beans and rapeseed appropriate quantitative and qualitative (Mierlita D., 2012, Marcu N., et al., 2005). Use of lupine and canola-type rapeseed in diets of birds provide some independence from costly imports of products and soy products, but also a reduction in the price/kg feed with positive effects on profit. Introduction lupine and canola-type rapeseed culture in Romania lead to diversification of crop production with a positive impact on the demand: supply in a market currently dominated by cereals. In addition lupine beans

and canola seeds should not be subjected to heat treatment to destroy the anti-nutritive factors (eg. tripsininhibitory if soybeans), making them an important protein source for farms and arable holding so they can ensure the production own most of the raw materials needed to produce fodder (Mierlita D., 2012). These macrocomponente feed not only a valuable source of protein, but at the same time are also a source of energy, due to the high content of fat (Petterson et al., 2000, Marcu et al., 2005; Mierlita D ., 2012).

Most authors have reported that lupine and canola seeds have a high content of PNA (non-starch polysaccharide) having a negative influence over digestion and productive performance of monogastric animals. Nutritional value of lupine beans can be grown successfully (primarily for monogastric animals) by removing coatings (Rubio et al., 2003) and using the appropriate enzymes (Steenfeldt et al., 2003). As compared to soybean, lupine seeds have a lower content of phytic acid and saponin, and the lectin and protease inhibitors, which improves the digestion of proteins (Sujak et al., 2006).

The objective of this study is to determine the chemical composition and nutritive value calculation of lupine grain and rapeseed meals as an alternative to conventional protein from soy products and by-products.

## MATERIAL AND METHODS

The research was conducted at the University of Oradea in 2013-2014. Were used white lupine beans free of alkaloids variety Energy (improved variety in France) and rape meals results after oil extraction by cold pressing the seeds free of erucic acid and glucozizi variety Helga (improved variety in Germany). These macrocomponente feed (grain lupine and canola-type rapeseed) were obtained from cultures performed in specific climatic conditions Cris Plain. Seed was imported from the company Joordens Zaden BV the Netherlands.

Samples were subjected to laboratory analysis, is determined dry matter content (DM), crude ash (Cen.b.), crude protein (Pb), crude fat (Gb) and crude fiber (Cb); using methods established for this purpose (AOAC, 1996). Crude protein was determined by nitrogen content (N × 6.25). The nitrogen content was determined by the Kjeldahl method (KJELTEC AUTO). Crude fat was determined by extraction with petroleum ether using Soxtec HT6 apparatus. Crude fiber was determined using the apparatus Dosi-fiber. Crude ash content was determined gravimetrically by ashing the sample at 550°C. Non-nitrogenous extractive substances (NPS) were calculated mathematically:

**SEN** = DM - (Pb + Cb + Gb + Cen.b).

To calculate digestible content were used for digestibility coefficients of nutrients for poultry enteritis, presented in the literature for each feed: Plavni and Sklan (1995) - for lupine seeds and Stoica et al. (2003) - for rapeseed meals.

In energy content (kcal/kg) was done using mathematical equations devoted to specific birds (Halga P. et al., 2005). And metabolizable energy was calculated taking into account the correction related to nitrogen balance (EMAn). For this calculation we used the equation proposed by Sibbald (1980):

**EMAn** = 3951 + 54,4 MG – 88,7CB – 40,8Ce;

where MG = crude fat; CB = crude fiber and Ce = crude ash.

**RESULTS AND DISCUSSION**

By respecting culture technology in specific climatic conditions Cris Plain (PFA Bertalan Layos) white lupine (var. Energyl) conducted a production of 3386 kg grain/ha (low limit cited in the literature: 3000-5000 kg/ha, Dijkstra et al ., 2003; Pisarikova et al., 2009) and spring rape variety Helga achieved a production of 2637 kg seed/ha, higher than that reported by Marcu et al. (2005). The data presented in Table 1, it follows that white lupine performed very well in the climatic conditions of the region northwest of the country, producing seeds with a high content of protein and fat, thus constituting an important source of energy-protein diets for broiler turkeys.

Energy lupine beans variety of laboratory determinations were made that raw chemical follows: 90.7% dry matter (DM); 38.6% crude protein (Pb); 9.21% crude fat; 15.04% crude fiber and 23.58% nitrogen-free extractive substances (SEN) (Table 1). Brenes et al. (1993a) reported that the high proportion of seed coating (approx. 16% of seed weight) is the leading cause of its high crude fiber. The coating removal would significantly reduce crude fiber content, making it comparable to the nutrient content of lupine grain to that of soybean (Vecerek et al., 2008; Nalle, 2009). The nutritional value of lupine grain estimated based on digestible content of chemical components is presented in Table 1.

From the data presented it follows that the total solids contained 907 g of lupine beans, digestible organic matter content is 539.4 g/kg. For poultry, beans, lupines provide relative to 1 kg feed itself: 3034 kcal DE (Digestible Energy); 2658.4 kcal ME (Metabolisable Energy) and 1896.6 kcal EN (Net Energy).

Rapeseed meals obtained after extraction of oil cold pressed rapeseed variety Helga, had the following chemical composition: 89.08% dry matter (DM); 35.34% crude protein (Pb); 3.81% crude fat; 11.23% crude fiber and 30.16% nitrogen-free extractive substances (SEN) (Table 2).

*Table 1.*

White lupine grain content in digestible nutrients and energy

| Item | Crude protein | Ccrude fat | Crude fiber | SEN | Total |
|---|---|---|---|---|---|
| Gross chemical content (% of feed) | 38,6 | 9,21 | 15,04 | 23,58 | 86,43 |
| Digestibility coefficient (%) * | 68 | 76 | 31 | 68 | - |
| Digestible content (g / kg) | 262,5 | 70 | 46,6 | 160,3 | 539,4 |
| Digestible Energy (DE-kcal/kg) | 1517,2 | 659,4 | 205,0 | 652,4 | 3034,0 |
| Metabolisable Energy (ME-kcal/kg) | 1118,2 | 665 | 197,1 | 678,1 | 2658,4 |
| Net Energy (NE-kcal/kg) | 677,3 | 559,3 | 148,6 | 511,3 | 1896,6 |
| EMAn** | - | - | - | - | 2967,4 |

SEN = nitrogen-free extractive substances;
* Plavnic and Sklan, 1995;
** EMAn - Metabolizable energy which takes into account the correction related to nitrogen balance.

*Table 2.*

White rapeseed meals content in digestible nutrients and energy

| Item | Crude protein | Ccrude fat | Crude fiber | SEN | Total |
|---|---|---|---|---|---|
| Gross chemical content (% of feed) | 35,34 | 3,81 | 11,23 | 30,16 | 80,54 |
| Digestibility coefficient (%) * | 70 | 45 | 35 | 40 | - |
| Digestible content (g / kg) | 247,4 | 17,1 | 39,3 | 120,6 | 424,4 |
| Digestible Energy (DE-kcal/kg) | 1429,9 | 161,1 | 172,9 | 490,8 | 2254,7 |
| Metabolisable Energy (ME-kcal/kg) | 1053,9 | 162,4 | 166,2 | 510,1 | 1892,6 |
| Net Energy (NE-kcal/kg) | 638,3 | 136,6 | 125,4 | 384,7 | 1285,0 |
| EMAn** | - | - | - | - | 2843,0 |

SEN = nitrogen-free extractive substances;
* Plavnic and Sklan, 1995;
** EMAn - Metabolizable energy which takes into account the correction related to nitrogen balance.

Energy value of rapeseed meals, estimated based on digestible content of chemical components related to 1 kg feed, is: 2254 kcal DE (Digestible Energy); 1892.6 kcal ME (Metabolisable Energy) (fig. 1) and 1285.0 kcal NE (Net Energy).

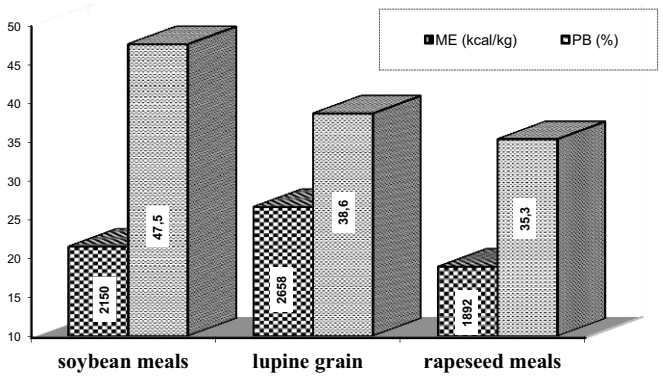


Fig. 1. The nutritional value of the calculated soybean meals, compared with the alternative protein sources tested.

Metabolizable energy calculated taking into account the correction related to nitrogen balance (EMAn) was 2967,4 kcal/kg if lupine and respective grain 2843.0 kcal/kg in the case of rapeseed meals. The results obtained in these studies are in agreement with those obtained in other studies (Rubio et al., 2003; Erbas et al., 2005, Marcu et al., 2005, Diaz et al., 2006; Sujak et al., 2006; Uzun et al., 2007; Vecerek et al., 2008) and confirms that the grains of white lupine and canola-type rapeseed cakes that are an important source of protein for feeding birds in general, but for turkey broilers. Crude protein content of lupine seeds varies between 28 and 48% (% of DM), depending on variety and climatic conditions. Even the same kind of lupine (Juno) protein content varied between 39,8 and 48,2%, depending on the year of harvest (Strakova et al., 2006). Energy value of lupine grain varies between 1920 and 3570 kcal ME / kg DM, depending on the variety, climatic conditions and content of alkaloids (Brenes et al., 1993, Hughes et al., 1998, Kocher et al., 2000). The positive effects of using enzymes in lupine-based diets have been demonstrated by several authors (Kocher et al., 2000, Hughes et al., 2000; Brenes et al., 2003; Mieczkowski et al., 2004).

## CONCLUSIONS

The results obtained in this study confirmed the excellent nutritional characteristics of the two unconventional alternative sources of protein for feeding broiler turkeys or free white lupine seed free alkaloids (variety Energy) and meals canola free erucic acid and glucozizi (variety Helga). Besides good productions performed at unit area, these new resources turkey chicks forage for food, they noticed the special nutritional qualities. The crude protein content (N x 6.25) was 38.6% for white lupine seeds and 35.3% for rapeseed meals while the energy was 2658 kcal ME/kg and that 1893 kcal ME/kg. These nutritional values are similar to those that characterize soybean meals (mean 46% Pb and 2150 kcal ME/kg), which is the main source of protein for feeding broiler turkeys. The results substantiate the need and opportunity to cultivate and use free alkaloid lupine beans and meals rapeseed free erucic acid and glucozizi as an important alternative source of protein and energy in poultry feed.

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