

## RAPESEED MEAL AND NAKED OATS IN LAYING HEN DIETS

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## ABSTRACT

Low-glucosinolate rapeseed meal (RSM) had no effects on laying performance compared to soybean meal (SBM). However RSM caused significantly more mortality, especially on diets containing more than 20 % RSM. Main reason for deaths was liver lesions. Also thyroid weights of hens on RSM diets were heavier. This enlargement of thyroid gland is not so severe un-healthy stages to hens. It is a normal function of organism to compensate unbalance in hormonal status caused by reduced iodine uptake. Hens are not dead to hyperthyroid, but to injurious liver rupture caused by toxic breakdown products of glucosinolates, e.g. nitriles. Naked oats in diets declined all laying performance results very significantly and had besides this significant performance lowering interactions with the linear effect of RSM. The fibrous, lignified antinutrients of rapeseed hulls together with  $\beta$ -glucans of naked oats might have reduced nutrient uptake. These results showed that it is not recommended to include more than 20 % RSM to laying hen diets, because of serious liver injury. Naked oats did not give as good responses as was expected, when it was used as the only grain in the diet.

## INTRODUCTION

Nowadays recommendation for the low glucosinolate RSM in broiler diets is up to 20 %, and for laying hens from 10 to 20 %. Factors that limit the use of RSM as a protein source in laying hen diets are egg tainting substances and occurrences of liver damages and goitrogenicity of RSM. Mortality from liver haemorrhage is more serious problem for laying hens than for younger birds when RSM is fed. Naked oats' nutritional values are quite different from the usual covered-seeded oats. Energy values have been reported to be at the level of maize and its crude protein (CP) content to be higher than most other cereal grains and to have better amino acid balance.

About ten years ago in Finland doctor Tuomo Kiiskinen made many studies on RSM in broiler and laying hen feeding (Kiiskinen 1983a, 1983b, 1983c, 1989). These meals contained glucosinolates from 11 to over 50  $\mu\text{mol}$  per fat free dry matter and maximum inclusion rates for broilers were 22 % and for laying hens 17 % in diet. After that time, new low-glucosinolate rapeseed varieties have been taken into growing. Seed crunching and fat extraction are now better and rapeseed oil has been accepted as a hygienic food oil. Also the good technical properties of rapeseed oil in machine lubrication has been noticed and there are hopes to get environmentally friendly diesel fuel from rapeseed. So it seems to be potential to get more RSM in animal feeding to substitute exported protein feeds like SBM. Today RSM in Finland is given mainly to cattle, but more interest to use it in pig and poultry feeding has again risen.

## EXPERIMENTAL

Materials and methods

RSM used in this experiment was solvent extracted from the Finnish double zero variety "Kulta" (*Brassica campestris* summer type) at Mildola Ltd.. The analysed nutrient content in dry matter of RSM was 38.1 % CP, 6.0 % Cfat, 13.5 % Cfib and 7.4 % ash. The total quantity of glucosinolates was 3.8  $\mu\text{mol/g}$ . Analysed nutrient content in dry matter of SBM was 50.1 % CP, 4.8 % Cfat, 6.1 % Cfib and 6.3 % ash. AMEn values used in feed calculations were 9.5 MJ/kg dm for RSM and 11.0 MJ/kg dm for SBM.

The naked oats' variety "Rhiannan" was Welsh origin and grown in Finland for experimental purposes. Its' analysed nutrient composition in dry matter was 16.7 % CP, 9.9 % Cfat, 3.3 % Cfib and 1.9 % ash. The barley used in this experiment had 13.2 % CP, 3.4 % Cfat, 5.1 % Cfib and 2.5 % ash in dry matter. Estimated AMEn values were 14.6 MJ/kg dm for naked oats and 11.0 MJ/kg dm for barley. The main composition of the experimental diets is presented in Table 1.

In the performance trial a total of 864 SCWL hens of Lohman hybrid (LSL) were housed in three-tier batteries three hens per cage. Statistical design of the experiment was three times three factorial, having three RSM levels (0, 50 or 100 % of SBM) and three naked oats levels (0, 50 or 100 % of barley). These nine feeding treatments were allocated by randomisation to 36 groups of hens, so there were four replicates per treatment. The performance trial consisted of eight 28-day periods while the hens were 24 to 56 weeks of age.

Table 1. Main composition of the experimental diets, laying performance and hens' welfare results.

Number of the diet	1	2	3	4	5	6	7	8	9	
RSM, g/kg		125	250		90	216		90	181	
SBM, g/kg	207	104		178	104		150	75		
Barley, g/kg	603	587	570	302	294	284				<b>SEM</b>
Naked Oats, g/kg				353	347	340	705	693	681	n = 4
Egg weight, g	64.5	64.1	64.3	64.6	63.7	64.1	62.9	62.8	62.8	0.98
Eggs, g/hen/d	57.5	58.6	59.4	58.9	57.8	57.3	56.1	55.5	53.7	2.21
Laying rate, %	89.2	91.6	92.6	91.3	90.9	89.5	89.4	88.4	85.6	3.43
Feed g/hen/d	126	129	132	124	125	124	119	122	121	4.1
CP g/hen/d	19.9	19.9	20.0	20.1	19.5	19.5	19.7	19.9	19.8	0.66
AMEn MJ/hen/d	1.44	1.48	1.48	1.47	1.50	1.46	1.51	1.51	1.50	0.049
FCR	2.20	2.21	2.22	2.10	2.15	2.17	2.12	2.20	2.27	0.080
Weight change, g	244	243	182	233	180	109	138	129	43	28.0
Mortality, %	0.0	2.1	6.3	2.1	2.1	9.4	2.1	5.2	13.5	1.95
- dead hens	0	2	6	2	2	9	2	5	13	
- liver lesions		1	4			3	1			
Thyroid weight mg/100 g bw.										n = 8
- dead hens		13.5	18.5	14.9	18.8	20.4	16.6	14.2	19.2	
- killed hens	15.5	17.2	19.5	15.2	13.8	20.5	16.3	17.0	19.0	1.47
Liver g/100 g bw.	3.36	3.62	3.34	3.36	3.39	3.71	3.63	3.47	3.84	0.185
Liver lesions	0	2	2	2	2	3	1	2	3	

## Results

RSM had no effects on laying rate, egg weight or egg output. Hens consumed the whole RSM diets about 3 g more than the whole SBM diets ( $p=0.027$ ), and thus had worse feed conversation ratio (FCR,  $p=0.002$ ). In protein (CP) or energy (AMEn) intake and utilisation there were no differences between various RSM levels. RSM caused significantly more mortality ( $p=0.001$ ). On SBM diets mortality was 1.4 % when it on 50 % RSM level was 3.1 % and on whole RSM diets 9.7 %. On diets three and six, which contained more than 20 % RSM, main reasons for death were liver lesions. Also thyroid weights of these hens were heavier than those of other dead hens. Thyroid weights per 100 g body weight were 4 mg heavier among the after trial killed hens in whole RSM diets ( $p=0.001$ ). In liver weights of the killed hens there were no significant differences among diets. Hens' live weight increased significantly less on whole RSM diets than on other diets ( $P=0.001$ ).

Naked oats in diets declined all laying performance results very significantly and had besides this significant interaction with the linear effect of RSM. Laying rate was over three per cent units lower, egg weight about 1.5 g lighter and daily egg output per hen 3.4 g less than on barley diets. When barley was substituted with naked oats, this had no effects in laying rate on SBM, but on RSM diets it caused seven per cent units drop ( $p=0.008$ ). This interaction reflected also to egg output, which was worst on RSM naked oats diet ( $p=0.012$ ). Hens ate the more energy containing naked oats diets significantly less ( $p=0.001$ ). Mean daily feed intake per hen on barley diets was 129 g and on naked oats diets 121 g. In CP consumption there were no differences between diets, but AMEn consumption was higher on naked oats diets ( $p=0.011$ ). Feed conversation ratio was significantly lower on all 50 % naked oats diets ( $p=0.007$ ). On whole naked oats diets RSM worsened FCR more than on the other diets.

Hens on all whole naked oats diets grew only 100 g while on the barley diets mean live weight change was 220 g ( $p=0.001$ ). Mortality on whole naked oats diets was 6.9 % and on barley diets 2.8 % ( $p=0.020$ ). Most of hens on diets nine and six died of general weakness and accidents. On thyroid or liver weights naked oats had no effects.

## ACKNOWLEDGEMENTS

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