ABSTRACT

The aim of this research was to establish the influence of different quantities of rapeseed meal (RM) and calcium in feed mix on productive performance of 360 chicks divided in 12 groups during the 42-day experiment. It was found that chicks in group C (0% of RM) and E3-5 (10% of RM) achieved significantly (P<0.05) higher body gains than those in groups E6-11 (20 and 30% of RM) at the end of the experiment. In the same time average body weights of groups EC,3,6,9 (0.8% of calcium) were significantly (P<0.05) higher than those in groups E1,4,7,10 (1.0% of calcium) and groups E2,5,8,11 (1.2% of calcium). We can conclude that 10% of RM in broiler diet didn’t have a negative effect on the production results. More than 0.8% of Ca in the broiler diet caused lower live weight.

Key words: Broiler chicks, Rapeseed meal, Calcium, Production results

Introduction

As a by-product of the production of rapeseed oil, the most used raw material in production of biodiesel remains a large amount of rapeseed meal (RM). In the order of the consumption of feedstuffs with high protein content, RM is after the soybean products on the second place. After reducing the glucosinolate content of rapeseed by plant breeding, the high content (13.5%) of crude fibre (Mawson et al., 1993) proved to be a limiting factor in the application of greater quantities of rapeseed meal in chicken feed. Researches undertaken indicate that good results can be achieved in broiler rearing if birds are fed diets containing 10 to 15% of rapeseed meal (Jamroz, 1995; Zeb et al., 2002). Feeding of broiler chickens with 1.2% Ca in feed mix didn’t have negative effect on body weight and feed conversion (Bakalli et al., 1996). Our preliminary results indicated synergistic effect of higher content of calcium and RM in the broiler diet. Therefore, the aim of this research was to establish the influence of different quantities (10, 20 and 30%) of rapeseed meal (RM) and calcium (1.0, 1.2 and 1.5% in starter and 0.8, 1.0 and 1.2% in finisher diets) on production results of chicks during the 42-day experiment.

Material and methods

The experiment involved 360 Ross broiler chicks divided into twelve groups: a control group (C) and eleven experimental groups (E1-11) – each comprising 30 birds, all of which were wing tagged. During the first three weeks of the experiment birds were fed a starter diet, followed by a further three weeks on a finisher diet (total of 42 days). Throughout the duration of the experiment, chicks in group C received no rapeseed meal and 1.0% in starter and 0.8% Ca in finisher diets; chicks in group E1-11 received a feed mixture containing combination of 10, 20 and 30% rapeseed meal and calcium.
Content of total and individual glucosinolates in rapeseed grain before extraction were determined by the method of high-performance liquid chromatography (ISO 9167-1-1992). The total concentration of glucosinolates in Silvia rapeseed meal was 21.78 mmol/kg. Table 2 presents the chemical

| Groups of chicks | C | E₁ | E₂ | E₃ | E₄ | E₅ | E₆ | E₇ | E₈ | E₉ | E₁₀ | E₁₁ |
|-----------------|---|----|----|----|----|----|----|----|----|----|-----|-----|
| RM 0            | 0 | 0  | 0  | 10 | 10 | 20 | 20 | 20 | 30 | 30 | 30   | 30  |
| Ca 0.8          | 1.0| 1.2| 0.8| 1.0| 1.2| 0.8| 1.0| 1.2| 0.8| 1.0| 1.2  | 1.2  |

meal and 1.0, 1.2 and 1.5% in starter and 0.8, 1.0 and 1.2% Ca in finisher diets. Distribution of the chicks in the experimental groups according to RM and Ca is showed in table 1.

Table 1. Distribution of the chicks in the experimental groups according to the different percentage of inclusion of rape seeds (RM) and calcium (Ca) in the diet.

Table 2. Performance of the calibration equation used to predict a validation data set.

| Groups | TGC mmol/kg | Moisture | Ash | Crude protein | Crude fat | Crude fiber | NFE¹ | Ca | ME² MJ/kg |
|--------|-------------|----------|-----|---------------|-----------|-------------|------|----|-----------|
| C      | 0.0         | 12.08    | 5.44| 22.66         | 4.29      | 3.66        | 51.87| 1.06| 12.23     |
| E₁     | 0.0         | 12.04    | 5.93| 22.15         | 5.02      | 3.92        | 50.94| 1.25| 12.24     |
| E₂     | 0.0         | 11.36    | 6.34| 22.36         | 5.79      | 3.90        | 50.25| 1.60| 12.20     |
| E₃     | 2.2         | 11.83    | 5.17| 21.05         | 5.82      | 4.33        | 51.8 | 1.15| 12.26     |
| E₄     | 2.2         | 11.36    | 5.80| 22.86         | 6.40      | 5.38        | 48.20| 1.23| 12.23     |
| E₅     | 2.2         | 11.31    | 6.37| 21.35         | 6.80      | 5.50        | 48.67| 1.57| 12.21     |
| E₆     | 4.4         | 11.19    | 5.48| 22.15         | 6.80      | 4.31        | 50.07| 1.20| 12.11     |
| E₇     | 4.4         | 11.88    | 5.68| 22.46         | 6.32      | 4.51        | 48.65| 1.25| 12.05     |
| E₈     | 4.4         | 11.73    | 6.34| 22.66         | 6.59      | 4.28        | 48.40| 1.50| 11.92     |
| E₉     | 6.5         | 10.81    | 5.42| 22.66         | 8.12      | 7.59        | 45.4 | 1.13| 12.06     |
| E₁₀    | 6.5         | 10.37    | 5.49| 22.51         | 8.48      | 7.40        | 45.75| 1.23| 11.99     |
| E₁₁    | 6.5         | 10.37    | 6.76| 22.66         | 8.07      | 7.26        | 44.88| 1.53| 11.87     |

| Groups | Moisture | Ash | Crude protein | Crude fat | Crude fiber | NFE¹ | Ca | ME² MJ/kg |
|--------|----------|-----|---------------|-----------|-------------|------|----|-----------|
| C      | 0.0      | 12.07| 5.05          | 19.44     | 4.85        | 4.33 | 54.26| 0.93     | 12.12 |
| E₁     | 0.0      | 11.71| 5.06          | 18.93     | 5.29        | 4.60 | 54.41| 1.05     | 12.05 |
| E₂     | 0.0      | 11.75| 5.30          | 18.43     | 5.52        | 4.39 | 54.61| 1.28     | 12.01 |
| E₃     | 2.2      | 11.39| 5.16          | 19.93     | 6.15        | 5.84 | 51.53| 0.98     | 12.12 |
| E₄     | 2.2      | 11.32| 5.48          | 19.44     | 6.65        | 5.68 | 51.43| 1.15     | 12.08 |
| E₅     | 2.2      | 10.62| 6.10          | 19.33     | 6.87        | 4.86 | 52.22| 1.25     | 12.00 |
| E₆     | 4.4      | 11.06| 5.33          | 19.94     | 6.28        | 5.72 | 51.67| 1.00     | 12.05 |
| E₇     | 4.4      | 11.23| 5.37          | 18.73     | 6.21        | 5.61 | 52.85| 1.12     | 11.98 |
| E₈     | 4.4      | 11.26| 5.73          | 18.83     | 6.96        | 5.42 | 51.80| 1.33     | 11.93 |
| E₉     | 6.5      | 11.89| 5.06          | 18.98     | 7.96        | 4.79 | 52.32| 1.03     | 12.05 |
| E₁₀    | 6.5      | 10.91| 5.62          | 18.73     | 6.93        | 4.82 | 52.99| 1.17     | 11.96 |
| E₁₁    | 6.5      | 11.15| 6.21          | 19.03     | 7.63        | 4.91 | 51.07| 1.32     | 11.87 |

¹ NFE = nitrogen free-extract.
² Calculated data from Allen (1993).
analyses of the starter and finisher diets with total glucosinolate content and with calculated ME.

Chicks were kept in accordance with the recommended Ross technology. Birds were weighed on days 1, 21 and 42, always at the same time of the day and in identical group sequence. The effects of RM and Ca on productive performance were analysed by least-square procedures using General linear Models within PROC GLM of SAS (1999). RM, Ca and their interaction were included in the model as main effects. Effects were considered significant if $P<0.05$.

**Results and conclusions**

Mortality was detected only in the starter period and was 0.81\% (two chicks E 3, one chick E 10). No significant interactions between RM and Ca were detected in the study, so only least square means for RM and Ca are presented in the Table 3.

It was found that chicks in groups fed 0, 10 and 20\% of RM realised significantly ($P<0.05$) higher body weights than those in groups fed 30\% of RM at the end of first 21 days of experiment. In the same time average body weights of groups with 1.0 and 1.2\% of calcium in diets were significantly ($P<0.05$) higher than those in groups with 1.5\% of calcium in diets. At the end of experiment significantly ($P<0.05$) higher body weights was found in groups fed 0 and 10\% of RM. Our results are consistent with a previous observation by Khan et al., (1996). On the contrary, Richter et al. (1996) found lower gains in chicks when inclusion rate of RM in the diet was 5\%. Based on these results, we can conclude than 10\% (2.2 mmol/kg glucosinolates) of RM in chick's diet didn't have a negative effect on the production traits. More than 0.8\% of Ca in the chick's finisher diet caused lower live weight.

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**Table 3. Chicks body weight (BW) and daily gain (DG) and at different days of the experiment.**

| % of Rapeseed meal (RM) | % of Calcium (Ca) | Significance |
|-------------------------|-------------------|-------------|
| 0          | 10               | 20          | 30          |
| 0.8        | 1.0              | 1.2         |             |
| BW g       |                  |             |             |
| d 21       | 613a             | 631a        | 612a        | 577b        |
|            | 640a             | 620a        | 564b        | *           |
| d 42       | 1790a            | 1767a       | 1670b       | 1630b       |
|            | 1850a            | 1705b       | 1588c       | *           |
| DG g/d     |                  |             |             |
| 0-21d      | 26.9a            | 27.8a       | 26.9a       | 25.2b       |
|            | 28.2a            | 27.3a       | 24.6b       | *           |
| 22-42 d    | 51.9a            | 54.2a       | 50.4b       | 50.1b       |
|            | 57.6a            | 51.7b       | 48.7c       | *           |
| 0-42       | 41.42a           | 40.99a      | 38.63b      | 37.66b      |
|            | 42.88a           | 39.47b      | 36.67c      | *           |

* $P<0.05$; ns- non significant.

Means with different letters are significantly different.