

THESIS OF A DOCTORAL (Ph.D.) ESSAY

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**THE EFFECT OF MAGNESIUM FEEDING ON THE
PRODUCTION PROPERTIES OF HENS**

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1. Introduction

Application of a given volume of fodder having the given nutritional values is indispensable for the perfect functioning of the body of our animals, and for the adequate economic results of their production. On the basis of the preliminary scientific researches necessities required for the maintenance of life, and nutritional values of fodders developed for an average production are specified in standards. These feeding standards applied in animal husbandry pay a special attention to the main nutritional values of the fodders. They include raw protein, raw fat, raw fibre, energy content, etc.

The appearance of new breeds and hybrids of high capacity developed in the last decades involved a more accurate specification of the necessities, mainly in respect of supplementation of vitamins and minerals. Though these stocks have excellent genetic properties, they can validate their capacities only under keeping and feeding circumstances developed for them. This applies also to the less intensive breeds of double use. Researches of the last few years showed that there are macro- and microelements among minerals which may result in the growth of production if they are fed as a supplementary premix

beyond values given in the basic feeding standard in case of breeds and hybrids having high genetic values.

During studies of minerals having a beneficial effect on the functioning of the organ the favourable effect of magnesium supplementation on vital processes has been proven in case of a number of macro- and microelements. Scientific researches relating to the efficiency of magnesium proved its beneficial effect first of all in the field of human therapy. The success of magnesium experiments made in human relation incited the researchers to use their results also in the field of animal husbandry.

I wished to join these experiments with my own studies with the purpose to observe the effect of magnesium added as a supplementation on the production results of hens.

2. Own studies

2.1 Objectives of the experiments

With a view to the assumed economic significance of the supplementary magnesium feeding in animal production, I wanted to establish the followings in my experiments:

- How the weight of the breeding eggs change when supplementary magnesium is fed?
- How magnesium supplementation of different levels affect hatching?
- Does the weight of the day old chicks change when magnesium is fed?
- How does magnesium added to the fodder of the laying hens affect the intensity of the embryo growth? Does the embryo weight measured on certain examination days (days 14, 16, 18 and 20) change depending on magnesium feeding?

- Does supplementary magnesium feeding affect the weight of the vital intestines (brain, heart, liver, stomach) of the embryo?
- Does the supplementary magnesium appear in the vital intestines (brain, hart, liver, stomach) of the developing embryo?
- How the magnesium balance of the laying hens change in the individual experimental groups?

2.2 Material and method

2.2.1 Experimental animals and their feeding

My studies were made on yellow Hungarian laying hens for 3 years. Magnesium was added in volumes 300 (Mg 1.), 400 (Mg 2.) and 500 (Mg 3.) mg/day in the individual experimental groups till the end of the egg collection period.

In every case the pre-feeding period started on laying week 20. Magnesium was added in the form of a HAMAG LP product (98,00 % MgO, the magnesium content of which is 58,67 %).

Based on 150 g of daily fodder consumption first the product was mixed into a little volume of fodder, and then it was diluted, taking care of homogeneity.

Each experimental group consisted of 40 laying hens and 4 cocks *for the study of examination of hatching and embryos*. The 10 days of pre-feeding period was followed by 10 days of egg collection.

The evaluation of experiment was by summary of the 3 years datas. So I managed the results of 3x40, i.e. 120 laying hens together.

I placed 8 laying hens from each experimental group in cages *for the study of the magnesium balance*. The pre-feeding period lasted 5 days, which was followed by the 10-day experimental phase.

2.2.2 Calculation of hatching %

Eggs put into the hatcher were transilluminated on days 7 and 19 of hatching. During candling I sorted out the infertile, bloody and rotten eggs. Further drop-outs were expected on hatching of the day old chicks. Unhatched chicks are included in the category of rotten eggs. Hatching % was given by the ratio of the hatched day old

chicks and of the fertile eggs, taking 60 eggs used in each group for the study of the embryos into consideration which were also deducted.

Hatching of all the four groups was made on the same machine, the time of the collection of the hatching eggs were identical.

2.2.3 Embryo dissection

I took 5-5 eggs (15-15 eggs with reduction of 3 years) from each group at random at each experimental time for the study of the individual organs of the embryo. The eggs were transilluminated again. The study was made on days 14, 16, 18 and 20 of the embryo growth. After measuring the weight of the eggs and of the embryos used for the dissection I studied the weight of the brain, heart, liver and stomach of the embryos as well as the magnesium content of these organs.

2.2.4 Magnesium utilization of the laying hens

The cast and the produced eggs of the animals in cages were continuously collected. The magnesium, calcium and phosphor contents of the cast and fodder samples, as well as of the examined eggs were specified in a laboratory. In the knowledge of the magnesium, calcium and phosphor

volumes taken with the fodder and emptied with the cast I specified the retention of the individual minerals.

2.2.5 Chemical testing procedures used during the experiments

Dry material, raw protein, raw fat, raw fibre, raw ash and magnesium contents of fodders fed during the experiments were specified with methods recommended in Volume 2 of the *Hungarian Fodder Code (1990)* (Chapters 5.1, 6.1, 7.1, 8.1, 10.1, 11.3, 11.4.2 and 11.6). The dry material and magnesium contents of the cast and of the eggs were examined also with the above methods in the laboratory of the Department of Nutrition of Animal of the University of West Hungary, and in the laboratory of the Department of Nutrition of Animals of the Georgic Agricultural Faculty of the University of Veszprém.

2.2.6 Statistic evaluation of the results

For the statistic evaluation of my experimental results (average, standard deviation, CV % and significance test) I used Microsoft Excel 2002 and the StatSoft Statistica 6.0 statistical program package.

3. New scientific results

On the basis of evaluation of the hatching and embryo dissection tests as well as of the evaluation of the results of the laboratory measurements the following new scientific results may be established:

1. The magnesium supplementation to the fodder of the laying hens had a beneficial effect on the hatchability of the eggs. The increase of the magnesium level reduced the number of drop-outs of eggs during hatching, thereby hatchability improved. The best hatching percentage was obtained with magnesium doses of 400 mg (80,87 %) where the volume of bloody and rotten eggs reduced (3,37 and 6,01%). As regards died eggs magnesium level of 500 mg had the most favourable effect (3,79 %), where hatchability was 77,79 %. The hatching results of the individual experimental groups proved to be better than the results of the control group.
2. On examining the ratio of the average weight of 14-, 16-, 18- and 20-day embryos and of the eggs we can establish that the supplementary magnesium feeding had a positive effect on the embryo growth.

The study of the embryos in the individual experimental groups showed a significantly higher embryo weight in comparison to the values of the control group. When 500 mg of magnesium was fed the average weight of the embryos was by 3,92 % more than the results of the control group on day 14 of dissection (NS), by 7,92 % on day 16 ($P < 0.01$), by 2,73 % on day 18 (NS), and by 7,73 % on day 20 of dissection ($P < 0.01$).

3. On examining the ratio of the intestines and of the embryo we could not observe a correlation between the fed magnesium volume and the change of weight of the individual intestines.
4. The magnesium content of the intestines of the embryo did not change when magnesium was fed or during the age.
5. The magnesium discharge of hens did not increase with the increase of the magnesium level. The magnesium retention of the control group increased from 63,17 % to 74,60 % in case of supplementation of 300 mg (Mg 1.), to 79,00 % in case of supplementation of 400 mg (Mg 2.), to 83,51 % in case of magnesium supplementation of 500 mg (Mg

3.). Magnesium absorbed in volumes exceeding the required level is stored in the body of the yellow Hungarian laying hens (20 week-old), it improves the quantitative figures of breeding egg production which supports the positive results of my experiments.

4. List of publications made in the theme of the dissertation

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