QUALITY OF LAYING EGGS USING PREBIOTIC ADDITIVES CREATED IN CAGE-FREE SYSTEM AND IN DIFFERENT DENSITIES

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Abstract

This study aims to evaluate the quality of eggs in laying hens reared at different densities in cage-free system, receiving diets with the addition of prebiotic additives. An observational study was carried out with 45 laying hens of the Novogen Brown scaling, which was in the phase of peak production (28 – 37 weeks), in prototypes of reduced scale without air conditioning and divided into group 1 (G1): density of two poultry /m² (11 poultry) and diet with addition of a prebiotic pool; group 2 (G2): density of three poultry /m² (17 poultry) and commercial diet without the addition *of prebiotics and antibiotics; group 3 (G3): density of three poultry /m² (17 poultry) and also diet with the addition of a prebiotic pool. In this study, the statistical evaluation was performed, the effects of densities 2 poultry /m² (G1) or 3 poultry /m² (G3) and the effects of diet with prebiotics (G3) and without prebiotics (G2) in laying poultry were performed. The data were submitted to variance analysis by the GLM procedure of the SAS Program V9 (2002), using the Student's T Test at a level of 5% significance. The results referring to eggeso (g), albumen height (mm), yolk color, haugh unit (UH), peel resistance (Kgf)* between *G1 and G3* showed no statistically difference, since in relation to the thickness of the shell (mm) *differed (P>0.05). In the analysis between G2 and G3, the statistical difference (P>0.05) obtained among all the panels analyzed. In the face of the above, it can be reported that the results of quality variables undergo the action of prebiotics in laying hens created in the Cage-free system.*

Keywords: Antibiotics, aviculture, physical-chemical characteristics.

1. INTRODUCTION

Very important in the Brazilian economy, aviculture, it is in the face of problems that can sensitize all its progress in the production of laying hens, such as the pressures in the change of the intensive breeding system aimed at animal welfare, prohibition of the use of antibiotics as a performance enhancer.

The intensive production system, adopted in the posture industry in Brazil since it directly affects animal welfare, especially when the density of housing is not respected, leading these animals to injury, tends to be replaced by *the Cage-free system,*or other semi-intensive systems that allows free access of poultry tograzing areas, being able to perform their natural behaviors (Blokhuis et al., 2000).

On the prohibition of antimicrobials used as performance improvers, prebiotics are compounds that have aroused great interest in the poultry area when used in the form of additives, representing a promising alternative to replace antibiotics, especially in young poultry or under stress conditions (Silva; Nörnberg, 2003), contributing to the balance of the intestinal microbiota, increased populations of beneficial bacteria *(mainly Lactobacillus* and *Bifidobacterias),*reduction of harmfulpopulations (mainly *Salmonellas and Escherichia coli*) and aid in the controlof *Clostridium*.

In view of this scenario, this study presupposes that the addition of prebiotics in the diet associated with densities has action on the quality of laying eggs created in *Cage-free*systems.

2. MATERIAL AND METHODS

Experiment site, climatic conditions and poultry management

The experiment was carried out at the Faculty of Sciences and Engineering (FCE/UNESP) located in the municipality of Tupã to the west of the state of São Paulo,located at 530 meters of altitude.

The experiment was approved by the Ethics Committee on Animal Use (CEUA) of the Faculty of Sciences and Engineering (FCE/UNESP) with protocol number 01/2019.

Forty-five laying hens of *the Novogen Brown slaw,*aged 28 to 37 weeks (1 o and 2nd cycle), with breeding cycles of 28 days, obtained in a commercial farm were used. The poultry used in the experiment had access to feed and water *ad libitum* through trough feeders and nipple-type drinking fountains. The lighting program was with a photoperiod of 16 hours, being used the natural lighting and complemented with artificial lighting provided by 4 LED *lamps.*

The poultry were housed in three prototypes on a reduced and distorted scale, existing in the experimental area of FCE/UNESP. The prototypes were masonry, with east-west orientation, and the east and west walls are fully closed masonry and the north and south walls are lined with grid screen and dimensions of 3.20m² X 1.40m² X 1.60m².

Data collection

An observational study was conducted in two cycles (28 days) from May to June 2019, with transition of the autumn and winter seasons. With laying hens that were at peak production.

For data collection to be performed, these poultry were divided into groups, where group 1 (G1): received a commercial diet with the addition of a mixture of prebiotics of galactolicossaccharides (GOS), fructoligosaccharides (FOS) and mananooligosaccharides (MOS) and the animal density of accommodation were 2 poultry/m² (11 poultry in the prototype); group 2 (G2): received a commercial diet without additives and animal density of alloage were 3 poultry/m² (17 poultry in the prototype); group 3 (G3) received a commercial diet with the addition of the prebiotic mixture composed of GOS, FOS and MOS and animal density of 3 poultry/m² (17 poultry in the prototype). The densities used were those recommended by the local CEUA and did not use antibiotics in the diet in any of the treatments. And submitted to an acclimatization period that lasted 7 days.

Diet

The diets were composed of corn and soybean meal, formulated with isoenergetic and isoaminoacid levels, according to values recommended by Rostagno et al., (2017) and presented in Table 1.

Table 1. Composition and calculated values of the diets of laying hens housed in different densities.

Ingredients	Quantity (kg)	
Macro Ingredients	**G2**	**G1 and G3**
Corn Grain (7.5 %)	625,5000	625,5000
Soybean Meal (46%)	265,0000	265,0000
Coarse Limestone	30,0000	30,0000
Fine Limestone (38%)	39,0000	39,0000
methionine	0,5000	0,5000
Premix min/vit kg/ton[1]	40,0000	40,0000
Prebiotic Additive[2]*	-	2,0000
Energy Met Ap Aves Kcal/Kg	2.808,7865	2.808,7865
Crude Protein %	16,5982	16,5982
Ether extract %	2,5299	2,5299
Gross Fiber %	2,7885	2,7885
Calcium %	4,0456	4,0456
Match Available %	0,3884	0,3884
Sodium %	0,1778	0,1778
Chlorine %	0,2308	0,2308
Lysine Dig Poultry %	0,7793	0,7793
Methionine Dig - Poultry %	0,3861	0,3861
Met+Cist Dig-Aves %	0,6102	0,6102
Triptofanodig-Aves %	0,1842	0,1842
Threoin A Dig-Aves %	0,5630	0,5630
Arginine Dig-Poultry %	1,0283	1,0283
Isoleucinadg-Ave %	0,6445	0,6445
Valinadig-Ave %	0,6911	0,6911

Legend: G2 = Group 2, G1 = Group 1, G2 = Group 2.

[1] Mineral and vitamin premix (warranty levels per kg of product) : vitamin A 8000 MUI; vitamin D3 2500 MUI; vitamin E 15000 mg; vitamin K3 1500 mg; vitamin B1 500 mg; vitamin B2 3000 mg; vitamin B6 2000 mg; vitamin B12 10000 mcg; niacin 18000 mg; calcium pantothenate 7000 mg; folic acid 500 mg; biotin 20 mg; iron 30000 mg; copper 8000 mg; manganese 70000 mg; zinc 70000 mg; iode 1000 mg; selenium 250 mg; methionine 800 g; choline 400,000 g; phytase 60 g; halquinol 30000 mg.

[2] Ontop dosed *prebiotic additive.*

Egg Quality

At the end of each cycle (last 5 days) adapted from the methodology of Silva *et al*. (2013), eggs were collected and analyzed to evaluate quality. For this analysis, the model machine *DET 6000* of the manufacturer NABEL®, available in the Environmental Comfort laboratory of the Faculty of Sciences and Engineering, which provides values of egg weight (g), albumen height (mm), yolk staining, haugh unit (UH),peel resistance (Kgf), shell thickness (mm).

Statistical analysis

In this statistical evaluation, the effects of densities 2 poultry /m² (G1) or 3 poultry /m² (G3) and the effects of diet with prebiotics (G2) and without prebiotics (G3) in laying poultry were analyzed. The data were submitted to variance analysis by the GLM procedure of the SAS Program V9 (2002), using the Student's T Test at a level of 5% significance.

3. RESULTS AND DISCUSSION

Table 2. Evaluation of the effect of densities 2 poultry /m² (G1) or 3 poultry /m² (G3) in laying poultry on the paâmeters: Egg weight (g); Height of albumen (mm); Yolk coloring; Haugh Unit (UH); Egg quality; Hull resistance (Kgf); Shell Thickness (mm).

TREATMENTS	**Egg weight (g)**	**Albumen height (mm)**	**Yolk coloring**	**Unit Haugh (UH)**	**Hull resistance (Kgf)**	**Shell thickness (mm)**
G1 - 2 poultry /m2	59,10 **A**	5,91 **A**	6,65 **A**	74,50 **A**	4,05 **A**	0,39 **B**
G3 - 3 poultry /m2	60,53 **A**	6,41 **A**	6,31 **A**	78,18 **A**	4,38 **A**	0,42 **A**
CV (%)	8,51	26,52	11,44	18,31	21,59	11,31
P value	0,2411	0,2083	0,0525	0,2744	0,1286	0,0155

*Averages followed by different capital letters in columns differ from each other by student's T Test at 5%.

Table 3. Evaluation of the effect of diet without prebiotics (G2) and prebiotics (G3) in laying poultry on the pameters: Egg weight (g); Height of albumen (mm); Yolk coloring; Haugh Unit (UH); Egg quality; Hull resistance (Kgf); Shell Thickness (mm).

TREATMENTS	**Egg weight (g)**	**Albumen height (mm)**	**Yolk coloring**	**Unit Haugh UH**	**Hull resistance (Kgf)**	**Shell thickness (mm)**
G2 - Diet if prebiotic	58,33 **B**	5,25 **B**	5,80 **B**	69,62 **B**	3,01 **B**	0,35 **B**
G3 - Diet com prebiotics	60,53 **A**	6,41 **A**	6,31 **A**	78,18 **A**	4,38 **A**	0,42 **A**
CV (%)	9,04	27,50	10,95	18,33	27,51	11,34
P value	0,0075	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001

*Averages followed by different capital letters in columns differ from each other by student's T Test at 5%.

When observing G1 and G3 (Table 2), it is noted that the variables of the egg(g); albumen height (mm); yolk staining; haugh unit (UH); egg quality; shell strength (Kgf)do not differ, where G3 even with higherdensity presents the highest results. In the variable thickness of the barck (mm), there was a difference and that the largest result is still in G3.

In relation to G2 and G3, which presented different diets and the same housing density (Table 3), a difference was found in all the variables analyzed (egg peso (g); albumen height (mm); yolk staining; haugh unit (UH); egg quality; shell resistance (Kgf); shell thickness (mm)where G3 presents the best results, being possible to observe the action of prebiotics again.

It is known that prebiotics can act beneficially in the intestinal health of their host, due to their power to stimulate selective growth in one or more groups of beneficial bacteria that can act in the lumial conditions, gastrointestinal structure and immune system (Silva and Nörnberg, 2003).

In studies performed, the use of prebiotics in diets of laying hens contributed to greater absorption of minerals, in particular the absorption of calcium and phosphorus, acting on a better eggshell (Świątkiewicz et al., 2010a) and bone resistance (Świątkiewicz et al.,2010b), in addition to increase the count of Bifidobacterium spp. cecal and reduce that of Clostridium perfringens (Pinedaquiroga et al., 2017).

In the present study, both in the group with different densities and in those who received different diets, the action of prebiotics was evidenced in the results of the variables analyzed.

4. CONCLUSION

It was concluded that the addition of probiotics in diets of laying hens created in the cage-free system promotes improvement in the requirements of egg quality, Egg weight (g); Height of albumen (mm); Yolk coloring; Haugh Unit (UH); Egg quality; Hull resistance (Kgf); Shell Thickness (mm), 28 to 37 weeks ofage, although the parameters were below the meanvaluesof the lineage manual.

For future studies it is necessary to increase the challenge, such as the housing density of thecage-freesystem, and a group that receives antibiotic as a performance enhancer for better analysis with the prebiotic and verification of its added pefomance in the poultry feed.

5. ACKNOWLEDGMENT

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