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Effects of Yeast Extract Addition in Diet on Performances and Feather Pecking of Pullets When Raising under Feed Restriction and Litter Removal

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Abstract: This study was performed with pullets to evaluate the effects of dietary yeast extract on bird performances and feather pecking. A total of 2400, 10-weeks-old pullets were divided into 8 groups: C, R, L and LR are control, feed restriction (from 09h00 to 15h00), litter removal (from 12 to 17 weeks of age) and both feed restriction and litter removal groups, respectively. CA, RA, LA and LRA groups received the diet supplemented with yeast extracts. The dietary yeast extract additive was used at the dose of 50 mg per kg live weight. The experiment lasted 8 weeks. Body weight, feed intake and feather pecking were recorded. Litter removal and/or feed restriction affected the growth rate of pullets and increased the frequency of feather pecking. The yeast extract dietary addition did not have any influence when animals were fed *ad libitum*, but significantly alleviated the feed restriction and litter removal effects. The results of the pecking observations showed that RA, LA and LRA groups had less frequency of gentle pecks and severe pecks compared to R, L and LR groups. In addition, pullets fed C and CA diets had the lowest frequency of gentle pecks (12.65 and 19.45%, respectively) and severe pecks (0.23 and 0.17%, respectively) compared to R, L and LR groups. In conclusion, the dietary addition of yeast extract could reduce significantly the feather pecking as well as the depressive effects of feed restriction and/or litter removal on body weight gain.

Key words: Feed restriction, litter removal, yeast extracts, feather pecking, performances, pullets

INTRODUCTION

The inability of hens to adapt to their social environment results in an increase in the frequency of abnormal behaviors, such as feather pecking, aggression and cannibalism (El-Lethey *et al*., 2000). In fact, commercial poultry farmers observed that feather pecking is a major welfare problem in pullets and laying hens and it has received much attention from producers and scientists over the years (Rodenburg *et al*., 2004). Savory (1995) classified five types of pecking behavior: aggressive pecking, feather pecking without removal of feathers; also called gentle feather pecking, feather pulling leading to feather loss; also called severe feather pecking, tissue pecking in denuded areas and vent pecking. There are some parameters which have been used as stress indicators in poultry like mortality rate, body injury and feather coverage (Fahey and Cheng, 2008). Birds, which developed feather pecking, showed high number of struggles, low Hypothalamus-Pituitary-Adrenal (HPA) axis reactivity (plasma corticosterone), high neurosympathetic reactivity (noradrenaline), low parasympathetic reactivity (heart rate) and low dopamine and serotonin turnover (Koolhass *et al*., 1999). The use of genetic to reduce the problem of feather pecking could be an interesting alternative (Hocking *et al*., 2001). In fact, the heritability of feather pecking ranges from 0.04 to 0.50 and therefore we can select strains that exhibited low feather pecking (Cuthbertson, 1980). The use of yeast extracts constitute another alternative to decrease feather pecking in pullets and laying hens.

In the present study, we evaluate the effects of the addition of yeast extracts to corn and soybean meal-based diet on performances of pullets and frequency of feather pecking.

MATERIALS AND METHODS

Animals and diets: Two thousand and four hundred, 10-weeks-old pullets (Shaver 2000, SOTAVI, Tunisia) were weighed, placed in 8 floor pens (i.e. 300 birds per pen; size: 3 x 5 m) and randomly assigned among 8 treatment groups. Used litter, top-dressed with 7 cm of wood shavings, was utilized as bedding. The room temperature was gradually decreased from 32°C at day 1 to 24°C at day 22. The light was continuous during the first three days then the lighting regimen was 23 h per day. Pullets received a standard single diet based (C) on corn and soybean meal and determined according to the nutritional requirements for chickens (Larbier and Leclercq, 1992) and calculated using PORFAL software version 2.0 (ITP-INRA, France). The basal diet was fed in mash form and contained no antibiotics or other growth factors and water was received *ad libitum*. Environmental disruptions were used as stressors in this study. Two groups (C and CA) were fed *ad libitum*

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and received respectively the basal diet supplemented (CA) or not (C) with yeast extract additive (Avicam®, Lesaffre Feed Additives, France). Three other groups (R, L and LR) had a limited access (R) to diet (from 09h00 to 15h00) or the litter has been removed (L) from 12 to 17 weeks of age or had both limited access to diet and the litter removal (LR) from 12 to 17 weeks of age. These three groups received a diet supplemented (RA, LA and LRA) or not (R, L and LR) with yeast extract. The dietary additive, Avicam®, was used at the dose of 50 mg per kg live weight. The dietary treatments were purchased from a commercial company (ACN, Solimon, Tunisia). The diets were given to pullets from 10 to 18 weeks of age. Body weights were determined at 10 and 18 weeks of age. Feed intake and feather (gentle or severe) pecking were recorded weekly and by a group of 300 chickens during the entire experiment and according to the Huber-Eicher and Sebo (2001) method.

Statistical analyses: The level of statistical significance was preset at $p \leq 0.05$. Data were statistically analyzed for treatment effect by the ANOVA procedure of the Statview software for Windows 4.5 (1992-1996). Mean differences were determined using the Fisher test of least significance.

RESULTS AND DISCUSSION

The results of the present study showed that the feed restriction decreased ($p<0.05$) the body weight of R group compared to C group (1052 vs. 1107 g, respectively). Moreover, weight gain (636 vs. 691 g, respectively) and feed conversion ratio (7.206 vs. 6.533, respectively) of pullets (Table 1) were depressed ($p<0.05$) by feed restriction. The litter removal also decreased body weight (1068 vs. 1107 g) and weight gain (651 vs. 691 g) and increased feed conversion ratio (7.062 vs. 6.533) of pullets compared to C group. The feed restriction associated to the litter removal did not affect the pullet performances. The reasons for environmental stressors (feed restriction and litter removal) effects on body weight are not well established. Carrera *et al.* (2006) reported that weight loss was produced by short term feed restriction and it can be prevented by repeated handling for 20 days. Therefore, it appears that acute and chronic stresses have different effects on body weight and as a consequence it may not be a good indicator for stress (Fahey and Cheng, 2008). The yeast extract (Avicam®) dietary addition did not have any influence when animals were fed *ad libitum*. Moreover, the pullet performances of LA and LRA did not improve by the yeast extract addition. Nevertheless, body weight (1052 vs. 1079 g, respectively), weight gain (636 vs. 662 g, respectively) and feed conversion ratio (7.206 vs. 6.851, respectively) of RA group were improved ($p<0.05$) by the addition of yeast extracts compared to R group. Feed restriction and litter removal affected also the mortality rate of pullets. In fact, the LR group had the highest mortality (10.33%) then R and L groups (9.33% and 5.00%, respectively). The use of yeast extracts decreased ($p<0.05$) the mortality rate of pullets stressed by feed restriction and/or litter removal. The lowest rate mortality was obtained in CA group. Similar results were reported by Moinard *et al.* (1998) and Craig and Muir (1996) who found that stressed hens had greater mortality rates and poorer feather coverage due to aggression associated with cannibalism. Ambrosen and Petersen (1997) suggested that incidence of cannibalism is positively correlated with poor feather coverage, because exposed skin is more easily damaged. In addition, aggressive pecking is mostly directed at the head and pecking associated with cannibalism is mostly directed toward the cloaca (Cloutier and Newberry, 2002).

The results of the pecking observations showed that feed restriction increased ($p<0.05$) the frequency of gentle pecks (55.10 vs. 12.65%) and severe pecks (0.97 vs. 0.23%) compared to C group. In addition, the litter removal (L group) alone or in combination with feed restriction (LR group) increased ($p<0.05$) the frequency of gentle pecks (51.61 and 56.90 vs. 12.65%, respectively) compared to C group. Moreover the results of the present study showed that L, R and LR groups had similar frequencies of gentle pecks. The increase of gentle and severe peacks in poullets due to environmental stressors (feed restriction and litter removal) can be explained in part by a changes in the neuroendocrine systems, including altered adrenal functions (Gross and Siegel, 1985). Thus, it is probably

Table 1: Effect of yeast extracts on pullets performances

Groups	Body weight (8 weeks, g)	Body weight (18 weeks, g)	Weight gain (g)	Feed intake (g)[1]	Feed: gain ratio
C	431±49^{a}	1107±92^{a}	691±104^{a}	4426	6.533±0.977^{a}
CA	437±54^{a}	1105±86^{a}	688±100^{a}	4381	6.482±0.998^{a}
L	447±53^{a}	1068±93^{bc}	651±107^{bc}	4478	7.062±1.159^{bc}
LA	404±53^{b}	1069±84^{bc}	652±96^{bc}	4416	6.910±0.992^{bc}
R	397±48^{b}	1052±82^{b}	636±95^{b}	4491	7.206±1.017^{b}
RA	426±63^{a}	1079±83^{c}	662±96^{c}	4450	6.851±0.989^{c}
LR	415±46^{b}	1113±86^{a}	697±97^{a}	4640	6.789±0.965^{c}
LRA	383±44^{c}	1047±85^{b}	631±98^{b}	4507	7.259±0.922^{b}
Probability[1]	<0.0001	<0.0001	<0.0001	-	<0.0001

[1]Values are means±SD of 300 birds per dietary group. Mean values within a column having different superscripts are significantly different by least significant difference test ($p<0.05$)

Table 2: Effect of yeast extracts on feather pecking in pullets

Groups	Gentle pecks (%)	Severe pecks (%)
C	12.65±09.04[a]	0.23±0.17[a]
CA	19.45±12.35[a]	0.17±0.18[a]
L	51.61±21.28[b]	0.00
LA	30.92±11.03[c]	0.11±0.17[a]
R	55.10±21.73[b]	0.97±0.45[b]
RA	30.64±10.43[c]	0.56±0.35[c]
LR	56.90±23.62[b]	0.72±0.41[b]
LRA	39.61±14.51[c]	0.41±0.40[c]
Probability[1]	<0.0001	<0.0001

[1]Values are means±SD of 300 birds per dietary group. Mean values within a column having different superscripts are significantly different by least significant difference test ($p<0.05$)

Table 3: Effect of yeast extracts on mortality rate of pullets

Groups	Mortality rate (%)
C	2.33[e]
CA	0.33[f]
L	5.00[d]
LA	2.33[e]
R	9.33[b]
RA	2.00[e]
LR	10.33[a]
LRA	6.66[c]
Probability[1]	<0.0001

[1]Values are means per dietary group. Mean values within a column having different superscripts are significantly different by least significant difference test ($p<0.05$)

that pullets who exhibited great social stress had a high corticosterone concentration. The alteration of the pullet immune function by increasing the T-lymphocyte profile is also associated with great social stress (Tsigos and Chrousos, 2002).

Furthermore, RA group receiving a diet supplemented with yeast extracts had less ($p<0.05$) frequency of gentle pecks (30.64%) and severe pecks (0.56%) compared to R group (55.10 and 0.97%, respectively). We observed also, in the present study, that the frequency of gentle pecks decreased ($p<0.05$) in LA and LRA groups (30.92% and 39.61%, respectively) compared to L and LR groups (51.61% and 56.90, respectively). The LA, RA and LRA groups exhibited similar frequencies of gentle pecks indicating that the efficiency of yeast extracts was independent of stress sources (feed restriction and/or litter removal). In addition, pullets fed C and CA diets had the lowest frequency of gentle pecks (12.65 and 19.45%, respectively) and severe pecks (0.23 and 0.17%, respectively) compared to L, R, LR, LA, RA and LRA groups. It is likely that yeast extract interfere with physiological characteristics of birds to decrease feather pecking (Koolhass *et al*., 1999).

In conclusion, the dietary addition of yeast extract could reduce significantly the feather pecking as well as the depressive effect of feed restriction on body weight gain.

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