THE EFFECTS OF VARYING LEVELS OF DIETARY SALT ON PERFORMANCE AND FAECAL PARAMETERS OF LATE PRODUCTION LAYERS

S. O. ARO, E. P. OWOKOTOMO AND A. D. ADEBAYO
Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria.
E-mail: sambolaro@yahoo.co.uk Mobile Phone: +234 706 232 9254

ABSTRACT

This experiment was performed to investigate the performance and faecal parameters of laying birds fed different levels of dietary salt. Four experimental diets designated as: T1 (control diet with 0.25% Salt), T2 (0.50% Salt), T3 (0.75% Salt), T4 (1.00% Salt) were fed to late production layers. Data from the birds on weight gain, feed intake, mortality, egg production, egg weight and feed conversion ratio were collected while faecal parameters like faecal dry matter, faecal volume, faecal density, faecal consistency and percentage moisture content were also taken as response criteria. The results showed that the total egg laid, average egg weight, feed conversion ratio and mortality of the experimental birds were not significantly different ($P > 0.05$) among the dietary treatments. The hen-day production, hen-housed production, and total feed intake were influenced significantly ($P < 0.05$) by the treatment diets. The faecal volume, faecal weight and the faecal density of the experimental birds were not significantly different ($P > 0.05$) but faecal output, faecal dry matter, faecal consistency, faecal moisture and percentage faecal moisture varied significantly ($P < 0.05$). It was observed that egg production was better conferred on the bird at 0.75% (T3) of dietary salt. Conclusively, this experiment showed that increase in the levels of dietary salt up to 0.75% could improve total egg production, livability and feed efficiency of late production layers. Increased faecal moisture, decreased faecal consistency and a predisposition to wet litter could result at levels above 0.75%.

Keywords: Dietary salt, faecal parameters, layers, performance

INTRODUCTION

Many ingredients go into the formulation of livestock diets. Each of these ingredients has different roles it plays in the general physiological functions, production and wellbeing of the animals. Not only are these ingredients essential in the diets of farm animals, their level of inclusion must as a matter of fact be optimum in order to forestall untoward physiological and nutritional consequences. One of such ingredients whose level of inclusion should be closely monitored is the dietary salt otherwise called sodium chloride (Nalco). Literature is replete with the dietary functions of NaCl and the various deficiencies that could ensue if its recommended allowance is compromised with in the livestock diets (www.ca.uky.edu, 2012). More importantly, the roles of dietary salt in laying birds at ensuring egg production performance and livability have been reported by many authors (Nesbeth *et al.,* 1976; Bai *et al.,* 1992; Jacob *et al.,* 2011).The level of dietary salt that is optimum for laying birds is still a subject of controversy. For instance NRC (1994) recommended a level of 0.25% as optimum for layers while Kellems and Church (1998) recommended 0.20% dietary salt for layers at the peak of lay. A level as high as 2-3%of the diet was even utilized by Oluyemi *et al.* (2011). It is also a well-known fact that dietary salt elicits watery faeces in livestock subjected to dietary salt insult above the recommended level (Oluyemi *et al.,* 2011). The dire consequences of such dietary salt insult on faecal parameters in terms of the added cost of faecal management are obvious. This is coupled with the emission of greenhouse gases (Macleod *et al.,* 2013) to the environment through enhanced rate of putrefaction of the watery droppings occasioned by the high salt content of the feed. In furtherance of the quest for the optimum salt level that will ensure maximum egg production, improve livability of the laying birds as well as mitigate the problems associated with watery faecal output, this experiment was conducted to investigate the effect of varying levels of dietary salts on the egg production performance and faecal characteristics of late production layers.

MATERIALS AND METHODS

The experiment was carried out at the poultry unit of the Teaching and Research Farm of the Federal University of Technology Akure (FUTA), Ondo State, Nigeria. One hundred and twenty Bovan Nera late production layers (70 weeks old) were purchased from FUTA Teaching and Research Farm. The layers were raised in battery cages under the same environmental conditions. Four experimental diets (Table 1) were formulated and used for this experiment. The experimental diets were formulated to meet the requirement of the late production layers. The layers were randomly distributed into four different experimental treatments with three (3) replicate per treatment and ten birds per replicate. The test ingredient - salt, was added to the experimental diets at 0.25kg, 0.50kg, 0.75kg and 1.00kg/100kg of feed. Routine medication and vaccination were administered throughout the duration of the experiment. Feed and water were given *ad libitum* during the day time for the-eight-week period of the study.

Data collection

Feed intake: The feed intake of the birds was recorded daily from which the feed conversion ratio was calculated as;

Feed conversion ratio = feed consumed / dozen eggs laid

Egg production: The egg weight was recorded daily while hen day and hen housed production were calculated as:

Hen housed production =

$$\frac{\text{Total egg produced at a given day}}{\text{No of hen housed at the beginning of the expt}} \times 100$$

Hen day production =

$$\frac{\text{Total egg produced at a given day}}{\text{No of hen housed at the given day}} \times 100$$

Faecal collection: At the 8[th] week of the experiment, faecal samples were collected from each replicate for three days to determine the feacal output, density, volume, dry matter, consistency and moisture content. A sizeable polythene sheet was spread under the battery cage and faecal samples were collected after 24 hours and weighed to determine the faecal output. Twenty (20) grammes of faecal sample were thereafter collected from each replicate to determine the faecal density using Archimedes principle. This procedure was repeated for three consecutive days.Also 20 g of the feacal sample per replicate were collected and oven-dried at 100° C to determine the dry matter content. Faecal consistency was scored using Marquardt *et al* (1999) 4-point scale.

Experimental Design/Statistical Analysis

The data collected were analyzed using one way analysis of variance (ANOVA). Significant differences where necessary were separated using Duncan Multiple Range Test (DMRT) of SPSS 17 (2008) package. Significance was accepted at $P > 0.05$.

RESULTS AND DISCUSSION

The results (Table 2) showed that the birds on 0.75% dietary salt (T3) had the highest number of egg produced. This is a confirmation of the role of dietary salt in egg production. Salt is needed in layers' diets for effective utilization of dietary protein and energy and for reproductive performance (Jacob *et al.*, 2011). The optimum level of salt inclusion for maximum egg production according to this trial is 0.75% as opposed to between 0.20-0.50 earlier on recommended (Kellems and Church (1998). Damron and Harms (1980) had earlier reported significant improvement in egg production when dietary salt was increased from 0.18 to 0.70%. This study also revealed that increase in dietary salt up to 1.00% level did not significantly depress egg weight, however its role in layers' immune competence (Larry, 2006) was clearly demonstrated when the percentage mortality of the experimental birds was considered. Birds on the high salt diets (T_3 and T_4) had lower mortality rates than birds on the low salt diets (T_1 and T_2). The better immuno-competence of the birds on the high salt diets was also revealed by the better percentage hen-housed production in T_3 and T_4. The increase in feed intake with a corresponding increase in dietary salt confirmed the role of dietary salt as an appetite enhancer (http://www.saltinstitute.org; NAP, 2010). The increase in feed intake may be due to enhanced palatability of the diets as the level of salt increased from T_1 to T_4 (NAP, 2010; Aganga *et al.*, 2003). Table 3 shows the faecal parameters birds fed varying levels of dietary salt. The faecal volume, and the faecal density were not significantly different ($P > 0.05$) among the different dietary treatments ranging between 13.60 (T_2) -17.93 ml (T_3), and 1.11 (T_3) – 1.49 g/ml (T_2) respectively. The faecal output, faecal dry matter, faecal consistency, faecal moisture and percentage faecal moisture of the experimental birds were significantly different ($P < 0.05$) among the dietary treatments ranging between 4.75 (T_2) – 5.65 kg (T_4); 5.40 (T_4) – 6.95 g (T_1); 1.00 (T_4) – 3.00 (T_1 and T_2); 13.05 (T_1) – 14.00 ml (T_4) and 65.25 (T_1)

– 73.00 % (T_4) respectively. The more watery faecal output (73% moisture content) of birds fed 1.00% dietary salt (Table 3) was a clear indication that this level of salt could provoke the incidence of wet litter with its attendant effects. The figures obtained on faecal moisture content of the experimental birds were however still lower than the 75% figure quoted in http://hencam.com (2014) The faecal consistency ranged from 2.37 (soft excreta) in T4 to 0.00 (normal excreta) in T1 and T2 gave a vivid picture of the effect of increase in the dietary salt level on faecal moisture content and consistency. Oluyemi *et al.* (2011) reported similar effect of varying dietary salt levels on faecal matter. The more watery faecal output (73% moisture content) of birds fed 1.00% dietary salt (Table 3) was a clear indication that this level of salt could provoke the incidence of wet litter with its attendant effects. The figures obtained on faecal moisture content of the experimental birds were however still lower than the 75% figure quoted in http://hencam.com (2014). The more watery faecal output (73% moisture content) of birds fed 1.00% dietary salt (Table 3) was a clear indication that this level of salt could provoke the incidence of wet litter with its attendant effects. The figures obtained on faecal moisture content of the experimental birds were however still lower than the 75% figure quoted in http://hencam.com (2014). The faecal consistency ranged from 2.37 (soft excreta) in T4 to 0.00 (normal excreta) in T1 and T2 gave a vivid picture of the effect of increase in the dietary salt level on faecal moisture content and consistency. Oluyemi *et al.* (2011) reported similar effect of varying dietary salt levels on faecal matter. The largest faecal output in T4 is also directly linked with the level of salt in the diets. The increase in dietary salt led to a corresponding increase in feed intake (Table 2) and a concomitant increase in water consumption leading to the passage of more watery excreta. Increased faecal moisture resulting from dietary salt has been reported by other workers (Hijikuro (1975; Oluyemi *et al.*, 2011).The increase in water consumption could have come as a result of physiological adjustment to high salt content of the feed by invoking the adrenocorticotropic-angiotensin regulatory pathway(Larry, 2006). The increased faecal moisture could also have come from the capacity of the intestinal tract linings of the birds to respond to the high salt levels by alteration of water re-absorption from the lower gastro-intestinal tract (Laverty and Skadhauge, 2008).

CONCLUSION

Most of the performance indicators for laying birds like total egg production, livability, percentage hen-housed and feed conversion ratio were best at 0.75% inclusion of dietary salt. Also feeding birds at salt level of 0.75 % improved feed consumption and efficiency. Feeding birds beyond 0.50 % level could however increase faecal moisture, decrease faecal consistency with a predisposition to wet litter.

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Table 1: Gross composition (g/100g) of the experimental diets