A study on the influence of poultry feed on the size, weight and protein content of egg

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Abstract

The egg of domestic fowl has been an important constituent of the cuisine of people around the world. The present study was carried out with the objective to analyse the influence of selected poultry feed on the size, weight and protein content of egg by feeding the hens with four different types of feed. Hens of the laying Gramasree variety were used in this experiments. Egg size, weight and the protein content was recorded as per standard procedures. Egg production significantly reduced in hen fed with cooked rice alone. When considering egg size and weight, domestic fowl fed with wheat, soya and groundnut had greater size. However, there has not been much variation in the protein content of all the eggs produced by the four hens in the present study. The study provides a baseline indication that the quality, size and weight of the egg are greatly influenced by their feed.

Keywords: Poultry feed, laying fowl, egg protein, egg quality

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Introduction

The egg of domestic fowl is an integral part of diet for non-vegetarians and egg eaters. It is a valued food source for convalescents and invalids. It is very important to learn in how and to what extent; the feed consumed by hens affect the composition and dietetic value of the eggs they produce. A hen's daily consumption of feed depends on the composition of feed. Feed ingredients for poultry diets are selected for the nutrients they can provide. Feed formulation helps to derive a balanced diet thereby ensuring the bioavailability of nutrients required by the bird. In addition to energy and protein, the formulations also provide minerals, vitamins and specific amino acids supplements. These supplements ensure health and performance of the fowl to lay eggs. The present study was undertaken to analyse the influence of selected poultry feed on the size, weight and protein content of egg.

Materials and Methods

Selecting the feed and hens

Four hens belonging to the same breed has been selected for conducting the feeding experiment and are named as A, B, C, and D. Four types of poultry feed were selected for each hen as cooked rice for hen A, whole wheat grain for hen B, an economic poultry feed for hen C and a mixture of rice and powdered wheat, soya, peanut and sugar for hen D.

Figure 1. Different Types of Feed used in the study

The cage was divided into four sections for each hen. The selected feed and water has been supplied inside the cages. The Feeding experiment was continued uninterrupted for a period of three months. After three months, the egg size, weight and the protein content in egg samples were analyzed.

Figure 2. Hen used for the study

Egg Size and Weight Measurement

Size and weight of the eggs were measured. The length and maximum breadth of each egg was measured using vernier caliper to know its size. An accurate measurement of weight was done using digital weighing balance.

Figure 3. Egg size and Weight Measurement

Determination of Protein in Egg

The liquid whole egg (2-2.2 gm) was digested using Micro- Kjeldahl digester in presence of digestion mixture which acts as catalyst (sodium sulfate/potassium sulfate: copper sulfate = 5:1) and 40 ml sulfuric acid. Flask was placed in an inclined position and heated gently until frothing ceases, then boiled rapidly until solution became clear. The sample was then cooled and distilled water was added to make the volume upto 250 ml. The diluted sample (10 ml) was distilled with 10 ml of 40% NaOH using Micro-Kjeldahl distillation unit. Steam was distilled over 2% boric acid (25 ml) containing mixed indicator (1 part 0.2% methyl red + 2 part 0.2% bromocresol green dye)

for 30 min. The ammonia trapped in boric acid was determined by titrating with 0.1 N sulfuric acid. The nitrogen percentage was calculated using the following formula:

$$\text{Nitrogen (\%)} = \frac{(A - B) \times 0.0014 \times \text{Total volume made}}{\text{Weight of sample taken} \times \text{Volume of distillate}} \times 100$$

Where, A = Titrated value for sample

B = Titrated value for blank

Protein percentage was determined by conversion of nitrogen percentage to protein by using conversion factor (5.73) as per Sosulski and Imafidon, 1990.

Results and Discussion

Egg Size

From the four sets A, B, C and D, 10 eggs for each category were collected. Length and breadth was recorded in cm. Category D had greater size (Length 4.6 ± 0.043 & Breadth 4.1 ± 0.054) followed by A (Length 4.4 ± 0.047 & Breadth 3.8 ± 0.066). The eggs in category C (Length 4.3 ± 0.049 & Breadth 3.8 ± 0.068) had intermediate size while Category B (Length 4.00 ± 0.065 & Breadth 3.7 ± 0.077) had the lowest size. The eggs also showed slight variation in their shapes (Fig. 4 and 5).

Figure 4. Eggs collected after three months of feeding experiment

Egg Weight

The egg in category D that is laid by the hen fed with a mixture of rice and powdered wheat, soya, peanut and sugar had the highest weight (55 ± 0.043 gm). The egg in category B, laid by the hen fed with whole-wheat grain alone had the lowest weight $44 \pm$

0.11 gm). The eggs in categories A and C possessed intermediate weights; (52 ± 0.15 gm, 50 ± 0.047 gm) respectively.

Figure 5. Variation in size of Eggs

Figure 6. Variation in weight of Eggs

Protein content

Slight variation in protein content was noted for the egg laid by the four sets fed with different feeds. It was observed that eggs from sample D laid by hen fed with wheat and a mixture of cooked rice and powdered wheat, soya, peanut, and sugar respectively had highest protein content, 13 ± 0.043 %. The lowest protein content has been observed in egg A (11.1 ± 0.047 %) laid by the hen fed with cooked rice. The eggs C that was laid by the hen fed with economic poultry feed had intermediate protein content of 12.5 ± 0.049 % and the eggs B that was laid by the hen fed whole-wheat grain had 12.5 ± 0.065 %.

Over the years, the composition of laying hen diets has gone through many changes. This is because the diet fed to commercial laying hens can vary depending on factors such as the strain of

layer, production goals, age, and weather conditions (Schaible and Patrick, 1980). A laying hen depends on the nutrients provided through diet to produce eggs, the quality and formulation of the diet is most important to a producer, especially considering that 65 to 75% of the cost to produce eggs is due to feed costs (Bell and Weaver, 2002). It has become increasingly important for producers to find a balance between feeding their birds on a least-cost basis and feeding the appropriate amounts of nutrients in the diet, as the hen needs them throughout her lay cycle to maximize profits.

Figure 7. Protein content in Eggs

There has been a significant reduction in egg production in hen A when cooked rice alone was fed. This may be due to problems of amino acid deficiency, imbalance in feed. Similar results due to lack of amino acids were observed by Grau and Almquist (1944) and (Hill 1969).

It is well known that egg size usually increases as dietary protein increases; however, the protein intake needed to achieve maximum egg size is unclear. In our study also, the egg size of hen D was higher which was fed with wheat, soya and groundnut. Leeson (1989) reported that egg size was dramatically increased as daily protein intake increased.

Numerous investigations have focused on methods of influencing egg weight through diet manipulation during various production phases. In the present study, egg produced by hen D had greater weight also. Increasing levels of protein might have resulted in improved egg size and weight (Leeson, 1989; Pesti, 1991; Parsons et al., 1993; Keshavarz and Nakajima, 1995). Parsons et al., (1993) reported that there was a substantial effect on egg weight and size grade out by increasing dietary CP from 16 to 18%.

There has not been any considerable variation

in the protein content of all the eggs produced by the four hens in the present study. The value of protein content was between 11.10-13%. It has been observed by Larbier et al. 1994, that reduced crude protein level inclusion in the diet will not affect egg qualities but will only reduce the level of egg production of the laying bird. 18-19 grams of protein/bird/ day is needed for large egg production. Decreasing protein level by too much will decrease egg numbers as well.

Conclusion

The present study provides a baseline indication that the quality, size and weight of the egg are greatly influenced by their feed. The effect of diet ingredients and their composition including starch, protein, sugar, fat, fiber results in variation in the quality, size and weight of eggs. The quality and formulation of poultry feed is most important in determining the egg quality and size. Therefore, the quality and formulation of the diet must be dealt with utmost importance as a laying hen draws on the nutrients provided in its diet to produce eggs.

Authorship contribution statement

Revathy. S : Conceptualization, Writing - original draft, Writing - review & editing,

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Declaration of Competing Interest

All authors declare that there exist no commercial or financial relationships that could, in any way, lead to a potential conflict of interest.

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