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Submission date: 22-Jun-2023 11:31AM (UTC+0700)
Submission ID: 2120698625
File name: nut_flour_Arachis_hypogeae_L._on_the_quality_of_chicken_eggs.pdf (505.88K)
Word count: 2978
Character count: 14224

AIP Conference Proceedings

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Cite as: AIP Conference Proceedings **2586**, 030002 (2023); https://doi.org/10.1063/5.0111065
Published Online: 24 January 2023

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View Online Export Citation

The Effect Dietary Peanut Flour (*Arachis hypogeae* L.) on the Quality of Chicken Eggs

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Abstract. This study aims to determine the effect of dietary peanut flour *(Arachis hypogeae* L.*)* on the quality of chicken eggs. A total of 200 laying hens were used in this study with treatments, and 5 replications, each occupied by 8 laying hens. The study used completely randomized design and Duncan's multiple distance test was used to determine the significant differences. Treatments were given peanut flour with levels of 0%, 1%, 3%, 5% and 7%, and the research period was 8 weeks and every week the egg quality test samples were examined. Variables include egg weight, egg yolk index, egg white index, egg yolk color, egg shell weight and egg shell thickness. Results showed that egg white index and egg yolk index were not significantly different ($P > 0,05$), but egg weight, egg yolk weight, egg yolk color, shell weight and shell thickness showed a very significant difference ($P < 0,01$). The conclusion of this study was peanut flour can be given up to a level of 7% can produce good egg quality.

INTRODUCTION

Eggs are a type of food that contain a high level of nutrients. The eggs are selected based on the criteria of cleanliness, freshness, surface area and egg mass which are the determinants of egg quality. Volume and coefficient of packaging, egg weight, shell quality, yolk index, albumen index, Haugh unit and chemical composition of eggs, eggshell strength are influenced by microstructure, shell thickness, specific gravity, egg mass, volume, surface area and percentage of eggshells [1]. Egg quality consists of several aspects related to the shell, albumen and yolk, and it is divided into external quality and internal quality. Internal quality is based on the size of the air cells, the quality of the egg albumen, yolk and the presence of blood spots on the eggs. Egg quality characteristics are influenced by age and genotype of chicken eggs, nutrition, maintenance system, and egg-laying time.

One of the major problems the livestock sector faces is the high production cost of 60-70%, especially the need for feed ingredient sources of protein and fatty acids required by laying hens. Local raw materials such as peanuts can be used as alternative feed ingredients of protein and fatty acid sources and are locally available in North Sulawesi Region. Peanut is one of the protein sources of a diet in Indonesia with a high economic value. The need for peanuts is increasing with the increase in population, nutritional needs, food, feed and food industries in Indonesia. Domestic peanut production is still insufficient for Indonesia's needs, leading to increased import substitution from abroad. The nutritional content in peanuts consists of 25-30% protein, 40-50% fat, 12% carbohydrates, and vitamin B1 placing peanuts in nutritional fulfilment after soybean plants [2].

The protein content in peanuts is high compared to other macronutrients, such that peanuts can be used as feed for livestock, especially chickens. The use of peanuts derived from normal-oleic (groundnuts) is usually used as a protein source for animal feed in several countries, such as India, Ghana, and Nigeria [3-7]. The addition of peanut flour, which contains fatty acids, can be useful for egg production. Peanuts contain fatty acids, namely oleic fatty acid and

The Third International Symposium on Food and Agrobiodiversity (ISFA 2021)
AIP Conf. Proc. 2586, 030002-1–030002-5; https://doi.org/10.1063/5.0111065
Published by AIP Publishing. 978-0-7354-4231-3/$30.00

linoleic fatty acid. The oleic fatty acid contained in peanuts can be used by laying hens, a[18]g as a natural source of egg yolk coloring, and also provides palmitic and starch in the form of trans fats in eggs. Normal-oleic peanuts (52% oleic acid and 27%[30]oleic acid) can be used as animal feed ingredients [8,9]. The use of peanut feed i[13]e form of high-oleic peanut (80% oleic acid and 2% linoleic acid) is used for chicken meat and can affect the chemical composition and quality of the meat. Feeding laying hens with high-oleic peanut and additional corn increased the levels of B-carotene, color intensity of egg yolks, and unsaturated fatty acids derived from oil [10].

Peanut (*Arachis hypogeae* L.) is a secondary crop that occupies the third rank after corn and soybeans. For a long time, efforts have been made to increase peanut production in various ways, namely through expansion of planting [10]as, intensification of peanut cultivation, and creating and seeking superior varieties with high production potential. Peanuts are rich in fa[14]gh protein, iron, vitamin E, vitamin B complex, phosphorus, vitamin A, vitamin K, lecithin, choline, and calcium. Peanut seeds contain 40–48% oil, 25% protein, and 18% carbohydrates and B-complex vitamins [11].

[1]

The study aimed to determine whether peanut flour *(Arachis hypogeae* L.*)* could improve the quality of chicken eggs. B[1]sed on the description of the previous research, the current study was conducted with the title: the effect of giving peanut flour *(Arachis hypogeae* L.*)* on the quality of chicken eggs.

MATERIAL AND METHODS

Making Peanut Flour

Peanuts harvested at the age of 4 months + 105 days were taken from Kawangkoan Village, Minahasa Regency, North Sulawesi Province. The harvested peanuts were dried for 3-4 days; when they were dry, they were roasted for 45 minutes using a large skillet mixed with sand. During the roasting process, the playback should not break so that the peanuts cook evenly. The roasted peanuts were ground using a milli[27]achine until they become flour. Peanut flour was analyzed at the Nutritional Biochemistry Laboratory of the Faculty of Animal Science, Gadjah Mada University, Yogyakarta. Analysis peanut flour: crude protein 34,58 %, crude fat 33,63 %, crude fiber 2,19 % , calcium 3,07 %, phospor 0,33 % and groos energi 6233 Kcal /kg.

Research Materials

The research materials used were 100 layer chickens, 94 weeks old. The feed provided consisted of yellow corn, fine bran, $CaCO_3$, concentrate and peanut flour as treatment. The composition of feed substances in the treated feed in this study are shown in Table 1. Observations stretched for 8 weeks. The battery cage was made of wire with a length of 60 cm, a height of 35 cm at the front, and a height of 30 cm at the back. Overally, the battery cage was equipped with a feed holder which is specially made of plastic material, and a drinking holder made of a pipe split into 2 parts.

Research methods

[5] [5]

The research method used a completely randomized trial design (CRD) [12]. The treatment used was with 5 treatments and 5 replications, so that there were 25 treatment units, wherein each unit consisted of 4 chickens, so the number of chickens used was 100 chickens. The treatments were arranged based on energy and protein according to the following treatment:

R0 = Basal Ration; R1 = Basal Ration (BR) 99% + 1% PF(Peanut Flour) R2 = BR 98% + 2% PF; R3 = BR 95% + 5% PF; and R4 = BR 93% + 7% PF.

Egg Quality observation [7]egg quality every 50 eggs were taken as samples. Data that taken to evaluate egg quality in the study. These [29]egg weight, egg yolk weight, egg white weight, wet shell weight, yolk color, egg white index, egg yolk index and eggshell thickness. The color of the egg yolk is observed by means of helper Roche Yolk Color Fan with a score of 1-15 with 15 kinds of colors.

TABLE 1. Content of Feed Treatments

	Protein (%)	Coarse Fiber (%)	Fat (%)	Calcium (%)	Phosphorus (%)	Energy Metabolism (Kcal/kg)
R0	17.01	5.42	7.55	2.41	1.06	2773.50
R1	17.15	5.44	7.82	2.42	1.06	2773.77
R2	17.42	5.48	8.36	2.43	1.04	2774.30
R3	17.70	5.52	8.90	2.45	1.03	2774.83
R4	17.98	5.55	9.44	2.46	1.01	2775.36

Research Variable

Egg Quality Analysis was conducted at CV Gunawan Manado, North Sulawesi. The measurement of parameters used the following formulae:

1. Egg weight, egg yolk and egg white.
   Measured by weighing the parts using an analytical balance scale
2. Egg white index (*albumen index*):

$$\frac{h}{0{,}5\ (d1 + d2)}$$

   wherein:
   h = length of egg white
   d1 = diameter of the longes egg white
   d2 = diameter of the short egg white
3. Egg yolk index (*yolk index*):

$$\frac{h}{0{,}5\ (d1 + d2)}$$

   wherein:
   h = length of the yolk
   d1 = diameter of the long yolk
   d2 = diameter of the short yolk
4. Egg yolk colour =
   Using a Roche Color Fan (a Roche color fan) is used as a comparison of the yolk color.

Data Analysis

The data obtained was analyzed using a pattern fingerprint according to the Complete Randomized Plan (RAL) and when the treatment had a significant effect, further analysis was done using the Duncan Multiple Distance Test [12].

RESULTS AND DISCUSSIONS

Based on the data in table 1, feed treatment consisted of peanut flour up to 7% in the formulated ration. The average egg weight was 65.15-68.45 grams/head. Standart Nasional Indonesia for consumption chicken eggs are grouped based on the weight, i.e. egg weight of 60 g (large). The results of the analysis of the variety of peanut flour of up to 7% showed a very significant effect ($P < 0.01$) on egg quality. This shows that peanut flour has a protein content of 30.55% and a balance between protein and energy is 17% and 2700 Kcal/kg. The results also showed that the protein content of peanuts can increase egg weight and egg quality. Peak egg production, egg weight and egg quality require nutrients from protein in chicken feed to form egg yolks and egg albumen [13]. This is in line with the opinion that rations that lack protein content in feed will reduce the quality of eggs and eggshells [14].

Laying hens have a very limited ability to store proteins; therefore, the protein concentration in the feed must be high enough to compensate for maximum egg production. Another factor that affects egg quality is the effect of hormones. Estrogen and progesterone stimulate protein synthesis in both egg white and egg yolk, resulting in an increase of the overall weight of the whole egg increases. Estrogen stimulates the synthesis of the ovalbumin, ovotransferrin and lysozyme proteins produced by the tubular glands of the magnum. It was observed that the tubular

magnum gland secretes most of the egg white protein, which consists of ovalbumin, lysozyme, ovotransferrin, and ovomucin and is stored in the form of granules [15]. The secretion of the tubular glands is stimulated by progesterone; as explained, the hormone progesterone is produced from the superficial epithelium of the ovum. The hormone progesterone stimulates the hypothalamus to activate factor releasing hormone to stimulate secretion (LH) from the anterior pituitary. Progesterone coupled with androgens function to regulate the development of the oviduct for albumin secretion from the magnum.

TABLE 2. Effects of peanut floor feed on egg's quality treatment.

Variabel	R0	R1	R2	R3	R4
Egg Weight (grams/head)	66,70^{b}±3,04	65,15^{a}±5,83	68,50^{a}±2,75	65,50^{a} ±3,69	68,45^{c} ±1,45
Egg White Index	0,079±0,00	0,079±0,00	0,083±0,00	0,078±0,00	0,082±0,00
Egg Yolk Index	0,44±0,02	0,46±0,04	0,44±0,02	0,44±0,02	0,44±0,01
Yolk weight	18,55^{a}±1,53	18,45^{a}±1,26	18,35^{a}±1,15	19,65^{b}±1,06	22,50^{c}±1,43
Egg Yolk Color	9,75^{a}±0,47	10,90^{b}±0,45	10,85^{b}±0,65	10,90^{b}±0,80	11,45^{c}±0,41
Shell Weight (grams)	6,10^{a}±0,47	6,10^{a}±0,33	6,60^{c}±0,13	6,20^{b}±0,11	6,70^{d}±0,32
Shell Thickenss (mm)	0,34 ^{b} ±0,00	0,33 ^{a}±0,00	0,33 ^{a}±0,00	0,33 ^{a}±0,00	0,34 ^{b} ±0,00

Note $^{a-d}$: Significan

Egg quality is one of the factors that determine whether eggs are good or bad. Based on this, the parameters in the current research were used to determine egg quality. The results of supplementing the protein source with peanut flour up to 7% produced an egg white index of 0.078 - 0.083, while the egg yolk index was 0.43 -0.44. Yolk weight 18.35 – 22.50 (g), yolk color 9.75 -11.45, shell weight 6.5 – 6.7(g), shell thickness 0.33-0.34(mm). Results of analysis of variance showed that the index of egg white and egg yolk color did not have a significant difference ($P > 0.05$) while egg yolk weight, egg yolk color, shell weight and shell thickness show very high significant differences ($P < 0.01$) . The 2008 National Standardization Agency stated that the index of egg yolk quality I = 0.458-0.521, quality II = 0.394-0.457, quality III = 0.330-0.393 [16]. The relationship between egg shape index and egg characteristics and quality showed that albumen index was10.4 – 11.3, yolk index 43.1-43.1, yolk color 11.0-11.2, shell weight (g) 6.05 – 6.5 shell thickenss (mm) 0.34 – 0.35 [17]. The results showed that peanut flour usage produces egg quality that can still meet the good quality standards.

The relationship between egg shape index and egg albumen [17], the correlation of egg index and egg shell thickness had effect on albumen length, yolk width, yolk height and yolk color [18]. Yolk weight is influenced by ovarian development, chicken weight, age at sexual maturity, quality and quantity of feed, disease, environment and feed consumption [19]. Research on the relationship between eggshell thickness and egg shell measurements with egg quality resulted in egg weight of 63.62-67.28 g/head and shell weight of 5.46 to 7.23 g, shell thickness 0.28 to 0.40 (mm) [20]. There is reported a positive correlation between eggshell strength and thickness [21]. The thickness of the shell has no correlation with the thickness of the eggshell and the strength of the eggshell, a factor that affects the mineral density and mineral content of the eggshell [22].

CONCLUSION

Peanut flour as a source of protein and a source of fat so as to increase egg quality.The use of peanut flour up to 7% as a protein source in laying feeds for chickens can improve egg quality.

ACKNOWLEDGEMENT

The authors would like to show their gratitude to the leadership of Sam Ratulangi University through this research fund funded by Unsrat Leading Applied Research. They are also grateful to CV Gunawan Animal Husbandry as a Research Partner.

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