Nutritional Content of Chicken Egg Flour Fed with Miana Flour (*Coleus scutellarioides* L.)

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Abstract. The aim of this research was to analyses nutritional content of chicken egg flour fed with miana flour (*Coleus scutellarioides* L.). Eggs consist of three main components are egg shell with membranes, egg white and yolks. The egg has high moisture content, fat and protein become egg as good medium for bacterial growth that shorten shelf life. The method used in the drying process was a drying method to remove part of the water from food ingredient by evaporation using heat energy. Drying egg flour was carried out by oven. Based on the results of the analysis of oven egg flour, the egg proteins (%) were R1 41.25, R2 41.29, R3 41.21, R4 41.35; fat (%) were R1 30.96, R2 30.50, R3 30.04 and R4 28.98. The carbohydrate rate (%) were R1 1.20, R2 1.25, R3 2.20, R4 2.35, water activities (Aw) were 0.4 + 0.1 - 0.5 + 0.1; pH 7,5 + 0 - 7.6 + 0, and emulsion capacity (%) were 54.1 + 1.2. – 55.1 + 1.2. Egg flour from miana leaf flour treatment up to 2% can increase egg flour carbohydrates, egg flour pH, emulsion capacity, reduce egg flour and keep same results for protein content and water activities.

Keywords: Egg flour, Miana flour, Nutrition.

1 Introduction

One of the most important products of the poultry industry is eggs, which are a high-quality source of protein, vitamins and minerals (1). These and other nutrients are required by humans and animals for construction of body structures, repair of worn tissues, growth and reproduction [2,3].

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Chicken eggs are a significant source of animal protein that has found extensive applications in the food industry due to their outstanding nutritional, functional and sensory attributes. Eggs are an almost perfect source of animal protein. Chicken eggs are a perfect food that contains nutrients such as protein (12.8%) and fat (11.8%). In 100 grams of whole eggs also vitamin A by 327.0 SI and minerals by 256.0 mg. Eggs contain high quality protein because it has a complete arrangement of essential amino acids and has a high biological value, which is 100% [4]. The use of eggs in the food sector is supported by the high production of chicken eggs and spread almost throughout Indonesia with relatively cheap prices and can be reached by all people as a source of protein [5].

Drying eggs into flour offers many advantages, including ease of storage, distribution, protection against microbial growth (low water activity), decreased weight-per-volume of whole eggs, and longer shelf life [6]. The use of egg meal as an additive to other food products is easier than the use of fresh eggs The drying process is a method to remove or remove some of the water from food by evaporation using heat energy. Egg drying can be done by several types of methods, namely spray drying and oven drying. Various industries have used egg flour as one of the raw materials for products or food additives, including the bakery, candy, biscuit, sauce, salad, and pharmaceutical industries. Egg powder is used in many sectors of the food industry because it is easy to handle in a safe manner, is not susceptible to bacterial growth and can utilize the right dose of water in its formulation.

Drying eggs into flour offers many advantages, including ease of storage, distribution, protection against microbial growth (low water activity), reduced weight per volume of whole eggs, longer shelf life. Using egg flour as an additional ingredient in other food products is easier than using fresh eggs [7]. The drying process is a method for removing or removing some of the water from a food ingredient by evaporation using heat energy. Drying eggs can be done using several types of methods, namely drying with a spray dryer and drying with an oven. Various industries have used egg flour as a raw material for products or food additives, including the bakery, candy, biscuit, sauce, salad and pharmaceutical industries [8].

Egg powder provides consumers with advanced characteristics as well as technological advantages not found in liquid egg products. The development of egg yolk drying methods can provide a more efficient and economical way to produce good egg yolk powder and also apply good processed products. Currently, Egg Yolk Powder (EYP) is mainly used by the food industry to produce various products such as pasta, pastries, and bread [9]. Miana leaf flour up to 2% in the feed of laying hens improved egg quality [10]. Based on these descriptions, research was conducted with the aim of studying the nutritional content of chicken egg flour fed with miana flour (*Coleus scutellarioides* L.).

2 Materials and Methods

2.1 Egg Flour Preparation

The stages of making egg flour are raw material preparation, egg breaking and filtration, pasteurization, drying, storage, packaging and distribution. Eggs which were made into flour were from purebred chicken eggs.

2.2 Drying

Egg drying would produce a product in the form of egg flour or egg powder. The egg drying process was carried out to remove water from the egg liquid by evaporation until the water content becomes less. The drying method used in the manufacture of egg flour consists of three kinds, namely spray drying, pan drying and freeze drying [9]. The pan drying method was the easiest drying method and was inexpensive. This drying process used oven. The temperature used ranges from 45°C -50°C. This temperature was create thickness of about 6 mm layer of material will produce a dry product with 5% moisture content [11].

2.3 Producing Egg Flour

Eggs used in producing egg flour were taken from the treatment using miana leaf flour in the feed of laying hens that have been reared for 8 weeks of treatment feeding. The research method used was an experimental method with a Completely Randomized Design (CRD) consisting of 5 treatments and 5 replications. So, there are 25 treatment units where each unit consists of 4 laying hens so that 100 chickens were treated. The structure of the treatments given were:
R0 = 100% Basal Ration (without Miana Leaf Flour/MLF)
R1 = Basal Ration 99.5% + 0.5% MLF
R2 = Basal Ration 99.0% + 1.0% MLF
R3 = Basal Ration 98.5% + 1.5% MLF
R4 = Basal Ration 98.0% + 2.0% MLF

The treatment ration was prepared based on the needs of laying hens in the layer phase, namely 17% protein and metabolic energy (EM) 2600 - 2700 Kcal/kg. The nutrient and metabolic energy content of the feed ingredients in ration described in Table 1.

Table 1. Nutrient Content of Treatment Rations

Food Substances/Energy	R0	R1	R2	R3	R4
Protein (%)	17.44	17.54	17.73	17.91	18.10
Fat (%)	7.53	7.59	7.59	7.58	7.58
Crude Fibre (%)	5.34	5.54	5.66	5.79	5.92
Ca (%)	2.17	1.85	1.85	1.85	1.85

P (%)	1.02	1.01	1.01	1.00	1.00
Energy metabolism (Kcal/kg)	2710.90	2737.72	2740.75	2743.77	2746.79

Note: Based on the calculation results of the food substance content table EM=EB × 70%.

The manufacture of egg flour begins with selecting eggs based on physically good appearance such as not cracked and clean, washing, cracking the shell and mixing, and measuring pH. Research on the manufacture of egg flour by oven was carried out at the Laboratory of Technology, Padjadjaran University, Bandung.

Eggs were taken as many as 5 eggs per treatment. A total of 30 eggs were treated by oven drying. Eggs totaling 30 grains, broken and shaken until evenly distributed then poured in the oven. The oven was heated at temperature of 45-50 0 C for 1 day then removed from the oven and beaten using a mixer so that it became egg flour. Egg flour was analyzed for protein (%), fat (%), carbohydrate (%), water activities (Aw) and pH 7.6 + 0. Emulsion capacity (%) was carried out at the Biotechnology Research and Testing Laboratory, Padjadjaran University, Bandung.

Drying eggs aims to reduce and prevent the activity of microorganisms to lengthen shelf life. Making eggs into egg flour can reduce storage space and easier handling and transportation. The stages of making egg flour are preparation of raw materials, egg breaking and filtration, pasteurization, drying, storage, packaging and distribution. Drying eggs produce a product in the form of egg flour or egg powder. The egg drying process is carried out to remove water from the egg liquid by evaporation until the water content becomes less. The drying methods used in making egg flour consist of three types, namely spray drying, pan drying and freeze drying [9].

This research used pan drying method. The layer drying method (pan drying) is the easiest drying method to do and does not require expensive costs. This drying was done using an oven. The temperature used ranges from 45-50 0C with 6 mm material layer thickness to produce a dry product with a water content of 5% [9].

3 Results and Discussion

Result showed that Miana Leaf Flour (MLF) contained 27.38% protein, 14.37% crude fiber, 3.4% fat, 0.19% calcium, 0.03% phosphor and 3652.31Kcal/kg Energy Metabolism. Nutrient value of oven-baked egg flour showed at Table 2.

Table 2. Nutrient content analysis of oven-baked egg flour showed

Nutrient content	R1	R2	R3	R4
Protein (%)	41.25	41.29	41.21	41.35
Fat (%)	30.96	30.50	30.04	28.98
Carbohydrate (%)	11.20	11.25	22.20	22.35
Water activities (Aw)	0.5±0.1	0.4±0.1	0.5±0.1	0.5±0.1
pH	7.5	7.5	7.6	7.6
Emulsion Capacity (%)	54.1±1.2	54.1±1.1	54.1±1.2	55.1±1.1

Note: The egg flour came from the treatment of chicken feed given MLF
R1 = 99.5% Control Feed/CF + 0.5% Miana Leaf Flour/MLF; R2 = 99% CF + 1% MLF; R3 = 99% CF+ 1% MLF; R4 = 98% CF+2% MLF.

The results of the analysis showed that the protein content of egg flour was 41.21 - 41.35%, egg flour fat 28.98% - 30.96%, carbohydrates 11.20 - 22.35%, water activities (Aw) 0.5 + 0 ,1; pH 7.6 + 0 and emulsion capacity (%) 54.1 + 1.2. Oven egg protein content 45.2 + 0.1, fat content 38.03 + 0.2, carbohydrate content 11.8 + 0.1.) (11). The protein content of egg flour is in accordance with SNI 01-4323-1996, which is at least 45%. The results of research in Table 1 showed the moisture content of egg flour above SNI 01-4323-1996 (5%) which was 6.74% (9). Drying eggs produced by oven dryer method in this research have protein, fat, water activities, carbohydrate and energy levels which were not much different as reported (7).

The oven drying method affected several functional properties of the egg flour components [9]. The emulsion capacity was 74.00% and the emulsion stability was 72.40%, the highest for egg yolk flour. This is because the compound that influences the ability of the emulsion is lecithin which is found in egg yolk. The emulsion capacity range did not differ between oven drying (55.1%) and spray drying (54.5%).

Egg white flour has the highest foaming power and foam stability i.e. 97.50 and 78.30%, respectively. The foaming power and stability of the foam are influenced by the proteins contained in egg whites. Water and oil absorption capacities have different values. These properties influence the rheological, functional and baking qualities of the product. The oil and water absorption properties of eggs also retain moisture and oil during baking and subsequent storage. This improves both the physical and sensory qualities of products [9]. The foam power range did not differ between oven drying (31.2%) and spray drying (29.5%) [7].

The nutritional value of egg flour, egg white flour and egg yolk flour were shown at Table 2. Drying eggs using a spray dryer and an oven produced protein levels, fat content, water content, carbohydrate and energy levels that were not much different [7]. The water content, protein levels and fat levels obtained in this research were in accordance with namely a maximum of 5% [12]. Low water content will enlengthen shelf life of the product so that it is easier to store, to package and to distribute. High protein levels are very profitable because egg flour is a product could be as a source of protein.

In addition to the nutritional value contained in eggs, another thing that is very important in the application of eggs as food is the functional properties of eggs. Functional properties of eggs are the ability of eggs to perform their functions in food. The functional properties of eggs are divided into two, namely egg white and egg yolk. Egg white functional properties consist of coagulation ability, foamability, and crystallization control in confectionery p Nutrition conten of chicken egg flour were protein, fat, carbohydrates, water activity and pH provide good quality. roducts. Egg yolk functional properties are emulsifying ability and color control [13].

4 Conclusion

Egg flour resulting from miana leaf flour treatment up to 2% can increase egg flour carbohydrates, egg flour, pH, emulsion capacity, reduce egg flour fat and provide the same results in protein content and water activities. Chicken egg flour contains protein, fat, carbohydrates, water activity and pH in good quality.

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References

1. Agbede JO. Alternative feed resources: Key to profitable livestock enterprise in Nigeria. Akure, Nigeria: Publications Committee; 2019.
2. Chen Y, Michalak M, Agellon LB. Importance of nutrients and nutrient metabolism on human health. Yale J Biol Med. 2018;91(2):95–103.
3. Réhault-Godbert S, Guyot N, Nys Y. The golden egg: Nutritional value, bioactivities, and emerging benefits for human health. Vol. 11, Nutrients. MDPI AG; 2019. p. 684.
4. Z. Wulandari, I. I. Arief. Review: Tepung Telur Ayam: Nilai Gizi, Sifat Fungsional dan Manfaat. J Ilmu Produksi dan Teknol Has Peternak. 2022;10(2):62–8.
5. Sekjen Kementan PD dan SIPSJ-KP. Outlook Komoditas Peternakan. Pus Data dan Sist Inf Pertan. 2022;64.
6. Lechevalier V, Nau F, Jeantet R. Egg powders. In: Woodhead Publishing Series. 2nd ed. Rennes Cedex: Woodhead Publishing Series in Food Science, Technology and Nutrition; 2024. p. 387–410.
7. Abreha E, Getachew P, Laillou A, Chitekwe S, Baye K. Physico-chemical and functionality of air and spray dried egg powder: implications to improving diets. Int J Food Prop [Internet]. 2021;24(1):152–62. Available from: https://doi.org/10.1080/10942912.2020.1867569
8. Tsivirko L, Yatsenko I V., Busol L V., Parilovsky OI, Bogatyreva AM, Kryvorotko RO. Dry egg products and definition of their safety and quality I. Veterinary science, technologies of animal husbandry and nature management. Vet Sci Technol Anim Husb Nat Manag. 2021;7:163–6.
9. Ndife J, Ejikeme C, Amaechi N. Effect of oven drying on the functional and nutritional properties of whole egg and its components. African J Food Sci [Internet]. 2010;4(5):254–7. Available from: http://www.academicjournals.org/ajfs
10. Leke JR, Wantasen E, Sompie F, Kiroh H, Laihad J, Siahaan R. Characteristics and quality of eggs from laying hens fed on Miana plant flour (Coleus atropurpureus L.). IOP Conf Ser Earth Environ Sci. 2024;1341(1).
11. Abrhám J, Vošta M, Čajka P, Rubáček F. The specifics of selected agricultural commodities in international trade. Agric Resour Econ. 2021;7(2):5–19.
12. UNECE. UNECE Standard Egg-2 : Egg Products. Agric Stand Unit, United Nations Econ Comm Eur [Internet]. 2010;6. Available from: www.unece.org/trade/agr

13. Stadelman R., Catteril O. Egg Sciences and Technology. 4th Editio. New York: Food Product Press; 1995.