

Non-Standard Eggs as an Alternative Source of Protein

Nazirova Raxnamoxon Muxtorovna

Doctor of Technical Sciences (Dsc), Associate Professor of the Department of “Technology of Storage and Primary Processing of Agricultural Products”

Ahmedova Ziyoda

Master's Student of Group M 24-22.
Fergana Polytechnic Institute

Abstract:

It is known that eggs are a complete food product. Eggs contain a full range of essential amino acids necessary for the full functioning of the body. The article discusses the problem of using broken eggs in the production of feed for young animals of various farm animals.

Keywords: protein, eggs, proteins, atomization, egg powder, digestibility, phospholipids, protein source.

Introduction

Spray-dried chicken egg product (*Gallus domesticus*) has been present in human food, pet food and livestock food for quite some time. This is explained, first of all, by its high-quality protein content. The set of essential amino acids contained in the egg is ideal for almost any type of living creature. Therefore, egg white is used as a natural standard for assessing the quality of protein in feed. Despite advances in the production of livestock and pet feeds, as well as the obvious knowledge in industrial aquaculture of the high nutritional value of eggs, their use in aquaculture feeds is still significantly limited. It is likely that historically formed ideas about the inaccessibility and/or high cost of egg products are key factors, but now it is necessary to change these stereotypes.

The nutritional content of the egg makes this unique product well suited for the production of feed for young animals, and cost estimates show that it is more economical to use eggs in production than other alternative ingredients. In addition, dried egg product can improve the sustainability of feeds, as well as provide end consumers with a recognizable and easy-to-understand explanation of “what my food eats”.

Eggs play a special role in specialized feeds or feeds that vary depending on the stages of animal development; indicators of productivity and physiological state are directly related to economic indicators at the time the product enters the market. The most striking example is early life diets in pig production, where eggs save expensive blood plasma, fishmeal, or a combination of both. Eggs may play a similar role in larval feed for some aquaculture species. However, the large number of patents on larval feed formulations makes it difficult to determine precise standards for this additional ingredient.

Objects and methods of research: Dried, feed egg product is made by processing eggs and separating the egg contents from the eggshell. The liquid is spray dried to a powder, which can then be formed into micro-granules to improve processing quality. The process includes



a pasteurization step to minimize biosecurity risks, but the eggs are not heat treated. This low-temperature treatment ensures that heat-sensitive amino acids such as lysine remain intact and preserved in the finished product. A high-quality dried egg product contains more than 90% digestible lysine and more than 95% digestible pepsin. Additionally, as a by-product of the food industry, eggs serve as a sustainable source of nutrients.

Results and discussion: The eggs included in the feed are rich in proteins and have high energy value, and therefore can replace more expensive ingredients. The overall nutritional composition of eggs differs somewhat from other, more traditional feed ingredients (Table 1). The protein contained in eggs is comparable to the protein in soybean meal (47% and 48%), the content of high-quality amino acids is equal to or even higher than that of fishmeal. The finished product has up to 80% less ash compared to fishmeal and poultry by-product meal and 50-75% more (calculated) metabolic energy than other ingredients. In addition, eggs are inherently rich in phospholipids (total content 12%, of which 75% is phosphatidylcholine) and are known for their very high cholesterol content (approximately 16,000 mg/kg). Both phospholipids and cholesterol have unique nutritional value for several aquaculture species.

Based on information obtained from National Research Council publications, the amino acid composition of egg whites better meets the needs of many young livestock species than most major ingredients currently used in feed. Egg whites are particularly rich in sulfur-containing amino acids (methionine and cysteine), the content of which in feed may be significantly limited due to industry trends to use soybean meal instead of fishmeal. The eggs will allow you to go far It is best to save fishmeal more actively without the risk of reducing the content of essential amino acids in feed. In practice, eggs should be included in the diets of species that have either high total protein and energy requirements (eg, rabbits, beef) or unique dietary requirements, such as turkey meat (cholesterol and phospholipids).

Table-1 Nutritional composition of eggs

Component, %	Spray dried eggs	Flour	Poultry by-product meal	Soy flour (48%)
Protein	47,2	64,5	55,9	48,5
Fat	41,1	9,6	13,6	0,9
Ash	3,6	19,0	14,5	5,8
Energy, kcal/g	5,3	3,1	3,5	3,0
Cholesterol	1,6	0,2	0,1*	
Total phosphorus	12	**	**	
Amino acids, g/100 g protein				
Arginine	6,02	5,67	7,73	7,42
Histidine	2,37	2,76	1,88	2,68
Isoleucine	5,47	3,98	4,11	5,36
Leucine	8,58	7,04	7,64	7,84
Lysine	7,20	7,46	5,94	4,62
Methionine	3,14	2,74	2,31	1,44
Methionine+Cysteine	5,91	3,63	3,95	2,91
Phenylalanine	5,34	3,89	2,97	5,57
Threonine	4,81	4,09	3,83	4,12
Tryptophan	1,23	1,02	0,82	1,44
Valin	5,47	4,70	6,53	5,57



*- estimated values; **- unknown.

For the production of feed for young animals, where dietary supplements of cholesterol, phospholipids, or both are needed, it is most profitable to use eggs. Each kilogram of eggs per metric ton of feed can save approximately 0.75 kg of fishmeal (as a protein source), 0.02 kg of synthetic cholesterol and 0.12 kg of additional phospholipids. The total cost of each ingredient shows that using eggs as a substitute for all three additives is more economical.

When using eggs in feed, it is necessary to monitor the amount of lipids supplied with food. Dried eggs contain approximately 40% lipids, including 13% saturated lipids (33% of total lipids). According to recipe standards, to maintain total lipid and saturated lipid balance within acceptable ranges for shrimp, egg content should remain between 6-8%.

However, if, for example, the egg content was 60 kg/metric ton (6%), this would potentially save approximately 45 kg of fishmeal, 1 kg of cholesterol and 7 kg of phospholipids. In rabbit and heifer feeds that require high levels of dietary protein and energy, eggs are an obvious ingredient choice. The composition of amino acids fully meets the requirements of the diet, in addition, eggs are rich in pure proteins (47% of the required 38-40%) and metabolizable energy. Unlike rabbit food, the saturated fat in eggs is beneficial for fish, whose diet requires fats that cannot be met by fish oils or vegetable oils.

Despite the nutritional value of eggs, their use remains limited today. In addition to outdated assumptions about the difficulty of availability and cost of this ingredient, another likely reason for this is the lack of research data assessing its effectiveness in feed for the relevant species. Trials are needed to prove that the high calculated nutritional value of eggs results in improved performance, savings in feed production or, ideally, both.

Conclusions: Studies of the effect of such feeds on various land animals show that the digestibility of amino acids from dried eggs is high in all cases. Thus, dried eggs can become a major source of nutrients in the diet of young animals of various animals, but research and testing under real-life conditions are needed to verify their actual contribution.

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