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ESSENTIAL FATTY ACIDS IN POULTRY NUTRITION

Lipids (fat and fatlike substances), like carbohydrates, contain three elements - carbon, hydrogen and oxygen. As feeds, fats function much like carbohydrates, such that they serves as a source of heat and energy and formation of fat. However, fat liberates more heat than carbohydrate when digested furnishing approximately 2.25 times as much heat or energy per pound on oxidation as do the carbohydrates.

The nutritional value of fats for poultry feed is determined by moisture, impurities, unsaponifiables, free fatty acids, total fatty acids and fatty acid composition. Poultry birds are capable of tolerating high levels of fats but cost usually permit only a maximum of 4 to 5% fat added to the ration.

The fatty acids commonly found in feed and tissue fats:

1. Saturated fatty acids: Lauric acid, which is found in large amount in coconut fat. Palmitic acid and stearic acid are most common saturated fatty acids in animal tissue.
2. Unsaturated fatty acids: Linoleic acid, which is a dietary essential, not synthesized by the bird. Arachidonic and Linolenic acids are essential fatty acids which can be synthesized from linoleic acid.

As for poultry, according to NRC (1994), there is 1% requirement for linoleic acid in practical diet formulation. This level is favourable for reproduction.

Beneficial applications of ω-3 and ω-6 oils in poultry

Adding ω-3 and ω-6 fatty acids to the diet has become more important recently. Dietary intervention with ω-3 may influence chicken immunity and lead to the production of poultry products with health benefits for the consumer (Mousa, 2017). Using PUFAs in poultry diets significantly reduces cholesterol and total lipid contents in blood and egg yolk. Ahmad *et al*. (2012) reported that the cholesterol content of eggs was decreased when birds were fed a diet supplemented with ω-3 fatty acids. Moreover, increasing dietary levels of FO and milled flaxseed improved the concentration of linoleic acid (LA), EPA, and DHA in the yolk, and the fatty acid deposition from FO was found to be two times greater than that from milled flaxseed when fed at the same dietary levels (Sihvo *et al.*, 2014). Designer eggs offer balanced ratios of PUFA: SFA (1:1) or ω-6/ω-3 PUFA (1:1). Omega-3 UFAs are important nutritional factors that modulate immune functions and are of great importance for nervous system development and for lowering blood platelet aggregation and the incidence of thrombosis, hypertension, and atherosclerosis, and have anti-tumor, anti-inflammatory, and cardioprotective effects (Ahmad *et al*., 2012). The content of ω-3 fatty acids in eggs can be increased by supplementing the diets of laying hens with certain dietary supplements, such as flaxseed, fish oil, safflower oil, linseed, fish meal, or algae. Omega-3 fatty acids can be introduced to the human consumer's body through these designer eggs; they

play an important role in the maintenance of the normal functioning of the body in that they protect the body from cardiovascular problems such as heart attacks. In addition, they can replace fish products in consumer diets (Ehr *et al.*, 2017).

The polyunsaturated linoleic and linolenic acids are considered to be essential fatty acids. Essential fatty acid deficiency in the laying hen results in a marked reduction in egg weight and affects the hatchability of fertile eggs. In reproductively active birds, deficiency of essential fatty acids results in impaired spermatogenesis in the male. Linoleic acid is required in the diet. However, it cannot be synthesized by the body tissue. This fatty acid, when deficient in the diet, retards the growth of young growing chicks, has an accumulation of liver fat and becomes susceptible to respiratory infection. Arachidonic acid, which can be synthesized from linoleic acid, can alleviate these deficiency symptoms, if included in the diet. The best source of essential fatty acids is vegetable oils such as corn oil, soyabean, or safflower oil. Rations based primarily on corn as grain usually contain sufficient linoleic acid. However, if they are high in barley, milo or wheat, some deficiency may be encountered in practical rations.

Fats make up 40% of dry weight of whole egg contents and about 17% and 12% of dry weight of market broilers and turkeys, respectively. Most feed ingredients contain 2 to 5% fat. The growth in chicks fed a fat-free diet slows down compared to those fed with basal diet supplemented with 4% corn oil. In broiler, a diet based on soybean meal and fish meal containing 0.18% linoleic

acid produces excellent growth. From these findings, the linoleic acid requirement in starting broiler is stated as below 0.2% of the diet.

Polyunsaturated fatty acid (PUFA) composition of some diet sources:

1. Corn oil contains 9.3% of linoleic acid, 1.5% of arachidonic acid and 0.2% of linolenic acid.
2. Safflower oil contains 21.5% of linoleic acid and 2.2% of arachidonic acid.
3. Fish oil contains 7.8% linoleic acid, 0.6% arachidonic acid and 0.3 % of linolenic acid.

Animal and vegetable oils serve the following functions in poultry diet:

1. It increases the calorific density of the ration.
2. It controls dusty feed.
3. It facilitates pelleting of feeds.
4. It increases palatability of the feed.
5. It helps homogenize and stabilize certain feed additives, especially of those of very fine particle size.

Requirement of fatty acids in other monogastric animals:

1. A well-balanced diet of an adult equine consists of 4% fat. It is fed at sensible levels of 250-500 ml/day for well exercised horse.

2. In rabbit, it is recommended to add 2-5 % oil in the diet of non-lactating does, whereas about 9.9% oil in lactating does has higher milk yields, higher weight gain and lower mortality of young ones. As per nutrient requirement of rabbits provided by ICAR (2013), the requirement of fat for growth stage, maintenance, gestation period and lactation period are 2-4%, and 2% respectively.
3. In swine, the digestibility of lipids in young, weaned pigs is low and increases with age, whereas the digestibility of milk fat in nursing piglets is very efficient. Lipids are typically supplemented in practical swine diets at a range of approximately 0.5 ppm. Fat requirement in starter ration is 2%, grower is 2% and finisher ration is 1.5%. Fat deficiency in swine ration leads to hair loss, scaly dermatitis, skin necrosis on the neck and shoulders and an unthrifty appearance.

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Author Information:

- **Dr Mamata Joysowal**, Assistant Professor, mamtajaiswal525@gmail.com
- **Dr. Gunoram Saikia**, Professor, gunoram.saikia@aau.ac.in
- **Dr. Bibeka N. Saikia**, Professor, bibekas.saikia5@gmail.com
- **Dr. Robin Bhuyan**, Professor, robin.bhuyan@aau.ac.in