Nutritional Profile of Poultry Offal and Its Utilisation as Fish Feed

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Poultry offal meal (POM) is an animal byproduct, generally consisting of parts of the animal considered ill-favoured for human consumption. High in protein, with an essential amino acid profile that more closely resembles fishmeal in comparison to terrestrial plant derived protein sources (Riche, 2015). POM is low in ash and contains little to no antinutritional factors found in plant-derived protein sources (e.g., proteolytic enzyme inhibitors) (Francis et al., 2001). Due to its afore mentioned advantages, global use of POM-based aqua feed has steadily increased (Badillo et al., 2014; Riche, 2015). The suitability of POM inclusion has been evaluated for many commercially important aquaculture species, including Oncorhynchus mykiss (rainbow trout) (Badillo et al., 2014), Lates calcarifer (barramundi) (Lewis et al., 2019), and Salmo salar (Atlantic salmon) (Hatlen et al., 2015). Despite its widespread utilisation in aquafeed, the confidence of aquafeed manufacturers to utilise POM as a protein source is currently hindered by high variation in both nutritional value and digestibility. Nutritional quality of a meal (i.e., the protein source within the diet) is directly linked to the essential amino acids present and their bioavailability, the structure of the proteins present, and the ability of digestive enzymes to act upon these proteins, which in-turn determines its digestibility (Friedman, 1999; Gilani et al., 2005). A decrease in di-gestibility and concomitant degradation of the nutritional value of protein meals can be attributed to the destruction of amino acids, a reduction in amino acid bioavailability, changes to protein structures and an inhibition of digestive enzyme activities. Therefore, in order to avoid negative downstream effects on digestibility, feed utilisation, and performance, the raw material source and processing methods must be scrutinised to ensure the resulting meals are highly digestible and balanced with essential amino acids.

Chemical properties

Poultry offal (PO) is a diverse material (Mayer, 1990). Most of the protein is derived from connective tissues. The average crude protein of PO is 61% ranges from 56.4 to 84.2%. PO is a good source of essential amino acids (Evans, M. 1985).

Table 1: Chemical composition (%) of poultry offal. (Dupree and Huner, 1984), (Meyer and Heckotter, 1986)

Proximate composition	Ranges
Dry matter	89.9-95.0
Crude protein	56.4-84.2
Crude fat	10.0-29.4
Ash	3-18
Crude fibre	0.4-3.6
N- free extract	2.0-5.4

Table 2: Essential	amino acid prof	ile of poultry o	ffal
(g/12gN)			

Amino acids	Ranges
Arginine	2.64-6.60
Histidine	0.75-1.43
Isoleucine	1.92-10.70
Leucine	3.34-9.50
Lysine	2.40-3.77
Methionine	0.77-2.80
Phenylalanine	1.67-5.30
Threonine	1.68-2.90
Tryptophan	0.46-0.80
Valine	2.18-3.50

The fat content of poultry offal depends not only on the technique of processing but also on the raw materials, especially if the abdominal fat is present in



large amount (Evans, 1985). The fat content therefore ranges widely but it is high in unsaturated fatty acids as follows (Mayer et al, 1986).

> Total saturated fatty acids: 32.6% Total unsaturated fatty acids: 63.1% PUFA (Polyunsaturated fatty acids): 17.6% Linoleic acids: 16.5% Linolenic acids: 1.1%

The crude fibre content of poultry offal is solely from the chyme crude fibre and the keratin of the feet. The differences of the ash content are high and may jump up since consumes gradually more prefer processed poultry meat than whole carcasses so that more bones go to the offal. (NRA, 1993): Poultry offal is a reliable source of iron and zinc along with choline. **Table 3: Vitamins and minerals content of poultry offal (Evans, 1985; Meyer & Heckotter, 1986; New**

Vitamins (mg)	Minerals
Vitamin E (mg)- 2.05	Calcium (%)- 3.36
Vitamin B1(mg)- 0.20	Phosphorus (%)- 1.77
Vitamin B2 (mg)- 10.50	Sodium (%)- 0.50
Vitamin B6 (mg)- 4.40	Potassium (%)- 0.42
Vitamin B12 (mcg)- 306	Magnesium (%)- 0.13
Folic acid (mg)- 0.75	Chlorine (%)- 0.54
Nicotinic acids (mg)- 43.4	Sulphur (%)- 0.52
Panthotenic acids (mg)- 9.95	Manganese (mg/Kg)- 11.0
Choline (g)- 4.10	Iron (mg/Kg)- 506.0
	Zinc (mg/Kg)-99.8
	Copper(mg/Kg)- 9.7
	Selenium (mg/Kg)- 0.78

Utilisation of poultry offal as fish feed.

In intensive and semi-intensive aquaculture system, 60-70% of the operational cost comes from feed. Therefore, there is a necessity to reduce feed cost by using locally available and low-cost feed



ingredients. The most expensive ingredient for the

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