



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2018; 6(6): 1536-1539

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Received: 01-09-2018

Accepted: 05-10-2018

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## Nutritional analysis of earthworm meal (*Eudrilus eugeniae*)

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**Abstract**

An experiment was conducted to analyze the chemical and nutritive value of the earthworm meal (*Eudrilus eugeniae*) and the complete analysis revealed the moisture, crude protein, crude fibre, ether extract, total ash and gross energy contents of earthworm meal were 5.3, 29.49, 1.25, 3.75, 45.66 per cent and 2649 kcal/kg, respectively. The calcium and phosphorus content of earthworm meal were 2.89 and 1.37 per cent. Amino acid profile of earthworm meal revealed that the glycine registered the highest (12.7 nmoles/ml) among non- essential amino acids and the threonine accounted for the highest (15.2 nmoles/ml) among essential amino acids. Lysine and methionine content were 12.3 and 6.3 nmoles/ml, respectively. Arginine and leucine levels are found to be at 8.0 and 9.3 nmoles/ml, respectively. The threonine recorded the highest percentage, while aspartic acid registered the lowest (0.5 nmoles/ml) among amino acids in earthworm meal. Thus, it could be concluded that earthworm meal is a rich source of protein, energy and amino acids, which could be used as an alternative to fish meal. Further, experiments needed to find the inclusion level and digestibility in poultry/other monogastric animals.

**Keywords:** earthworm meal, proximate composition, amino acid composition

**Introduction**

Fish meal is the conventional animal protein source used in poultry feed and it has been accounted for its balanced amino acids, vitamin content and palatability (Tacon, 1993) <sup>[10]</sup>. The cost of high quality fish meal is increasing due to declining of fish and competition for feed in animal husbandry. Hence, there is a need to search for alternative sources of animal protein (Sales and Janssens, 2006) <sup>[7]</sup>. These alternatives must be able to supply adequate indispensable and dispensable amino acid requirements which should be equal to fish meal.

Earthworm meal (vermin meal) is better alternative to fish meal in terms of quality and has been found to be an efficient substitute for fish meal in livestock nutrition. The potential value of earthworm as a protein source has been established by several authors (Sogbesan and Ugwumba, 2008; Sogbesan and Madu, 2008) <sup>[9, 8]</sup>. Vielma-Rondon (2003) <sup>[12]</sup> revealed that earthworms are an excellent and rich source of (> 60 % w/w) protein. Furthermore, many studies had shown that earthworms not only serve as a protein rich source but also as essential amino acids sources, especially lysine.

Previous study showed that earthworm meal of *Lumbricus rubellus* had 65.63 per cent crude protein content (Damayanti *et al.*, 2008) <sup>[1]</sup>, earthworm meal of *Lumbricus terrestris* contained 32.60 per cent protein (Julendra *et al.*, 2010) <sup>[4]</sup> and earthworm meal of *Perionyx excavatus* contained 57.2 per cent crude protein and had complete amino acid (Tram *et al.*, 2005) <sup>[11]</sup>. Although the special quality of earthworm meal has been known well as potential fish meal replacement as protein source, but it's still necessary to study about the essential amino acid composition in earthworm meal. Hence, the present study was conducted to estimate the protein and amino acid composition of earthworm meal which can be potentially included as alternative for fish meal.

**Materials and Methods**

Earthworm, *Eudrilus eugeniae*, was obtained from Krishi Vigyan Kendra, Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam, Kanchipuram District. The worms were bred and maintained at a pit belonging to Department of Agronomy, Madras Veterinary College, Chennai (Plate 1a).

**Preparation of earthworm pits**

Earthworm pit was filled with gravel sand for about 40 cm, followed by layering with soft

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manure made of cow dung. This was topped further with cow dung and partially decomposed dry leaves alternately. The pit was wetted frequently to maintain suitable dampness for housing earthworms. After preparation of the pit, earthworms (2 kg) were inoculated in the pit and allowed to multiply. The pit was covered with wire mesh at the top to prevent predator intrusions. Adult earthworms with well differentiated clitellum were collected for the preparation of earthworm meal (Plate 1b).

#### Preparation earthworm meal

Earthworm meal was prepared by powdering incubated earthworms at 60°C for 24 hours in hot air oven (Edwards, 1985), collected by standard protocol for earthworm culture (Plate 2a, 2b, 2c and 2d).

#### Proximate analysis of earthworm meal

Proximate analysis of earthworm meal was done at the Animal Feed Analytical and Quality Assurance Laboratory, Veterinary College and Research Institute, Namakkal as per the standard procedure.

#### Amino acid estimation of earthworm meal

The amino acid composition of earthworm meal was determined by High pressure liquid chromatography as per the method described by Istiqomah *et al.* (2009) [3].

Amino acid of earthworm meal was analyzed by using High Pressure Liquid Chromatography (HPLC). Chloride acid 6N (10 ml) was added into 2 gram of earthworm meal and kept in high temperature of disclosed reaction cylinder. Sample was hydrolysed by autoclave (110°C) for 20 hours then preserved in well-closed state at room temperature. Then the sample was evaporated in 50°C temperature prior to neutralization by NaOH 6N addition. The sample was filtered by 0.45 µm millex filter paper using vacuum filter. Before the sample was injected to the HPLC, 275 µL Ortho Phthalaldehyde (OPA) solution (0.01 g phthalaldehyde, 9 ml methanol, 40 ml buffer borax pH 9.1, 100 µL 2-mercaptoethanol) were added into 25 µL sample, vortex and allowed to react for 5 minutes. The HPLC operation was carried out at C18 column, movable phase A: Sodium acetate pH 5.0; B: 80 Methanol (MeOH) / 15 Buffer acetate / 5 Tetrahydrofluran (THF) (v/v/v), rate flow 1.5 ml/minute, detector: fluorescence λ excitation 340 nm; λ emission 450 nm. The chromatogram have been presented in Plate 3.

### Results and Discussion

#### Proximate analysis of Earthworm meal

The nutritional composition of the dried powder of *Eudrilus eugeniae* (EWP) was furnished in Table.1. The present findings revealed that the crude protein and energy content of the EWP was high both in quality and quantity (29.49% ± 0.011 and 2649 kcal/kg), respectively. The present study was in accordance with the result of Lourdmay and Uma (2012) [5] who also stated that crude protein per cent of powdered earthworm *Eudrilus eugeniae* was about 31 per cent. Earthworms contain significant amount of several minerals that are nutritionally important (Paoletti *et al.*, 2003) [6].

Calcium and phosphorus per cent content of earthworm meal were 2.89 and 1.37, respectively.

**Table 1:** Proximate analysis of Earthworm meal (%)

Components	Concentration
Moisture	5.3
Crude protein	29.49
Crude Fibre	1.25
Ether Extract	3.75
Total Ash	45.66
Calcium	2.89
Phosphorus	1.37
Gross Energy	2649 kcal/kg

#### Amino acid composition of Earthworm meal

The potential value of earthworm as a protein source had been established by several authors who had also suggested that earthworms provide a substantial nutrition to the animals consuming. Furthermore, the various studies had shown that not only earthworm could serve as a rich protein source but also as a source of essential amino acids, especially lysine which is limiting in many raw materials which used as feed. Amino acid composition of earthworm meal is very similar to that of fish meal and potentially superior than fish meal. Non-essential and essential amino acid content of earthworm meal (nmoles/ml) were presented in Table 2 and 3, respectively.

**Table 2:** Non - Essential amino acids content of earthworm meal (nmoles/ml)

Amino acids	Earthworm meal
Glycine	12.7
Serine	8.6
Glutamic acid	4.1
Tyrosine	4.0
Alanine	2.7
Aspartic acid	0.5

**Table 3:** Essential amino acids content of earthworm meal (nmoles/ml)

Amino acids	Earthworm meal
Threonine	15.2
Lysine	12.3
Valine	10.1
Arginine	8.0
Leucine	9.3
Phenylalanine	6.5
Methionine	6.3
Isoleucine	6.2
Histidine	3.4

The high essential amino acid composition of earthworm meal would produce better result when included in animal feed. The earthworm meal contains around 98 per cent of absorption by animal organism due the balance between vitamins and amino acids. The amino acid contents of earthworm meal were varied depending on species and food source.

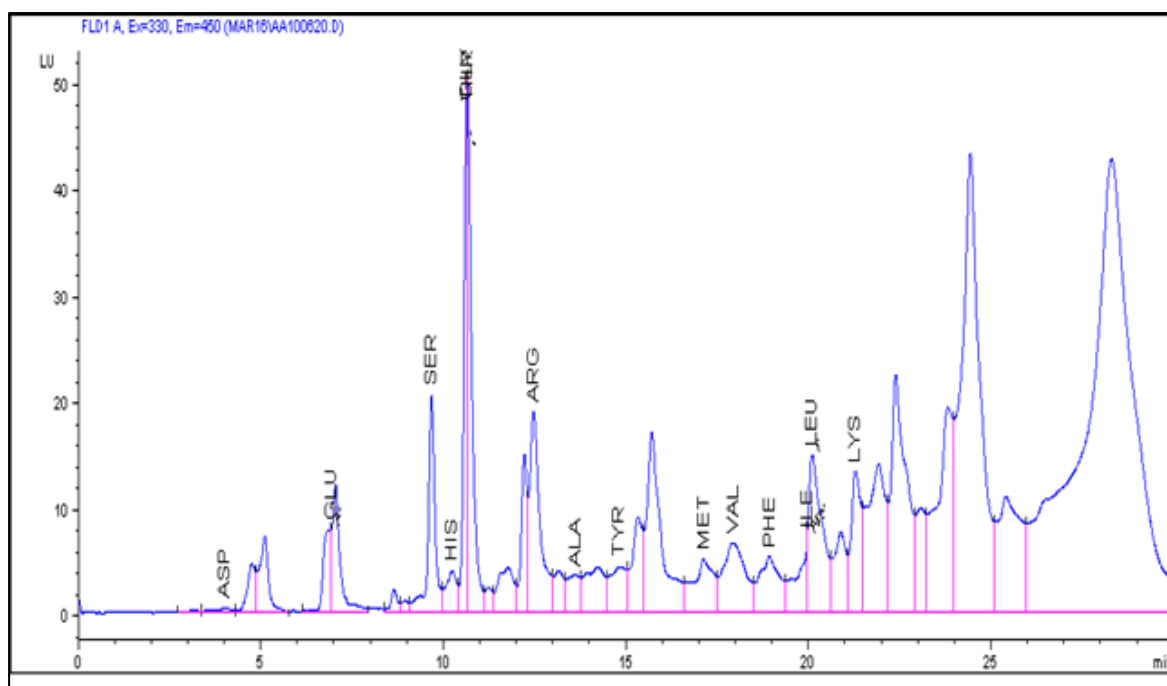


Plate 3: Chromogram of amino acid

## Conclusion

The nutritional analysis of Earthworm, *Eudrilus eugeniae* provides the qualitative and quantitative evidence to support that earthworm meal can be used as a source of protein and essential amino acids and which could be potentially used to replace fish meal in livestock and poultry nutrition.

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