The Pharma Innovation Journal 2022; 11(10): 1536-1538

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(10): 1536-1538

www.thepharmajournal.com
Received: 26-08-2022
Accepted: 27-09-2022

**P Sivashankar**
Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India

**C Kathirvelan**
Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India

**P Vasanthakumar**
Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India

**K Rajendran**
Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India

**Corresponding Author:**
**C Kathirvelan**
Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India

# Study on nutrients, mineral, vitamin and heavy metal profile of yeast derived protein

**P Sivashankar, C Kathirvelan, P Vasanthakumar and K Rajendran**

**Abstract**
Yeast derived protein is one among the alternative protein feed ingredients is being used in poultry. The nutrient, minerals, vitamins and heavy metal analysis of yeast derived protein was analysed in this study. Yeast derived protein was collected from six different poultry farms in the Namakkal district of Tamil Nadu. The proximate analysis of the sample for moisture, crude protein, crude fibber, ether extract and total ash was done. The nutrient composition of yeast derived protein as moisture (3.22 %), crude protein (70.33 %), ether extract (1.26 %), and crude fibre (10.76 %) and total ash (10.51 %). The mineral analysis revealed that high in Calcium (0.07 %), Potassium (0.5 %), Zinc (2.618 ppm) and manganese (1.9339 ppm). The vitamin analysis revealed that vitamin C (0.0023 µg) and vitamin B12 (0.6875 µg) respectively. The heavy metal analysis revealed low levels of arsenic, lead, chromium and cadmium. The results of nutrient, mineral, vitamin and heavy metal analysis showed that yeast derived protein can be used in livestock and poultry diets for its high protein and mineral value.

**Keywords:** Yeast derived protein, nutrient, minerals, vitamins, heavy metals

## Introduction
The demand for raw materials keeps on increasing due to macroeconomic factors. The need to develop cheap and readily available alternative feeding materials to support animal growth has become imperative. Microorganisms have been used for the synthesis of high protein products, Single Cell Protein. They can naturally convert low protein organic mass into high protein organic products by various processes.

Single Cell Protein is a term coined in 1960's to embrace the microbial biomass products which are produced by fermentation. Protein consists of processed microorganisms (as yeasts or bacteria) grown in culture and that is used as a source of food, especially for livestock. Single Cell Protein is basically composed of proteins, fats, carbohydrates, ash ingredients, water and other elements such as potassium and phosphorus (Jamel *et al*., 2008) [6]. The composition of SCP depends on the nature of the substrate and also on the organism used.

Single cell protein from yeast and fungi has up to 50-55% protein it has a high protein-carbohydrate ratio (Mchoi and park, 2003) [7]. It contains more lysine and less amount of methionine and cysteine. It also has a good balance of amino acids and high B-complex vitamins and is more suitable as poultry feed. Single cell proteins produced by using bacteria contain more than 80% protein although they have small amount of sulfur-containing amino acids and are high in nucleic acid content.

Among protein meals from various oilseeds, soybean meal (SBM) is the most preferred source in poultry diets due to its high crude protein content (40% to 48%) with balanced amino acids coupled with high digestibility (Ravindran, 2013) [11]. Soybean meal meets approximately 80% of poultry birds' protein and amino acid requirements at all stages (Ndazigaruye *et al.*, 2019) [9]. However, the use of soybean meal is sometimes limited due to fluctuation in its availability and variations in price. The high price of SBM necessitates exploring alternative protein sources in commercial livestock diets. Moreover, the cost of all other protein sources escalates whenever soybean costs go high.

Non-conventional protein sources like single cell protein in dry powder form can be effectively used as a replacement protein in poultry ration (Gad *et al*., 2010) [4]. Yeast is one of the best microorganisms for substrate (grains) derived protein production (Adedayo *et al.*, 2011) [1]. Yeast derived protein is rich in not only crude protein value but also a good source of vitamins and minerals, therefore it can be used effectively as an alternate protein source in poultry feeds (Amata, 2013) [2]. Yeast contains thiamine, riboflavin, biotin, niacin, pantothenic acid, pyridoxine, choline, streptogenin, glutathione, folic acid and p-amino benzoic acid

(Ugalde and Castrillo, 2002) [12]. Yeast single-cell proteins (SCPs) are playing a greater role in the evolution of aquaculture diets (Gao *et al*., 2008) [5]. Yeast derived protein and soybean meal have more or less similar essential amino acid compositions (Adedayo *et al*., 2011) [1] and can be used for protein supplementation in the poultry diet by replacing costly conventional sources like soybean meal and fish meal to reduce the feed cost. Therefore, the objective of the study was to determine the nutritional value of yeast derived protein would help to prepare data for feed supplements and alternative non-conventional feed ingredients for animals while the functional properties would assist in predicting the behavior of nutrients in feed formulation.

## Materials and Method

### Collection of Yeast derived protein

The yeast derived protein powder was randomly collected at six different poultry farms in the Namakkal district of Tamil Nadu. The sample was stored in an airtight container and prepared for chemical analysis.

### Proximate analysis of Yeast derived protein

The proximate analysis of yeast derived protein was analyzed for moisture, crude fiber, crude protein, total ash and ether extract content as per the standard method (AOAC, 2012) [3].

### Mineral analysis of Yeast derived protein

The mineral analysis of yeast derived protein for calcium and phosphorous were analyzed as per AOAC (2012) [3]. The trace mineral (magnesium, potassium, sodium, iron, zinc, manganese, copper and cobalt) content of yeast derived protein was analyzed using Atomic Absorption Spectrophotometer (AAS).

### Vitamin analysis of Yeast derived protein

The fat-soluble, water-soluble vitamins and vitamin C were analyzed using High-Performance Liquid Chromatography (HPLC) method.

### Heavy metals analysis of Yeast derived protein

Heavy metal (lead, nickel, cadmium, chromium and arsenic) content of yeast derived protein powder was analyzed through the acid digestion method using Atomic Absorption Spectrophotometer (AAS).

**Table 1:** Proximate composition of collected Yeast derived protein (on DMB)

| Sample | Moisture (%) | Crude Protein (%) | Crude Fiber (%) | Ether Extract (%) | Total ash (%) |
|---|---|---|---|---|---|
| 1 | 3.19 | 70.56 | 10.75 | 1.25 | 10.45 |
| 2 | 3.34 | 69.85 | 11.23 | 1.28 | 10.52 |
| 3 | 3.35 | 70.74 | 10.65 | 1.22 | 10.05 |
| 4 | 3.23 | 70.28 | 10.58 | 1.25 | 10.79 |
| 5 | 3.08 | 70.45 | 11.11 | 1.24 | 10.26 |
| 6 | 3.15 | 70.08 | 10.25 | 1.32 | 10.96 |
| Average | 3.22 | 70.33 | 10.76 | 1.26 | 10.51 |
| SE | 0.04 | 0.13 | 0.15 | 0.01 | 0.14 |

Number of samples (n=6)

**Table 2:** Average mineral composition of yeast derived protein (per 100 g)

| Name of the Mineral | Level |
|---|---|
| Calcium (mg) | 69.92 |
| Phosphorus (mg) | 41.06 |
| Magnesium (mg)) | 53.21 |
| Potassium (mg) | 516.21 |
| Sodium (mg) | 103.24 |
| Iron (ppm) | 0.0235 |
| Zinc (ppm) | 2.6180 |
| Manganese (ppm) | 1.9339 |
| Copper (ppm) | 0.0041 |
| Cobalt (ppm) | 0.0819 |

**Table 3:** Average **v**itamin composition of yeast derived protein (per 100 g)

| Name of the Vitamins | Level |
|---|---|
| Vitamin B1, B2, B3 | BLQ |
| Vitamin B6 | BLQ |
| Vitamin B5 | BLQ |
| Biotin | BLQ |
| Folic Acid | BLQ |
| Vitamin $B_{12}$ | 0.6875 µg |
| Beta carotene | BLQ |
| Vitamin C | 0.0023 µg |
| Vitamin E | BLQ |

BLQ- Below the Level of Quantification

**Table 4:** Heavy metal analysis of yeast derived protein (n=2)

| Name of the Element | Level (ppm) |
|---|---|
| Lead (Pb) | 0.1351 |
| Nickel (Ni) | 0.1916 |
| Cadmium (Cd) | 0.7177 |
| Chromium (Cr) | 0.1851 |
| Arsenic (Ar) | BLQ |

BLQ- Below the Level of Quantification

## Results and Discussion

The nutrients like moisture, crude protein, crude fiber, ether extract and total ash content in yeast derived protein were given in Table 1.

The yeast derived protein powder contained enormous portion of crude protein (70.33 %), ether extract (1.26 %), crude fibre (10.76 %), total ash (10.51 %) and moisture (3.22 %). The mineral composition revealed that yeast derived protein has a good source of calcium, potassium; manganese and Zinc were given in Table 2. Thirdly, the vitamin composition revealed a good source of Vitamin C and $B_{12}$ was given in Table 3 and finally containing minimal amounts of heavy metals were given in Table 4.

The average protein content in yeast derived protein was 70.33 per cent and similarly, other authors expressed the crude protein value between 45 to 55 per cent (Miller and Litsky., 1976) [8]. The high level of protein in yeast derived protein revealed that yeast derived protein can be used as a protein source in livestock ration especially for poultry in the

place of conventional protein ingredients. The mineral profile of yeast derived protein in the present study shows that yeast derived protein has rich in calcium, zinc, manganese and potassium. A similar observation was also made by feeds (Amata, 2013) [2]. The vitamin profile of yeast derived protein is rich in vitamin C and $B_{12}$. Similar findings were also reported by feeds, Amata (2013) [2] and Ugalde and Castrillo, (2002) [12]. The heavy metal of yeast derived protein in this study revealed that trace levels of arsenic and minimal levels of lead (0.1351 ppm), nickel (0.1916 ppm), chromium (0.1851 ppm) and cadmium (0.7177 ppm) were present. Similar findings were observed from waste- activated sludge (Nkhalambayausi-Chirwa and Lebitso, 2012) [10].

The results of the present study revealed that yeast derived protein contains an appreciable amount of crude protein, crude fiber and ether extract serving as a good source of protein for livestock and poultry. Similarly, Yeast derived protein also contains a high amount of calcium, potassium, manganese, zinc and vitamin like vitamin C and $B_{12}$. It can be concluded thus yeast derived protein can contribute significantly to the nutrient requirement of livestock species especially an alternative protein sources for poultry.

**Acknowledgments**

The authors are grateful to the Dean, Veterinary College and Research Institute, Namakkal and Tamil Nadu Veterinary and Animal Sciences University, Chennai for providing the necessary facilities for carrying out this research work. This is part of MVSc. research work.

**Reference**

1. Adedayo MR, Ajiboye EA, Akintunde JK, Odaibo A. Single cell proteins: as nutritional enhancer. Adv. Appl. Sci. Res. 2011;2(5):396-409.
2. Amata I. Yeast a single cell protein: characteristics and metabolism. Int. J Appl. Biol. Pharm. 2013;4:158-170.
3. AOAC. Official Methods of Analysis, Association of Official Analytical Chemists, 19th Edn, Washington, D. C, USA; c2012.
4. Gad AS, Hasan E, Abd El Aziz A. Utilization of *Opuntia ficus-indica* waste for production of *Phanerochaete Chrysosporium* bio protein. Journal of American Science. 2010;6(8):208-216.
5. Gao J, Zhang HJ, Yu SH, Wu SG, Yoon I, Quigley J, *et al.* Effects of yeast culture in broiler diets on performance and immune modulatory functions. Poultry Science. 2008 Jul 1;87(7):1377-1384.
6. Jamel P, Alam MZ, Umi N. Media optimization for bio proteins production from cheaper carbon source, Journal of Engineering Science and Technology. 2008 Aug 1:124-130.
7. Mchoi MH, Park YH. Production of yeast biomass using waste Chinese biomass bio energy. J Microbiol. 2003;25:221-226.
8. Miller BM, Litsky W. Single cell protein in microbiology. McGraw-Hill, New York, NY; c1976, p. 408.
9. Ndazigaruye G, Kim DH, Kang CW, Kang KR, Joo YL, Lee SR, *et al*. Effects of low-protein diets and exogenous protease on growth performance, carcass traits, intestinal morphology, cercal volatile fatty acids and serum parameters in broilers. Animals. 2019 May 9;9(5):226.
10. Nkhalambayausi-Chirwa EM, Lebitso MT. Assessment of nutritional value of single-cell protein from waste-activated sludge as a protein supplement in poultry feed. Water Environ. Res. 2012 Dec;84(12):2106-2115.
11. Ravindran V. Poultry feed availability and nutrition in developing countries. Poultry Development Review. 2013 Jan;2:60-63.
12. Ugalde UO, Castrillo JI. Single cell protein from fungi and yeasts. Appl. Mycol. Biotechnology. 2002;2:123-149.