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Formulation of Fish Feed Using *Moringa oleifera*

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ABSTRACT

In Aquaculture and Fisheries production of food is important with nutritional security. Developing aquaculture increase the demand of good quality food production. Usually in aquaculture fishmeal is used as feed but due to cost-effectiveness and availability animal protein-based fish feed are not convenient to fish farmers. So, its a need of time that aquaculture industry shift towards plant-based feed formulation with having easily available natural sources. In feed formulation consideration of availability of feed formulation ingredients and cost-effectiveness and rich protein content these are most essential part of formulation. In present feed formulation all these points are considered and feed is formulated. Present feed formulation aquaculture (*moringa oleifera*) leaves were used as main ingredient along with some other ingredients which are also rich in protein. Moringa leaves are rich in proteins, vitamins and minerals and easily available tropical and subtropical region. The fish feed was accepted by fishes and simply consumed.

Index Terms: Fish feed, aquaculture, moringa

I.INTRODUCTION

“On a global scale, the growth of aquaculture remains inspiring but has slowed slightly during the last decade (FAO, 2012, 2014). To grow this especially in the low and middle-income countries outside of Asia, but in Asia continues to dominate overall production. In the coming years, fish production from capture fisheries will not increase significantly, if at all. Thus, demand for cultured fish will increase with the growing population and rising incomes in the low and middle-income countries, but how much and where aquaculture will grow remains uncertain (Bostock et al., 2010; World Bank, 2013). A major part of population growth (and therefore fish demand) will no doubt occur in the fast-growing economies of the global south, often in urban centres (UN-DESAPD, 2014).” Aquaculture growth is mostly depend on feed cost so production of

cost-effective feed is a major challenge for this industry and hence feed formulation with easily available sources must be done.

Feed should supply all the essential nutrients for fish ensuring flesh and quality of water. In feed formulation all the nutrients should be in acceptable quantities. Raw material for formulation should be easily available prior to feed formulation one should consider these points. Hence in the present fish feed formulation moringa (*Moringa oleifera*) leaves were used. Moringa is fast growing tree found in Indian subcontinent. Commonly known as drumstick tree, horseradish tree and benzolive tree which belongs to family Moringaceae. Moringa leaves and pods are used for traditionally as herbal medicine. Moringa plant is found in dry region and it grows without exclusive irrigation. It is cultivated to use for combat malnutrition mostly in infants. All the parts of the tree are used for various purposes like leaflets, stems, flowers, roots, young seeds and leaves. Leaves are sun, shade oven dried and well-preserved for their nutrients. It is valued dietary supplement used in many dairy products. Moringa leaves are rich in Energy, proteins, Fats, Carbohydrates, vitamins and minerals in both the form fresh as well as in dried leaves. Leaves are rich in minerals like Mg, P, K, Cu, S, Ca and Fe. Vitamins like Vitamin A, B1, Riboflavin Nicotinic acid, Thiamine and Ascorbic acid. It is also rich in amino acids like Arg, Val, His, Lys, Trp, Phe, Leu, Met, Ile and Val. Hence in the present feed formulation considering all these nutritional value, Medicinal value and availability moringa leaves were used in feed formulation.

II. RESEARCH METHODOLOGY

Feed formulation is the progressions and combination of feed ingredients to form Mixture which will meet the precise goals of feed production. It is habitually a compromise between a practical considerations and ideal formula. While during process of feed formulation one must take into account the price, availability of ingredients used, anti-nutritional factors and palatability of mixtures (Azevedo P.A. 1998)., *Moringa oleifera* and some other ingredients like eggs, milk powder, turmeric powder, corn flour, cod liver oil, vitamins such as vitamin B Complex and E, agar powder, garlic, pepper powder and cumin powder were used for formulation.

Feed preparation

Moringa oleifera leaves (80gm) were taken as main ingredients. Other ingredients such as eggs (70 gm), milk powder (60 gm), and corn flour (20 gm) were added and mixed well. As an binding agent Agar powder (4 gm) was added; cumin powder (0.5gm), pepper powder (0.5gm) turmeric (0.5gm) and garlic (1 gm) as an antibiotics. The above prepared mixture was boiled and cooled for room temperature, after cooling vitamin mixture of vitamin B complex (1gm) and vitamin E (1 gm), cod liver oil (3.5 ml), were added. It was kept for refrigeration upto 12 hrs. After 12 hrs kept at room temperature for some time and then squeezed over plastic tray like noodles and then dried at room for 48 hrs. The noodles that are dried crushed into small pieces then sun dried to avoid fungal infection, stored in the plastic containers.

Moringa (*Moringa oleifera*)

Moringa oleifera is rich source of energy, protein, carbohydrates, vitamins and minerals. Many studies have been carried out on nutritional value of moringa leaves for various purposes by many reserchers. *Moringa oleifera* leaf extract shows nutritional value per 100 g Carbohydrate 9.1 g, Dietary fiber 2.1 g, fat 1.7 and protein 8.1. These results conformity with those obtained in previous studies Madukwe EU (2013). shows the results of vitamin content in *Moringa oleifera* such as vitamin A 80 µg thiamine (B1) 0.103 mg, Riboflavin (B2) 0, 112 mg, Niacin (B3) 1.5 pantothenic acids (B5) 0.48 mg, vitamin B6 0.129 mg folate (B9) 41 µg Vitamin C 8.6 mg.

Milk powder

In present feed formulation Nestle milk powder was used. Which holds 20 standard amino acids. It is rich in minerals and vitamins like A, D. Average nutrient in milk are 36% proteins; 52% carbohydrates (particularly lactose); and 1.3% calcium.

Nutritional value of milk powder / 100 gms

“Protein: 20.5 gm; Carbohydrates: 52.7gm; Fats: 19gm; Saturated Fatty Acids: 10.9 gms; Cholesterol: 0.05 gm; Mono Unsaturated Fatty Acid: 4.21gm; and Poly Unsaturated Fatty Acid (PUFA): 0.41gm.”

Egg

Egg albumin contains 15% of proteins dissolved in water. It contains about 40 different types of proteins. The proteins in egg white are, ovalbumin: 64%; ovatranseferin: 12%; ovomucoid: 11%; ovomucin: lysosymes: 3.5% 1.5%; globulin: 8%; (USDA, 2008).

Corn flour

Corn flour was used as filler and binder in present formulation. It contains proteins: 3 gms; carbohydrates: 23gms; and fat:1gm. The major ingredients are maize and starch. Starch acts as additive in feed processing. It has 110 calories per gm. (USDA, 2008).

Cod liver oil

Cod liver oil is derived from the liver of cod fish *Gadus callarias*. It has a mild fishy taste and smell. It contains small amount of fish protein (Aviram M, Brox J. Nordoy A, 1986). It is a good source of the vitamin A and D, as both the vitamins are nutritionally important to body. Cod liver oil along with vitamin E prevents the body from increasing oxidant stress. It helps to reduce generation of free radicals in body. It has been used in form of a gelatin coated capsule named as Seacod. Each single soft gelatin capsule contains 300mg of cod liver oil.

Agar powder

Agar powder used as a binding agent to form a unique mass of the feed. It is a polymer made up of subunits of sugar galactose. It acts as an emulsifying and suspending agent in many feed products.

Vitamin mixture

Vitamin B and E were used in equal proportions.

Vitamin B complex

Each capsule contains of vitamin B complex is composed of Thiamine mononitrite; Vitamin B2, B6, B12; Nicotinamide; Folic acid; Biotin; and Titanium dioxide. It helps activity of enzymes. It plays an significant role in cell metabolism and growth. (Vera Reader, 1930). Vitamin B is an crucial nutrient for development and other bodily functions (Guyton., Boys HF., 2007).

Vitamin E

Each tablet contains Tocopherol acetate of 400mg. Its performances as an antioxidant, shields body against free radicals. which are theoretically destructive by products of energy metabolism.

Turmeric powder

Turmeric powder was used for its antioxidant, antibacterial, anti-inflammatory and hepatoprotective purpose. In feed formulation it is used as adjuncts.

Nutritional value /100 gms.

“Protein: 8.6%; Fat: 8.9%; Carbohydrates: 63.0%; Fiber: 6.9%; Moisture: 5.8%; Total ash: 6.9%; Calcium: 6.2%; and, Iron: 0.05%. The caloric value is 390 calories per 100 gm (USAID,2004). It also contains 5% essential oil, and 3% Curcumin which is a polyphenol” (Sharma S; Agarwal S; and Kulkarni SK, 2006).

Garlic paste:

It is used for its antibiotic and antibacterial properties (American Chemical society, 2002).

Nutritional value of garlic / 100 gms

Protein: 6.3%; Carbohydrates: 29%; Moisture: 62.8%; Total fat: 0.1%; Fiber: 0.8; Total ash: Vitamin C: 13 mg; 1.0%; Calcium: 0.03%; Iron: 0.001%; Phosphorus: 0.31%; and Nicotinic acid: 0.4 mg. The caloric value is 1429 (USAID, 2004).

Pepper powder:

It is used as a stimulant for appetite. In India it is used in number of health-related problems (H. J. D. Dorman and S.G. Deans 2000). Pepper has two main components- volatile oil and pungent component commonly known as piperine. Black pipers contain 0.6 to 2.6% essential oil. Nutritionally pepper contains Vitamins A, B and C.

Cumin powder

In research observed that animals shows that the secretion of pancreatic enzymes are significant factors in digestion and assimilation.

Nutritional value of cumin / 100 gms.

Carbohydrates 44.24 gm; vitamin C 7.7 mg; dietary fibers 10.5 gm; dietary fibers 10.5 gm; fats 1.53; iron 66.36mg; sodium 168 mg; zinc 4.8 mg; calcium 931 mg; vitamins such as A 64 mg; thiamine B1 0.628mg; riboflavin B2 0.327 mg; niacin B3 4.579 mg; foliate B9 10 mg;; and E 3.38 mg⁹ (USDA,2008).

III. RESULTS AND DISCUSSION

Fish requires nutrition for growth and development. Main objective of feed formulation is to reduce the feed formulation cost as well as get maximum profit from aquaculture. Traditionally most of the fish farmers were used animal proteins for feeding however day by day drastically the prizes of these are increasing so one should search for other alternatives. *Moringa oleifera* is having high nutritional value. It is rich source of minerals. Minerals content in “*Moringa oleifera*, such as Calcium 99.1 mg, Iron 1.3 mg Magnesium 35.1 mg Manganese 0.119 mg, Phosphorus 70.8 mg Potassium 471 mg, Sodium 70 mg, Zinc 0.85 mg these results were in conformity with those obtained in previous studies (Moyo B, Masika P, Hugo A, Muchenje V 2011) . Which shows the results of essentials amino acids (ug/ml) content in *Moringa oleifera* leaf extract Threonine 36.77, Valine 22.1, Methionine 2.13, Leucine 20.50, Isoleucine 31.8, Phenylalanine 36.8, Histidine 30.88, Lysine 27.67, Arginine 21”. In the present study feed ingredients which are used are easily available and with limited cost. Basic idea of this feed formulation is to use the ingredients in most effectively. Feed prepared was tested on fishes and the formulated feed is easily accepted by fishes and simply consumed and healthy growth and development of fishes. Fish feed formulation is an excessive scope in aquaculture industry. Formulated feed must supply all the nutrients which are required for maintenance of important physiological function of fishes like fish health, growth, disease resistance and reproduction which was seen in experimental fishes fed on formulated feed with esteem to SGR, FCR, PER and FCE.

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