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E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Seri By-Products As An Alternate Source of Protein in Poultry Feed: A Review

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Abstract

Increase in consumption of poultry meat and egg in the nearest future has augmented (increased) demand for new poultry feed ingredients to support sustainable intensive production. Therefore, the feed industry needs new sources of highly digestible protein with a desirable amino acid composition to substitute other valuable but limited protein sources of animal origin, such as fishmeal. The search for alternative and sustainable proteins is an issue of major importance that needs possible solutions in the short-term, making insects an increasingly attractive feed option. The class of insects includes the largest variety in the world including species providing a high protein with Essential Amino Acids (EAA), especially Sulphur amino acids content, which can be successfully utilized as poultry feed. The aim of this paper is to review the present state of knowledge concerning the use of insect protein in poultry nutrition. It is illustrious that insects have an enormous potential as a source of nutrients (protein) and active substances (polyunsaturated fatty acids, antimicrobial peptides) required for poultry production. Many researchers have mentioned that insect proteins may be successfully incorporated as feed material in poultry diets. The main objective of this review is to highlight the importance of Silkworm and seri-byproducts as a source of protein, which is high-quality in nature and the potential of its inclusion in poultry diets.

Keywords: Silkworm, Protein; Poultry Feed, Insects.

Introduction

In developing countries human population growth and urbanization has resulted in increased demand of food with animal origin (Abdullah et al., 2011; Steinfeld, 2003). Report of FAO (Food and Agriculture Organization 2010) states that contribution of poultry meat is around 33% of the total global meat production, this increased production of animal proteins, is related to increased demands for feeds, particularly for ingredients which have high protein and energy values. The major poultry ingredients are facing market competition and this competition between food, feed and agro-fuels is expected to increase prices of poultry feeds. Moreover, the constant improvement of the genetic potential of poultry has resulted in an increased nutrient density in poultry feeds, which limits the possibility to include low quality feed ingredients. This creates conditions compulsory for producers to look for alternative and locally available feed sources.

When formulating diets, the main emphasis lay on the crude protein (CP), because protein is the critical constituent of poultry diets, and together with the other main nutrients such as carbohydrates, fat, water, vitamins, and minerals, is essential for life (Cheeke, 2005). However, protein is also one of the most expensive ingredients in poultry diets. Therefore, nutritionally and economically, proper protein usage is essential in all feeding systems, as improvident (wasteful) usage increases the cost of production.

Sources of Protein for Poultry

Vegetable (plant) and animal products are the two most important protein sources in poultry diets. The majority of an animal's dietary protein requirement is supplied by plant protein sources. Soybean meal (SBM) is preferably used as a protein source in poultry feed manufacturing. Its CP content is about 40–48%, and this depends on the quantity of hulls removed and the oil extraction process. (V. Ravindran, 2013). Because of their deficiency in some amino acids, diet formulations with plant proteins usually require a supplementary source of amino acids or other protein

Sources such as animal protein. Anti-nutritional factors (ANFs) in plant protein have limited their use in poultry feeds. (Adeyemo and Longe, 2007). Poultry nutritionists have now paid more attention to the use of animal protein sources to create balanced diets (Akhter et al., 2008). Animal proteins are well balanced in terms of EAA that are necessary for body growth and development. In various countries, during poultry feed manufacturing, care is taken that animal protein ingredients should be incorporated in the feeds, particularly for young birds, which require a high level of amino acids. The essential amino acid requirements are gradually decreased as the bird's age increases.

Animal-based, protein-rich feed ingredients are generally made up of fish meat or blood meal and are well balanced in terms of EAA that are necessary for body growth and development, but they are expensive for commercial poultry production. Therefore, they are usually used to complement the amino acid balance in the diets rather than as the main protein source. Supplementation of animal protein sources may considerably improve performance parameters over standard diets. However, this may be because of the high concentration of EAA or it may be due to the lower percentage of indigestible carbohydrates present in SBM (Soybean Meal) (Firman and Robbins, 2004).

Animal protein supplements are derived from poultry and poultry processing; meat packing and rendering operations; fish and fish processing, and milk and dairy are processing (Denton et al., 2005). Bone meal, meat meal, poultry meal, hydrolyzed feather meal and to a lesser extent blood meal have all been used as important feedstuffs for poultry feeding (G.G.Pearl, 2002). In developing countries Fishmeal is mainly used in poultry feed to provide protein of animal origin as inclusive ingredient in the diet. Poultry production is thus dependent on the availability of fish meal.

Fishmeal prices are on the rise. Increasing demand has led to sharply higher prices and, for small farmers; this means that fishmeal is less accessible. At the same time, aquaculture is the fastest-growing animal-food producing sector and will need to expand sustainably to keep up with ever-increasing demand for fish. There is a severe shortage of cereals and oilseed (cakes) also for use in poultry feeds. Hence, feed-food competition give rise to looking for alternative feeds and other utilizing techniques to improving the nutritive values of poor ingredients (Reddy and Qudratullah, 1996; Mengesha, et .al. 2011).

The increasing cost and decreasing supply of traditional feedstuffs are expected to limit the future expansion of poultry production. This situation highlights the imperative need to improved utilization of the wide range of alternative feedstuffs available in the countries. Hendy et al. (1995) and Nweze et al. (2011) reported that changes in feeding systems is influenced by the needs to make the best use of resources available that can also lead to significant changes in demand for some feeds. According to reports, from Kenya, alternative programs must be initiated to encourage local production of main poultry feed ingredients (John and Njenga 1992).

Insects as Animal Feed

Insects have a similar market to fishmeal; they are used as feed in aquaculture and livestock and also in the pet industry. Although aquaculture is growing but fishmeal is declining rapidly as a source of feed. Thus ensuing high prices for fishmeal and recent high demand together with increasing production pressure on aquaculture, has led to research into the development of insect proteins for aquaculture and livestock - which could eventually supplement fishmeal. (FAO, 2013). Insects are natural food sources for many fish and poultry industry. Ravindran and Blair (1993) cited the use of soldier flies (*Hermetia illucens*) grown on manure and housefly pupae (*Musca domestica*) as replacements for soybean meal in poultry diets. The nutritional value analysis of house fly larva meal closely matches that of fishmeal, making it a potentially attractive alternative for use as a protein-rich feed ingredient for livestock and aquaculture operations (Hussein et.al.2017). Other unconventional protein sources such as maggot meal (Atteh and Ologbenla, 1993), housefly pupae meal (El-Boushy and van der Poel, 1994), shrimp waste meal (Fanimo *et al*., 1996), meat meal (Ravinder *et al*., 1996), termite meal (Fadiyimu *et al*., 2003), and grasshopper meal (Ojewola *et al*., 2005) have been used to replace fish meal as inclusive level or as a whole with significant results. All these researches have reported reduction in feed cost with increased profitability and without compromising the performance characteristics. (Ijaiya and Eko, 2009.) Onsongo et.al. (2018) explored potential of partially replacing this SFM(Soya and fish meal) with black soldier fly prepupae meal (BSFPM) in Cobb 500 broiler chicken diets with 16.0% higher Cost Benefit Ratio.

Ramos Elorduy et. al. (2002) conducted similar experiments with mealworms (*Tenebrio molitor*), rearing them on low-nutritive waste products and feeding them to broiler chickens. The mealworms were able to transform the low-nutritive waste products into a high-protein diet, making *T. molitor* a promising source of alternative protein, in particular as a replacement of soybean meal in poultry feed. Similar results were found in trials with *Anabrus simplex, Acheta domesticus, Bombyx mori, Alphitobius diaperinus, Tribolium castaneum* and termite. (Ramos.Elorduy.et.al. 2002). It is suggestive that by feeding insects to chickens, the use of antibiotics in the poultry industry which may lead to human infection with drug-resistant bacterial strains may be diminished. (FAO 2013)

Chitin, a polysaccharide found in the exoskeleton of insects, may have a positive effect on the functioning of the immune system. Research is needed to ascertain whether feeding chickens with insects (containing chitin) will make the use of antibiotics superfluous by strengthening the immune system. In studies, it is suggested that chitin is an allergen (Muzzarelli, 2010). However, chitin and its derivative, chitosan (produced commercially by the de-acetylation of chitin), rather than acting as

allergens have been found to have properties that could improve the immune response of specific groups of people (Goodman, 1989; Muzzarelli, 2010;).Moreover, chitin has shown potential for boosting immune system functioning, making it a promising alternative to antibiotics currently used in livestock (FAO 2013.) The use of chitin for medical and industrial purposes needs to be explored further.

Silkworms as an Alternative Feed

In most developing countries, animal production is hindered by scarcity and the expense of fishmeal as a feed ingredient. In India, where the poultry industry is one of the fastest-growing agro-businesses, the use of expensive fishmeal as a feed ingredient is threatening the poultry farmers. Grasshoppers, crickets, cockroaches, termites, lice, stink bugs, cicadas, aphids, scale insects, psyllids, beetles, caterpillars, flies, fleas, bees, wasps and ants have all been used as complementary food sources for poultry (Ravindran and Blair, 1993)

FAO's Animal Feed Resources Information System (now called Feedipedia) provides information about the use of insects as animal and fish feed, including insects such as the desert locust (Schistocerca gregaria), common housefly maggots (Musca domestica) and domesticated silkworm (Bombyx mori). Krishnan et al., (2011) have reported the use of sericulture waste, for feeding poultry with better conversion rates compared to conventional feed stock.

As a commercial process when dealing with poultry nutrition, the first attention is given to the cost of the ingredients used. Therefore our understanding for the importance of nutrition in the development of birds has probably been restricted by our dependence on the use of the most available and cheapest traditional feedstuffs. Consequently there has been recent research interest in the identification and utilization of alternative locally available feed resources in formulating poultry diets.

Likewise, few studies have shown how silkworm pupae – byproducts of silk manufacturing – can replace fishmeal entirely in the diets of layer chickens (i.e. in egg production) and supplement chicken diets (50 per cent). Srinivas et.al. Showed that the SSP (spent silkworm pupae) were rich in protein containing 18 amino acids especially rich in Sulphur containing amino acids viz Cystine and Methionine which are most important for *t*he growth of broiler and improvement of the quality of eggs. A growth and metabolic study on chicks fed with SSPM revealed that half of the fish meal (5 per cent) can be safely replaced by de-oiled silkworm pupae on equal protein basis in chick rations. In these cases there has also been reduction in feed cost and increased profitability without compromising the performance.

Conclusion

The technique of feeding insects to poultry will be beneficial in developing agriculture based recycling systems, reducing waste and potentially aid in reducing environmental pollution.

Therefore, it needs a solution to reduce the use of fish meal by substituting with high quality ingredient and on affordable prices. One of the ingredients that can be used is industrial waste such as silkworm pupae. Silkworm pupae have a potential to be used as animal feed. In the contest of above information a research project has been undertaken to search the possible probabilities of including silkworm pupae as a protein source in poultry feeds. After a survey conducted in nearby poultry farms of Jabalpur it has been reported that most of the poultry farmers are not fully aware about the potentiality of silkworm pupae meal as a rich source of protein to be utilized in poultry feeds. It can be concluded, based on many experimental results, that meals from insects may be successfully used as feed material in poultry diets moreover use of silkworm pupae is more economic than other insects.

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