

**Indian Farmer**

Volume 10, Issue 12, 2023, Pp. 474-477  
 Available online at: [www.indianfarmer.net](http://www.indianfarmer.net)  
 ISSN: 2394-1227 (Online)

**Popular Article****Role of moringa feeding in sustainable poultry production**

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Received: 25/11/2023

Published: 05/12/2023

**Introduction**

One of the sectors in the country with the quickest growth is the poultry enterprises. The poultry sector is growing at a pace of 15 to 20 percent annually overall. From backyard farming to industrial farming, poultry production offers the least expensive form of animal protein. Livestock accounts for 14% of the national GDP, although poultry only makes up 1% of it. Meat production has increased by 2.9% since the Red Revolution. More frequently aquaculture, poultry, and livestock are growing at a steady pace and have the potential to increase farm earnings. The livestock sector, which includes dairy, poultry, meat, eggs, and fisheries, noticed a compound annual growth rate (CAGR) of 7.9% from 2014–15 to 2020–21, based to the Economic Survey (2022-23). Its share of the total agriculture gross value added (GVA) increased from 24.3% in 2014–15 to 30.1% in 2020–21. The Department of Animal Husbandry and Dairying's annual report for 2022–2023 states that in the past few decades, commercial production techniques employing innovative scientific advances have replaced traditional agricultural methods in the poultry industry in India. The country generates an estimated 5 metric tons (MT) of broiler meat annually; according to trade estimates, the industry is now growing at 6–7% year.

An official statement states that during the period 2021–2022, the country produced 126.53 billion eggs. At this moment, it is expanding at a 5% annual rate. Data from the Agricultural and Processed Food Products Development Authority (APEDA) show that exports of poultry products increased from USD 71 million in the previous financial year to USD 137 million in 2022–2023, an almost 100% increase. India possesses abundant livestock and poultry resources, which are important in enhancing the socioeconomic status of the rural inhabitants. The country's poultry population increased by 17% to 851.81 million in relation to the 20th Livestock Census, from 729.21 million based to the 19th Livestock Census, 2012. Expert Market Research (EMR) projects that the Indian poultry market would be worth USD 28.18 billion by 2022. The market is anticipated to develop at a compound annual growth rate (CAGR) of 8.1% between 2023 and 2028, driven by the rising popularity of online services and the expansion of online food delivery channels. By that time, it is estimated to reach USD 44.97 billion. Although the government's policy initiatives under various five-year plans have contributed to this transition in the poultry enterprise, it could not be said that these initiatives have brought the industry to its current heights.

The Indian Council of Agricultural Research, agricultural institutions, and various other research organizations, as well as trade regulatory agencies like the Agricultural and Processed Products Exports Development Authority (APEDA), get funding from the government for sector-related research activities. In addition, the government provides technical assistance and loans through nationalized banks, particularly the National Bank for Agriculture and Rural Development (NABARD), to the industry. The issue affecting the poultry production industries in the majority of developing nations is raising feed costs, which account for 60–70% of total production costs. The goal of current techniques for raising poultry is to maximize profit while lowering production expenses. This has made it necessary to search for less expensive, more readily available, and less competitive alternatives to some of the substances used in poultry feed, especially protein sources. In this case, the ideal substitute protein source for poultry production might be the leaves of *Moringa oleifera*. For the purpose of laying eggs, a hen has to eat 8.84 kg from birth to 150 days of age, while a layer needs to eat 36.5 kg annually.

## Uses and properties

As a natural feed additive, *M. oleifera* has sustained production performance and enhanced the health of hens. Natural herbs have developed a significant demand in poultry production due to their potential to improve production performance and health condition. Although poultry is an inexpensive and high-quality source of protein, production expenses provide a significant barrier to poultry farming in impoverished countries such as India. It is necessary to transition to some non-traditional feed sources, which will lower feed costs and lessen rivalry for protein between both humans and poultry. One special illustration of an alternate protein supplement for poultry is *M. oleifera*. Its many other qualities include antibacterial, antioxidant, anti-cancerous, anti-cholesterol, and immune-boosting qualities, in addition to having a healthy nutrient composition. Therefore, in addition to lowering production costs, it may also help in lowering the risks to public health caused by the use of different antimicrobials in poultry feed. *M. oleifera* goes by several names, including horse radish, ben oil, miraculous, miracle, and drumstick plants. Moringa is referred to as Sahjan in Hindi. This tree develops quickly and is found in all tropical destinations. Moringa has been utilized for a variety of purposes, including medicinal, water purification, cattle feed, and human food (drumsticks, pods, and leaves for vegetables). It offers many health advantages and is highly adaptable.

### Nutritional profile of *Moringa oleifera* -

*M. oleifera* is utilized as a livestock feed substitute as it is high in nutrients and has the lowest levels of anti-nutritional elements. Protein, essential amino acids, minerals, vitamins, and other bioactive components are abundant in the plant's leaves, seeds, and stems, as determined by nutritional analysis. Limited information is currently available regarding the nutrient makeup of this plant's roots.

**Leaves:** Minerals (Ca, Mg, P, K, Cu, Fe, and S) along with fat, protein, and fiber are all found within Moringa leaves. The leaves of Moringa plants contain many vitamins, including ascorbic acid, vitamin B complex, nicotinic acid, and vitamin A (beta-carotene). Arg, His, Lys, Trp, Phe, Thr, Leu, Met, Ile, and Val are among the other amino acids that have been identified in it. Poultry can benefit from the use of Moringa leaves to meet their nutritional and dietary needs. Nutritive components including tannins, saponins, tripsin inhibitors, and pyhtates are found in trace levels in Moringa leaves (Ogbe and Affiku 2011). The levels of crude protein (71.2-267.9 g kg<sup>-1</sup> DM), crude fiber (210.0-490.0 g kg<sup>-1</sup> DM), NDF (48-842 g kg<sup>-1</sup> DM), ADF (39-805 g kg<sup>-1</sup> DM), and ADL (11-452 g kg<sup>-1</sup> DM) vary amongst the different morphological parts of *M. oleifera*, including leaves, stems, whole plants, and pods (Mabruk et al. 2010).

**Pod:** It has high levels of protein, ash, fats, fiber, and non-structural carbohydrates. In addition, there are fatty acids such as oleic acid, linoleic acid, palmitic acid, and linolenic acid. Gram-positive and gram-negative bacteria are inhibited from growing by the antibacterial activities of Moringa seed, pod, and leaf extract. Furthermore, it has the ability to act as an antioxidant, which improves the performance of birds by removing free radicals, activating antioxidant enzymes, and inhibiting oxidases.

**Seed:** In conjunction with fatty acids like behenic, linoleic, and linolenic acid, and phytochemicals like tannins, saponins, phenolics, phytate, flavonoids, terpenoids, and lectins, it also includes oleic acid (Ben oil), an antibiotic known as pterygospermin, and phytate. Other nutrients found in Moringa seeds include lipids, fiber, proteins, minerals, vitamins A, B, and C, and amino acids.

Among the positive effects of Moringa *oleifera* leaves on poultry diets, the following can be highlighted:

- Antimicrobial, anticoccidial, and antioxidant effects
- Immune modulating effects
- Reduces cholesterol levels in eggs
- Better yolk color
- Produces healthy enterocytes
- Enhances growth performance and carcass traits

### Pharmacological Properties of *Moringa oleifera* -

There has been an increase in demand for natural foods with active ingredients like phytochemicals over the past decade. Phytochemicals such glucosinolates, alkaloids, flavonoids, phenolics, carotenoids, and sterols can be found in significant quantities in the various portions of Moringa *oleifera* trees. Gopalakrishnan et al. (2016) suggest that these compounds provide Moringa *oleifera* its therapeutic qualities. As to reports, Moringa *oleifera* possesses numerous beneficial properties, including anti-oxidant, anti-tumor, anti-inflammatory, anti-diabetic, anti-bacterial, and hypolipidemic properties.

### **Moringa as poultry feed -**

Neither Moringa leaves nor powder will be willingly consumed by poultry. But it is possible to separate off around half of the protein content from the leaves and add it to chicken feed in the form of a concentrate. Fuglie (2000) claims that phytase, which breaks down phytate and increases phosphorus absorption, can be added to Moringa leaves to boost their nutritional value for poultry. In a contrast with the control diet, Onu and Aniebo (2011) reported that broiler diets containing 7.5% Moringa oleifera leaf meal had a significant ( $p < 0.05$ ) impact on the broilers' average final body weight, average daily increase, average daily feed intake, and average feed conversion. Moringa oleifera leaf meal (MOLM) can be substituted for soybean meal in broiler diets up to a level of 5% inclusion in the total ration without having a detrimental effect on the biological performance of birds, as reported by Tesfaye et al. (2013), who additionally looked over the effects of the inclusion of five levels (0%, 5%, 10%, 15%, and 20%) of MOLM on the growth performance of broilers.

In the words of David et al. (2012), broiler feeds with two levels of Moringa leaf powder (0.05% and 0.1%) may enhance the growth performance and carcass yield of the chickens. In contrast to these investigations, Pagua et al. (2014) observed no discernible effects of adding Moringa leaf powder to broiler diets on feed intake, body weight gain, feed conversion ratio, final weight, feed cost per kilogram of broiler produced, income over feed, or chick cost. As reported by Annongu et al. (2014), broiler growth performance declined as the amount of Moringa in the diet increased. Nevertheless, it was found that introducing 25% more Moringa leaf meal to broiler diets as a protein supplement increased growth compared to commercial diets in the study that evaluated the effects of replacing soybean meal with Moringa leaf meal on the growth performance of broilers.

In accordance to a research study conducted by Zanu et al. (2011), fish meal can be largely replaced with Moringa oleifera. Several investigations have been conducted to investigate into the influence of Moringa oleifera on laying hen performance in addition to research utilizing broilers. According to one of these research, up to 10% of cassava-based layer diets can safely contain Moringa oleifera leaf meal (MOLM) without having a detrimental effect on production. Moringa oleifera leaf meal was additionally shown in several evaluates to be acceptable in laying hen diets at levels of 10% to 15% (Abou-Elezz et al. 2012).

### **Effect of various level of Moringa leaf meal on the laying hen's performance -**

It has been revealed through research that supplementing Moringa oleifera leaf meal to chicken diets enhances poultry production at an inexpensive price of feed. Based on current research, introducing M. oleifera leaf powder to poultry diets boosts both egg production and egg quality in the birds. In comparison to the control diet, it has been shown that adding 2.5 and 5% of M. oleifera leaf powder to the layer bird food enhances the number of eggs laid each week, as well as the weight, width, surface, height, and weight of the yolks as well as the albumen weight and yolk ratio. A study conducted by Kakenji et al. (2007), there was a significant ( $P < 0.05$ ) increase in egg weight when 5% M. oleifera leaf powder was substituted for sunflower seed meal in a layer diet. It was discovered that introducing 5% of M. oleifera leaf powder to the layer ration greatly enhanced the absorption of protein and the appearance of the yolk. Comparing the laying performance to the control diet revealed no negative impacts. Moringa oleifera leaf meal has also been shown in several investigations to be acceptable in laying hen diets at levels of 10% to 15%.

### **Effect of inclusion Moringa leaf meal on the performance of broiler -**

According to research reports, the body weight increase, average daily gain, and feed conversion ratio of broiler chicks fed M. oleifera leaf meal at rates of 1, 3, and 5% of DM intake were considerably greater than those of the control group. When M. oleifera was incorporated at 200, 400, and 600 g, respectively, in 100 kg of feed, Onunkwo and George (2015) encountered no statistically significant differences in the body weight gain and feed intake of broiler chickens considering M. oleifera leaf meal compared to the control group. The broiler's feed intake, body weight gain, feed conversion ratio, final weight, feed cost per kilogram of broiler produced, income over feed, or chick cost were all not significantly impacted by the addition of Moringa leaf powder to their meals. With regard to these assessments, M. oleifera leaf meal is appropriate to be utilized as a rich source of protein in poultry diets and has no negative impacts on growth performance.

### **Conclusion**

M. oleifera could be advantageously introduced to the diets of hens as an immune-stimulating and natural growth enhancer. In order to use M. oleifera as an effective method for organic meat and egg production, experts suggest conducting further research on it as a potential antibiotic substitute in hens. It is feasible to draw inferences that M. oleifera can be incorporate into chicken rations as an environmentally beneficial feed supplement. Prior studies illustrated that expensive protein sources including fish meal, soybean meal, and sunflower seed cake may be significantly replaced by Moringa

oleifera leaf meal. It is perfectly safe to incorporate up to 20% Moringa leaf meal in broiler diets and up to 10% in layer diets without causing a detrimental impact on performance. Broilers should only be offered Moringa un-decorticated seed powder up to 1.5% of the total diet during the finisher stage - not the starter stage.

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