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Traditional and Non-Traditional Feeds in Poultry Feeding: A review

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Abstract

Quite a few nations have a thriving poultry feed sector. This essay focuses on Feed, which is regarded as the most expensive component of poultry production. Feed processing also raises the price of feed, in addition to the cost of ingredients. The population of the world is projected to rise to 9.1 billion people by the year 2050. Meat and egg consumption from chicken is rising worldwide, primarily in developing nations. As a result, there would be a rise in the demand for poultry feeds worldwide. Due to their significance in improving the general health of birds, additives in poultry feeding are nowadays a need in any product of factories making feedings. Nowadays, especially in emerging nations, the supply of feeds for chicken nutrition is becoming increasingly competitive. The use of alternative feedstuffs to replace soybean and yellow corn in poultry diets and the alternative feedstuffs that can be used in poultry feeds are both being pursued. Additionally, the availability of nutritional content and methods for enhancing the nutritive quality of such nontraditional feedstuffs.

Keywords: Poultry feed, Traditional feeds, Non-traditional feeds, alternative feedstuffs

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Introduction

Animal production is an important aspect of agricultural production, whereas it is not less significant than plant production because it is considered a basic source of food, most animal products are used as main inputs in stimulating the industrial sector. Products like these are utilized as raw materials. One of the primary sources of animal protein is poultry, as it provides the consumer with eggs and meat, in addition to the fact that its meat has a high percentage of protein compared to the meat of other animals. While sheep's feed conversion ratio is 5.5:1, meaning the animal consumes 5.5 kg of feed to produce 1 kg of meat, meat chicken has a high feed conversion ratio compared to other animals, reaching 2:1, meaning the bird consumes 2 kg of feed to produce

1 kg of meat. In addition, meat chicken requires less space than livestock, which require large pastures and breeding pens to produce meat. (Hamed, 2020).

Because of its benefits, which include a quick turnover of capital, a major contribution to reducing customers' food needs, and a high likelihood of creating work opportunities, the poultry business is one of the primary foundations of the economy of many countries (AL-Tamimy *et al.*, 2022). The most significant sources of dietary protein for the global population are eggs and poultry meat. Given that the issue of nutrition persists despite efforts to control other factors, such as genetics and environmental factors, nutrition may be the solution to the aforementioned issues. Modern biotechnology has produced new feeding techniques that better meet the nutritional needs of laying hens and mothers, lowering the cost of feed, which accounts for about 65-70% of the cost of production (Aljebory & Naji, 2021).

Customers are more inclined to purchase goods from a business in a competitive market if it meets their demands and specifications. Therefore, in order to remain competitive in the market, businesses concentrate on upgrading production methods. Understanding current technology, which is essential for a successful business, was necessary for process improvement. Once the problem's underlying causes have been determined, the process may then be improved (Amin and Sobhi, 2023). It is becoming increasingly important to optimize the operations in a feed mill to boost capacity while keeping the needed quality since feed manufacturing faces significant hurdles and a demand for better quality feed. Older feeding techniques, such as foraging, were no longer able to support big farms due to the expansion of the poultry business. As a result, alternatives had to be devised in order to feed the ever-increasing number of chickens (Cobb-Vantress, 2018).

Since they have a positive effect on removing harmful microbes and promoting bowel health, antibiotics have long been added to poultry feeds. However, in recent years, The usage of these antibiotics has been under intense scrutiny recently due to the rise of bacterial strains resistant to them and their potential harm to human health (Ye *et al.*, 2020), This prompted researchers to search for natural food additives that are safe to use, with organic acids, probiotics, enzymes, and other food additives such medicinal plants (AL-Khalaifah, 2018; AL-Gharawi *et al.*, 2018).

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Methodology

In conducting this research, we used studies related to Traditional and Non-Traditional Feeds in Poultry Feeding and explained and reviewed them.

Results

One of the most crucial methods for raising forage quality is fermentation technology, which inhibits the growth of pathogenic bacteria in the feeding regimen by fermenting with probiotics (Aljebory & Naji, 2021), raising the amount of protein in it Additionally, the fermentation process increases the production of amino acids like methionine and lysine. This boosts the amount of protein the bird digests and absorbs (Nkhata *et al.*, 2018). This research aimed to know the Traditional and Non-traditional Feeds in Poultry Feeding, ingredients in poultry feed, additives of poultry feed, importance of additives to poultry feedings, and the substitute feedstuffs that can be used in poultry diets.

Poultry Feed Availability and Human Nutrition

Since feed is the most expensive component of poultry production, it is crucial that low-cost, high-quality feeds be easily accessible if poultry production is to remain competitive and grow to meet the world's demand for animal protein. The output of chicken meat and eggs has steadily increased over the world over time, and this trend is anticipated to continue. The demand for animal proteins will rise in areas with rapid economic expansion and increased household incomes. The steady increase in global poultry output has been caused by a number of variables, including: (1) Genetic advancements in poultry strains used for producing meat and eggs. (2) A better comprehension of nutrition's fundamentals. (3) Prevention of disease. For instance, the time it takes a meat chicken to grow to a market weight of 2 kg has continuously lowered, going from 63 days in 1976 to 35 days in 2009, and the effectiveness of turning feed into poultry products also keeps getting better. The need for feed and raw materials is significantly being affected by the increase in chicken production (Ravindran, 2013).

Numerous elements, including as food, stress, antibiotics, and current breeding practices, have an impact on an animal's health and growth. Antibiotics are administered to birds in prophylactic doses in order to preserve and stabilize their health. However, antibiotics may have unintended consequences that impair human health when consumed with foods derived from animals. Increase of human antibiotic resistance to microorganisms, some illnesses could be detrimental to public health. Causing some scientists in the world to use less antibiotics and more alternative treatments (Al-Tamimi & Al-Tamimi, 2019).

Nutrient Requirements for Poultry Feeding

Poultry requires a balanced diet of nutrients for optimal growth and health. Depending on the species, age, and whether the birds are being raised for meat or eggs, different nutrients are needed. The minimum amounts of recommended nutrients for meat chickens of various ages and layers are summarized in Table 1. Different classes of poultry must be fed various sorts of diets in order to satisfy these particular requirements (Ravindran, 2013). An appropriate quantity of water, vitamins, minerals, and enough protein and carbs are needed to raise healthy chickens (Bessei, 2006). Balanced poultry feeding is the one that contains nutrition elements in the right quantities and proportions that meet the need of poultry, thus before preparing poultry feeding, we must know the bird's need for energy, protein, vitamins, and minerals. Economic factors must be taken into consideration when taking feeding.

Prepare balanced feeding with the lowest cost. Grains (wheat, barley, yellow corn, etc.) are the main carbohydrate sources in poultry feeding because they contain a high percentage of starch that poultry can digest efficiently. Yellow corn and wheat are mostly used in poultry feed because they have high levels of energy. There are two natural protein sources (herbal and organic). Grains are low in protein quantity and quality. They lack some amino acids. Soybeans represent the best herbal protein source in poultry feeding because they contain necessary aminic acids abundantly due to the low nutritional value of herbal protein in grains, it’s necessary to get protein from other sources. Usually using concentrated protein substances of organic origin like wastes of meat of livestock, poultry and fish, blood and feather powder, and milk powder. We can also add a mix of salts and vitamins, a source of calcium and phosphorus is table salt (calcium stone and table salt) (Kougias *et al.,* 2013).

Table 1. Shows The Suggested Minimum Nutrient Requirements for Meat and Laying Hens Per Kilogram of Feed (90 Percent Dry Matter).

		Meat chickens			Laying hens
Nutrient	Unit	0–3 weeks	3–6 weeks	6–8 weeks	
Metabolizable energy	kcal/kg	3 200	3 200	3 200	2 900
	MJ/kg	13.38	13.38	13.38	12.13
Crude protein	%	23	20	18	15
Amino acids					
Arginine	%	1.25	1.10	1.00	0.70
Glycine + Serine	%	1.25	1.14	0.97	-
Histidine	%	0.35	0.32	0.27	0.17
Isoleucine	%	0.80	0.73	0.62	0.65
Leucine	%	1.20	1.09	0.93	0.82
Lysine	%	1.10	1.00	0.85	0.69
Methionine	%	0.50	0.38	0.32	0.30
Methionine + Cysteine	%	0.90	0.72	0.60 0.58	0.58
Phenylalanine	%	0.72	0.65	0.56	0.47
Phenylalanine + Tyrosine	%	1.34	1.22	1.04	0.83
Threonine	%	0.80	0.74	0.68	0.47
Tryptophan	%	0.20	0.18	0.16	0.16
Valine	%	0.90	0.82	0.70	0.70
Fatty acid					
Linoleic acid	%	1.00	1.00	1.00	1.00
Major minerals					
Calcium	%	1.00	0.90	0.80	3.25
Chlorine	%	0.20	0.15	0.12	0.13
Non-phytate phosphorus	%	0.45	0.35	0.30	0.25
Potassium	%	0.30	0.30	0.30	0.15
Sodium	%	0.20	0.15	0.12	0.15
Trace minerals					
Copper	mg	8	8	8	-
Iodine	mg	0.35	0.35	0.35	0.04
Iron	mg	80	80	80	45
Manganese	mg	60	60	60	20
Selenium	mg	0.15	0.15	0.15	0.06
Zinc	mg	40	40	40	35

Source: National Research Council (1994).

Ingredients In Poultry Feed

Poultry feeding represents highest cost in producing poultry process. Constitute about 60-75% of total cost from hatchlings till marketing. Thus, principle in producing is to build feeding in lowest prices to get lowest cost of feeding used to realize revenue in production process. Aim of nutrition is to provide poultry body with food used to get energy, build body tissues, and renew them preserve body cells and fluids in coordinated stillness. Carbohydrates represent basic source of energy in poultry feeding. Body uses aminic acids in feeding protein after digesting in building protein tissues. To release energy from food and build body proteins vitamins and minerals must exist (Myszograj, 2012).

1. Energy

Protein, fat, and simple carbs are all sources of energy for poultry. They can't digest and use several types of complex carbohydrates, such fiber, hence feed formulation should be done using an energy-based strategy. The traditional unit of measurement for the amount of energy present in feed ingredients and the needs of poultry is called "metabolizable energy" (ME). This accounts for the energy losses in the pee and feces. When the food contains enough of the other necessary nutrients, birds eat solely to meet their energy needs. Therefore, a key factor affecting the amount of energy used by poultry is the diet's energy content. Varied kinds of chickens require varied quantities of energy for metabolic reasons, and a deficiency will influence productive performance. When the dietary energy level changes, the feed consumption will alter. (Ravindran, 2013).

2. Protein and amino acids

For the synthesis of egg protein as well as for the maintenance and growth of muscles, dietary protein serves as a supply of amino acids. The 20 amino acids required for the synthesis of protein in eggs and muscles are all biologically required. Ten of them are categorized as essential dietary components because they are either completely absent or produced too slowly to satisfy metabolic needs. They must be included in the diet. Other amino acids can be used to synthesize the balance; these are referred to as dietary non-essential ingredients and are not need to be taken into account when formulating feed. However, from a physiological perspective, all 20 amino acids are necessary for the body to synthesize the various proteins. Lysine, methionine, threonine, tryptophan, isoleucine, leucine, histidine, valine, phenylalanine, and arginine are the necessary amino acids for poultry. Some people also believe that glycine is crucial for young birds. Because methionine and phenylalanine can be used to make cysteine and tyrosine, respectively, these amino acids are regarded as semi-essential. The three limiting amino acids in the majority of poultry diets are lysine, methionine, and threonine (Ravindran, 2013).

3. Fats and fatty acids

In order to reach the required nutritional energy concentration, poultry diets typically incorporate fats due to the higher energy density of fat compared to carbs and protein. The majority of realistic diets contain between 3 and 5 percent fat. Additional advantages of employing fats include greater palatability of diets and better dust management in chicken houses and feed mills. Although there is no established requirement for fats as a source of energy in poultry, linoleic acid has been shown to be necessary. The only necessary fatty acid that hens require is linoleic acid, and practical diet-fed birds rarely show signs of insufficiency in this nutrient. Egg size is the primary effect of linoleic acid in laying birds (Ravindran, 2013).

4. Mineral

The creation of the skeletal system, general health, general metabolic activity, and preservation of the body's acid-base balance all depend on minerals. Along with sodium, potassium, chloride, sulfur, and magnesium, calcium and phosphorus are considered macro-minerals since they are the most prevalent mineral components in the body. Macro-minerals are substances that must be consumed in diets at amounts greater than 100 mg/kg. For the development and upkeep of the skeletal system as well as for the production of eggs with acceptable shell quality, calcium and phosphorus are essential (Ravindran, 2013).

5. Vitamins

Vitamins are divided into water-soluble (vitamins B complex and C) and fat-soluble (vitamins A, D, E, and K) groups. All vitamins, with the exception of vitamin C, must be consumed through food. Since it can be produced by birds, vitamin C is often not regarded as a dietary necessity. However, dietary vitamin C supplements may be helpful in challenging situations like heat stress. Compared to other nutrients, vitamins have more intricate metabolic functions. Vitamins are players or mediators in all of the body's metabolic pathways, not just simple body-building components or energy sources (Ravindran, 2013).

6. Water

Animal productivity and a number of physiological processes depend on water (El Sabry *et al.,* 2023). The most crucial but frequently ignored component in poultry nutrition is water. Almost every physiological function of the bird is influenced by water. (1) The digestion of feed requires a steady stream of water. (2) Nutritional absorption. (3) The elimination of waste. (4) Controlling one's body temperature. About 80% of the body is made up of water. In contrast to other animals, chickens constantly eat and drink. Even a brief water shortage has an irreversible impact on their ability to produce and thrive. Therefore, water must always be accessible. The amount of feed consumed and the rate of growth are closely connected. It is challenging to pinpoint a bird's exact water needs because they depend on a number of variables, including the environment, the bird's age, and its physiological condition. In most cases, it is believed that water consumption will be twice as great as feed intake. Drinking water should be between 10 and 25 °C in temperature. Consumption will decline at temperatures over 30 °C.

Water quality is similarly crucial; poor water quality can result in low productivity and significant financial losses. Water is the perfect carrier for impurities like chemicals and minerals as well as the growth of dangerous bacteria. In dry and semi-arid areas with limited water supplies, water quality for poultry can be a significant problem. Particularly, the subsurface water in these regions sometimes contains a lot of salt. Birds can handle saline drinking water with less than 0.25 percent salt, however limiting water intake can result in sodium poisoning (Ravindran, 2013).

Feeding Additions

Feeding additions are all nutritional and non-nutritional materials added to feeding mix in relatively small portions such as (vitamins, mineral salts, aminic acids, anti-fungal, anti-coccidia, anti-oxidants biotics and enzymes, etc.) there are other additions like critics and alics (such as citric acid – formic – sorbic). Function of these additions makes up for lack of acidity in stomach, decrease stomach acidity and acidity, and digestive system. Raise production of pepsin enzyme to digest protein, increase time of food spent inside stomach, for more suction, to malfunction work of sickening germs, stop their growth and multiplying in stomach. To give animal immunity enhances production of saliva. As a result, increase consumption of feed and growth (Altalb & Batkowska, 2023). Since the 1970, antibiotics have been added to chicken feed as a supplement to promote growth and preserve the birds against the harmful effects of pathogenic bacteria. In response to worries about the development of widespread antibiotic resistance in human diseases, the European Union prohibited antibiotics in 2006. To sustain the best chicken production (Sabir *et al.*, 2023). Many researchers are still interested in finding alternatives to the traditional sources used in chicken feeding, particularly since the cost of the diet is largely derived from the fodder materials represented by grains and protein concentrates. In order to replace the primary sources of grain, such as yellow maize and wheat, when they become rare on the market, it is, therefore, necessary to look for alternatives that are readily available. In order to partially or totally replace the primary sources in a useful and practical manner, an integrated nutritional evaluation of non-traditional fodder alternatives must be completed (Al-Shemmari, and Almashhadani, 2023).

One of the key elements that have a big impact on how well broilers function during the summer is the heat (Dalolio *et al.,* 2021). It also results in a greater requirement for vitamins, minerals, and amino acids including methionine, lysine, and threonine. A sufficient supply of amino acids is therefore necessary for the production of proteins involved in a variety of physiological activities, including signal transduction, hormone signaling, cell structure, and antioxidant systems, in order for broiler growth rates to be maintained under heat-stress conditions. In order to reduce the heat stress caused by high environmental temperatures in broiler production, nutritional and management therapies can be implemented (Maharjan, 2020).

Natural Feed Additives to Poultry Feeding

Producers of poultry are looking for alternatives to antibiotics, which have the potential effects to reduce the enteric pathogen bacteria and ability to enhance growth performance in birds, and reduce contamination of poultry meat (Ocak *et al.*, 2008). Plant-based feed additives are often known as phytogenic or phytobiotic substances. Antibiotics could be replaced with herbs in poultry diets because of their antibacterial properties. A wide range of plants' bioactive components have antibacterial properties (Cross *et al.,* 2007). Windisch & Kroismayr (2006) outlined plant-derived foods that poultry added to their diets to increase productivity. According to various researchers, adding medicinal and aromatic plants to broiler diets has been linked to gains in body weight, weight gain, feed conversion efficiency, and feed costs (Sabir *et al.,* 2023).

Herbs and substances of plant origin (garlic, oregano, thyme, anise, rosemary, and cinnamon) are defined as photobiotic or botanical natural feed additives. Numerous studies on such substances in poultry production have shown more beneficial effects such as antimicrobial, antiviral, antioxidant, and enhancing gut function (Mohamed and Hassan, 2023). Natural plants taking the interest are given pollution-free, safe, and natural additives to feeding. Feedings in turn act like natural alternatives for antibiotics because they have good features, in toxic, chemical residues free, increase appetite, and enzymes of the digestive system produce antibiotics as well as antigerm, anti-virus, and anti-oxidants. The main effect of herbal additives comes from a good effect on the microbial environment of the digestive system, to control potential causes of diseases. improvement of digestion in intestines to suck main nutrients allowing poultry to grow faster, lessen harmful microbes inside intestines, decrease intestines' diseases, to achieve the most benefit of food for the bird. Using some plants like coriander and kurkomic helped to enhance the microbial environment by decreasing harmful microbes and increasing good ones (Fanatico, 2005).

Azolla is a small-leaf floating fern. Is commonly found in stagnant or slow-moving water in ponds, lakes, marshes, swamps, and streams (Taghilou *et al.,* 2023). The aquatic and floating fern Azolla belongs to the Azollaceae family. It has a crude protein content of 25–35%, 10-15% minerals, and 7–10% amino acids, particularly lysine (El-Ghany, 2020). Due to its protein, crude fiber, and mineral content, Azolla can be used as a bio-fertilizer or as a feed supplement for aquatic and terrestrial animals. Azolla grows in natural water bodies to form a mat that can help reduce the evaporation of water from them, making water available year-round (Jayasundara, 2022).

Azolla can increase growth performance in poultry by up to 5% when added to their diet (Shambhvi *et al.*, 2021).

Importance Of Vegan Additives to Poultry Feeding

Additives showed effects on growth such as: increase amount of consumption for the bird, improve functions of intestines, and enjoying food. This positive effect of vegan additives is attributed to improving tasting food due to scent and flavor not to mention the good effect over discharges of the digestive system like digestive enzymes and bile gall. Positive effects include passing time, amount swallowed, and digestive discharges promoting activity of the digestive system. All these effects will increase and develop digestion. Vegan additives promote the efficiency of tricin, Lipin, and amiliz enzymes in table poultry (Hasan 2001). Vegan additives have effects on the mucus of intestines in chickens like the balance of microbes, some morphological changes like an increased amount of velvets in the intestines and colon, keep intestines healthy a basic condition to achieve perfect performance and revenue in broiler and egg poultries in addition to strategies of perfect feeding.

Some vegan additives helped in improving the taste of feeding consequently improving in productivity of poultry. Vegan additives make feeding safe by decreasing diseases in the digestive channel thus improving the microbic environment of intestines which can decrease in turn pollution of slaughtering. Natural additives play an important rule in egg production in quantity and quality some natural additives were used to produce eggs rich in some important ingredients like omega-3 to lessen harmful cholesterol. All this reflected positively on consumers. Some natural vegan additives like the Buka plant and some essential oils decrease the emission of ammonia and nitrogen thus preserving the environment, lessening pollution, and achieving goals of sustainable development (Kelleher *et al.*, 2002).

Researchers and experts are working to increase the perseverance and lengthen the productive life of the laying poultry flocks by finding and developing modern crosses for laying hen breeds, using balanced feed rations, and using feed additives that promote the health and production of this poultry, particularly the additives affecting the improvement of the environment and health of the alimentary canal in order to increase the economic return (Nevling, 2018). According to Ali *et al.* (2020) that one of the most important new challenges in the poultry industry is the search for natural additives to water and feed in order to improve the productive efficiency of poultry, especially in light of the European Union's 2006 ban on the use of antibiotics that stimulate growth, and among these additions are mineral elements, which are essential nutrients for growth And the production of domestic birds, including selenium, is one of the rare mineral elements of high importance for human and animal health, as it is considered one of the very important elements for a healthy immune system and a good immune response, as it has a role in increasing the immune susceptibility of the body, and that food rich in selenium leads to strengthening the immune response in poultry, and that Recommendations for the concentration of selenium in broiler diets 0.15 ppm, noting that toxic concentrations in the range of 10 - 20 mg / kg feed work to reduce growth and hatching rate, and the most important sources rich in selenium are walnuts, nuts, seafood, meat, poultry and grains.

Indicated Sabir *et al.* (2023) to the Peppermint one of the oldest medicinal plants in the world and a member of the Labiatae family. It is frequently utilized in herbal treatment and is thought to be very helpful in boosting immunity and battling secondary infections. The main treatment properties of mint's leaves derive from the plentiful menthol, which is the primary phenolic compound with antibacterial properties. Peppermint contains polyphenolic compounds and hence could possess strong antioxidant properties. Basil (*Ocimum basilicum* L.), also known as sweet and garden basil, is a plant that is widely grown in the Mediterranean region. Basil, also known as Rehan in Arabic, is a member of the Lamiaceae plant family and contains essential oils that are high in phenolic compounds, polyphenols like flavonoids, and anthocyanins.

The research conducted by Hussein (2021) indicated that peppermint has a high protective efficacy against the intestinal health and deteriorating performance of broilers with coccidiosis. Sabir et al. (2023) in study to investigate the possible effects of different herbal plants as feed additives on the performance and quality of meat of broilers, to that an investigated peppermint and basil leaf contains different active compounds, such as tannins, flavonoids, glycosides, saponin, steroids and terpenes. For the forty-nine-day experimental period, a number of 600-day-old broiler chicks (Ross 308 strain) were randomly divided into four treatments with five replicates and 30 chicks in each replicate. The dietary treatments were created as follows: control (T1), standard diet; (T2), standard diet with 1% peppermint; (T3), standard diet with 1% basil; and (T4), standard diet with a mixture of 0.5% peppermint and 0.5% basil. According to the study's findings, compared to the control group, basil and the combination of two additions resulted in the best live body weight and weight gain. At the conclusion of the trial period, the boiler's feed intake, feed conversion ratio, carcass weight, and meat quality showed no discernible variations. According to the results of the current study, broilers that are fed peppermint, basil, or both tend to grow faster and have better feed conversion ratios, though not statistically.

Ali & Rebh (2020) conducted a study In order to ascertain the impact of adding a synergistic mixture of cumin and thymus powder to broiler diets and to ascertain their impacts on various blood parameters and broiler production performance. Ross-308 broiler chicks, which are 240 days old, were placed into 4 groups, each with 60 chicks, for each treatment. Each treatment's chicks were separated into three groups of 20 each. The treatments included (T1) a regular diet given without any additions, (T2) a regular diet given with additions, (T3) a regular diet given plus 1g of thyme per kg of feed, and (T4) a regular diet given plus 1g of cumin plus 1g of thymus per kg of feed. Blood was also taken during the experiment and at the ages of 3 weeks and 6 weeks. Up until the point of commercialization, the production characteristics are calculated every week. The productivity features, which comprised body weight and feed consumption, revealed a substantial improvement (P 0.01), the weight gain and food conversion ratio were between $P<0.05$ to P 0.05. Improvements to the glucose and protein levels, as well as ongoing advancements in the experimental variables for the activity of the liver enzymes under investigation including ALP, AST, and ALT have all improved the blood's properties. Consequently, it can be inferred that the addition of these medicinal herbs alone or chicken meat has clearly improved the majority of the productive and biochemical traits. As a result, it can be introduced as one of the significant food additives to enhance the productive and physiological performance of birds.

Al-Dadhli *et al.* (2020) study looked at the productivity of broilers to determine the impacts of adding green tea as an antioxidant. 100 unsexed, one-day-old Ross 308 chicks with an initial average body weight of 41g each were used in this study. The chicks received five treatments at random, and each treatment was then split into two replicates (10 chicks each). The treatments: T1 (control) was the only treatment; T2, T3, T4, and T5 each had 0.25, 0.50, 0.75, and 1% of green tea added, respectively. In comparison to control, all additive treatments significantly improved (p 0.05) live body weight, weight gain, and feed conversion ratio, according to the study's findings. While accumulative feed consumption significantly decreased across all treatments when compared to control.

Study from Al-Sofee & Yonis (2020) undertaken in the chicken farm to find out how adding thymus vulgaris powder to the diets affected the laying quail's reproductive and productive performance. Coturnix 90 Day old unsexed quail were randomly divided among four treatments, each with four replicates and nine birds six female and three male in each replicate, first, a basic diet without any additions served as the control. Dietary supplements of Thymus vulgaris Powder at concentrations of 0.5, 1, and 1.5% were used as the second, third, and fourth treatments, respectively. When comparing the third and fourth treatments to the control, statistical analysis of the data revealed a substantial improvement (p 0.05) in the total number of eggs, average egg weight, hen day productivity, and feed conversion ratio (g feed / g eggs). Additionally, there was a notable increase in daily and total egg mass in treatments 2, 3, and 4 as compared to control. There is no discernible change in live body weight, average body weight gain, feed intake, the ratio of feed to egg (g feed / g egg), mortality rate, fertility rate, hatchability rate from total and fertile eggs, and embryo mortality.

In study Dhiab & Al-Saadi (2021) about the impact on the egg quality traits of aged laying chickens, brown Lohmann, of adding tartaric and salicylic acids alone as well as a combination of water and food. The quality of the eggs produced degrades as the birds advance in their productive lives and reach their peak production, and the reason is that the body organs, especially those involved in the production of the eggs and represented by the activity of the digestive and reproductive systems, are subject to fatigue. Tartaric and salicylic acids, which are regarded as natural organic acids, are two of the organic acids utilized as feed additives. Many fruits, including grapes, bananas, and tamarind, contain tartaric acid, an aliphatic acid that is thought to have antibacterial properties. Salicylic acid is a type of aromatic acid that is present in willow plants. It is regarded as an anti-inflammatory and an antipyretic.

Used 210 laying chickens that were 60 weeks old. The experiment's 112 days (16 weeks) of running time were divided into four equal periods of 28 days each, distributed equally among 21 ground hens, 10 laying hens for each hen, and dispersed among seven treatments, each of which had three replications, T1 was given a standard diet with no supplements (control), T2 was given a standard diet with 0.2% tartaric acid and water, T3 was given a standard diet with 0.2% salicylic acid and water, T4 was given a standard diet with 0.4% tartaric acid and water, T5 was given a standard diet with 0.2% tartaric acid in the diet, T6 was given a standard diet with 0.2% salicylic acid in the diet, and T7 was given a standard diet supplemented with 0.4% a mixture of tartaric and salicylic acid in the diet. The addition of the two acids to the water and feed significantly improved the shell weight, shell thickness, albumin height, albumin weight, Haugh unit, rate of yolk height, and yolk weight, resulting in a significant improvement (P 0.01) in the quality characteristics of the eggs produced. When compared to the control treatment, the yolk diameter was significantly smaller for the addition coefficients.

Wasman (2022) stated L-Threonine "is often the third limiting amino acid, and it is important for gut health, morphology, and function, as well as the optimal utilization of total sulfur amino acids and lysine, immunity, carcass traits, structural protein synthesis, antibody, uric acid, and pancreatic enzymes, intestinal barrier maintenance, and mucin synthesis. The intestinal mucosa is protected by the mucus layer, which contains mucins, and glycoproteins that need Threonine for production". Threonine supplementation increased body weight, feed conversion, and dressing percentage in broiler animals. According to a paper, "threonine supplementation for the first 42 days improved Feed Conversion in broiler" and based on NRC (1994), the diet must contain 0.48% threonine.

Wasman (2022) discovered in a study carried out between July 7 and August 17, 2021, to ascertain the impact of L-Threonine supplementation on a number of productive and physiological aspects. 200 broiler chicks were randomly divided into five treatments under heat stress (36.04 2 °C): T1 control treatment, T2, T3, T4, and T5 standard diet with L-Threonine 250, 500, 750, and 1000 mg/kg, respectively. The results demonstrated that the addition of L-Threonine to the diet enhanced broiler production under heat stress conditions. For example, body weight increased significantly (P 0.05) in T3 and T5 to reach 2187 and 2235 g, respectively, from 2145 g in T1, and the H/L ratio decreased in T4 and T5 compared with T1. Effects on physiological traits like red and white blood cell count, hematocrit, cholesterol, glucose, total protein, and others were not affected.

Experiment was carried out by Jabr & Ibrahim (2020) to evaluate the effects of red ginseng roots (Panax ginseng) alcoholic extract on female Japanese quail characteristics related to egg production and quality as well as chemical analysis. 180 female birds altogether, 6 weeks old, were employed. They were randomly assigned to four treatments, each with three replicates and 15 birds each. The 8-week experiment involved raising the birds in four floor batteries. The experimental treatments were 0, 50, 75, and 100 mg/L of water for the T1, T2, T3, and T4 groups, respectively. Plant roots were chemically analyzed, and the amounts of saponins, flavonoids, alkaloids, terpenes, and tannin were estimated. Analysis of a plant root alcohol extract revealed the presence of phytochemicals such as saponins, flavonoids, alkaloids, terpenes, and tannins. At the age of 9 weeks, there was a substantial (P0.05) increase in the rate of egg production in T2. A significant ($P \leq 0.05$) was found in egg weight in T3 at ages 7, 9, 12 and 13 weeks in comparison with T1, T2 and T4, while T2 and T3 was significantly increased compared to T1 at age of 8, 11 weeks. In terms of the egg's qualitative characteristics, the rate of relative weight of albumin was substantially higher in T3 and T4 than in T1 and T2, although the rate of relative weight of egg yolk was significantly higher in T1 and T2 (P 0.05). While T3 grew in rate of Haugh unit compared to other experiment treatments, T1 increased in rate of relative weight of egg shell compared to T2, T3, and T4. In general, we can say that ginseng additions of 50 and 75 mg/ml drinking water had the best outcomes.

According to some studies, potato peels may be used in small amounts in the diets of broiler chickens due to their favorable qualities that encourage their inclusion in the diets due to the significant nutrients they contain, as it contains energy represented by (2043 kcal/kg) and crude protein 10.5%. Contains a number of important amino acids, including lysine and methionine (Al-Ani, 2018).

Nontraditional Feedstuffs in Poultry Feed

Feed manufacturers have constantly looked for alternative, highly nutritious, and affordable feed components (Ghayas *et al.,* 2023). The term "nontraditional feedstuffs" refers to feed substances that haven't been used in chicken diets in a traditional or commercial way. Soybean meal and yellow maize have the ability to completely or largely replace the non-traditional feedstuffs in chicken meals. Soybean meal and yellow maize are common feedstuffs in chicken feeds due to their high nutritional levels. Furthermore, other animals place a significant demand on these two dietary elements. Currently, attempts are being conducted worldwide to replace soybean meal and yellow maize in monogastric animals like poultry with alternate sources of protein and energy (Alshelmani *et al.,* 2021.

It is common knowledge that some developing nations produce a significant amount of alternative feedstuffs, including wheat bran, rice bran, cotton seed meal, copra meal, and palm kernel cake, which are classified as agricultural waste byproducts. Many of these agricultural waste by-products, however, contain anti-nutritional elements including nonstarch polysaccharides (NSPs) such xylan and mannan. According to research, NSPs are the primary cause of the birds' small intestines becoming more viscous, which raises the moisture content of their excreta. Consequently, the health and productivity of the hens may be impacted. As a result, there are restrictions on using these agricultural waste byproducts in poultry feed (Alshelmani *et al.,* 2016).

Alternative Feeds for Yellow Corn

In the diets of chickens, yellow corn serves as a major source of energy (Alshelmani *et al.,* 2016). Yellow maize can be replaced in the diet of chickens with a few non-traditional feed components. There are several restrictions, however, including the existence of antinutritional substances that lower feed intake and growth performance (Table 1). The availability of these nutrients and their composition are unknown because there aren't any research facilities in developing nations, which limits the utilization of these feeds (Alshelmani *et al.*, 2021).

Table 2. Alternative energy sources that can be used in place of yellow corn in chicken diets.

Ingredient	Limitation
Sorghum	high level of tannins
Wheat bran	Low metabolizable energy and high fiber content
Distillers dried grains with solubles (DDGS)	Variability and availability of nutrients
Date wastes	Date pits have a high fiber content, little lysine, methionine, leucine, or isoleucine.
Millets	High fiber and tannins

Source: Alshelmani et al. (2021).

Alternative Feeds for Soybean

Soybeans are frequently utilized as the primary source of protein in poultry diets (Leeson & Summers, 2005). Certain amounts of soybean meal in the diets of chickens can be replaced by several non-traditional feed components. There are some restrictions, though, like the existence of anti-nutritional substances that lower feed intake and growth performance (Alshelmani *et al.*, 2021), (Table 3).

Table 3. Other sources of protein for soybean meal in chicken's diets

Ingredient	Limitation
Canola meal	Presence of glucosinolates, senapine, phytate, fibers, tannins, and low metabolizable energy
Peanut (groundnut) meal	Trypsin inhibitors, potential aflatoxin contamination
Peas	Lack of sulfur-containing amino acids, and moderate energy levels
Lupins	High fiber, low metabolizable energy
Sesame meal	High levels of phytate
Blood meal	Palatability and low growth rate
Palm kernel meal	High fiber, coarse texture, and high NSPs
Cottonseed meal	High fiber, gossypol, dry and dusty nature, phytate, sterculic acid
Feather meal	Low in amino acids availability
Insects and worms	Microbial deterioration and lipid oxidation during storage
Earthworms	High fat (PUFA), and lipid oxidation during storage
Algae	High fat (PUFA), and lipid oxidation during storage
Azolla	High fiber content
Single–cell protein	High fat (PUFA), and lipid oxidation during storage

Source: Alshelmani et al. (2021)

Using Copper Nanoparticles as A Replacement Feed Addition in The Poultry Diets

Trace elements are necessary dietary components that organisms need to consume only in very small amounts (Brugger *et al.,* 2022). Specific trace element concentrations within the organism are typically least from 50 mg/kg BW, in contrast to macro elements, with the exception of iron (National Research Council, 2005). Generally, blende into the compound feed in the form of inorganic or organic materials. During the past years, also special physically processed forms have been put on the market, the most prominent of which are nanoparticles of common sources (such nano ZnO). In the European Union, feed additives require the authorization in accordance with Regulation (EC) No. 1831/2003. The approval process should guarantee that a feed additive is safe for the environment, the animal, the people handling the product, and anybody who consumes products made from animals. (Brugger *et al.*, 2022).

Animals need the trace element copper (Cu), but because it cannot be stored by the body, it must be taken as a regular food supplement. Additionally, feed ingredients frequently lack copper, thus commercial diets should supply the necessary quantity of copper in a biologically active form, which depends on the physical and chemical characteristics of the supplement form that the copper is provided in (European Commission, 2003). The primary source of copper in the diets of chickens and other animals is copper sulphate (CuSO4); nevertheless, the inorganic salt exhibits poor bioavailability due to the presence of components that can block absorption. As a result, adding inorganic minerals to animal feed puts the ecosystem at danger since increased mineral excretion taints the land and water (Bao & Choct 2009).

To boost bioavailability and absorption of Cu and prevent negative effects on the health and performance of hens, attempts have been made to locate substitute sources of the mineral (Scott *et al.,* 2017). The commercial usage of nanosized minerals, which have lately been employed as a tool in the disciplines of biology, biotechnology, mineral nutrition, physiology, reproduction, and pharmacology in animals, has been modernized by the development of nanotechnology (Peters *et al.*, 2016). According to Feng *et al.* (2009) nanoparticles are defined as particles with a size of 1-100 nm in which the physical, chemical, and biological properties of materials are fundamentally different from those of their bulk form. Additionally, their diminutive size boosts the efficacy of the active substances and may result in a reduction in the amount applied (Sri Sindhura *et al.*, 2014).

Due to their high electrical and melting points, minimal electrochemical migration behavior, high bioavailability, and comparatively inexpensive production costs, Cu nanoparticles (Cu-NP) have recently attracted a lot of attention (Tamilvanan, 2014). Cu-NP has a smaller size and more surface area than the bulk material, which improves thermoconductivity and fluid viscosity and opens up a wide range of applications, including chemosensors, surfactants, and antimicrobials (Boyles *et al.,* 2015). In addition to lowering the pathogen load to enhance health and decrease Cu excretion into the environment, the main goal of utilizing Cu-NP as feed additives in chickens is to increase growth and performance. Cu-NP is biologically more active than bulk Cu due to their tiny size and high surface-to-volume ratio, which allows for more effective interaction with biological processes and may reduce the quantity of Cu needed in the diet without having a negative impact on chicken performance or the environment.

The majority of research has highlighted the advantages of Cu-NP as a feed supplement for poultry and other animals in terms of performance, antibacterial activity, and immunological state. Additionally, a lot of research has been done on the synthesis and stability of Cu-NP. To get the most out of Cu-NP and prevent any potential hazardous consequences, it is crucial to manage the size and concentration. To describe the effects of Cu-NP on gut microorganisms and metabolite synthesis, more research should be done. Before there may be widespread adoption, more toxicological, histology, and residue analyses of Cu-NP in the body and excrement should be conducted. Cu-NP integration in animal nutrition, which can improve animals' health and performance, ought to be done with less danger to consumers. To prove the safety of using Cu-NP in animal nutrition, however, and prevent any harm to animals, the environment, and people, more research is still needed (Scott *et al*, 2017).

Conclusion

By using balanced feed rations and feed additives that promote the health and production of the poultry, particularly those that improve the environment and health of the alimentary canal, it is important to the Improve the quality and increase of feedand lengthen the productive life of the poultry in order to increase the economic return of these herds. The usage of alternative feedstuffs in the chicken business will increase because of their high nutritional value and affordable cost as a source of protein and energy. These unconventional feedstuffs also don't compete with people.

Conflict of Interest

No conflict of interest

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