Int.J.Curr.Res.Aca.Rev.2026; 14(2): 59-72

EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 (Online) Volume 14 Number 2 (February-2026)

Journal homepage: http://www.ijcrar.com

doi: https://doi.org/10.20546/ijcrar.2026.1402.008

# Chemical Composition and Nutritional Value of Commercial Poultry Compound Feed Produced In Ethiopia: Review

**Teshome Werku***

*Oromia Agricultural Research Institute at Bako Agricultural Research Center, Ethiopia, Haramaya University, Ethiopia*

**Corresponding author*

## Abstract

Poultry production is a key component of Ethiopia's agricultural economy, contributing significantly to food security, income generation, and rural employment. The industry covers a wide range of production strategies, from small backyard operations using native chickens to large commercial enterprises using exotic poultry breeds for increased productivity. As the demand for poultry products increases, commercial compound feeds that are nutritionally balanced are becoming increasingly important. The aim of the review is to review the nutritional value and chemical composition of commercial poultry feeds produced with a focus on feeds for broilers and layers. These feeds are specifically designed to meet the diversity of poultry's particular physiological requirements. Broiler feeds are high in protein (20–23%) and metabolizable energy (2800 3200 kcal/kg) to promote rapid growth. With a focus on diets for broilers and layers, this course investigates the nutritional value and chemical composition of commercial poultry feeds produced in Ethiopia. Layer feeds are designed for egg production and have moderate protein levels (14–16%) and high calcium content (3.5–4.5%) for eggshell quality, while broiler feeds have high protein (20–23%) and metabolizable energy (2800–3200 kcal/kg) to support rapid growth. Energy sources like maize and wheat, as well as protein sources like fishmeal, soybean meal, and noug cake, are the main components of Ethiopian poultry feeds. The nutritional value of poultry feeds varies greatly, though, mostly as a result of variations in feed processing, manufacturing techniques, and ingredient quality. The health and productivity of poultry can be impacted by this variability, which can also affect the digestibility and bioavailability of important nutrients. The seminar identifies several feed quality issues, such as inconsistent sourcing of ingredients, differences in feed formulation, and a dearth of standardized quality control procedures. Reduced feed efficiency, poor poultry health outcomes, and decreased productivity can all be caused by these problems. The seminar also emphasizes how crucial it is to comprehend feed composition since it is necessary to raise poultry productivity and guarantee the long-term viability of Ethiopia's expanding poultry industry.

## Article Info

*Received: 28 December 2025*
*Accepted: 30 January 2026*
*Available Online: 20 February 2026*

## Keywords

Commercial poultry feed, Broilers, Layers, Crude protein, Metabolizable energy (ME) and Feed ingredients.

## Introduction

Ethiopia is home to numerous livestock species and is naturally endowed with various agroecological zones and favorable environmental conditions. Poultry is the largest group of livestock species, accounting for over 30% of all animal protein consumed worldwide (Alemneh and Getabalew, 2019). According to Urgesa, (2023), the proportionate share of poultry in global animal protein production was expected to rise to 40% by 2020, with the developing world experiencing the largest increase. Poultry production also plays a significant role in Ethiopia's agricultural sector, contributing to food security, income generation, and employment opportunities (Fekadu *et al.,* 2023)

Ethiopia's indigenous poultry production system is an essential component of the country's farming system. It is characterized by small flocks, low input, and an unstructured marketing system (Yadessa *et al.,* 2017). The production systems are classified as traditional family poultry production, improved family poultry production, and specialized poultry production based on purpose, flock size, and composition, as outlined in the Livestock Master Plan (LMP). Indigenous chickens are the predominant poultry species in Ethiopia, with the emerging practice of managing commercial lines (Fekadu *et al.,* 2023)

The nutritional value of commercial poultry compound feeds varies significantly across different poultry types, such as broilers, layers, and turkeys. These variations are driven by the specific nutritional requirements of each bird type, which are influenced by factors such as growth rate, egg production, and metabolic demands. Compound feeds for poultry generally consist of a mix of various ingredients such as cereals, soybean meal, fish meal, and other protein-rich components, combined to meet the nutritional requirements of poultry. The high energy content in formulated feeds is primarily due to substantial lipid and carbohydrate levels (Ky *et al.,* 2023). These feeds are designed to provide not only energy but also essential amino acids, vitamins, and minerals necessary for maintaining health and productivity (Ebsa *et al.,* 2019).

Broilers are meat-type chickens raised for rapid growth and high feed efficiency. Their dietary requirements are optimized for muscle growth and energy utilization. Commercial broiler feeds are typically formulated with high levels of protein, energy, and essential amino acids to support rapid growth rates (Hascik *et al.,* 2010). For instance, corn is noted for its high digestible energy (DE) content and palatability, making it highly favorable in broiler diets (Ky *et al.,* 2023). Broiler feeds typically contain 20–23% crude protein, with a focus on essential amino acids like lysine, methionine, and threonine to support muscle growth (Yu *et al.,* 2024). Metabolizable energy (ME) levels range from 2800 to 3200 kcal/kg, with higher energy diets promoting faster growth and better feed conversion ratios (FCR) (Yu *et al.,* 2024). FCR is a critical parameter for broilers, with optimal values ranging from 1.5 to 2.0. Diets with higher digestibility and lower fiber content tend to improve FCR (Ru *et al.,* 2003). Enzyme supplements, such as phytase and xylanase, are often added to improve nutrient digestibility and reduce anti-nutritional factors in plant-based ingredients (Mohamed *et al.,* 2024).

Layers are egg-producing hens that require diets optimized for egg production and egg quality. Their feeds are formulated to provide adequate calcium, phosphorus, and protein to support eggshell formation and yolk development. Layer feeds typically contain 14–16% crude protein, with a focus on essential amino acids like lysine and methionine to support egg production (Akinola and Ekine, 2018). Layers require high levels of calcium (3.5–4.5%) and phosphorus (0.8–1.2%) to maintain eggshell quality and bone health (Akinola and Ekine, 2018); Kodani *et al.,* 2022). Metabolizable energy levels range from 2600 to 2800 kcal/kg, focusing on maintaining egg production and reducing feed costs (Akinola and Ekine, 2018). Feed additives, such as vitamin D and zinc, are often included to improve eggshell strength and yolk color (Kodani *et al.,* 2022); (Leke *et al.,* 2024).

Soybean meal and canola meal are predominant protein sources for providing essential amino acids. Soybean meal, in particular, contains approximately 44–48% crude protein and is high in essential amino acids necessary for chicken growth (Ebsa *et al.,* 2019). Fishmeal is another valuable protein source, offering high-quality protein and omega-3 fatty acids (Khudaer, 2024). The addition of fats, such as vegetable oils or animal fats increases the energy density of the feed. The lipid content generally varies from 5–7%, providing essential fatty acids required for optimal growth and reproduction (Sredanović *et al.,* 2012). Additionally the Turkey's birds have unique nutritional requirements that balance growth and egg production. While specific studies on turkey feeds are limited, their dietary needs are generally intermediate between broilers and layers, with a focus on balanced protein, energy, and mineral levels. Turkey feeds typically contain 16-18% crude protein, with a focus on essential amino acids like lysine and methionine to support growth and egg production (Roszkowicz-Ostrowska *et al.,* 2022). Metabolizable energy levels range from 2700 to 3000 kcal/kg, with a focus on supporting both growth and reproductive functions (Roszkowicz-Ostrowska *et al.,* 2022). Turkeys require adequate levels of calcium and phosphorus to support bone development and eggshell formation (Roszkowicz-Ostrowska *et al.,* 2022). Diets with balanced protein and energy levels are critical for maintaining growth performance and egg production in turkeys (Roszkowicz-Ostrowska *et al.,* 2022). Overall, a well-balanced poultry ration includes a variety of vitamins (A, D, E, K, B-complex) and minerals (calcium, phosphorus, magnesium, iron, zinc), which are vital for bone development, immune function, and overall health (Mateos *et al.,* 2024). The nutritional value of commercial poultry compound feeds varies significantly across broilers, layers, and turkeys, reflecting their unique physiological and production requirements. Broilers require high-protein, high-energy diets for rapid growth, while layers need diets rich in calcium and phosphorus for egg production. Turkeys, with intermediate requirements, benefit from balanced protein and energy levels. Understanding these differences is critical for optimizing feed formulation and improving production efficiency in poultry farming. Therefore, this seminar aims to review the chemical composition and nutritional value of commercial poultry compound feeds produced in Ethiopia, with a focus on evaluating their suitability for different poultry types, includes broilers and layers, and turkeys based on their specific physiological and production requirements.

The specific objectives of this review are to identify and describe the major ingredients used in the formulation of commercial poultry compound feeds in Ethiopia. To review the chemical composition (crude protein, metabolizable energy, crude fiber, minerals) of commercial poultry feeds produced in Ethiopia. And also to review factors affecting the nutrient quality and challenges of Poultry Feed Industry in Ethiopia.

## Overview of Ethiopian poultry production

Poultry production in Ethiopia can be traced back to the domestication of red jungle fowl, which were introduced to the region from Southeast Asia. Over time, these birds adapted to the local environment, giving rise to various indigenous breeds that are still prevalent today. These indigenous chickens were valued for their hardiness and ability to thrive under minimal management conditions (Getu, 2014). The introduction of exotic poultry breeds to Ethiopia began in the mid-20th century, with the first exotic chickens arriving in 1953. These breeds were introduced to improve productivity, particularly in terms of egg and meat production. However, the adoption of exotic breeds was initially met with limited success due to their poor adaptation to local environmental conditions, lack of proper management practices, and insufficient access to quality feed and veterinary services (Tirfie, 2021). The majority of the poultry population is concentrated in the highland regions of the country, particularly in the Oromia, Amhara, and Southern Nations, Nationalities, and Peoples (SNNP) regions. These regions are followed by Tigray and other parts of the country (Urgesa, 2023).

The poultry production systems in Ethiopia can be broadly classified into three categories: Village or Backyard Production System: This is the most common production system in Ethiopia, accounting for the majority of the country's poultry population. Under this system, chickens are kept under extensive or semi-intensive conditions, with minimal inputs and outputs. Indigenous breeds dominate this system, and production is primarily for household consumption and local markets (Urgesa, 2023). Small-Scale Commercial Production System this system involves the rearing of chickens on a slightly larger scale, with some level of intensification. Small-scale commercial producers often use a mix of indigenous and crossbred breeds and may have access to better management practices and market outlets (Guteta, 2021). Large-Scale Commercial Production System the most advanced production system in Ethiopia, characterized by the use of exotic breeds, modern housing, and intensive management practices. Large-scale commercial producers are primarily focused on producing eggs and meat for urban markets. However, this sector is still in its infancy and faces several challenges, including high production costs and limited access to finance (Tirfie, 2021).

However, Poultry production in Ethiopia is primarily focused on egg and meat production. Indigenous chickens are the main contributors to egg production, accounting for approximately 95% of total egg output. However, the productivity of indigenous chickens is relatively low, with an average of 30-60 eggs per hen per year. Exotic breeds, which are primarily used in commercial production systems, can produce up to 250 eggs per hen per year under intensive management conditions (Milkias, 2016; Sebho, 2016). Meat production in Ethiopia is also dominated by indigenous chickens, which account for the majority of the country's poultry meat output. However, the per capita consumption of poultry meat in Ethiopia remains low, averaging just 2.85 kg per person per year. In Ethiopia from the total chicken meat production local chickens with an average annual output of 72,300 metric tons (Teklewold *et al.,* 2006) contribute about 99.2 % of meat production.

Day old chickens of different populations of indigenous chickens measures live weight of 27.3g per chicken (Kibret, 2008). (Dana, 2011) in adult live body weight of the different populations of indigenous local chickens, also reported 1.6 kg for male and 1.3 kg for females. According to the result of Kibret (2008), who indicated that the meat production ability of indigenous chicken was limited in growth performance. Local males may reach 1.5 kg live weight at 6 months of age and females about 30% less (Kibret, 2008).

## Major Ingredients Used in Commercial Poultry Feeds

Common feed ingredients used in poultry feeding are typically selected based on their ability to meet the birds' nutritional requirements for energy, protein, fiber, minerals, and vitamins. Energy sources form the bulk of poultry diets and primarily include cereals such as maize (corn), wheat, sorghum, and barley, as well as alternative sources like cassava and molasses. Corn is the most commonly used cereal due to its high starch and energy content, and is often included at levels of 55%–65% in poultry diets (Dinani *et al.,* 2019). It is primarily used as an energy source because of its high starch content, which is easily metabolized by birds. Corn is often the base ingredient in poultry feed formulations, providing approximately 70-80% of the dietary energy ((Nsiah *et al.,* 2023).

The digestibility of corn varies depending on factors such as processing methods and the age of the birds. For example, young broilers (at 21 days of age) show slightly lower digestibility of amino acids in corn compared to older birds (at 42 days of age) (Brito *et al.,* 2011). Wheat is also widely used for its high carbohydrate content. It is a good source of energy and contains gluten, which can improve the pellet quality of feed. However, wheat has lower energy content compared to corn and may contain anti-nutritional factors such as NSPs, which can impede digestion in young birds (Bello *et al.,* 2023)

The digestibility of wheat is generally higher than that of barley but lower than that of corn. For instance, the standardized ileal digestibility (SID) of lysine in wheat is higher than in barley but lower than in corn (Szczurek, 2010). Other cereal grains such as barley, sorghum, and triticale are also used in poultry diets, though to a lesser extent. Barley contains β-glucans, which can reduce nutrient absorption, while sorghum is known for its low digestibility of amino acids such as lysine and threonine (Lemme *et al.,* 2004); Ravindran *et al.,* 2005). Pearl millet and sorghum serve as additional energy sources, with pearl millet noted for its higher content of non-starch polysaccharides (NSPs) compared to maize and sorghum (Senthilkumar and Balakrishnan, 2013). These ingredients provide the metabolizable energy required for maintenance, growth, and production.

Soybean meal is the most widely used protein source in poultry diets due to its high protein content (approximately 48%) and excellent amino acid profile (Banaszkiewicz, 2011). It is particularly rich in lysine, an essential amino acid for growth and egg production. The digestibility of soybean meal is high, with SID values for most amino acids exceeding 80% (Szczurek, 2010) *(Lemme et al.,* 2004); Szczurek, 2010). Among plant-based proteins, soybean meal is the most prevalent due to its high digestibility and rich amino acid profile especially lysine and methionine and is typically included at levels of 25%–30% (Dinani *et al.,* 2019). Other plant-based protein sources include groundnut cake, cottonseed cake, sunflower meal, and canola meal. Sunflower meal, in particular, has a higher insoluble NSP content (Senthilkumar and Balakrishnan, 2013). Soybean meal is often combined with cereal grains like corn and wheat to balance the dietary energy and protein requirements of birds. However, its use is being partially replaced by alternative protein sources such as insect meals and agri-industrial by-products due to sustainability concerns (Özkan *et al.,* 2024).

Animal-based protein sources such as fishmeal, meat and bone meal, blood meal, and feather meal are also incorporated into poultry diets to provide high quality, digestible amino acids crucial for tissue development and productivity. Fishmeal is a high-quality animal protein source used in poultry diets, particularly for young birds. It is rich in essential amino acids such as lysine, methionine, and threonine, and has a high digestibility coefficient (approximately 90%) *(Nsiah et al.,* 2023). Fishmeal is also a good source of minerals such as calcium and phosphorus, which are critical for bone development and eggshell formation (Mutucumarana *et al.,* 2014). However, the use of fish meal is limited by its high cost and potential for contamination with heavy metals and persistent organic pollutants (Nsiah *et al.,* 2023).

Other protein sources such as canola meal, cottonseed meal, and sunflower meal are also used in poultry diets. Canola meal is a good source of protein but contains anti-nutritional factors such as glucosinolates, which can reduce thyroid function in birds (Ravindran *et al.,* 2005). Cottonseed meal is rich in protein but has a lower digestibility due to its high fiber content (Ravindran *et al.,* 2005). Animal by-products such as meat meal, bone meal, and feather meal are also used as protein sources. Feather meal, for example, is a good source of cystine, an amino acid important for feather development (Lemme *et al.,* 2004).

The digestibility of grains and protein sources is a critical factor in poultry nutrition, commonly evaluated using apparent ileal digestibility (AID) and standardized ileal digestibility (SID). Corn generally exhibits high SID values for most amino acids, ranging from 70% to 90%, although its lysine digestibility is lower compared to soybean meal (Szczurek, 2010); Brito *et al.,* 2011). Wheat has slightly lower SID values than corn, particularly for lysine and threonine, due to the presence of non-starch polysaccharides (NSPs), which impair nutrient utilization in young birds (Ravindran *et al.,* 2005); Szczurek, 2009).

Barley shows the lowest digestibility among cereal grains because of its high fiber and β-glucan content, which hinders nutrient absorption (Ravindran *et al.,* 2005). Among protein sources, soybean meal ranks highest in digestibility, with SID values exceeding 80% for most amino acids and being especially rich in lysine and threonine (Lemme *et al.,* 2004; Szczurek, 2010). Fishmeal also has high digestibility, with SID values ranging from 80% to 95%, and serves as an excellent source of sulfur-containing amino acids like methionine and cystine (Vergara-Rubín and Guevara-Carrasco, 2023). In contrast, other protein sources such as canola meal and cottonseed meal have lower digestibility, with SID values for lysine around 70% and 60%, respectively (Ravindran *et al.,* 2005).

Grains like corn and wheat primarily supply energy in poultry diets, whereas protein sources such as soybean meal and fish meal provide essential amino acids required for optimal growth and productivity (Pirgozliev *et al.,* 2019). Recently, attention has turned to alternative protein sources such as insect meals and agro-industrial by-products, which offer potential to reduce feed costs and improve environmental sustainability in poultry production (Özkan *et al.,* 2024). Furthermore, supplementing poultry diets with exogenous enzymes like phytase and xylanase enhances nutrient utilization; phytase increases phosphorus availability in soybean meal, while xylanase improves the digestibility of NSPs in wheat and barley (Bello *et al.,* 2023). As generally, corn, soybean meal, and fish meal are the most commonly used ingredients in poultry feeding due to their high nutritional value and digestibility. Grains such as corn and wheat provide energy, while protein sources such as soybean meal and fishmeal supply essential amino acids. The digestibility of these ingredients can be further improved by using exogenous enzymes and proper feed formulation.

## Nutritional Value and Composition of Commercial Poultry Feeds

Commercial poultry feeds are formulated to meet poultry's nutritional requirements, which include protein, energy, fat, fiber, minerals, vitamins, and water. The chemical composition of these feeds varies based on the type of poultry (e.g., broilers and layers) and their growth stages. For instance, broiler feeds are typically higher in energy and protein to support rapid growth, while layer feeds are formulated to support egg production (Barszcz *et al.,* 2024).

Crude protein (CP) is one of the most important nutritional components in poultry feeds, essential for growth, maintenance, reproduction, and production. It supplies the necessary amino acids required for body tissue synthesis, enzyme production, and optimal physiological function. In commercial poultry production, the protein content of compound feeds must be precisely formulated to meet the specific requirements of different poultry categories such as broilers, layers, and chicks at various growth stages.

Numerous studies have evaluated the crude protein content of commercial poultry feeds in Ethiopia. Negash (2020) reported that the dry Matter content ranges between 89.61%-91.31% for layer poultry, respectively. The Crude Protein content ranges between 10.91%-17.90%, for layer, respectively. The crude protein content in feed ingredients: corn has an average CP content of approximately 9.77% (Anjum *et al.,* 2014).

Soybean meal has a high CP content at around 42.48%, making it a primary protein source (Anjum *et al.,* 2014).Canola meal CP ranges from 33.8% to 43.7% (Anjum *et al.,* 2014). Sunflower meal has lower CP content, ranging from 27.1% to 28.0% (Anjum *et al.,* 2014). Animal protein sources like fishmeal show a high CP content of 50.68%, while feather meal has 39.47% (Anjum *et al.,* 2014).

The broiler starter feeds' CP content varies from 18.7% to 25.5% (Dutta *et al.,* 2020). Broiler finisher feeds' CP ranges from 18.7% to 25.5%, indicating significant variability among brands (Dutta *et al.,* 2020). Organic vs. conventional feeds: Conventional feeds have a higher average CP of 19.28% compared to 14.39% in organic feeds (Bologa *et al.,* 2013). Similarly, Fekadu *et al.,* (2023) found that some feed manufacturers under-declared protein levels, with actual CP content being 2–3% lower than the labeled value. Fatty acid also supplementation can slightly increase CP content in broiler chicken diets, with control diets showing 18.26% CP compared to 19.21% with supplementation (Fitrianingsih and Sandiah, 2015).

In addition, the microbial contamination in poultry feeds often compromises nutritional quality, underscoring the need for strict monitoring and quality assessment in feed production (Sultana *et al.,* 2017). Similarly, Pavlović *et al.,* (2019) noted that deficiencies in protein are linked to poor poultry health and reduced productivity, with variations reported in crude protein content ranging from 11.91% to 27.29%. This variability emphasizes the challenge of formulating feeds that meet the nutritional needs of birds while minimizing environmental impacts, such as nitrogen excretion due to excessive crude protein levels. While high CP levels are essential for optimal growth and production in poultry, excessive protein can lead to environmental concerns due to nitrogen waste. Balancing protein content with sustainability practices is crucial in poultry feed formulation. Therefore, crude protein (CP) is a vital nutrient in poultry diets, supporting growth, reproduction, and productivity.

Metabolizable energy (ME) is a critical nutritional parameter in poultry feed formulation, representing the energy available to the bird after losses in feces, urine, and gaseous products of digestion are subtracted from the gross energy intake. It is the primary source of energy that supports maintenance, growth, egg production, and metabolic activities. In poultry nutrition, diets are typically formulated based on ME values expressed in kilocalories per kilogram (kcal/kg). The ME requirement varies by poultry species and production stage.

According to the National Research Council (Council and Nutrition, 1994), broiler starter feeds should contain approximately 3,000–3,200 kcal/kg ME, broiler finisher diets around 3,200–3,300 kcal/kg, and layer feeds between 2,750–2,850 kcal/kg. A proper balance between energy and protein is essential to optimize feed intake, weight gain, and feed conversion efficiency. Low ME levels can limit growth, while excess energy can lead to fat deposition and reduced productivity.

Metabolizable energy is the energy that remains after accounting for important losses (Warwick and Baines, 2000). The poultry feeds analyzed in the study exhibited metabolizable energy values ranging from 2971.48 ± 65.44 Kcal/kg to 3686.18 ± 29.08 Kcal/kg. These values indicate the energy available to the poultry from the feeds, which is crucial for their growth, health, and egg production (Igwemmar *et al.,* 2022). (Livesey, 2001) described ME as the amount of energy available for total (whole body) heat production at nitrogen and energy balance. The ME content in analyzed feed brands ranged from 2,971.48 ± 65.44 kcal/kg to 3,686.18± 29.08 kcal/kg. These results are similar to the ME values reported by Dewa and Tikau (2019), ranging from 1,984.40 to 3,339.60 kcal/kg, ranging from 2,801.14 to 3,026.90 kcal/kg. In contrast Bukar and Saeed (2015), observed a wider ME range of 1,737.30 to 4,622.70 kcal/kg.

The mean ME values of all the feed rations exceeded the Standard Organization of Nigeria minimum requirements of 3,050 kcal/kg for starter, 2,800 kcal/kg for grower, 3,100 kcal/kg for finisher, and 2,600 kcal/kg for layer feeds. For instance, a study on male Muscovy ducks found that diets with higher protein (21%) and ME (3100 kcal/kg) resulted in improved performance and larger muscle fiber diameters, although this also led to higher abdominal fat levels (Tugiyanti *et al.,* 2013). Similarly, in cross-bred chicks, increasing protein levels from 17% to 22% improved feed conversion ratios and weight gain during the starting phase (Jeong *et al.,* 2009)

Furthermore, the mean ME values in starter (3,357.73 ± 143.54 kcal/kg) and layer (3,153.16 ± 168.99 kcal/kg) rations were above the (Council & Nutrition, 1994), recommended levels of 3,200 kcal/kg and 2,900 kcal/kg, respectively. Supplementing diets with fat can increase ME content, as fat is highly metabolizable. A study on broiler chickens found that increasing dietary fat levels improved body weight gains and feed conversion efficiency (Korol *et al.,* 2001). Similarly, a study on laying hens showed that higher energy levels, achieved through fat supplementation, increased egg weight and ether extract levels (Kim & Kang, 2022). Additionally, ingredients with higher fat content, such as Moringa seed meal, tend to have higher ME values, whereas high-fiber ingredients like palm kernel cake (PKC) may reduce ME due to lower digestibility (Azizi *et al.,* 2021).

To enhance the consistency and quality of ME in commercial poultry feeds, regular proximate analysis and formulation based on precise ingredient nutrient values are necessary. Investment in regional feed analysis laboratories and training of feed millers in energy balancing techniques is recommended. Moreover, the use of digestibility enhancers and enzyme additives can help improve the energy availability from fibrous ingredients.

Crude fiber (CF) is an important parameter in poultry feed formulation, representing the indigestible portion of plant material, primarily composed of cellulose and lignin. Although poultry possess a simple monogastric digestive system with limited capacity to utilize fibrous materials, small amounts of fiber are essential for proper gut motility and digestive function. The presence of high dietary CF limits the gut performance and thus modulates digestion (Hetland *et al.,* 2004). While it is not practical to produce diets that have no CF, diets for commercial broiler chickens are often formulated to contain minimal dietary CF levels (Sarikhan *et al.,* 2010).

This minimal CF in diets is controlled because chickens do not have digestive enzymes to degrade fiber to extract nutrients such as ruminants. According to the study of Mahata *et al.,* (2020) found that excessive crude fiber levels led to reduced daily weight gain in broilers, indicating adverse effects on growth. Similarly, Mandey *et al.,* (2017) confirmed that higher dietary fiber levels decreased feed intake, emphasizing the importance of careful ration formulation to avoid over-inclusion of fiber.

In addition, crude fiber plays a significant role in enhancing gut health and promoting proper digestive function in poultry. According to Jha & Mishra (2021) dietary fiber influences gastrointestinal tract (GIT) development and digestive physiology, facilitating nutrient digestion, fermentation, and absorption.

Fiber contributes both soluble and insoluble components that can positively modulate gut morphology and function, promoting the growth of beneficial gut microflora (J. Tejeda & K. Kim, 2021). Moreover, the presence of crude fiber aids in promoting satiety and regulating feed intake. Nuraini *et al.,* (2020), appropriate levels, crude fiber can improve fecal excretion rates without significantly impairing nutrient absorption. This property is particularly beneficial for laying hens, as it may support improved feeding behavior without compromising egg production.

While crude fiber is beneficial in moderate amounts, excessive inclusion can have negative effects on feed efficiency and bird performance. Pornsuwan *et al.,* (2023) reported that high proportions of crude fiber in feeds reduce nutrient absorption and overall feed efficiency, due to the limited digestive capacity of poultry. As poultry possess relatively short digestive tracts, their ability to digest high levels of fiber is limited, leading to reduced feed utilization and growth performance.

Additionally, factors such as the source of fiber and the type of poultry being fed can influence the optimal level of crude fiber. For example, the inclusion of fibrous materials should consider the overall nutrient content of the diet and the physiological status of the birds (Beshara *et al.,* 2017).

The ash and mineral composition of poultry feeds is influenced by various factors, including the type of feed resources used and their geographical origin. In Ethiopia, poultry feeds often incorporate local agricultural by-products and naturally occurring resources, which contribute significantly to their mineral content. These minerals are crucial for optimizing poultry nutrition, supporting growth, enhancing productivity, and maintaining health.

The ash content of Ethiopian feed resources varies widely, ranging from 7.24% in sorghum to 13.25% in *Pavonia schimperiana Hochst* (Abazinab *et al.,* 2024). Feed ingredients like limestone and marble powder exhibit extremely high ash contents between 81% and 99% highlighting their potential as valuable mineral supplements (Abegaze Beyene, 2015).

Common macro-minerals found in Ethiopian poultry feeds include calcium (Ca), potassium (K), phosphorus (P), magnesium (Mg), and sodium (Na), while key micro-minerals include manganese (Mn), iron (Fe), copper (Cu), and zinc (Zn) (Asmare *et al.,* 2018). For instance, Desho grass (*Pennisetum pedicellatum*), a widely used forage, contains notable levels of Mg and P, though its mineral profile can vary with altitude and harvesting time (Asmare *et al.,* 2018). Similarly, limestone and marble powder have been found to be rich in iron, with Fe concentrations ranging from 548.59 to 8,238.67 ppm, and they also contain manganese and copper levels comparable to those in conventional animal feeds (Abegaze Beyene, 2015). Calcium (Ca) and phosphorus (P) requirements are routinely expressed on a total and available basis, respectively. The abundance and lower prices for inorganic Ca sources (e.g. limestone) and the low Ca concentrations in plant feedstuffs have delayed the necessity of establishing digestibility values of Ca in various feedstuffs. Phytic acid in plant-based feedstuffs forms complexes with minerals such as P (and Ca), rendering much of the ingested P unavailable to the bird (Singh, 2008). Therefore, considering the available P (total P – phytate P) during feed formulation has been a common practice to reflect the P requirement closely. Recently, diet formulation on a digestible Ca and P basis has been suggested to closely meet the Ca and P needs (Adedokun & Adeola, 2013). Thus, more research has been conducted on Ca and P digestibilities in poultry (David *et al.,* 2019). Additionally, date stone meal, a by-product of date fruit processing, is reported to be rich in minerals and can be included in poultry diets at levels up to 10% without negatively influencing performance. This makes it a cost-effective alternative to traditional grains (Attia *et al.,* 2021).

Overall, the chemical composition of commercial poultry feeds, particularly crude protein (CP), metabolizable energy (ME), crude fiber (CF) and ash plays a crucial role in determining the nutritional adequacy and performance outcomes in poultry production systems. Variability in CP and ME levels across feed brands in Ethiopia indicates inconsistency in formulation practices, with some feeds falling below on the other hand, exceeding recommended nutritional standards. Crude protein, essential for growth and productivity, varied significantly due to differences in ingredient selection and manufacturing practices, sometimes leading to under- or over-supply, which affects both bird performance and environmental sustainability through nitrogen excretion.

Metabolizable energy values, critical for supporting maintenance and production functions, also showed wide ranges across feed types. While many ME levels exceeded international and local recommendations, imbalances with protein could reduce feed efficiency or increase fat deposition. Ingredients with high fat or low fiber content enhanced ME availability, while high-fiber ingredients reduced energy utilization.

## Factors Affecting the Nutrient Quality of Poultry Feeds

The quality of feed ingredients plays a significant role in determining the overall nutritional value of poultry feed. Variations in ingredient quality can be attributed to factors such as the geographical origin of raw materials, seasonal fluctuations, and differences in farming practices. The quality of cereal grains, such as maize, wheat, and sorghum, influences the protein, energy, and fiber content in poultry feed. Grain quality is often affected by soil health, climatic conditions, and storage methods. For example, grains harvested during dry seasons may have lower nutrient levels due to reduced moisture content (Fekadu *et al.,* 2023). Oilseeds, such as soybean meal and canola meal, are important protein sources in poultry feeds. However, the protein content can vary depending on the processing methods used. For instance, the protein in soybean meal may degrade if improperly processed, reducing its overall quality (Sharif *et al.,* 2014).

The method used to process feed ingredients significantly impacts the nutritional quality of poultry feed. Several processing methods are employed, including milling, grinding, pelleting, and extrusion. The fineness of grinding affects the digestibility of ingredients. Finer grinding may improve digestibility but can also lead to the loss of certain nutrients, particularly fats (Amerah *et al.,* 2007). Pelleting is commonly used in poultry feed production to improve feed handling and palatability. However, excessive heat and pressure used during pelleting can cause nutrient degradation, especially of vitamins and amino acids, which are sensitive to heat (Fekadu *et al.,* 2023). These processes also affect nutrient retention, particularly in terms of protein digestibility and fat stability. Overheating during extrusion can destroy essential amino acids and reduce the overall protein quality of the feed (Bologa *et al.,* 2013).

Proper storage of poultry feeds is essential to preserve the nutritional quality of ingredients. Poor storage practices can lead to the degradation of essential nutrients due to moisture, heat, and pest contamination (Iravani *et al.,* 2024). High moisture content can lead to microbial contamination, such as mold and bacteria, which can degrade nutrients like vitamins and amino acids. Excess moisture also leads to the production of mycotoxins, which can be harmful to poultry health (Jha & Mishra, 2021).

Excessive heat during storage can cause the oxidation of fats, reducing their nutritional value. The degradation of vitamins, particularly Vitamin A and Vitamin D, also occurs at elevated temperatures (Tarkhan *et al.,* 2020). Inadequate storage conditions may lead to contamination by pests (insects, rodents) and pathogens, which not only reduces feed quality but also poses health risks to poultry (Yang *et al.,* 2014). The variability in raw materials used in feed formulation can result in inconsistent nutrient quality. Factors such as environmental conditions, soil health, and crop variety can cause fluctuations in the protein, energy, and mineral content of feed ingredients. For instance, the nutrient composition of crops like alfalfa, maize, and other grains can vary depending on soil quality, rainfall, and farming practices. This results in variations in the nutrient profile, which impacts the final feed quality (Dewa & Tikau, 2019). The nutrient content of feed ingredients also varies based on the geographical origin of the raw materials. For example, maize grown in high-altitude regions may have different nutrient content compared to maize grown in lowland areas due to variations in soil types and climate (Asmare *et al.,* 2018).

The addition of vitamins, minerals, enzymes, and other supplements is essential for ensuring balanced nutrition in poultry feeds. However, the quality and effectiveness of these additives depend on their source and formulation. Deficiencies or excesses of certain vitamins and minerals can significantly affect poultry health and performance. For example, inadequate levels of calcium and phosphorus in layer diets can lead to poor eggshell quality (Sultana *et al.,* 2017). Enzyme additives are often included in poultry feeds to enhance the digestion of complex carbohydrates, particularly in feeds containing high fiber. However, the quality and activity of enzymes depend on their storage conditions and expiration date (Sarikhan *et al.,* 2010).

The formulation process involves selecting the right mix of ingredients to meet the nutritional requirements of poultry. Inaccurate formulations, such as under- or overestimation of nutrient content, can lead to poor feed quality. A well-balanced feed should contain the right proportions of protein, energy, fiber, and micronutrients. Miscalculations in balancing protein and energy can lead to inefficient feed utilization and poor growth performance. Amino acid balance is crucial in poultry diets. Deficiencies in essential amino acids, like lysine, methionine, and threonine, can hinder growth and productivity (Bologa *et al.,* 2013).

## Challenges in the Poultry Feed Industry in Ethiopia

The poultry feed industry in Ethiopia faces several significant challenges that hinder its growth and efficiency. These challenges stem from a combination of resource limitations, disease prevalence, and inadequate infrastructure, which collectively influence poultry production and marketing. The availability of key ingredients such as maize, soybean, and oilseed cakes is limited due to competition with human food and industrial uses. There is a limited supply of commercial feed, with most poultry relying on household waste and non-conventional feed sources (D. Abera *et al.,* 2024). Many smallholder farmers practice irregular supplementation, primarily using cereal grains, which is insufficient for optimal poultry health (Kebede, 2016).

Poor agricultural productivity, recurrent droughts, and fluctuating yields contribute to inconsistent raw material supply. Seasonal variation in crop production leads to price volatility and supply shortages (Tirfie, 2021). Feed accounts for 65–75% of total poultry production costs in Ethiopia. Increasing demand for agro-industrial by-products and double taxation on mixed rations have led to escalating feed costs (Negash, 2017).

Most protein-rich ingredients like soybean meal and premixes are imported, making feed prices highly sensitive to foreign exchange fluctuations and import duties. Transport and logistics challenges further inflate the cost of feed distribution, especially to remote areas. There is limited regulation and enforcement of feed quality standards across the country. Many feed manufacturers do not adhere to proper formulation practices or quality testing, resulting in nutritionally imbalanced or adulterated feeds.

The lack of laboratories and technical capacity to routinely analyze feed contributes to poor quality assurance. Essential feed additives such as vitamins, minerals, amino acids, and enzymes are either scarce or too expensive due to import dependency. Small-scale and backyard poultry producers often cannot afford or access balanced feed supplements, resulting in suboptimal bird performance (Fekadu *et al.,* 2023).

Many feed mill operators and poultry farmers lack technical knowledge in feed formulation and poultry nutrition. Poultry in Ethiopia is significantly affected by diseases such as Newcastle disease and Salmonella, which not only threaten poultry health but also pose zoonotic risks to humans (Assefa, 2024). The close proximity of different poultry production systems facilitates disease transmission, exacerbating the challenges faced by farmers (Assefa, 2024). Extension services on poultry nutrition are limited, especially in rural areas. Inadequate training on feed management contributes to inefficient feeding practices and high feed wastage (G. S. Abera & Chala, 2023). The poultry marketing system is poorly developed, characterized by informal channels that limit producers' access to markets (Sime, 2022). Inadequate access to credit, water, and electricity, along with low education levels among producers, further complicate the production and marketing landscape (Sime, 2022). Many feed mills operate with outdated or manually operated equipment, resulting in low production efficiency and inconsistent feed quality.

Limited access to modern processing technologies like pelleting and extrusion affects nutrient preservation and feed conversion efficiency (Smith *et al.,* 2020). There is a lack of locally generated data on alternative feed ingredients and their nutritional value. Minimal investment in feed research and weak linkages between universities, research institutions, and feed manufacturers hinder innovation. Weak policy enforcement and absence of clear guidelines for feed manufacturing, distribution, and quality control limit the development of the sector. Institutional fragmentation among ministries, feed associations, and regulators affects coordinated planning and support (FAO, 2019).

In conclusion, Poultry production plays a vital role in Ethiopia's agricultural sector, significantly contributing to food security, income generation, and rural livelihoods. Commercial poultry compound feeds are central to the productivity and health of poultry species such as broilers, layers, and turkeys, each with specific nutritional demands. Broiler diets are formulated for high protein and energy to support rapid muscle gain, while layer feeds prioritize calcium, phosphorus, and essential amino acids for sustained egg production.

Although research is limited, turkey feeds require a balanced nutrient profile to meet both growth and reproductive goals.

In Ethiopia, commonly used feed ingredients include maize as a primary energy source, with soybean meal, noug cake, and fishmeal as protein sources.

The chemical composition of commercial poultry feeds shows substantial variability, particularly in crude protein (CP), metabolizable energy (ME), crude fiber (CF), and ash content. CP is vital for tissue growth and egg output but often diverges from labeled values, resulting in either deficiencies or excessive nitrogen excretion. ME variability affects feed efficiency and fat deposition.

To address these challenges and enhance poultry feed quality and productivity, the following strategic directions are proposed: strengthen national feed quality standards and enforce compliance through inspections and certification systems; train feed producers and formulators on modern feed processing technologies and quality control measures; establish and equip regional laboratories for routine nutrient analysis and quality assurance of feed ingredients; promote research into alternative and underutilized feed ingredients, such as Moringa seed meal and insect-based proteins, to reduce reliance on conventional sources. Conduct studies to improve the digestibility of key nutrients (calcium and phosphorus) and mitigate the effects of anti-nutritional factors like phytic acid; develop balanced rations that optimize nutrient use and minimize environmental impacts, such as nitrogen emissions from excessive protein intake. Encourage selective breeding and crossbreeding of indigenous chickens with adaptable exotic strains to improve productivity; provide support to commercial operations through improved infrastructure, veterinary care, and financial access; and strengthen policy frameworks and attract investment in the poultry value chain to support both subsistence and commercial systems.

## References


Abazinab, H., Duguma, B., & Muleta, E. (2024). The effect of agro-ecological zone on the chemical composition of feed resources in the Gera district, southwest Ethiopia. *Discover Agriculture*, *2*(1), 68. https://doi.org/10.1007/s44279-024-00090-7

Abegaze Beyene, A. L. (2015). The feasibility of using natural rocks as sources of iron, manganese and copper in livestock feeding in Ethiopia. *Glob. J. Sci. Front. Res*, *15*, 55287307.

Abera, D., Abebe, A., & Alebachew, H. (2024). Assessment of poultry feed and handling mechanisms of poultry production challenges in Benishangul-Gumuz Region, Western Ethiopia. *Cogent Food & Agriculture*, *10*(1), 2313254. https://doi.org/10.1080/23311932.2024.2313254

Abera, G. S., & Chala, E. M. (2023). *Current Status of Indigenous Chicken Production performance, Opportunity and Challenges in Ethiopia: A Review*.

Adedokun, S. A., & Adeola, O. (2013). Calcium and phosphorus digestibility: Metabolic limits. *Journal of Applied Poultry Research*, *22*(3), 600–608. https://doi.org/10.3382/japr.2012-00674

Akinola, L. A. F., & Ekine, O. A. (2018). Evaluation of commercial layer feeds and their impact on performance and egg quality. *Nigerian Journal of Animal Science*, *20*(2), 222–231.

Alemneh, T., & Getabalew, M. (2019). Exotic chicken production performance, status and challenges in Ethiopia. *International Journal of Veterinary Science and Research*, *5*(2), 39–45. https://doi.org/10.17352/ijvsr.000040

Amerah, A. M., Ravindran, V., Lentle, R. G., & Thomas, D. G. (2007). Feed particle size: Implications on the digestion and performance of poultry. *World's Poultry Science Journal*, *63*(3), 439–455. https://doi.org/10.1017/S0043933907001560

Anjum, M. A., Hussain, Z., Khan, S. H., Ahmad, N., Amer, M. Y., & Iftikhar, N. (2014). Assessment of poultry feed ingredients used in commercial compound feed. *Pakistan Journal of Life and Social Sciences*, *12*(2), 69–73.

Asmare, B., Demeke, S., Tolemariam, T., Tegegne, F., & Jane, W. (2018). Appraisal of mineral content of desho grass (Pennisetum pedicellatum Trin.) as affected by stage of maturity and agro-ecologies in Ethiopia. *Journal of Agriculture and Environmental Sciences*, *3*(1), 56–70.

Assefa, B. (2024). Epidemiological Landscape and Zoonotic Risks of Poultry Diseases in Ethiopia: Implications for Public Health and Poultry Production. *International Journal of Clinical Infectious Diseases*, *3*(2).

Attia, A. I., Reda, F. M., Patra, A. K., Elnesr, S. S., Attia, Y. A., & Alagawany, M. (2021). Date (Phoenix dactylifera L.) by-products: Chemical composition, nutritive value and applications in poultry nutrition, an updating review. *Animals*, *11*(4), 1133. https://doi.org/10.3390/ani11041133

Azizi, M. N., Loh, T. C., Foo, H. L., & Teik Chung, E. L. (2021). Is palm kernel cake a suitable alternative feed ingredient for poultry? *Animals*, *11*(2), 338. https://doi.org/10.3390/ani11020338

Banaszkiewicz, T. (2011). Nutritional value of soybean meal. *Soybean and Nutrition*, *2011*, 1–20. https://doi.org/10.5772/17672

Barszcz, M., Tuśnio, A., & Taciak, M. (2024). Poultry nutrition. *Physical Sciences Reviews*, *9*(2), 611–650. https://doi.org/10.1515/psr-2022-0117

Bello, A., Giménez-Rico, R. D., Gilani, S., Hillen, B. C., Venter, K. M., Plumstead, P., & Dersjant-Li, Y. (2023). Application of enzyme matrix values for energy and nutrients to a wheat-corn-soybean meal-based broiler diet supplemented with a novel phytase, with or without a xylanase–β-glucanase, achieved a production benefit over a nutritionally adequate unsupplemen. *Poultry Science*, *102*(12), 103131. https://doi.org/10.1016/j.psj.2023.103131

Beshara, M. M., Rizk, Y. S., El-Shhat, A. M., Awad, A. L., & Abdallah, A. G. (2017). Effect of feeding different levels of dietary fiber on productive and economical performance in local ducks: 1-During growing period and subsequent laying performance. *Journal of Animal and Poultry Production*, *8*(11), 425–433. https://doi.org/10.21608/jappmu.2017.41934

Bologa, M., Pop, I. M., & Albu, A. (2013). *Research on chemical composition of mixed feed used for the feeding laying hens in different systems production (conventional and organic).*

Brito, A. B. de, Stringhini, J. H., Xavier, S. A. G., Gonzales, E., Leandro, N. S. M., & Café, M. B. (2011). Digestibilidade dos aminoácidos do milho, farelo de soja e gérmen integral de milho em galos e frangos de corte cecectomizados. *Revista Brasileira de Zootecnia*, *40*, 2147–2151. https://doi.org/10.1590/S1516-35982011000900017

Bukar, H., & Saeed, M. D. (2015). *Proximate and heavy metals analysis of selected poultry feeds from Kano Metropolis, Nigeria.*

Council, N. R., & Nutrition, S. on P. (1994). *Nutrient requirements of poultry: 1994*. National Academies Press. https://doi.org/10.17226/2114

Dana, N. (2011). *Breeding programs for indigenous chicken in Ethiopia: Analysis of diversity in production systems and chicken populations*. Wageningen University and Research. https://doi.org/10.18174/167742

David, L. S., Abdollahi, M. R., Ravindran, G., Walk, C. L., & Ravindran, V. (2019). Studies on the measurement of ileal calcium digestibility of calcium sources in broiler chickens. *Poultry Science*, *98*(11), 5582–5589. https://doi.org/10.3382/ps/pez367

Dewa, U. A., & Tikau, F. W. (2019). Proximate and elemental analysis of some selected commercial poultry feeds in Nigeria. *CaJoST*, *1*(2), 148–153.

Dinani, O., Tyagi, P. K., Mandal, A., Tiwari, S., Mishra, S., & Sharma, K. (2019). Recent unconventional feedstuffs for economic poultry production in India: A review. *Journal of Entomology and Zoology Studies*, *7*(5), 1003–1008.

Dutta, P., Ahamed, S., Akter, N., Barua, K., Bhowmik, P., Islam, S., & Hossain, M. E. (2020). Variations in the nutrient content of the commercial broiler feeds manufactured by different feed companies in Bangladesh. *Bangladesh Journal of Veterinary and Animal Sciences*, *8*(2), 130–140.

Ebsa, Y. A., Harpal, S., & Negia, G. G. (2019). Challenges and chicken production status of poultry producers in Bishoftu, Ethiopia. *Poultry Science*, *98*(11), 5452–5455. https://doi.org/10.3382/ps/pez306

Fekadu, T., Esatu, W., Takele, D., Tesfaye, E., Zewdie, Y., Amssalu, K., Yirgu, T., Endawek, M., Shiferaw, S.,

& Million, B. (2023). *Ethiopia National Poultry Development Strategy 2022–2031*.

Fitrianingsih, A. M., & Sandiah, N. (2015). Chemical Composition of Broiler Chicken Breast Fed Ration with Supplementation of Protected Fatty Acid. *INTERNATIONAL SEMINAR IMPROVING TROPICAL ANIMAL PRODUCTION FOR FOOD SECURITY*, 154.

Getu, A. (2014). Review on Ethiopian poultry origin, domestication, classification and characterization of its production systems. *Middle-East Journal of Scientific Research*, *22*(7), 1025–1032. https://doi.org/10.5829/idosi.mejsr.2014.22.07.21883

Guteta, A. (2021). Dynamics of poultry production system, constraints, opportunities and marketing in Ethiopia. *Dynamics*, *77*.

Hascik, P., Kacaniova, M., Mihok, M., Pochop, J., Benczova, E., & Hlinku, T. A. (2010). Performance of various broiler chicken hybrids fed with commercially produced feed mixtures. *International Journal of Poultry Science*, *9*(11), 1076–1082. https://doi.org/10.3923/ijps.2010.1076.1082

Hetland, H., Choct, M., & Svihus, B. (2004). Role of insoluble non-starch polysaccharides in poultry nutrition. *World's Poultry Science Journal*, *60*(4), 415–422. https://doi.org/10.1079/WPS200325

Igwemmar, N. C., Kolawole, S. A., Omoniyi, A. O., Bwai, D. M., Fagbohun, A. A., & Falayi, O. E. (2022). Proximate composition and metabolizable energy of some commercial poultry feeds available in Abuja, Nigeria. *Journal of Applied Sciences and Environmental Management*, *26*(10), 1675–1682. https://doi.org/10.4314/jasem.v26i10.13

Iravani, S., Aziz-Aliabadi, F., & Vakili, R. (2024). Feed processing: a review of the impacts of conditioning time and temperature on feed quality and broilers performance. *World's Poultry Science Journal*, *80*(3), 657–679. https://doi.org/10.1080/00439339.2023.2266518

J. Tejeda, O., & K. Kim, W. (2021). Role of dietary fiber in poultry nutrition. *Animals*, *11*(2), 461. https://doi.org/10.3390/ani11020461

Jeong, Y. D., Youn, M. J., Ryu, M. S., & Ryu, K. S. (2009). Effects of dietary various energy and protein levels on productivity, blood composition and meat quality in cross-bred chicks. *Korean Journal of Poultry Science*, *36*(1), 57–67.

Jha, R., & Mishra, P. (2021). Dietary fiber in poultry nutrition and their effects on nutrient utilization, performance, gut health, and on the environment: a review. *Journal of Animal Science and Biotechnology*, *12*, 1–16. https://doi.org/10.1186/s40104-021-00558-2

Kebede, M. (2016). Poultry production systems and its feed resources in Ethiopia: a research review. *Scientific Journal of Animal Science*, *5*(2), 220–227.

Khudaer, F. (2024). Harnessing Enzymes for Optimal Poultry Feed Formulations (Mini Review). *Sainsmat: Jurnal Ilmiah Ilmu Pengetahuan Alam*, *13*(1), 1–18.

Kibret, B. (2008). *In situ characterization of local chicken eco-type for functional traits and production system in Fogera woreda, Amhara Regional State*. Haramaya University.

Kim, C.-H., & Kang, H.-K. (2022). Effects of energy and protein levels on laying performance, egg quality, blood parameters, blood biochemistry, and apparent total tract digestibility on laying hens in an aviary system. *Animals*, *12*(24), 3513. https://doi.org/10.3390/ani12243513

Kodani, S., Msamala, D., Chigumira, R., Shumba, T., & Muzofa, P. (2022). Implications of diet and quality consistence of feed on poultry layers egg quality. *African Journal of Agricultural Research*, *18*(8), 617–631. https://doi.org/10.5897/AJAR2022.16214

Korol, W., Bielecka, G., Jaskiewicz, T., & Matyka, S. (2001). The effect of an elevated fat level and feed protein concentrate on nutrient utilization and carcass quality of broiler chickens. *Journal of Animal and Feed Sciences*, *10*(3), 485–496.

Ky, I., Parkouda, C., Somda, M. K., Diawara, B., & Dicko, M. H. (2023). Nutritional and economic value of local poultry feeds, formulated by design of experimental (DOE) method. *International Journal of Biological and Chemical Sciences*, *17*(3), 985–994. https://doi.org/10.4314/ijbcs.v17i3.12

Leke, J. R., Wantasen, E., Sompie, F., Kiroh, H., Kumajas, N., Laihad, J., Kaunang, C., & Siahaan, R. (2024). Evaluation of Feed Additive Nutmeg Seed Powder on Egg Quality Characteristics and Egg Production. *Journal of Applied Veterinary Science and Technology*, *5*(2).

Lemme, A., Ravindran, V., & Bryden, W. L. (2004). Ileal digestibility of amino acids in feed ingredients for broilers. *World's Poultry Science Journal*, *60*(4), 423–438. https://doi.org/10.1079/WPS200327

Livesey, G. (2001). A perspective on food energy standards for nutrition labelling. *British Journal of Nutrition*, *85*(3), 271–287. https://doi.org/10.1079/BJN2000286

Mahata, M. E., Deni, I., Nofrianti, A., Rizal, Y., & Ardi, A. (2020). Effect of Nutritional Supplements of Fermented and Unfermented Betel Nutshell Waste in Performance of Broiler Chickens. *Journal of World's Poultry Research*, *10*(1), 118–124. https://doi.org/10.36380/jwpr.2020.14

Mandey, J. S., Kowel, Y. H. S., Regar, M. N., & Leke, J. R. (2017). *Effect of different level of energy and crude fiber from sawdust in diets on carcass quality of broiler.*

Mateos, G., Talegón, G., Aguirre, L., Corrales, N. L., Lázaro, R., Svihus, B., Liu, S. Y., Macelline, S. P., Selle, P. H., & Dridi, J. S. (2024). *Advances in poultry nutrition* (Vol. 159). Burleigh Dodds Science Publishing. https://doi.org/10.19103/AS.2023.0112.06

Milkias, M. (2016). Chicken meat production, consumption and constraints in Ethiopia. *Food Sci. Qual. Manag*, *54*, 1–12.

Mohamed, M. G., Metwally, A. E., Mahmoud, R. E., & El-Gamal, M. F. (2024). Impact of using phytase enzyme with different levels of calcium and phosphorus on broiler chickens performance, carcass traits and blood parameters. *Journal of Advanced Veterinary Research*, *14*(3), 420–426. https://doi.org/10.5455/javr.2023.n724

Mutucumarana, R. K., Ravindran, V., Ravindran, G., & Cowieson, A. J. (2014). Measurement of true ileal digestibility of phosphorus in some feed ingredients for broiler chickens. *Journal of Animal Science*, *92*(12), 5520–5529. https://doi.org/10.2527/jas.2014-7905

Negash, D. (2017). Review on compound animal feed processing in Ethiopia: Condition, challenges and opportunities. *Journal of Nutrition and Health*, *3*(2), 60–64.

Negash, D. (2020). Evaluation of commercial animal feed quality and manufacturing status in Ethiopia. *Acta Scientific Nutritional Health*, *4*(2), 1–13.

Nsiah, B., Ofori, H., Oduro-Yeboah, C., Kyereh, E., & Johnson, P.-N. T. (2023). Incidences of aflatoxin contaminations in ingredients, feed and products of poultry from two regions in Ghana. *Heliyon*, *9*(12). https://doi.org/10.1016/j.heliyon.2023.e22143

Nuraini, N., Nur, Y. S., & Djulardi, A. (2020). Response of laying quail to a diet enriched with cocoa pods fermented by Pleurotus ostreatus. *Journal of World's Poultry Research*, *10*(1), 96–101. https://doi.org/10.36380/jwpr.2020.12

Özkan, S., Bay, V., Cömert Acar, M., & Yalcın, S. (2024). Partial replacement of soybean with local alternative sources: effects on behavior, cecal microbiota, and intestinal histomorphometry of local chickens. *Frontiers in Veterinary Science*, *11*, 1463301. https://doi.org/10.3389/fvets.2024.1463301

Pavlović, M., Pavlović, I., Radović, M., & Ivanović, S. (2019). Nutritive and microbial quality of feed for laying hens from Serbian market in 2018. *Veterinarski Glasnik*, *73*(1), 40–49. https://doi.org/10.2298/VETGL1901040P

Pirgozliev, V., Rose, S. P., & Ivanova, S. (2019). *Feed additives in poultry nutrition.*

Pornsuwan, R., Pootthachaya, P., Bunchalee, P., Hanboonsong, Y., Cherdthong, A., Tengjaroenkul, B., Boonkum, W., & Wongtangtintharn, S. (2023). Evaluation of the physical characteristics and chemical properties of black soldier fly (Hermetia illucens) larvae as a potential protein source for poultry feed. *Animals*, *13*(14), 2244. https://doi.org/10.3390/ani13142244

Ravindran, V., Hew, L. I., Ravindran, G., & Bryden, W. L. (2005). Apparent ileal digestibility of amino acids in dietary ingredients for broiler chickens. *Animal Science*, *81*(1), 85–97. https://doi.org/10.1079/ASC42210085

Roszkowicz-Ostrowska, K., Młotkowska, P., Kowalczyk, P., Marciniak, E., Barszcz, M., & Misztal, T. (2022). Central stimulatory effect of kynurenic acid on BDNF-TrkB signaling and BER enzymatic activity in the hippocampal CA1 field in sheep. *International Journal of Molecular Sciences*, *24*(1), 136. https://doi.org/10.3390/ijms24010136

Ru, Y. J., Hughes, R. J., Choct, M., & Kruk, J. A. (2003). Variation in nutritive value of commercial broiler diets. *Asian-Australasian Journal of Animal Sciences*, *16*(6), 830–836. https://doi.org/10.5713/ajas.2003.830

Sarikhan, M., Shahryar, H. A., Gholizadeh, B., Hosseinzadeh, M.-H., Beheshti, B., & Mahmoodnejad, A. (2010). *Effects of insoluble fiber on growth performance, carcass traits and ileum morphological parameters on broiler chick males.*

Sebho, H. K. (2016). Exotic chicken status, production performance and constraints in Ethiopia: a review. *Asian Journal of Poultry Science*, *10*(1), 30–39. https://doi.org/10.3923/ajpsaj.2016.30.39

Senthilkumar, R. P., & Balakrishnan, V. (2013). Non-starch polysaccharide content of commonly used poultry feed ingredients. *Indian Journal of Animal Nutrition*, *30*(2), 221–223.

Sharif, M. K., Butt, M. S., Anjum, F. M., & Khan, S. H. (2014). Rice bran: a novel functional ingredient. *Critical Reviews in Food Science and Nutrition*, *54*(6), 807–816. https://doi.org/10.1080/10408398.2011.615586

Sime, A. G. (2022). Review on poultry production, processing, and Utilization in Ethiopia. *Int J Agricultural Sci Food Technol*, *8*(2), 147–152. https://doi.org/10.17352/2455-815X.000147

Singh, P. K. (2008). Significance of phytic acid and supplemental phytase in chicken nutrition: a review. *World's Poultry Science Journal*, *64*(4), 553–580. https://doi.org/10.1017/S0043933908000173

Smith, J., Wright, I., Grace, D., & Perry, B. (2020). Conclusion: The Future of Research at ILRI. *The Impact of the International Livestock Research Institute*, 699. https://doi.org/10.1079/9781789241094.0699

Sredanović, S. A., Lević, J. D., Jovanović, R. D., & Đuragić, O. M. (2012). The nutritive value of poultry diets containing sunflower meal supplemented by enzymes. *Acta Periodica Technologica*, *43*, 79–91. https://doi.org/10.2298/APT1243079S

Sultana, N., Haque, M. A., Rahman, M. M., Akter, M. R., Begum, M. D., Fakhruzzaman, M., Akter, Y., & Amin, M. N. (2017). Microbiological quality of commercially available poultry feeds sold in Bangladesh. *Asian Journal of Medical and Biological Research*, *3*(1), 52–60. https://doi.org/10.3329/ajmbr.v3i1.33571

Szczurek, W. (2009). Standardized ileal digestibility of amino acids from several cereal grains and protein-rich feedstuffs in broiler chickens at the age of 30 days. *Journal of Animal and Feed Sciences*, *18*(4), 662–676. https://doi.org/10.22358/jafs/66405/2009

Szczurek, W. (2010). Standardized ileal digestibility of amino acids in some cereals, rapeseed products and maize DDGS for broiler chickens at the age of 14 days. *J. Anim. Feed Sci*, *19*, 73–81. https://doi.org/10.22358/jafs/66284/2010

Tarkhan, A. H., Saleh, K. M. M., & Al-Zghoul, M. B. (2020). Heat exposure affects the mrna levels of antioxidant enzymes in embryonic and adult broiler chickens. *Jordan Journal of Biological Sciences*, *13*(4), 431–435.

Teklewold, H., Dadi, L., Yami, A., & Dana, N. (2006). Adopting poultry breeds in the highlands of Ethiopia. *Ethiopian Institute of Agricultural Research*, *26*.

Tirfie, F. W. (2021). Review on poultry production status and economic contribution of the sector in Ethiopia. *Food Science and Quality Management*, *109*, 1–9.

Tugiyanti, E., Yuwanta, T., Zuprizal, Z., & Rusman, R. (2013). *Improving performance, meat quality and muscle fiber microstructure of native Indonesian muscovy duck through feed protein and metabolizable energy.*

Urgesa, L. (2023). Review on Poultry Production, Trends and Development Strategies in Ethiopia. *Ann Agric Crop Sci*, *8*(1), 1124.

Vergara-Rubín, V. J., & Guevara-Carrasco, V. R. (2023). Digestible energy content and apparent digestibility coefficients of fish meal, soybean meal, corn, wheat middlings and soybean oil in paiche Arapaima gigas. *Peruvian Journal of Agronomy*, *7*(3), 179–185. https://doi.org/10.21704/pja.v7i3.1982

Warwick, P. M., & Baines, J. (2000). Point of view: Energy factors for food labelling and other purposes should be derived in a consistent fashion for all food components. *British Journal of Nutrition*, *84*(6), 897–902. https://doi.org/10.1017/S0007114500002404

Yadessa, E., Tulu, D., Bogale, A., Mengistu, G., Aleme, M., Shiferawu, S., Esatu, W., & Amare, A. (2017). Characterization of smallholder poultry production systems in Mezhenger, Sheka and Benchi-Maji zones of south western Ethiopia. *Research Journal of Agricultural Science Research*, *5*(1), 2360–7874.

Yang, H., Dey, S. K., Buchanan, R., & Biswas, D. (2014). Pests in Poultry, Poultry Product-Borne Infection and Future Precautions. *Practical Food Safety: Contemporary Issues and Future Directions*, 535–552. https://doi.org/10.1002/9781118474605.ch25

Yu, Y., Ai, C., Luo, C., & Yuan, J. (2024). Effect of Dietary Crude Protein and Apparent Metabolizable Energy Levels on Growth Performance, Nitrogen Utilization, Serum Parameter, Protein Synthesis, and Amino Acid Metabolism of 1-to 10-Day-Old Male Broilers. *International Journal of Molecular Sciences*, *25*(13), 7431. https://doi.org/10.3390/ijms25137431

**How to cite this article:**

Teshome Werku. 2026. Chemical Composition and Nutritional Value of Commercial Poultry Compound Feed Produced In Ethiopia: Review. *Int.J.Curr.Res.Aca.Rev.* 14(2), 59-72.
doi: https://doi.org/10.20546/ijcrar.2026.1402.008