



The Characteristics, Challenges and Prospects of Small Scale Poultry Farming in Developing Countries

Isayas Asefa Kebede*

Department of Veterinary, Wolaita Sodo University, Wolaita Sodo, Ethiopia

ABSTRACT

This paper document is a review on the characteristics, challenges and prospects of small scale poultry farming in developing countries. The term poultry represents bird species that can be domesticated and reared by human for their economic value. The food and agriculture organization of the United Nations has classified poultry production systems into four categories as sector one, two, three and four. In a large number of low income countries, backyard/household production (sector 4) is the largest system of poultry production and a critical source of income and nutrition for poor households. Small scale poultry production has developed in a large number of developing countries around the world as an important source of earning for the rural poor. Poultry production systems of tropical regions are mainly based on the scavenging indigenous chickens found in virtually all villages and households in rural area. Small scale poultry production systems in the form of small, semi or fully scavenging, household flocks, or slightly larger more intensive units have developed in a large number of developing countries around the world as a source of livelihood support for the rural poor people. In spite of the potential benefits of small scale poultry production, a number of challenges and obstacles which are called constraints limiting the success and profitability of both backyard and semi intensive production have been identified, including infectious diseases, low input of veterinary services, poor housing, poor biosecurity, predators and the quality and cost of feed. But constraints associated with inputs such as feed cost, quality and availability, as well as marketing of product, among others, poses a gloomy and uncertain future for the poultry industry. In recent years there has been growing recognition among the development community of the role of small scale commercial poultry production in accelerating the pace of poverty reduction and reaching out to the poorest of the poor.

Keywords: Challenges; Poultry farming; Prospects; Small scale

INTRODUCTION

The term poultry is used collectively to designate those species of birds that have been domesticated to reproduce and grow in captivity so as to render the products of

economic value. Chickens, turkeys, ducks, geese, some quail and pheasants, guineas and pigeons generally meet the above criteria. However Ray and Roy used the term poultry farming to designate the rearing of any or all domesticated fowls including chicken, turkeys, ducks and geese primarily for their

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Corresponding author: Isayas Asefa Kebede, Department of Veterinary, Wolaita Sodo University, Wolaita Sodo, Ethiopia; E-mail: byisayas@gmail.com

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meat and eggs or feathers. They provide meat, eggs, feathers, fertilizer, animal food and other by products such as pharmaceuticals. Poultry also provides food security and protein sufficiency for poor countries.

Poultry farming means the rearing of birds for their meat, eggs and other byproducts that are of economic value. Poultry farming in general is an activity characterized by a very wide range of operations of livelihood and subsistence farming at one end of the spectrum to highly commercial operations at the other. The various systems used in keeping birds include the free range system or traditional village system/the backyard or subsistence system; the semi intensive system and the small scale intensive system.

Sonaiya revealed that the poultry production systems in Africa are mainly based on the scavenging indigenous chickens found in virtually all villages and households in rural Africa. These systems are characterized by low output per bird. Nevertheless, over 70% of the poultry products and 20% of animal protein intake in most African countries come from this sector. Therefore, increased poultry production would impact positively on household food security through improved diet and income generation. According to Benabdeljelil, et al., some of the challenges that affect the poultry industry reflected in production, marketing and consumption of poultry products and the availability of all year round feed and water resources in appropriate quantity and quality, financing and marketing constitute the major challenges for sustainable poultry production [1-5].

Small scale poultry production has developed in a large number of developing countries around the world as an important source of earning for the rural poor. In the last few years, the recognition of small scale commercial poultry production helps to accelerate the pace of poverty reduction riding in new height in Bangladesh. The government of Ghana identified poultry production as having the greatest potential for addressing the acute shortfall in the supply of animal protein and job creation and established an integrated poultry project in Accra. Flake and asserted that the poultry industry in Ghana grew rapidly during the 1980's to 1990's, developing into a vibrant agricultural sector and supplying about 95% of chicken meat and eggs in the country. Gueye writes that 85% of rural households in Sub-Saharan Africa keep chickens or other types of poultry [6-8].

In Ethiopia, the agricultural sector is a corner stone of the economic and social life of the people. The sector employs 80%-85% of the population and contributes 40% to the total GDP. Poultry production system in Ethiopia is an indigenous and integral part of the farming system that ranges from nil input traditional free ranges to modern production system using relatively advanced technology.

Despite their low productivity, the indigenous chickens are known to possess desirable characters such as thermos tolerant, resistant to some disease, good egg and meat flavor, hard eggshells, high fertility and hatchability as well as high

dressing percentage. Poultry production systems of tropical regions are mainly based on the scavenging indigenous chickens found in virtually all villages and households in rural area. Approximately 80% of the chicken populations in Africa are reared in these systems.

Small scale poultry production systems in the form of small, semi or fully scavenging, household flocks, or slightly larger more intensive units have developed in a large number of developing countries around the world as a source of livelihood support for the rural poor. In recent years there has been growing recognition among the development community of the role of small scale commercial poultry production in accelerating the pace of poverty reduction and reaching out to the poorest of the poor. There is also growing evidence to demonstrate the role of small scale poultry production in enhancing the food and nutrition security of the poorest households and in the promotion of gender equality. In spite of the potential benefits of small scale poultry production and government support, the industry faces challenges including lack of market access, high cost of feed and veterinary drugs, lack of utilities (electricity, water and telephones), halaal (accepting poultry product based on Muslim religious law), low prices offered by wholesalers and retailers and lack of slaughtering facilities. Therefore, the objectives of this paper are:

- To describe characteristics of small scale poultry farming in developing countries.
- To overview the major challenges of small scale poultry farming in developing countries.
- To highlight the future prospects of small scale poultry farming in developing countries.

LITERATURE REVIEW

Characteristics of Small Scale Poultry Production System

The Food and Agriculture Organization of the United Nations (FAO) has classified poultry production systems into four categories (sectors) based on the level of integration of operations, the marketing system and the level of biosecurity. And which includes: Sector 1, sector 2, sector 3 and sector 4.

Sector 1 refers to the large scale integrated commercial systems with high commercial orientation and high biosecurity. Sector 4, at the other extreme, refers to village level production systems with households raising few birds for their own consumption or for local markets, and minimal levels of biosecurity. Sectors 2 and 3 fall in between these two extremes depending on the level of market linkage and the level of biosecurity as cited in Sonaiya (Table 1).

Table 1: Classification of poultry production on the basis of biosecurity level.

Sectors	Descriptions
Sector 1	Industrial integrated system with a high level of biosecurity and birds or products that are marketed commercially.
Sector 2	Commercial poultry production system with a moderate to high level of biosecurity and birds or products that are sold through slaughterhouses or live-bird markets.
Sector 3	Smallholder commercial poultry production including waterfowl, generally with low levels of biosecurity and birds or products that are usually sold through live-bird markets.
Sector 4	Village or backyard production with minimal biosecurity and birds or products that are consumed locally.

The majority of producers in sector 4 comprise poor households with almost zero asset base, and highly vulnerable and insecure livelihoods. In India, for example, household poultry has found special favor with the poor (landless, marginal and small farmers) and among tribal, scheduled castes and other backward caste communities.

In a large number of low income countries, backyard/household production (sector 4) is the largest system of poultry production and a critical source of income and nutrition for poor households. In Ghana, for example, rural poultry accounts for 60%-80% of the national poultry population. In Northeastern Nigeria more than 70% of rural households kept chickens. Information from Bangladesh and Nigeria, where detailed disaggregated data on the structure of poultry population is available, indicates that sector 4-type production accounts for more than 90% of the poultry population.

The households used poultry enterprise as an entry point to take the first step towards capital accumulation and poverty alleviation. In general in this system, the poultry are kept under low input, low output conditions and managed by the women and children of the household.

Typically, flock size ranges between five and fifty birds, with the birds being raised under a traditional extensive scavenging system without special inputs in terms of feeding, housing or labour. There is little or no linkage with input and output supply chains, and the chicks are usually obtained by hatching home produced eggs for home consumption or for limited trade within the village. The production performance of these birds is relatively poor, with 40-60 eggs and about 1 kg–1.5 kg meat at the end of the production cycle [9-11].

Reason for Low Productivity in Sector 4

The birds are generally free ranging, with few or no inputs being provided. Housing in these systems is rudimentary and mostly built with locally available materials such as wood, mud bricks, sugarcane stems, bamboo and cereal stoves. Biosecurity measures are more or less absent; although some observers believe that the natural genetic diversity found in

this system provides adequate resistance to diseases and the ability to withstand disease outbreaks, unlike intensive systems. But, put forward an estimate of approximately 825 million for the number of chicks, guinea keats and ducklings dying each year in Africa as a result of diseases and predation.

Roberts argues that starvation associated with dwindling biomass availability in villages is an important factor contributing to poor growth and survival in village poultry. Under these circumstances, simple interventions, such as supplementing feed using creep feeders, can significantly enhance the survival and growth of chickens. Other reasons for low productivity include management system (leading to overburdening of chickens with a variety of tasks, such as brooding and rearing chicks, leaving little time for productive purposes) and variability in the quantity and quality of feed.

Reason for Keeping Poultry by Rural Households

Irrespective of the direct contribution to household income, small scale poultry is often recognized as an important contributor to overall livelihood security. In Tamil Nadu, a state in Southern India, generation of planned and regular income was identified as the main reason for poultry keeping, whereas in Rajasthan in Northwestern India, poultry were almost wholly kept for household consumption reports income supplementation and augmentation of domestic meat supply to be the primary reasons for keeping poultry in backyards in Ghana. A number of children from poor African households have reported that payment of their school fees is dependent on the income derived from their poultry micro enterprises found that starvation during the lean season declined by almost 75% in the case of poultry rearing households and in FAO provide approximate figures as shown in [Table 2](#) for the proportional contribution of birds kept under small scale family production systems to the total poultry population in selected African and East Asian countries [12-15].

Table 2: Proportion of national poultry flock accounted by family poultry production.

Countries	Percentage of national poultry population in family poultry production
Cameroon	70
Central African Republic	80
Côte d'Ivoire	73
Ethiopia	99
Gambia	90
Kenya	70
Malawi	90
Mali	90
Nigeria	93
Senegal	70
Sudan	75
Togo	70
Uganda	80
United Republic of Tanzania	70
Zimbabwe	25–30
Cambodia	90
Indonesia	64
Lao People's Democratic Republic	90
Thailand	10
Vietnam	70

The Structure of Poultry Sector in Ethiopia

The poultry sector in Ethiopia can be classified into three major production systems based on some selected parameters such as breed, flock size, housing, feed, health, technology, and biosecurity.

Village or Backyard Poultry Production System

Backyard poultry is the predominant system in Ethiopia and accounts for nearly 99% of the poultry population. This poultry production system is characterized by local chicken breeds, individual farm household management, minimum labor inputs where birds are kept under a scavenging system, little or no inputs for housing, feeding or health care, and they are not business oriented rather destined for satisfying the various needs of farm households. And the birds feed by scavenging and thus mix with people and other livestock.

Small Scale Poultry Production System

Modest flock sizes usually ranging from 50-500 exotic breeds kept for operating on a more commercial basis. Birds are kept

both indoor and outdoor with a low bio security level. The small scale intensive poultry is newly emerging system in urban and peri-urban areas, where either broilers or egg type exotic breeds of chicken are produced along commercial lines using relatively modern management methods. This activity is being undertaken as a source of income in and around major cities and towns such as Debre Zeist. Most of these farms obtain their feeds and foundation stocks from the large scale commercial poultry farms and involved in the supply of table eggs to various supermarkets, kiosks and hotels through middlemen.

Commercial Poultry Production System

This is a highly intensive production system and the flock size is usually greater or equal to 10,000 birds. Birds kept indoor conditions with a medium to high bio-security level; and nearly 2% of the national poultry population. A few companies that are situated mostly in Debrezeit areas; which includes: Elfora, Alema, and Genesis farms. Seven public Poultry Multiplication and Distribution Centers (PMDC) located in different regions operating with the major

objective of distributing improved exotic breeds to smallholder farmers. The national poultry meat and eggs consumption is estimated, on an average to be 77,000 and 69,000 tonnes per annum respectively. In the mid 1990's, the per capita egg and poultry meat consumption in Ethiopia was estimated at 57 eggs and about 2.85 kg, respectively.

Major Challenges of Small Scale Poultry Farming

Smallholder farming is faced with a lot of challenges which include the following: Lack of information to small holder farmers, Limited access to modern agricultural technology, lack and high cost of farm inputs, inadequate agricultural credit, marketing problems, poultry diseases, and nutritional constraints.

Economic Challenges

One key element causing the deterioration of the local poultry industry is the competition faced from cheap imports from the EU. Other reported constraints include the high energy prices which continue to increase production costs by over 60%. Oppong-Anane, asserted that poultry feed cost in Ghana, is even higher compared to other countries and takes 70%-80% of the production cost and Quaye reported that the feed manufacturing industry in Ghana is saddled with the unstable prices of feed ingredients. Banks' lending rates have remained stubbornly high in Ghana, even as the benchmark product rate has been recently reduced and Oppong-Anane concluded that high interest rates on loans with unachievable repayment schedules make it economically unfriendly for commercial poultry farmers to subscribe for banking product.

Okantah, et al., concluded that, constraints associated with inputs such as feed cost, quality and availability, as well as marketing of produce, among others, poses a gloomy and uncertain future for the industry [16-19].

Gopal Krishnan and Mohanlal argue that food costs represents 65%-75% of total cost of commercial poultry production, depending mainly in the relative costs of feed constituents, labour, housing and miscellaneous items of costs in a particular situation. Therefore, it becomes imperative that economic as well as nutritionally balanced diets are provided during all phases of productive life in eggers, chickens, growers and layer stages and in broiler, starter and finishing 3 stages. The economics of poultry feeding depends to large extent on the local situation of food availability and competition for the same food stuff for use by human beings.

Mosinyi cited high costs of feeds, veterinary requisites and poultry equipment, as well as, lack of utilities (*i.e.*, water, electricity and telecommunications) as some major constraints in Botswana's poultry industry. Badubi, et al., reported that poultry feed represents a serious problem to the farmer and prevents birds from achieving maximum growth. Also, Badubi, et al., reported high feed expense and low prices offered by chain stores to be some major constraints in small scale broiler production. The price of raw materials for feed production will also influence poultry production in the next few years. According to OECD-FAO

estimates, feedstuff prices will be higher than the historical average between 2010 and 2019, but lower than the peaks experienced in 2007 and 2008. Additionally, the workers reported that feed quality was variable in quality and that its supply was irregular [20].

Disease Challenges

As per FAO report, Bangladesh and other five countries India, China, Egypt, Indonesia and Vietnam has been suffering from the H5N1 virus. This is because of 'firmly entrenched' due largely to 'weak producer and service associations' to support farmers. In aforesaid countries avian flu is still endemic due to poor veterinary and livestock production services retard appropriate revealing and managing of infection. Due to bird flu we cannot know export chicken in Nepal and also Middle East countries. As such negative impact has been felt. Approximately 825 million for the number of chicks, guinea Keats and ducklings dying each year in Africa as a result of diseases and predation. In this context, expansion of veterinary services including vaccination is essential.

Newcastle Disease (ND) constitutes the most serious epizootic poultry disease in the world, particularly in developing countries. No progress has been made in controlling ND in free ranging village flocks, which represent more than 80 percent of the total poultry population. Several recent surveys in Africa showed high rates of sero-positivity in the absence of vaccination. In developing countries, ND occurs every year and kills an average of 70%-80% of the unvaccinated village hens.

The current environmental imbalance is considered to be a factor contributing to the outbreak of emerging diseases, as well as re-emerging diseases such as Severe Acute Respiratory Syndrome (SARS), Hantavirus, highly pathogenic avian influenza, and other food borne diseases. Although traditional approaches involving medical technology combined with active involvement of social, ecological, and political disciplines can be an effective tool in controlling diseases.

Salmonella is one of the most common organisms causing food borne diseases worldwide. In the US, *Salmonella* is the second largest cause of food poisoning, where it spread widely between 2009 and 2010 (CDC/United States, 2009-2010). In EU countries, approximately 100,000 patients suffered from food poisoning caused by *Salmonella* in 2010. In Thailand, *Salmonella* was found to be the second largest cause of food poisoning, following Rotavirus in 2008. The main cause of human salmonellosis is the consumption of meat such as chicken contaminated with *Salmonella*.

Poultry disease is widely distributed in Ethiopia and Newcastle Disease (ND) is the most important cause of economic loss in poultry production in the country. Diseases are the major limiting factor to rural household poultry production system. In the more recent past Gumboro disease (IBD) has caused great losses through mortality and poor performance of poultry that survive the outbreaks.

Technical Problems

Low technical knowledge was cited by MoFA as affecting the efficiency and the effectiveness of local poultry production in Ghana. Day old chicks produced locally are of poor quality and is also linked to the poor development of commercial poultry in Ghana. One of the reasons for low production is the absence of any legislative framework or policy to regulate the operations of local hatcheries. As a result poor day old chicks are produced. The number of hatcheries decreased from 28 in the 1980's to 10 in the 2000's. Additionally, most of the poultry hatcheries are only producing at about 60% of capacity due to low demand. Low demand for locally produced DOC is due to high mortalities recorded during brooding and poor laying capacity of pullets.

There is insufficient youth participation in the agricultural sector to which the poultry is a sub sector even though this class of people is the most productive of any society as it contains people in the prime of their lives physically and mentally. The hub of the majority of world economies is based on the reliance on SME's, which accounts for some 90% of a country's GDP and 80% of employment in some of them.

According to Ghana annual poultry report, a agriculture continues to be the highest contributor to Ghana's Gross Domestic Product (GDP) in the area of corporate taxes, export duties, and import taxes flowing from their activities and had it that private sector is critical for employment creation, growth and development of Africa. Chicken is one of the major sources of animal protein all over the world. Barbut and Ramatu et al., confirmed this by asserting that currently, chicken consumption in Ghana is between 75,000-90,000 metric tons every year. Commercial poultry offers opportunity for farmers to generate income to sustain their livelihood as well as serves source of inputs for the production of other products. Levy and Powell noted that, SME's are thought to be flexible and innovative organizations that are able to respond quickly to customer and market demands flexibility. Technical factors and the evolution of science and technology, the availability of natural resources and water (which are becoming increasingly limited), and the maintenance of trade barriers must also be considered. According to Odoemenem and Obinne there is very limited access to modern improved technologies and their general circumstance does not always merit tangible investments in capital, inputs and labour. Agricultural technology for the smallholder farmer must help minimize the drudgery or irksomeness of farm chores. It should be laborsaving, labour enhancing and labour enlarging. The farmer needs information on production technology that involves cultivation, fertilizer application, pest control, weeding and harvesting. This sort of information is at the moment being diffused by extension workers, other farmers, government parastatals and agricultural equipment dealers but the impact is yet to be felt.

Market Problems

Eggs are mostly sold in crates or boxes lined with sawdust.

Eggs are marketed base on size and colour, the sizes are large, medium, and small and the colors are white and brown eggs. Most Ghanaians attach superstition to white eggs and thus purchases of the browns are higher than white shell eggs. In spite of these, eggs are produced all year round. Droppings from farms are sold to farmers or given out for free. Major buyers of these droppings are onion and shallot farmers in the Northern and Volta Regions of Ghana respectively. However, there are other commercial and backyard crop farmers as well as fish pond farmers who also patronize this product. High transportation costs have contributed to high cost of production as farmers have to travel long distances to destination.

According to Anon, supermarkets chain stores do not buy products from small scale broiler producers under the pretext that birds are not slaughtered hygienically and in accordance with the halaal ritual. According to Halaal food authority, halaal means permitted, allowed, lawful or legal according to the Islamic faith. In relation to food or drink, it means that the food or drink is lawful, permitted or allowed for Muslims. The Islamic dietary laws define what food and drinks are halaal. According to Toronto public health for meat and poultry to be halaal, animals must be slaughtered according to Islamic dietary laws (Zariah). Halaal calls for animals to be prayed for before slaughter and be slaughtered in a way that allows full bleeding. The opposite of halaal is haram, which means prohibited, not allowed, unlawful or illegal under Muslim religion. Halaal food is considered to be healthy for consumption by Muslims. Few studies on marketing constraints of small scale broiler producers have been carried out. Therefore, a study was carried out to ascertain marketing challenges faced by small scale broiler producers in 13 centers (3 towns and 10 rural) of Botswana.

Marketing comprises all business activities involved in the movement of commodities from production to consumption. Bamiduro, observes that increase cost in of transportation is the major problem facing marketing of agricultural products in Nigeria. The farmer's market information needs are those that enable him make rational and relevant decisions. Ozowa, observes that market information services have the function of collecting and processing market data systematically and continuously, and of making it available to market participants in a form relevant to their decision making. Distance to markets significantly affects the revenue gained by village poultry producers in Ethiopia. The lack of a proper infrastructure for the sale of rural poultry is identified by Kyvsgaard as a constraint to generating revenue from poultry production. The transaction costs can be significant if the markets are far from the household, and this decreases the price obtained by the farmer.

Environmental and Management Challenges

Environmental challenges: Thermal comfort inside poultry facilities is essential, as unfavorable environmental conditions significantly affect production. Both excessive cold and heat

may cause production losses and impair bird health and welfare and, in extreme situations, increase bird morbidity and/or mortality. The evolution of technology and of the knowledge on thermoregulation physiology and behavior will reduce mistakes in poultry house design and in bird management that can cause thermal discomfort. The development of information technology allows new techniques in the study of broiler thermal comfort, such as the use of real time image analysis using video cameras, image acquisition hardware, and image analyzing software programme to acquire process and evaluate information.

Interestingly, inside broiler houses, 80% of the heat is not produced by lamps or brooding systems but by the birds themselves. Proper evaluation of this heat production may allow creating mechanisms for the utilization of this energy, which could be translated in significant cost savings.

Management related challenges: Food contamination by pathogens is the main concern of consumers. The loss of information or of traceability is the main risk factor for the entrance of contaminants into the process of animal feed production.

Animal Welfare and its Consequences

The welfare of animal production can be accessed from two perspectives: Through anthropomorphism, where consumers put themselves in the place of livestock and make conclusions about their welfare often based in subjective ideas. Animals that are reared in poor welfare conditions are not able to express their maximum genetic potential. And through animal performance; consumer concerns relative to poultry welfare are becoming increasingly relevant in the meat market. There is a positive correlation between the strictness of welfare legislation and income of the citizens of a country and consequently their purchasing power.

Feeding

Scavenging was one of the characteristics of village chicken production system. The exact amount of supplementation of the feed is not clearly known in this system. But, this result is not in line with reports of who stated that village chickens don't receive regular and enough supplements.

Future Prospects of Small Scale Poultry Farming

Employment, poverty alleviation and improved nutrition are all potential benefits from continued support and encouragement of poultry development. Effective control measures taken by the government of India in rapidly containing the recent outbreaks (instead of blaming backyard poultry production) demonstrate that well-orchestrated public-private partnership in disease prevention and control can contribute substantially towards minimizing public health risks emanating from small scale scattered poultry production. Aho, predicts that poultry meat output may be impacted and fall before that of eggs in the world production. The factors that influence the production of poultry meat and eggs, he said, are real income per capita, the distribution of

that income, the cost of grain and the size of the human population. Poultry will do well despite higher grain costs," said Aho. This is because, at around 2:1, feed efficiency is better for poultry meat than pork (3:1) or beef (4:1), largely thanks to the tremendous progress made by broiler genetics companies. Another important factor is the difference in water requirement: 3,000 liters for chicken compared to 6,000 liters for pork and 16,000 liters for beef.

In recent years there has been growing recognition among the development community of the role of small scale commercial poultry production in accelerating the pace of poverty reduction and reaching out to the poorest of the poor. There is also growing evidence to demonstrate the role of small scale poultry production in enhancing the food and nutrition security of the poorest households and in the promotion of gender equality.

DISCUSSION

Feed Mill

Ingredient nutrient variations caused by plant cultivar, processing, harvest year, nutritional density, presence of mycotoxins, etc., will need to be more seriously considered if the main purpose of the business will be reaching the precision nutrition concept. As an example, observed that amylose to amylopectin ratio is one of the main factors that determines true metabolized energy of corn, and can be used to predict available energy for poultry through genetic engineering, were able to improve the nutritional quality of corn, developing low phytate varieties studying soybean meal coming from Malaysia, USA and Argentina, were able to identify differences in apparent metabolized energy of the samples that influenced the performance of the broilers. Therefore, it is clear that at least these ingredients can no longer be considered as commodities, and their qualitative and quantitative aspects must be taken into account when someone is making purchasing decisions.

To accommodate ingredient differences, the segregation concept must be implemented in feed mills. This will demand investments in silos to store different batches, according to nutritional characteristics of the ingredients. For corn and other cereals, besides investment in silos, feed mills will need to implement cleaning structures and gravity separators should become a common practice to separate them based on their densities. However, the implementation of ingredient segregation is limited to wet chemistry techniques, which are usually expensive and time consuming. This limitation may be overcome by the use of NIRS (Near Infrared Reflectance Spectroscopy), that allows immediate analysis of energy as well as amino acid composition and digestibility of each feedstuff batch. So, the design of new feed mills will have to consider the use of NIRS, providing more storage, dosing, and milling flexibility, which will allow savings that are not feasible today due to the lack of this physical infrastructure.

Nutrient Utilization and Feed Formulation

Out of the trends currently observed and that will define how nutritionists are going to formulate diets in the next 10 years is the increasing cost of raw materials and the pressures to reduce feed costs and nutrient environmental excretion will be emphasized. These factors will cause diets to be formulated more accurately, avoiding large safety margins. The biofuel industry will compete for raw materials used for animal feeding, and will require the utilization of its byproducts. In this case, knowledge of the analysis of the nutritional content and digestibility of these materials, which are not yet standardized, as in the case of Distillers Dried Grain Soluble (DDGS), for example in the US, should be developed. In this context, enzymes will be increasingly used, as they improve ingredient digestibility and nutrient absorption, as well as reduce the detrimental effects of anti-nutritional factors, thereby allowing higher flexibility in the use of feedstuffs as well as reducing feed costs and pollutant excretion in animal waste. Higher emphasis will also be placed on anti-nutritional factors that change energy and nutrient availability for broilers, using particle size and diet processing to maximize nutrient supply. Better pelleting, expansion and extrusion processes, among others, will be developed, in terms of physical aspects (temperature, moisture, and pressure, time) and their effects on nutrient utilization.

Skinner-Noblet, et al., observed that pelleting improves effective dietary energy value by changing the behavior of broilers, which includes higher feed intake of birds fed pelleted feed. Methodologies to evaluate the impact of heat stress during corn and soybean meal drying on their nutritional quality are currently available. Corn particle size and density may also result in different nutrient digestibility, and should be better evaluated. Observed higher starch digestibility in broilers fed whole wheat grain as compared to those fed ground wheat. Parsons, et al., concluded that higher particle sizes promote a linear increase in the feed efficiency of broilers. Figueiredo, et al., observed that corn density is directly related to its metabolized energy content.

As to protein nutrition, new synthetic amino acids, produced at competitive prices, will become commercially available. In addition to lowering feed costs, this will also reduce nitrogen excretion in the environment. Research on the next limiting amino acids after threonine will be extremely important, and their requirements will have to be evaluated not only relative to lysine, but also as to minimum intake and impact of their use under practical broiler production conditions. For instance, the use of valine for broilers, whose beneficial effects were demonstrated, is becoming a reality. Energy is usually the most expensive nutritional component of poultry diets. Therefore, a higher efficiency in its utilization will result in lower feed cost. One of the strategies to be considered is formulating diets not only takes into account a feedstuff's metabolized energy but also its net energy defined as metabolisable energy minus energy loss due to heat increment, that is, the energy that is effectively used for production. This strategy may allow reducing feed cost and nutrient excretion [21].

CONCLUSION

The poultry industry is known to be a major contributor to economy of country in developing countries through employment creation, and the enhancement of nutrition and food security. Poultry products which are cheaper and more acceptable source of animal protein have decreased the purchase of red meat which is more costly and beyond the purchasing power of the average citizens. In spite of these contributions, the poultry industry is faced with a number of problems that necessitate solution. These include infectious diseases, low input of veterinary services, poor housing, poor biosecurity, and predators and, the quality and cost of feed. But constraints associated with inputs such as feed cost, quality and availability, as well as marketing of product, among others, poses a gloomy and uncertain future for the poultry industry. In recent years there has been growing recognition among the development community of the role of small scale commercial poultry production in accelerating the pace of poverty reduction and reaching out to the poorest of the poor.

RECOMMENDATIONS

Based on above conclusion the following points are recommended:

- Preventing the introduction of infectious agents into the farm should be the goal of all farmers.
- There should be a stable market price for sale.
- The government should provide adequate training for farmer's on poultry management and husbandry.
- Quality feed ingredients should be provided.

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