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REVIEW ARTICLE
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Review on Challenges and Opportunities of Poultry Production Systems, Genetic Resources, and Improvement in Rwanda

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ABSTRACT

The most common poultry production system in Rwanda is an extensive system based on rearing indigenous chicken with low productivity. The objective of the present review was to highlight the challenges and opportunities of poultry farming, genetic resources, and strategies to improve poultry production in Rwanda. Poultry farming in Rwanda is facing many challenges including, feed scarcity, dependency on day-old chick imports, and poor access to credit, poor housing, and poor local genetic breeds and diseases. On the other hand, it presents opportunities such as active participation of public agencies in livestock research and improvement, higher chicken meat acceptance, and low start-up capital. Rwanda needs to pay more attention to its diversified indigenous chicken to select the best parent stocks to improve poultry production.

Keywords: Broiler, Genetic resources, Indigenous chicken, Layer, Opportunities

INTRODUCTION

Meat consumers appreciate poultry, especially chicken meat because it is healthy and has no religious restrictions or taboos (Jin et al., 2018; Zhang et al., 2021). Rwanda has a faster-growing population and is among the most densely populated countries in Africa. The current population of Rwanda is about 13, 3 million people with a density of 525 people/km^2, as of October 5, 2021 (UN, 2021). Chicken production is gaining popularity globally. Chicken meat shared 33% (about 112.86 tonnes) of the global meat production which reached 342 million tonnes in 2018 (FAO, 2020). In Rwanda, the number of chickens reared is ranged between 5 and 7 million, in which the majority is indigenous chickens (IC) counting between 4.5 million and 4.8 million birds, however, the productivity is still low (FAOSTAT, 2014; ILRI et al, 2017; Habimana et al., 2020). Two major poultry rearing systems are found in Rwanda; these are traditional poultry rearing and commercial rearing systems (Mazimpaka et al., 2020). NISR (2012) found that 46% of Rwandan households keep indigenous chicken (IC). More than 87.4% of indigenous chicken (IC) are kept in rural communities under traditional farming systems within in small flocks of 5-10 birds (ILRI et al., 2017; Habimana et al., 2018; Mazimpaka et al., 2020). In 2016, chicken production was estimated to be 15,715 tonnes of meat and 243.7 million eggs (8,160 tonnes) (ILRI et al., 2017).

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There are many challenges of chicken farming in Rwanda, including feed scarcity, dependency on day-old chick imports, and poor access to credit, poor housing and poor genetic breeds, and many others. On the other hand, these challenges can be turned into opportunities to boost chicken production and diversify animal products.

Several countries including Rwanda paid attention to their genetic resources, especially domestic animals. To use domestic animal resources sustainably, the Food and Agriculture Organization (FAO) of the United Nations, developed the global information system or database known as Domestic Animal Diversity Information System (DAD-IS). Rwanda has a local chicken breed commonly known as Poule Locale (in the French language) (DAD-IS, 2021). There are also different imported chicken breeds, including Bleue de Holland, Derco, Hubbard, ISA Brown, Rhode Island Red, and Sussex (DAD-IS, 2021).

Globally, Africa is reported to be the lowest meat consumer (FAOSTAT, 2019). Regarding the consumption of products of animal origin in Rwanda; it was reported that the per capita meat consumption levels were 7.9 kg for meat (Hirwa et al., 2016) and 1kg for eggs in Rwanda (ILRI et al., 2017) which were below 50 kg for meat and 300 eggs or about 15 kg per person per year as recommended by (FAO, 1999). Concerning poultry meat consumption per capita per year, Africa consumes the lowest quantity per capita with 6.73 kg of average poultry meat, followed by Asia with 9.79 kg, Europe with 23.35Kg, 39.13 kg for America, and 42.67 kg for Oceania while the world average poultry meat consumption is 14.99 kg per person per year (FAOSTAT, 2019). Rwanda is among the countries in Africa with the lowest poultry meat consumption with 1.19 kg of chicken meat (ILRI et al., 2017).

To increase household income, food, and nutrition security, Rwanda set strategies to transform chicken farming from a subsistence farming system to a knowledge-based chicken farming system. This transformation would be achieved through the collaboration of different stakeholders, including private investors, the public sector, and poultry farmers. There is a need for detailed information on the poultry production sub-sector, challenges and opportunities, chicken breeds existing in Rwanda, and available programs to improve the poultry production in Rwanda.

Therefore, the objective of the current paper was to review the challenges and opportunities of poultry production systems, genetic resources in chickens and to sort out existing strategies for improving poultry production in Rwanda.

POULTRY PRODUCTION SYSTEMS IN RWANDA

As one of the most densely populated countries in Africa, Rwanda is facing the challenge of land shortage and a faster-growing population. Taking into account these problems, an agricultural activity requiring a small land, but targeting higher productivity would be the sustainable solution. Starting a Poultry farming enterprise requires a small piece of land and a small capital but can fill the gap of protein deficiency and alleviate poverty (FAOSTAT, 2014a; Mazimpaka et al., 2020). Two systems of chicken farming coexist in Rwanda. These are extensive (traditional) chicken farming and intensive (commercial) chicken farming systems (Mazimpaka et al., 2020).

1. The extensive (traditional) chicken farming system

The most common chicken production system in Rwanda is the extensive production system. In this system, farmers rear indigenous chicken with no inputs. In Rwanda, there are about 4.5 million chickens reared under extensive system in rural areas (FAOSTAT, 2014; Mbuza et al., 2016a; Mahoro et al., 2017; Mazimpaka et al., 2020). This is the traditional production system because chickens get food from scavenging around the village and rarely get food wastes (Mazimapaka et al., 2020).

There is no Provision of other inputs such as improved housing, additional feed, and health care. This farming system is found in rural, urban, and peri-urban areas. In rural areas, farmers normally consume eggs and chicken meat themselves or sell them to the near markets to supplement their income. In traditional chicken farming, flock size is usually between 2 and 20 birds per household, with the majority being below 10 chickens per household (Mbuza et al., 2016a; Mazimpaka et al., 2017). In the Traditional system, farmers initially buy the birds from neighbors or village markets. Crossbreeding of local chicken with the exotic pure breed is very rare. This production system always leads to low productivity.

2. The commercial chicken farming system

The intensive (commercial), the chicken production system in Rwanda is still at its infancy stage. Different exotic breeds are used in this system, including Bleue de Holland, Derco, Hubbard, ISA Brown, Rhode Island Red, and Sussex (DAD-IS, 2021). In Rwanda, there were 772,674 layers and 974,543 broilers which produced 160.3 million eggs and 10,634 tonnes of meat in 2016 (ILRI et al., 2017). In this production system, some farmers keep layers to produce eggs while others keep broilers specialized for chicken meat production. Commercial production system is also known as intensive production system and is characterized by larger flock sizes compared to the traditional farming system and sales of chicken meat and eggs produced on the farm. In addition to that, commercial chicken farming uses basic bio-security measures and semi-automatic feeding systems. In commercial broiler chicken keeping, birds are kept permanently in houses. Most of the farms in commercial chicken production are found in peri-urban areas followed by those found in urban areas (Mbuza et al. (2016b).

GENETIC RESOURCES

1. Local chicken breeds reared in Rwanda

In Rwanda, local chicken breeds are of huge importance. They are resistant to diseases adapted to the harsh environment and can use low-quality feed available (Hirwa et al., 2019). These local chickens are distributed in the 5 agroecological zones of Rwanda (Habimana et al. 2021). Indigenous chickens are diversified from feather to shank color, which presents the potential for genetic improvement (Hirwa et al., 2019; Habimana et al. 2020). Habimana et al. (2020) found that indigenous chicken was characterized by low productivity weighing between 0.8 kg and 1.8 kg for a mature hen and can lay between 40 and 100 eggs per year. The same author also reported that the majority of indigenous chickens were normally feathered due to the cool environment in Rwanda. The following figure 1 and 2, respectively represent different types of a feather, indigenous male chicken (left) and indigenous female chicken (right) found in Rwanda.

In Rwanda, there are different exotic chicken breeds to meet market demand for both meat and eggs. Among imported breeds, some are layers, broilers, and others for dual purposes.

2. Layers

Isa Brown and Lohmann Brown, both breeds are imported from Belgium and are suitable for layer poultry (Cocchini and Steeg, 2019). Isa brown chicken is very popular for producing eggs and are adaptable to different climatic conditions, require low cost of maintenance and, can produce 300 eggs in the first laying year (Kolawole and Folake, 2019). Cocchini and Steeg (2019) reported that chickens of Isa and Lohmann breeds start laying eggs at 6 months old and can live about 1.5 years and in ideal conditions, the brown breed's chickens lay more than 400 eggs during their lifetime.

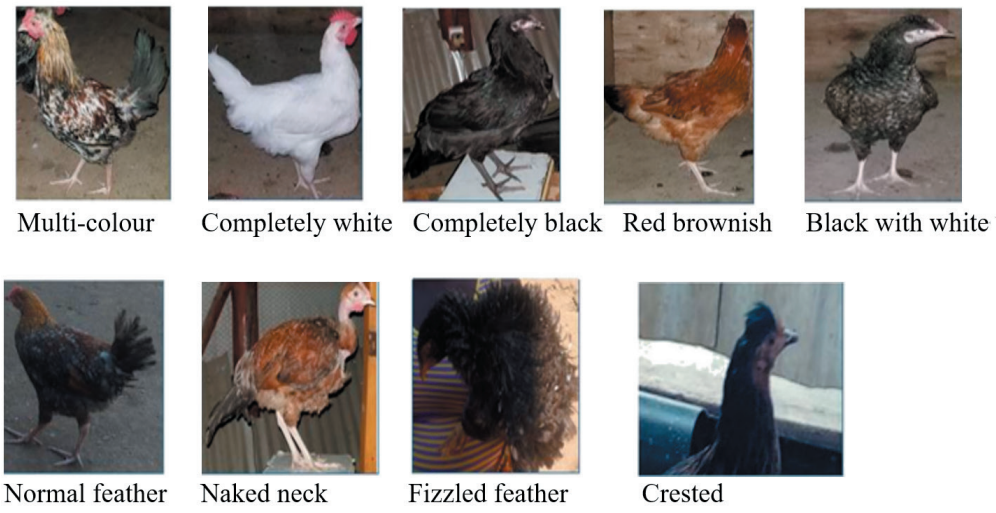

Figure 1. . Feather categories of Indigenous chickens in Rwanda (Source: Habimana et al., 2021)

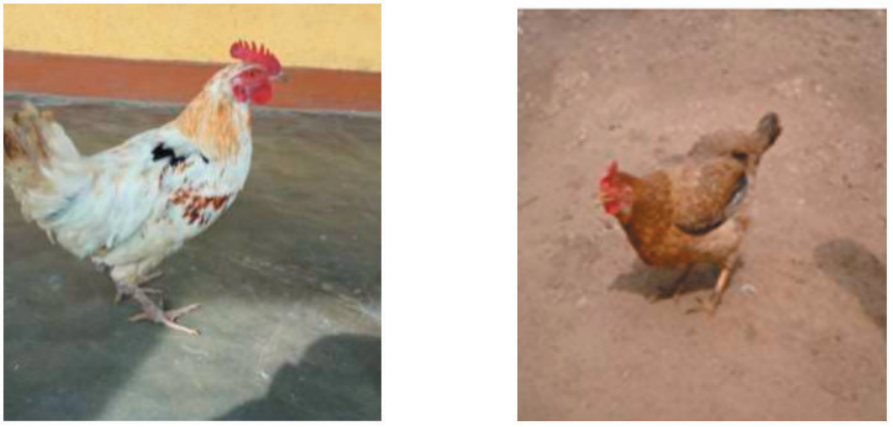

Figure 2. Indigenous male chicken (left) and indigenous female chicken (right) Source: Hirwa et al., 2019

3. Broilers

The most distributed broilers in Rwanda are Cobb 500 and Ross 308 and are usually imported from Uganda, but sometimes they can be imported from Europe (Cocchini and Steeg, 2019). The Cobb breed was the most preferable broiler breed due to the higher growth performance once fed on proper ration (Mbuza et al., 2016b).

4. Dual-purpose chicken breeds

The Sasso breed is imported from France and is used to produce both meat and eggs. They can lay 200–300 eggs during their lifetime). The Sasso breed is easily manageable and farmers can afford their prices to start the business of rearing Sasso chickens (Cocchini and Steeg 2019).

CHALLENGES OF CHICKEN FARMING

Poultry farming in Rwanda is facing many challenges. Some of the constraints are specific to chicken reared under extensive production systems but others are common to both extensive and intensive chicken production systems. There are many challenges of rearing indigenous chicken in Rwanda, including, the low genetic potential of indigenous chicken, diseases, low input, feed scarcity, thieves, lack of trained personnel, poor housing (Mahoro et al., 2017; ILRI et al., 2017).

1. Feeds

Feed is recognized as the critical factor for the success of the chicken farming (ILRI et al., 2017). Poor feeding was reported to affect chicken productivity. Poultry is known to have higher efficiency to convert feed into eggs and meat than other livestock species (Mbuza et al., 2016). The poor feed is, the poor productivity it will be. In Rwanda, feeds shortage is attributed to the low productivity of maize and soy, major components for poultry feed ingredients. There is also a very high competition with human consumption (ILRI et al., 2017).

2. Lack of trained personnel

Chicken farming is practiced by people with the primary education and illiterate people (Mahoro et al., 2017). Skilled personnel with secondary or university education are employed in non-farms works. This will affect poultry farmers because they can't use locally available materials to make chicken feeds (ILRI et al., 2017).

3. Low genetic potential of indigenous chicken

Indigenous chickens are predominant with low productivity (ILRI et al., 2017; Mahoro et al., 2017) but can be improved through selection within the local breeds and crossing local breeds with high producing exotic breeds.

4. Diseases

Bio-safety guidelines for disease prevention are not implemented and in case of disease outbreaks such as new castle disease and infectious bursal disease (IBD/Gumboro), and the loss will be unquantifiable. The most biosecurity measure practiced by the majority of chicken farmers was cleaning the chicken's shelter (Mazimpaka et al., 2020). Different chicken diseases occur in Rwanda. They include Newcastle disease, which is the most important disease which causes high mortality in young and adult birds (Mahoro et al., 2017). Salmonellosis and coccidiosis diseases also caused losses to the chicken farmers.

5. Marketing, processing, and the lack of commercial day-old chick

Market fluctuation has been reported to be a challenge to chicken production in Rwanda (Mahoro et al., 2017). Besides this, the shortage of slaughtering houses for chicken and the lack of egg processing plants also affect the poultry industry in Rwanda. Availability of day-old chicks is challenging to the commercial production system because these day-old chicks are mostly imported from Uganda, Belgium, and Netherlands and suppliers can not meet the demand (ILRI et al., 2017).

OPPORTUNITIES

1. Public agencies backing for livestock research and improvement

The government of Rwanda through its agencies shows the active participation in research and improvement of the livestock sub-sector in general and poultry farming in particular. In 2010, Rwanda Agriculture and Animal Resources Development Board (RAB) was established through the fusion of three existing agencies, including Rwanda Animal Resources Development Authority (RARDA), the Rwanda Agricultural Development Authority (RADA), and the Rwanda Agriculture Research Institute (French acronym: ISAR) to implement policy in agriculture and livestock production, to do research and disseminate information to farmers. In 2016, the government of Rwanda set the roadmaps to transform livestock from subsistence level to the knowledge-intensive market-oriented sub-sector (ILRI et al., 2017).

2. Higher chicken meat preference

Apart from challenges, poultry farming has many opportunities in Rwanda for investors and farmers. Chicken meat has a higher demand in Rwanda, especially a higher preference for indigenous chicken meat. In many countries, including Rwanda, chicken meat has no taboo or religious-related restrictions (Mbuza et al., 2016b; Zhang et al., 2021). Chicken meat is very rich in useful nutrients such as protein, vitamins, and minerals and has low-fat content with more unsaturated fatty acids making it more preferable meat consumers (Jin et al., 2018; Zhang et al., 2021). The demand for chicken meat keeps on growing and this creates an opportunity for poultry farmers to produce more chicken products.

3. Low start-up capital and big market size

As a country with land scarcity, chicken farming would be a profitable business in Rwanda. Starting chicken farming requires less land area, little capital, and other inputs compared to other livestock species but can take in income generation, poverty reduction, and food security (FAO, 2014, Mazimpaka et al. 2020). Rwanda is among the African countries which consume the least quantity of meat in general and chicken meat in particular. This presents a very good chance for investors to increase chicken productivity to meet the protein requirements for about 13.4 million people in Rwanda (UN, 2021).

GENETIC IMPROVEMENT OF CHICKEN RESOURCES IN RWANDA

Indigenous chickens are very diverse from feather to the shank. This is beneficial for the selection and genetic improvement of existing chicken breeds. Rwanda has set strategies to transform the chicken industry from the subsistence level to the improved production system. This transformation will be achieved through improved selection among indigenous chicken and introducing dual purpose tropical breeds (ILRI et al. 2017). Public and private organizations will join hands to achieve a knowledge-based chicken farming enterprise. To supply the feed processing sector, facilitating the importation of additional raw materials, including maize will be implemented to solve the feed shortage in Rwanda (ILRI et al. 2017). To sustainably improve existing indigenous chicken, genetic diversity among indigenous chicken is being identified (Habimana et al. 2020), but still needs efforts to fully understand the genetic makeup of indigenous chicken in Rwanda.

CONCLUSION

Poultry farming is important sub-sector of livestock industry in Rwanda. Chicken meat has no religious restrictions and is the source of proteins, vitamins, minerals and unsaturated fatty acids. To start poultry farming requires a small land area and a little capital, but can generate income in the short period of time. The discussed challenges would be addressed in order to improve poultry production in Rwanda.

CONFLICT OF INTEREST

The authors have declared that they have no conflicts of interest

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