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Review Article

The strategic management of backyard poultry farming: The scenario in rural India

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Abstract

The socio-economic and nutritional benefits of small-scale backyard poultry farming were well-known throughout the globe. In India, rural people also initiated to adopt this model for the improvement of their well-being. The backyard poultry farming concept is becoming more popular among resource-poor farmers in rural areas. This practice provides a high economic return with alow initial investment. This small-scale poultry sector not only economically supports the rural families but also, gets the source of nutritious foods as poultry meat and eggs. Apart from these, such a small-scale local business model is ideal for the economic independence and empowerment of rural women. Still, several hurdles and limitations need to be overcome for the successful establishment of backyard poultry farming in rural India as the high mortality rate in chicks, lack of proper infrastructure, the unstable production rate of desi breeds, lack of scientific knowledge for handling the birds, predators, harsh climatic exposures and most importantly, the fluctuations of the price of feed and feed supplement. In this review, we comprehensively discuss these constraints, benefits of the cooperative small-scale poultry farming model with the support of microfinancing institutions, scientific skill developments, and strategic management for the overall improvement of backyard poultry farming.

Key words: Backyard poultry farming, Breed, Food production, Health management, Poultry feed

Highlights

- The review is helpful to understand the basic management of backyard poultry farming.
- In this review, we discuss different aspects and benefits of the microfinance cooperative poultry model.
- The review is quite important to add value for improving the food security and sustainable development of poultry farming.
- We discuss the importance of micro-entrepreneurship training on poultry farming in rural areas.
- The review emphasizes the role of rural women empowerment in small-scale poultry farming.

Introduction

Food is an essential and indispensable part of our life. The worldwide sources of food are agriculture and livestock. These two important farming practices have immense contributions to the world as well as the Indian economy (Gowane *et al*., 2019). The development and maintenance of livestock are considered an integral part of the Indian agriculture system and contribute in many ways to the growth and development of the small agricultural sector especially in rural areas (Banda *et al*., 2021). Livestock provides financial assistance in the production of nutritious food products, in generating income and employment, and timely support during droughts. In addition, livestock farming is an essential and promising practice for environmental protection, ecosystem integrity, bio-energy supply, production of bio-fertilizers, bio-fuels that save on the use of non-renewable energy sources and greatly reduce environmental pollution (Scherr *et al*., 2008). Therefore, apart from agriculture, the growing population in emerging and developing countries like India gets its food requirements from livestock. Among different animal

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agriculture practices, poultry farming provides a good, sustainable source of meat and eggs as a daily requirement across the country (Vaarst *et al*., 2015).

In the current scenario, poultry farming has been growing at a very fast rate and is still expected to show a climb high in the future. According to the 20th Livestock Census report, it was estimated that total poultry birds in India count as 851.8 million. Interestingly, among them, 250 million (near about 30%) are considered as 'backyard poultry' mainly maintained by small and marginal farmers (Padhi *et al*., 2016). The small farmers (who have 5,000-25,000 poultry birds) in the rural areas of Andhra Pradesh, Karnataka, Tamil Nadu, Telangana, Maharashtra, West Bengal, Kerala and Assam have the highest poultry populations (Kolluri *et al*., 2019). Indian small farmers generally reared chickens, turkeys, ducks and geese for poultry purposes. Worth mentioning that, India has made considerable development in the production of broiler chicken during the last two decades. With the rise of scientific and technological advancements, poultry farmers are introducing high-quality breeds, standard poultry farming equipment, good rearing infrastructure, vaccines, and effective medicines to maintain healthy poultry chickens. As a result, India achieved the ranks of the fifth largest producer of poultry broiler and the fourth-largest producer of eggs in the world as well (Hafez *et al*., 2020).

Importance of backyard poultry farming in India

Although poultry farming has shown a very promising and rising trend in recent days, the major growth of this industry was found confined in urban or semi-urban areas of the country. It is easily understandable that most of the rural population don't have opportunities to access fresh eggs and chicken meat from intensive farming or commercial poultry sectors due to a lack of proper preservation facilities and very little demand for processed meat (Devi *et al*., 2014). It's a fact that 65% of the Indian population is estimated as rural people (Kumar *et al*., 2020) and their staple food is carbohydrates like rice and wheat. They don't get a substantial amount of protein from their daily food. Therefore, it is extremely important to protect them from malnutrition and associated diseases by providing them with balanced nutrition with animal protein supplements. To overcome this issue, along with the intensive poultry production system, backyard poultry farming (BYPF) using high-quality chicken breeds or native breeds is not only drawing huge attention but also acquiring popularity in the rural population to resolve the problems of hunger, malnutrition and protein deficiency (Alders *et al*., 2018). Moreover, BYPF would be a potential subsidiary income source among the rural people in our country (Kumar *et al*., 2021).

Phases of backyard poultry farming

There are two important phases of backyard poultry farming including, a) nursery rearing and b) free-range rearing.

a) Nursery rearing: The most important point in nursery rearing is artificially providing proper feed, temperature, protection to the newborn chicks (Hedlund *et al*., 2019). This phase is extremely important in backyard farming as it resembles intensive poultry farming in the context of quality feeding, proper management, and good health care practices (Rajkumar *et al*., 2021). In this phase, chicks are reared until they reach the age of 4-6 weeks and mature enough to start scavenging their feed and protect themselves from their surrounding predators.

b) Free-range rearing: Another important phase in which chicks (between 4-6 weeks of age) are familiarized into the backyards carefully. Poultry farmers should observe the seasonal temperature before introducing the chicks in the backyard. The total number of domestic chicks mainly depends on the availability of area coverage and the source of natural feed. According to experts, a total of 15-20 chicks per family is an ideal number for effective free-range rearing.

It was observed that up to 200 chicks are

ideal for rearing under a small-scale free-range phase. In that case, chicks are needed a large foraging area and a hygienic poultry house for their night shelter (Tufarelli *et al*., 2018).

To get optimum productivity from chicken, 'supplementary feeding' is of utmost importance. In general, chickens reach their protein requirements during foraging in backyards. They scavenge on insects, soil worms, etc. After foraging in the daytime, the chickens should be fed with cereal grains and oilseed cakes in the evening. Through this process, chickens are meet the basic requirements of essential nutrients (Tufarelli *et al*., 2018). Farmers should give the mixture of stone grit, shell grit, or lime powder as a calcium supplement during the egg-laying phase (Wakenell *et al*., 2016). It was proven that without proper calcium supplements, chickens often lay brittle or broken eggs, even shell-less eggs (An *et al*., 2016).

The usefulness of small-scale intensive poultry farming in the rural area

Small-scale intensive poultry farming is mostly practiced by rural, resource-poor people who often experience food insecurity throughout the year. Such a poultry farming model is easily accessible to those rural people, and most importantly it could be a good income and nutritious food source for them to improve food security (Kumaresan *et al*., 2008). Not only does small-scale poultry farming enhance nutrient utilization in a better way, but also it greatly contributes to mixed farming practices and women empowerment in rural India (Nordhagen *et al*., 2018). Generally, poultry farmers should start small-scale intensive farming including 200 to a few thousand chickens, which could be reared in a similar way to intensive broiler farming. Intensive farming should be continued till chickens reach a bodyweight of about 1.5 kg in a flock. Such practice is beneficial for the production of meat by using fast-growing chicken varieties including, Krishibro, Vanaraja, Kuroiler, Srinidhi and Rainbow Rooster (Rajkumar *et al*., 2021). It was estimated that about 10–20% of the backyard poultry farming is continued with this model system, especially in north-eastern states, and large areas in Himachal Pradesh (Thakur *et al*., 2012). Apart from the beneficial side of extensive small-scale poultry production systems, rural farmers often face significant obstacles to getting full benefits due to disease and predation. Such problems can be overcome with better agricultural and livestock management (Conan *et al*, 2012).

The management of small-scale intensive poultry farming

Studies demonstrated that native village chickens are useful and an important income source for domestic expenses. Traditional free-range poultry production systems in developing countries can be improved with the proper use of quality dual-purpose chickens (Kumaresan *et al*., 2008). Important Indian chicken breeds which were documented for small scale intensive poultry farming including, Ankleshwar, Aseel, Daothigir, Busra Chittagong, Denki, Haringhatta black, Ghagus, Kadaknath, Kashmir Faverolla, Kalasthi, Miri, Tellichery, Punjab Brown, Titri, Nicobari, Teni, frizzle fowl and Naked neck (Agarwal *et al*., 2020). Apart from the documented breeds, some desi chicken breeds are also reported (Sankhyan *et al*., 2013). According to research, scientists have found eight different strains of native chickens which are identified and reared by the rural peoples of East Godavari district of Andhra Pradesh including, Shankarjati Kodi, Nati Kodi, Medajari Kodi, Geesa Kodi, Rencha Kodi, Mattedu Kodi, etc. Interestingly, these indigenous breeds are Aseel in origin which has great value for their tasty meat, good fighting abilities, agility, and quick escape ability from their predators (Padhi *et al*., 2016). But farmers need to keep in mind that native chickens are slow growers in nature. Naturally, desi hens lay about 50-100 eggs in a year with alternating brooding phases. As discussed earlier, Aseel meat is superior in quality and composition; therefore, it is very popular among native

chickens compared to commercial broilers (Rajkumar *et al*., 2016). It was observed that the native chickens are slow-growers and also poor layers in nature but they have the qualities to be ideal as a brooder, exceptional foragers, robust-bodied, and resistant to seasonal diseases (Rajkumar *et al*., 2017).

Maintaining good chicken varieties which are highly productive, have better immunity against seasonal diseases with a short budget for nutrition and management is challenging for the farmer. Therefore, farmers always need to maintain good breeds or varieties. The researcher suggested good ways to introduces elective breeding in already established desi breeds and also crossbreeding with exotic varieties or native breeds (Rajkumar *et al*., 2021). Besides breeding, nutrition plays a crucial role in regulating the genetic potential of the poultry chickens for improving the numbers and quality of eggs, also maintaining their body weight. Well-adjusted nutrition should provide young chicks with their overall health improvements and proper functioning of body metabolism (Cherian *et al*., 2015). Of note, the requirements of nutrients vary with the type of breed, body size, genetic makeup, age, the temperature inside the poultry, physical stressors, etc. (Barzegar *et al*., 2020).

The importance of night shelter in backyard poultry was always mentioned by different experts (Conan *et al*., 2012). Therefore, night shelter infrastructure should be proper for the birds to protect them from predators and adverse outside environmental conditions. The types of night shelters are variable and largely depend on the flocks' size as well as available resources (Al-Qamashoui *et al*., 2014). In India, small-scale and intensive poultry farmers usually made night shelter constructions with asbestos roofs, concrete walls (made up of cement instead of mud), and wire mesh for cross-ventilation purposes (Zhao *et al*., 2014). It was estimated that a poultry bird ideally requires one square feet space for their growing phase and around 2.5 square feet during the egg-laying phase inside the night shelter (Kumar *et al*., 2013).

Another important aspect of the backyard poultry management system is always to keep an eye on the health issues of birds. The studies showed that health management in poultry largely depends on bio-security and proper vaccination (Hofacre *et al*., 2002). Maintaining the highest level of bio-security like the commercial sector could be difficult for backyard poultry farmers such as proper immunization of birds under the scavenging system, veterinary facilities, protection from predator attacks were considered main constraints for the small-scale poultry farmers (Hossain *et al*., 2021). The most predominant chicken diseases were found as Newcastle disease and Fowlpox. These viral diseases show remarkable infectivity in the hot and humid coastal regions, therefore periodic vaccination is extremely important to protect the flocks (Hassan *et al*., 2020). Also, the chickens are naturally exposed to different pathogenic loads while scavenging and need continuous monitoring of their health conditions. If some disease symptoms appear, immediately the diseased birds should be separated from others and need to take necessary measures (Galarneau *et al*., 2020). Despite the several limitations, it is recommended to practice mass vaccination programs with the help of local NGO teams, veterinary experts, Govt. departments to control the viral diseases effectively (Kumar *et al*., 2015). It was a proven fact that the proper use of a thermostable vaccine has successfully decreased the Newcastle disease infection in backyard poultry farming (Dey *et al*., 2017). Apart from this, there are possibilities for poultry birds for exposing different other pathogens including, avian influenza, infectious bronchitis, infectious bursal disease and Marek's disease which are potential causes of significant morbidity and mortality (Fulton *et al*., 2013). Some bacterial and parasitic diseases also cause harm to the poultry birds but can be prevented with proper vaccination and biosecurity measurements (Hauck *et al*., 2017). According to research, both bacterial and parasitic infections occur from the source of contaminated poultry feed and water. To prevent such situations, mass deworming

should be done in specific time intervals (six months intervals recommended) (Bessell *et al*., 2019). It is generally suggested to apply deworming-related medications a week before the vaccination of poultry birds to prevent viral diseases. Several studies identified the potential source of contamination as sewerage in the backyards. The contaminated water mostly contains different harmful intestinal parasites including cestodes, nematodes and trematodes, which affect the health and hygiene of poultry birds (Asumang *et al*., 2019) and could be a reason for huge losses to the poor farmers. Other sources of external parasites are night shelter houses or poultry rooms with unhygienic conditions such as the damp, moist, wet floor, and poor ventilation systems (Singh *et al*., 2017). Therefore, experts always suggest to poultry farmers to keep breeding and rearing areas clean with proper disinfectants (Fig. 1). Small-scale intensive poultry farming needs proper surveillance, training, reporting as well as the documentation of breeding history, abnormal symptoms of birds, vaccination, mortality trends if concerned, etc. (Thornton *et al*., 2010)

Antibiotic resistance in poultry birds is a matter of concern now. Data suggested that substantial anti-microbial resistance of *E. coli* bacteria in chicken was developed in most of the poultry farms worldwide. Interestingly, Norway and Sweden had good practices for using fewer antibiotics showed lower levels of *E. coli* resistant in poultry birds (Wierup *et al*., 2021). According to research, overuse of antibiotics may have some adverse effects on chicken such as administration of tetracyclines for a long time may show metabolic deregulations and immunosuppressive effects. For these reasons, there was a reduction of normal intestinal microbiota observed in the gut of poultry birds and they become more prone to different opportunistic infections (Shang *et al*., 2018). During excessive antibiotic treatment, commensal microbes are destroyed in young birds and there is a fair chance to develop harmful bacteria and coccidia populations (Noack *et al*., 2019). Prolonged use of other two antibiotics including, aminoglycosides and sulfonamides may damage the kidney and weaken the minerals absorption capacity in poultry birds (Mund *et al*., 2017). Also, the overdose of steroid

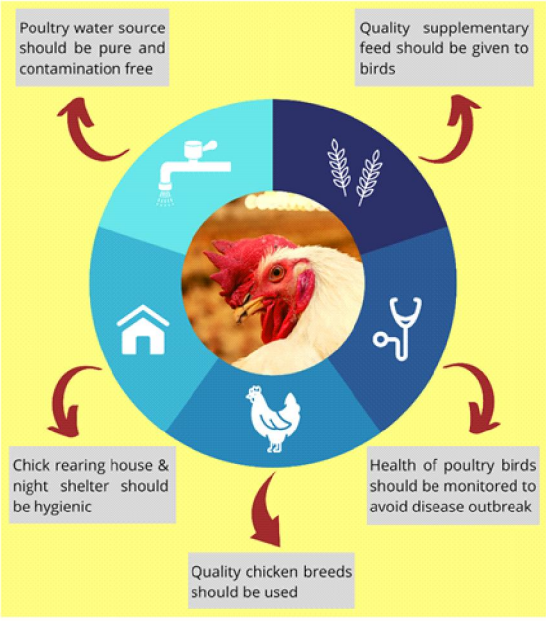

Fig. 1. Strategic components for small-scale intensive poultry management

hormone therapy demonstrated a negative effect on chicken's health and sometimes causes food toxicity (Jeong *et al*., 2010).

Importance of microfinancing co-operative poultry farming model in rural India

The micro-financing cooperative poultry farming model was considered beneficial for small-scale intensive farmers who own the local poultry farms and together run and share the profits (Kumar *et al*., 2015; Chaiban *et al*., 2021). The successful cooperative poultry model was established by a nonprofit organization in the central part of India with nearly 10,000 farmers. Importantly, most of them were rural women, previously involved in other manual laborworks. After successful training on poultry management, women farmers were provided with initial monetary support by giving a part loan to build the poultry farming infrastructures. In this model system, each farmer is required to start work with 300-400 chicks. Currently, they work with 600-1000 chickens/batch, and the estimated productivity level is 220 eggs/chicken/year. Moreover, the health and hygiene issues of each poultry farm (known as a cluster) are monitored by the team of para-veterinary personals (Beesabathuni *et al*., 2018). Nowadays, several microfinance organizations are supporting small-scale intensive poultry farmers in rural areas. The cooperative model was successful in India because of the flourishing and fast-growing input industries, giving procurement at affordable prices for different NGOs to help poor farmers. Studies also suggested that India achieved the position of the third-largest producer of eggs in the world, mostly with the collective efforts of medium and large-scale poultry farms (Chatterjee *et al*., 2015).

Discussion

Backyard poultry farming could be an excellent initiative for rural people of India and may play an important role in improving food security and sustainable development. In this current scenario, small-scale poultry farmers are facing hurdles at the initial stage of their business establishments but strategic management and support from NGOs, social volunteers, Govt. sectors are expected to increase the net productivity and cost-effectiveness of backyard poultry farming (Fig. 2). Scientists already identified the major

Fig. 2. Support systems and sequential chain of small-scale intensive poultry farming model

hurdles in this field including, unavailability of superior breeds, poor health and hygiene, recurrent emergence of viral diseases in poultry birds, antibiotic resistance-related problems, inappropriate infrastructure for rearing house and night shelters, the high price of chicken feed supplements, a high mortality rate of the birds, etc. With the advancement of animal husbandry research, effective and low price vaccines, quality supplemental feeds, disinfectants, and improved poultry water sanitization systems are available now in the market. Therefore, it is anticipated that challenges and limitations will reduce to a substantial level soon. Also, the practice of backyard poultry farming will give the benefit of economic independence to the rural women who are actively involved in this small business. Farmers need to comprehend the importance of native and better-quality breeds for the improved production of eggs and meat as they have a good demand nowadays. Overall, the cooperative backyard poultry farming model will be beneficial and environment-friendly if proper strategic planning and training are provided to the poultry farmers on regular basis.

Conclusion

In order to achieve maximum benefits from backyard poultry farming, strategic and systemic training is required for rural communities. In addition, technical and motivational support should be provided to encourage farmers for running small-scale backyard poultry production systems, since this is an important sustainable agricultural practice for increasing food production, food security, and women empowerment and employment to the rural Indian population.

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Author's contribution: SB, BG: Conceptualized the review and have made a direct, significant and intellectual contribution to this work.

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