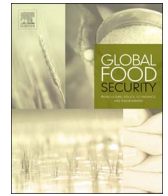




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Small-scale poultry and food security in resource-poor settings: A review

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ABSTRACT

Small-scale poultry production systems are mostly found in rural, resource-poor areas that often also experience food insecurity. They are accessible to vulnerable groups of society, and provide households with income and nutritionally-rich food sources. However, they also improve food security in indirect ways, such as enhancing nutrient utilisation and recycling in the environment, contributing to mixed farming practices, contributing to women's empowerment, and enabling access to healthcare and education. Further, they may contribute to several of the Sustainable Development Goals, and to future food security through maintaining biodiverse genomes. In extensive small-scale poultry production systems, significant impediments to achieving these contributions are disease and predation, which can be reduced through improved agricultural and livestock extension and community animal health networks. For small-scale intensive systems, feed price fluctuations and inadequate biosecurity are major constraints.

1. Introduction

Small-scale poultry (SSP) production systems have been integrated with human livelihoods for thousands of years, enhancing diet, income, and food and nutrition security of the rural poor (Alders and Pym, 2009). Currently, global livestock production systems are under scrutiny, given the projected environmental and food system impacts of increasing livestock production to meet the growing demand for animal-source foods (ASFs) (Delgado, 2003). This review highlights literature that demonstrates and describes linkages between SSP production and food security in low- and middle-income countries (LMICs) with limited resources (resource-poor settings). The potential contributions and impacts of extensive, small-scale scavenging poultry production systems in rural, resource-poor areas differs significantly from more intensive systems in urbanised settings; these differences are highlighted while the contributions of SPP to each dimension of food security – availability, access, utilisation and stability – are explored. Lastly, common constraints to small-scale poultry production in resource-poor areas, and, should these be addressed, their potential contributions towards achieving the United Nations' (UN's) Sustainable Development Goals (SDGs) are presented.

2. Methods

2.1. Review of literature

The terms “small-scale poultry”, “scavenging chickens”, “village chickens”, and “backyard poultry” were searched in Web of Science, BIOSIS Previews, CAB abstracts, and Medline, yielding 1176 results. The search was refined by research area (eliminating 254 results), then assessed for relevance to SSP production, resource-poor areas, and food and nutrition security by article title (eliminating 749 results), then abstract (eliminating 141 results), leaving 32 articles reviewed in full. The Food and Agriculture Organization of the United Nations (FAO) document repository, reference lists from selected documents, and the knowledge of co-authors were also utilised to source relevant publications. Information related to rural, family, or backyard poultry were included if they were relevant to SSP production. Results are grouped by relevance to each dimension of food security. As the majority of SSP production systems raise chickens, this review will use the terms “poultry” and “chickens” interchangeably.

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2.2. Poultry system definitions

Small-scale poultry production systems, largely comprised of chickens, account for the majority of the poultry population in LMICs (Gilbert et al., 2015). The term “family poultry” is used for systems which rely on family labour and, generally, locally available feed resources (FAO, 2004; Thieme et al., 2014). Thieme et al. (2014) describes four categories of family poultry production: small extensive scavenging (1–5 adult birds), extensive scavenging (5–50 birds), semi-intensive (50–200 birds), and small-scale intensive production (> 200 broilers or > 100 layers). Although this spectrum of systems may be viewed as a continuum, SSP farmers utilise the production system that best suits their situation and objectives (Rota et al., 2014). More intensive poultry raising systems require reliable access to inputs, including commercial stock, feed, labour, and health services as well as efficient marketing channels (Branckaert and Guèye, 2000; Mack et al., 2005; Thieme et al., 2014). In rural areas, access to markets, cold chains, and veterinary services is typically limited (Thieme et al., 2014).

The largest number of households worldwide are engaged in “village poultry” production, which encompasses the first two systems, and are comprised of mostly indigenous or sometimes crossbred species (Alders and Pym, 2009). In these free-ranging systems, birds largely scavenge for feed, although supplementary feed may be given, and housing, if provided, is simple and made from locally-available materials (Sonaiya, 2004; Thieme et al., 2014). Small-scale poultry production is commonly incorporated into mixed production systems with crops and other livestock, and are a way for vulnerable households to spread risks (Alders et al., 2013; Thieme et al., 2014). Flocks are self-propagating, with broody hens laying 30–80 eggs per year in 2–4 clutches, and spending time between clutches to rear chicks (Fotsa et al., 2014; Mapiye et al., 2008).

3. Dimension one: availability

The availability dimension of food security generally refers to national food availability, taking into account domestic food production, stores, imports, and aid (WFP, 2009), however, it is also considered at the household level. Food availability refers to foods of “appropriate quality”, and those which are culturally and socially acceptable by a given population (FAO, 2006). Poultry are generally the most numerous livestock in resource-poor areas, where their contributions to food availability are both direct, through supplying nutrient-rich and culturally acceptable products for human utilisation, and indirect, through enhancing crop, vegetable and other livestock production with the provision of manure and pest control.

3.1. Availability in vulnerable areas

Despite small flock sizes, in aggregate, rural poultry flocks account for 60–90% of the poultry population in many LMICs across Africa and Asia (Akinola and Essien, 2011; Guèye, 2000a; Mapiye et al., 2008). Dolberg (2007) and Gilbert et al. (2015) noted the relationship between income and poultry production systems, showing that extensive, scavenging poultry systems are most commonly found in rural, resource-poor areas. Fig. 1 highlights the overlapping distribution of extensive poultry production systems and food insecure areas.

It is common for livestock to fulfill multiple roles within households in resource-poor settings, and livestock ownership does not necessarily translate to increased utilisation of ASFs (Turk, 2013). However, Azzarri et al. (2014) found that ownership of poultry is associated with increased chicken utilisation. This is likely due to their small size and short production cycles, factors which make households more likely to decide to slaughter or sell in times of need, compared to larger livestock (Kariuki et al., 2013). Rural poultry supply 70–90% of poultry products in Africa (Alabi et al., 2006; Branckaert and Guèye, 2000; Kitalyi, 1998;

Mack et al., 2005), and contribute 20–32% of total animal protein intake (Kitalyi, 1998; Tadelle et al., 2003).

There is high demand for meat from indigenous chicken breeds, due to their suitability to local taste preferences and cooking methods (Aini, 1990; Choprakarn and Wongpichet, 2008; Kitalyi, 1998; Umaya Suganthi, 2014). The persistence of SSP production systems in regions where large-scale commercially-produced poultry products are available is an example of food sovereignty, where communities have chosen a sustainable production system that produces healthy, culturally appropriate food.

3.2. As a food source

Meat (both muscle and organ meat) and eggs from indigenous chickens constitute a high-quality food source, densely packed with essential macro- and micronutrients. Animal-source foods are particularly concentrated in highly bioavailable iron, vitamin A, vitamin B12, zinc, and riboflavin - nutrients that are often deficient or absent in the largely vegetarian diets common in rural, resource-poor settings (Bwibo and Neumann, 2003; de Bruyn et al., 2015; Demment et al., 2003; Murphy and Allen, 2003; Turk, 2013). Slaughter of livestock for home consumption is conducive to use of the entire carcass, including organ meats and bones, which are good sources of high bioavailable vitamin A, vitamin B12, iron, riboflavin, niacin, thiamin and folate (Williams, 2007). Consuming foods with high concentrations of bioavailable nutrients is particularly important for infants and young children, with limited gastric volume, pregnant and lactating women who have increased nutrient requirements, elderly people who may have decreased intestinal absorption capacity, and those who are ill (Olaoye, 2011).

Eggs, containing all nutrients required to support the development of a chick, have a “nearly perfect balance of nutrients” (Vizard, 2000) to meet human nutrition requirements. Eggs have been recognised as the lowest-cost source of protein, vitamin A, vitamin B12, riboflavin, iron and zinc (Drewnowski, 2010), and are also a good source of folate, selenium, vitamin D, and vitamin K (Applegate, 2000). Liver and eggs are among the best sources of vitamin A available (Vizard, 2000). Although ASFs are significant contributors to dietary energy and protein, it is their concentration of micronutrients and their ability to counter multiple micronutrient deficiencies that make them particularly valuable food sources. It has been shown that regular ASF consumption has significant positive benefits for children's nutritional status, linear growth, and educational outcomes, leading to increased income and productivity in adulthood (Bwibo and Neumann, 2003; Demment et al., 2003; Murphy and Allen, 2003). Thus, the cumulative benefits of SSP product utilisation are far greater than being an available food source alone. Dolberg (2007) stressed that the consumption of ASFs in LMICs should not be tempered by the known health risks associated with overconsumption of ASFs seen in high-income countries.

3.3. Enhancing food availability and production

One of the major food security concerns related to livestock production is the diversion of potential human food sources to livestock feed, particularly in the case of monogastric livestock (Flachowsky, 2002). However, the scavenging feed resource base (SFRB) utilised in extensive and semi-intensive poultry production transforms feed ingredients in the environment that are less suitable or unavailable for human consumption, including plant seeds, earthworms, and insects, into palatable and nutrient-rich food products for people (Sonaiya, 2004, 2014a).

Small-scale poultry production is commonly used as part of mixed or integrated farming systems, which allows farmers to use resources efficiently, spread risk and protect against shocks (Alders et al., 2013; Prein, 2002). In Bangladesh, Helen Keller International reported great

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