

Contribution of backyard poultry productive systems (BPS) to food security and their potential zoonotic risks

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Abstract

Backyard productive systems are one of the most widespread form of animal production in the world. These systems raise animals from different species and different ages in an environment that lack of biosecurity measures, representing a risk for both animal and public health. However, these productive systems contribute to the household's economy and food security. If Chile faced a health emergency where poultry had to be slaughtered or withdrawn, it would be essential to consider the social and economic impact that this would have on small producers.

Keywords: *backyard, food security, policy, animal health, economic*

Introduction

Over the last fifteen years, the Food and Agriculture Organisation of the United Nations (FAO) and the International Fund for Agricultural Development (IFAD) have paid special attention to small-scale production systems, particularly those raising poultry since they may play an important role in the achievement of some of the Millennium Development Goals (MDGs) agreed on by the United Nations (UN). These goals are related to improving food security, income generation, reducing child mortality, promoting women's empowerment and poverty alleviation (12).

Promoting poultry farming to poor families living in rural areas would help to accomplish these goals, allowing families to constantly have food available in their homes, as well as giving them the possibility of generating revenue due to the marketing of animals and/or products (5). However, backyard production systems (BPS), which are small scale production systems and the most widespread form of animal production in the world, do not apply basic hygiene and biosecurity measures while raising their animals. In this way, people may handle, sell and consume sick animals without considering that those infections can also be potentially harmful to them or neighboring production systems. Saying this, it is notable that animal diseases could affect both, animals and humans (6). Animals can be affected by an increased mortality or a decrease in their production while humans can get sick when dealing with zoonotic diseases. But mainly, animal diseases can impact human's wellbeing by reducing their food security and the household's economy (8).

Additionally, transboundary diseases represent a serious

risk to poultry, livestock production and international trade, so the actions implemented by public Veterinary Services to fight endemic or exotic animal diseases can also affect animal production and households' food security. Isolating animals, good farm hygiene, use of effective vaccines, close monitoring, and quick culling when necessary, among others, are some of the known and proven practices to control and prevent the spread of diseases (3). This carry important negative economic consequences for producers, but in the case of smallholders these losses are more consequential as they may convey the drying up of all income sources, the loss of their main investment, the loss of related animal products and, more importantly, the loss of animal protein availability. Backyard production systems have normally a role in the transmission of diseases, due to poor biosecurity practices and poor government control as they are not normally registered. It is therefore very important that the profile and practices of these systems are well understood in order to allow effective disease control programs together with the need to generate baseline information about the contribution of animal rearing to the wellbeing and food security of households'. Until recently, there has been little effort in evaluating the [perhaps unwanted] impacts of the measures that reduce the risk of diseases, including their effects on the livelihoods of small farmers and their families (8).

This study seeks to characterise BPS that breed poultry in the central zone of Chile with respect to biosecurity measures, animal handling, and food security in order to make recommendations on how to deal in response of an animal emergency at BPS level.

Materials and methods

The study area considered three regions in the central zone of Chile: Valparaiso, Metropolitana and Libertador General Bernardo O'Higgins (LGB O'Higgins). According to the last animal census published in 2007 this area contains 16,289 BPS breeding poultry (7). Considering this population registered by the census, the sample size was of 384 BPS. Since there is no quantitative information available on the contribution of poultry breeding to food security in BPS, it was considered that in 50% of BPS in central zone of Chile, poultry breeding contributes to the household's economy and food security, in order to maximise the sample size. The accepted error and confidence level used were 5% and 95%, respectively (2). Once sample size was obtained, a proportional stratified random sample approach was used. The strata were the provinces within the three regions.

The 384 BPS were surveyed with a field questionnaire in order to characterise the structure, animal handling and biosecurity measures of BPS breeding poultry. In addition, the contribution of poultry to the economy and food security of the households were also registered. The survey consisted of a semi-structured questionnaire with 62 questions, which was applied to poultry owners during 2013-2015.

Every BPS was geo-localised by a Global Positioning System device (Garmin GPSMAP® 64s). All generated data during field activities was organised in Microsoft Excel® spreadsheets.

Firstly, descriptive statistics were provided to characterise BPS. Secondly, a gross margin analysis per household was performed to characterise the economic contribution of poultry to each household. The gross margin analysis was done as described by Rushton (2009) (9). Finally, a regression model was developed in order to know the variables that best explained the contribution of poultry rearing to food security.

Results

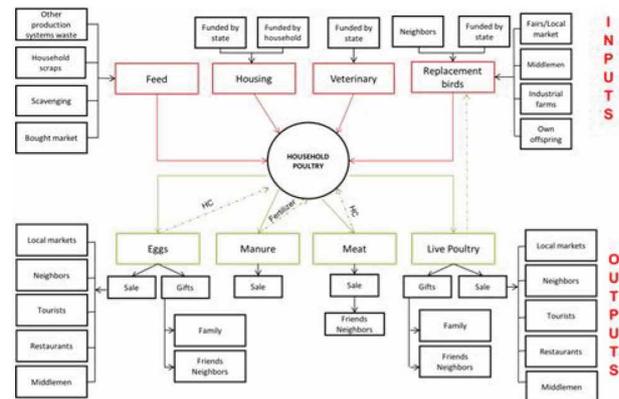
The median per capita income was US\$130. The median age of poultry owners was 59 years old. Some houses didn't have electricity, meaning they couldn't have a fridge where to keep food. The households keep approximately 33 poultry, composed mainly by domestic chickens. Almost a half of the BPS besides of raising animals from different ages, also raised animals from different species, altogether. Even when all BPS keep poultry for household consumption, almost 60% of them also do selling. Poultry are fed mainly by scavenging, household scraps and grains. Even when most poultry do get potable water, some animals had to obtain their drinking water from environmental sources. Almost none BPS had veterinary advice, however, one third of the owners said that they treat sick poultry with drugs, meaning antibiotics and anti-inflammatories and some treated their sick animals with natural herbs.

Regarding to stabling, in 90% of the BPS, poultry could freely roam during the day, allowing them to have contact with other animal species, wild animals and neighbor's animals. For handling mortalities, various practices were identified. Even when buried was the most common practice, it is important to note that almost half of the BPS surveyed had the practice of throwing their dead animals direct to the garbage or far away from the farm. Regarding to the gross margin analysis, 62% of the households ended the year with a positive balance. The production conceptualisation gave us the information of the inputs and outputs of these production systems and the different origins and destinations of each input and output (Figure 1).

We also wanted to determine the importance of poultry breeding to the households, so a question was developed in which owners were consulted if they would be willing to stop breeding birds if they were paid a monthly salary for the rest of their lives. Not surprisingly 56.2% of the owners

answered they would not stop breeding birds for any monthly salary. This could be explained by the results generated from the regression model, where the independent variables (i) Owner's age, (ii) Economic cost of locomotion to the closest market, (iii) Per capita income, (iv) Number of chickens, (v) Sex of poultry owner, (vi) Households' size, and (vii) Presence of a car, explained the 12% of the variability of the dependent variable (Chicken consumption).

Figure 1. BPS operation conceptualisation.



Discussion

Food insecurity and poverty are deeply interrelated phenomena. Any attempt to define, measure or combat them must take into account this relationship explicitly. Extreme poverty has declined significantly over the last two decades; even though hunger and poverty are not completely eradicated as there are still families all around the world living in areas with difficult access to food, which shows that there is still much to be done. Poultry breeding by rural families have been widely perceived as a good option to ensure food security, generate cash, and promote women's empowerment at a relatively low investment (5). However, if promoting ownership of poultry by families in order to achieve the above objectives is an idea to be considered, it is crucial to assess the feasibility and economic viability of this activity, as well as knowing the chances of this contribution to be continuous in time. Breeding this kind of animals should be cost-effective and constraints should be taken into account.

The fact that in 59.6% of the cases women are the ones in charge of poultry management and in 70% of BPS that do selling, women are in charge of marketing the products, demonstrate the contribution of poultry production to women's empowerment, which goes hand in hand with the idea of making progress toward gender equality and the empowerment of women described by the MDGs (12,13).

With respect to animal handling, the fact that all owners give to their birds something to eat more than what they can scavenge implies that there is a concern for the maintenance and production of their animals. However, almost 11% of the owners declared that their animals got water from environmental sources such as lakes, rivers, among others.

This, on the whole with lack of biosecurity measures of poultry kept in BPS, which are consistent with other international and national studies, (1,6) in addition to the fact that only few producers have some kind of veterinary advice, make these productive systems more vulnerable to the reception and/or dissemination of infectious diseases. Even more when birds are mostly kept in a free or partial free ranging system, which allows poultry to have free contact with wild birds, neighbors' animals, humans and even pigs, which is a key point to take in consideration as 20% of surveyed BPS also kept pigs from which in 68%, poultry had free contact with them. This item becomes interesting and could represent a risk for the emergence of diseases, for example, a new variant of Influenza virus, as there is free contact between poultry, wild birds, pigs and people, In this way, not only public health could be in risk, but also the productive system as a whole. The introduction of diseases to these productive systems may kill the animals, decrease their production and in cases of notifiable diseases, may force the Chilean Veterinary Service to intervene with policy measures which may include poultry culling in the infected premises as well as the elimination of every poultry kept within determined kilometers around (10). If this happens, it becomes crucial to assess the feasibility and economic viability of interventions in each specific operating environment, as not all BPS operate in the same way (5). One of the questions of the survey was to consult the owners, how much money would they be willing to accept (monthly) for the rest of their lives for stop raising chickens. Not surprisingly, a 56.2% of the owners declared that no monetary amount would be sufficient to meet the fact of having their eggs and chickens constantly available. People who answered this, declared that even if they received money instead of their poultry, they do not have either, physical access to markets where they could buy products to replace what their poultry give them, nor health conditions compatible to travel the distances they should to get to the closest market. This, added to the fact that 69% of the owners did not have their own vehicle to move from one place to another and that 58.7% of the owners are older than 55 years old. This was shown by the results obtained in the regression model, where exactly these variables were the ones that best explained the contribution of poultry rearing to these households. This information would be a key point when considering public policies facing a sanitary emergency, since the lack of physical access to markets makes money or animal replacements once the emergency is finished, not an alternative. In this sense, it might be more sensible to consider a policy where eggs and chicken or other animal protein source were delivered to the families against the removal of birds. Besides, through this study, three houses with no electricity were identified, implying that they could not have a refrigerator to keep meat, which added to the long distances families should travel to get meat, further demonstrates the great importance that poultry represents for these households.

It is also worrying that some owners declared throwing their dead animals to the garbage or far away. If animal and public health wants to be protected, it becomes imperative that education on biosecurity measures and animal diseases reaches this population. Dead animals could become a constraint not only for the owners, but also for the community living around that house. Diseases may spread and food security may be impaired, especially when 75% of households indicated that they usually give away eggs/poultry to their neighbors, which contributes to the food security of the community.

Regarding to the gross margin analysis, it can be concluded that more than a half of the families get some economic benefit from raising poultry. Even though, the remaining 38% leaves the question of why families keep breeding poultry despite their economic balance is negative. Is it because it is the easiest way for them to have affordable food at any time? Or is the tradition and culture of keeping animals so strong, that it doesn't allow them to get rid of the animals even though their maintenance represent a cost to the household? These are some questions that need to be considered when making any intervention against possible health emergencies.

However, it is necessary to do a more thorough economic analysis to have more accurate conclusions. In this study no replacement costs of the animals were incorporated, since 65% of the owners declared replacing the animals with their own production and due to the lack of records in the BPS, unbundled detail of the remaining 35% could not be obtained. Even though most of them answered they just bought a rooster every three years. The cost of the animal's housing was not considered either, as they were built by household waste materials.

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