

Original Research Paper

Assessment of Poultry Production System in Rwanda, A Case Study in Nyagatare District

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Abstract: A cross sectional study was conducted on 160 indigenous poultry farmers in Nyagatare District to assess the effect of poultry cages on increasing poultry production in smallholder low cost village poultry farmers in Nyagatare district. Data were collected through pre-tested semi-structured questionnaires, participatory rural appraisal, observations and interviews. Most of farmers kept the dwarf type of local chicken (53.5%), night poultry confinement still rare, low cages use, scavenging causing high mortality and predation of chicks. Neighbors (50.8%), markets (30%) were the mainly source of birds. Clutch size ranged from 5 to 18 eggs with mean of 13±2 hatchability and hen maturity age averaged was 7±2.1 month. Predation (42%), diseases (23%) and lack of credit (20%) were the main challenges. Low Productivity due to poor nutrition, genotype, diseases and management. Feed supplementation, selected good genotype, Cage use and disease control are recommended to improve growth rate and egg production.

Keywords: Indigenous Chicken, Cages, Constraints, Poverty Alleviation, Rwanda

Introduction

Poultry, particularly chickens are the most numerous and widely raised livestock species in the world (FAO, 2012). In Africa, almost every homestead keeps some poultry for mainly home consumption and cash sales (Dorji and Gyeltshen, 2012). Poultry industry in Rwanda is characterized by the coexistence of two systems, namely; the rudimentary village poultry and commercial poultry production which is at its infancy stage (Kryger *et al.*, 2010; Heidloff, 2012). The two systems are facing scarcity of inputs to fully exploit their potential (MINAGRI, 2012).

Indigenous chickens in Rwanda are about 1.2 million and are kept by 87.4% of the rural communities in small flocks of up to 5-10 birds mainly under free range system. The birds are hardy and thrive under a harsh environment with minimal inputs and they get most of their feed from scavenging and may occasionally benefit from kitchen and other household wastes (Mbuza *et al.*, 2017). In Rwanda, indigenous chickens contribute to 3,000 tons of eggs and 2,144 tons of chicken meat

produced annually (FAOSTAT, 2014; ECIV 4, 2016). Despite this contribution, this sector does not receive adequate attention from many agricultural policy makers and livestock specialists. In addition, small-scale poultry farming and their socioeconomic significance in Rwanda and elsewhere are normally overlooked by many researchers, development partners and extension workers (Guèye, 2007).

The report of households survey (NISR, 2012) conducted by Rwanda National Institute of Statistics showed that out the total number of 2,492,642 households 1,146,615 (46%) keep indigenous chicken. Although poultry have the greatest potential for providing the much-needed animal protein and for generating household income in rural Rwanda, most families have been engaged in poultry production at a subsistence level (MINAGRI, 2013). Hence the quantity of poultry and poultry products are insufficient (Kryger *et al.*, 2010; Heidloff, 2012). In Rwanda, the low productivity of local poultry has often been attributed to low genetic potential, biosecurity and low standards of husbandry practices—(MINAGRI, 2009; RAB, 2011). Poultry has

high feed conversion ratio and the village chickens are usually more resistant to diseases than the commercial chickens. Poultry keeping requires less land and low start-up capital and poultry farming can contribute to poverty alleviation and food security, (FAOSTAT, 2014). It is considered as a production enterprise, which has a promising future in Rwanda (EDPRS 2, 2013; NISR, 2013). However, inadequate and inefficient poultry housing technology and feed industry negatively poultry production, there is therefore need to provide farmers with cheap, affordable housing (Cages) and good disease management practices in order to reduce on chicken mortality due to predation, diseases and parasites during the rainy season. The provision of cages and on farm feed mixer machine could contribute towards addressing some of these challenges of the village chicken production (Carter, 1971). This study was therefore designed to assess the effect of poultry cages on increasing poultry production in smallholder poultry farmers in Nyagatare District, in the Eastern Province of Rwanda.

Methods and Methodology

The study consists of both quantitative and qualitative data which were collected using semi-structured pre-tested questionnaire administered to poultry farmers in five sectors of Nyagatare district and analyzing the data obtained from the farmers enabled the researcher to draw valid, dependable conclusion and recommendation. A survey pre-tested questionnaire was prepared translated from English into Kinyarwanda poultry farmers' native language. The study concerned only local poultry farmers with at least 2 and above mature chicken in selected five sectors of Nyagatare district. A multi-stage sampling procedure was employed to select representative households in five Sectors of Nyagatare District, bearing in mind the differences in production systems within Sectors and Cells of a District. A total of 160 households were randomly selected using systematic random sampling method as shown in Table 1 in determining the sample size basing on the sectors in the study area. Accordingly, five (5) Sectors were selected

depending on location, poultry population density, predominant rearing system and level of urbanization. Based on these criteria 5 Sectors namely Nyagatare, Karangazi, Rwemiyaga, Matimba and Rukomo was purposively surveyed. In each selected Sector, 50% of administrative Cells were randomly selected.

Sample Size Determination

Based on the 2013 census of Nyagatare district the total number of households keeping livestock in the five survey sectors was 2490 (NISR, 2013). Where 26% are in poultry production (= 648) and using a simplified process of determining the sample size for a finite population, Krejcie and Morgan (1970) table, the ultimate sample size was determined to be 160 farms. Based on this method, sample size for each sector was determined as follows:

$$N = \sum_{i=1}^5 (n_i)$$

Where:

N: Sample size

i: Number of sectors

n_i: Number of selected farmers in each sector

In addition; feeds service providers, Veterinary service providers and poultry product processors in the study area were interviewed for detailed information on prices, marketing and constraints among others.

Results and Discussion

Demographic Characteristics of the Respondents

Most respondents (52.6%) were in the modal range of 41-50 years of age, followed by that of (24.6%) above 51 years and the aged 20-30years were only (3.7%). The reason behind the majority of respondent being in modal range of 41-50 years could be attributed to the facts that most of household leader are supposed to generate household income hence involve in poultry farming. With regard to educational level most of the farmers (53.9%) had only primary and only (3.4%) had attained tertiary education (Fig. 1).

Table 1: Determination of sample size in selected sectors

Sector	No of households	Poultry farmers	Proportion of each sector	Number of selected farmers
Nyagatare	310	81	12.45%	10
Karangazi	907	236	36.42%	86
Rwemiyaga	650	169	26.1%	44
Matimba	331	86	13.3%	11
Rukomo	292	76	11.73%	9
Total	2490	648	100%	160

Source: Primary source, selected households from each sector 2018

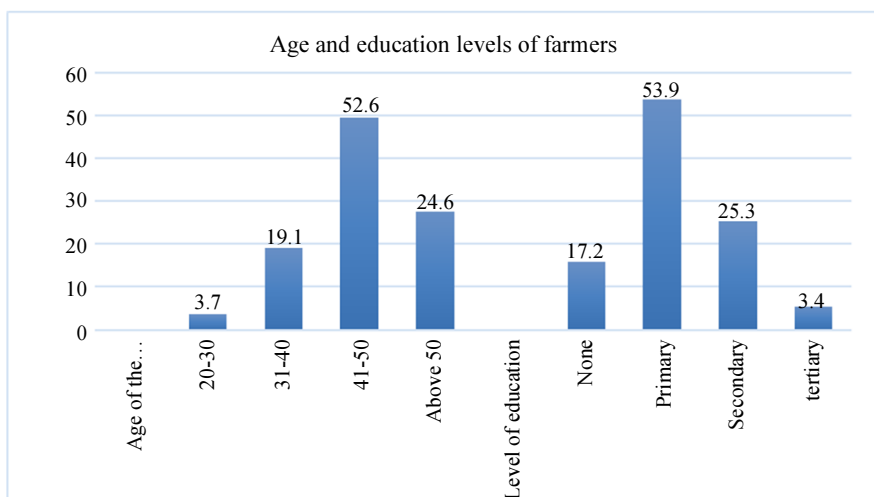


Fig. 1: Age and educational levels of respondents; Source: Primary source, Nov 2018

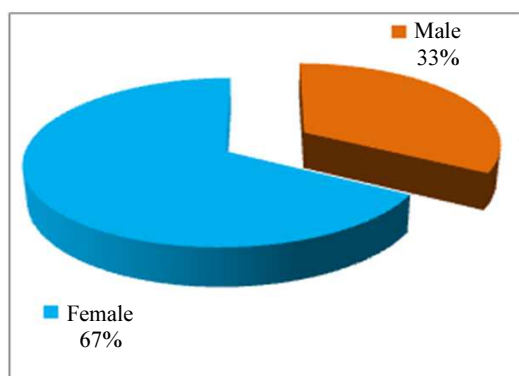


Fig. 2: Gender of surveyed poultry farmers; Source: primary data, Nov. 2018

Gender of Surveyed Poultry Farmers

The illustration shown by the Fig. 2 about gender of surveyed poultry farmers in the surveyed sectors showed that the majority of the surveyed poultry farmers about 67% were female and 33% were male. This could be attributed by the fact that, women always prefer to rear chicken as it does not require a big capital to start the business this agree with Alabi *et al.* (2006), Akinola and George (2008) who reported that indigenous chicken in Nigeria, as in many parts of Africa are an important income source especially for rural women. The observation of the results also showed that there other people starting poultry farming activities as a quick and easy way for generating income to enable them to reduce poverty, similar result was reported in Ethiopia by Sohn *et al.* (2011).

Flock Size

The results show that Flock size in Rukomo sector is very small as majority of respondents (71%) had flock size ranging from three to ten birds followed by 23% of

respondents who had flock size between 11-20 birds while only 6% of poultry households had flock size above 20 birds. This was linked to fear of diseases in big number of poultry and small market available for them. The results are similar to that of Naphade (2013) in Ethiopia who found that a greater number of farmers in Metema district had average flock size of 10 chickens per household. The results also agreed with the results of Tadelle *et al.* (2003) who found that poultry production in the eastern African region, is characterized by small flocks, nil or minimal inputs, with low output and periodic devastation of the flock by disease. Furthermore, Mailu *et al.* (2012) reported that in Kenya, the average flock size (FZt) was 22 and birds offered for sale over three months were 9.3 (or roughly three birds each month), most of which (74%) were sold at the farm gate and 19% sold at the nearest market and the remainder sold at markets further away.

Current Status of Poultry Cages Use

The analysis of the surveyed data as shown by the Table 2 bellow on the subject of the association between current statuses of poultry cages use among the poultry farmers and poultry production pointed out that, there was none among poultry farmers using battery cages, the same results was reported by Li *et al.* (2016) on effect of cages on poultry production. Source of birds through other channels and source of information through Colleagues and Veterinarians were seen to be associated with cage usage (p-values < 5%). Despite the available associations, baskets and Folding Unit System (FUS) were the most used cages as it is clarified in the distribution of each considered poultry production factors.

Distance to Market Source of Birds

The end result of the survey as illustrated by the Fig. 3 shows that the majority of the poultry farmers around

51% move beyond 4 kilometers journey to reach to the market source of birds, followed by 41% who move between 2 and 4 kilometers while only 8% representing the minority group with less than 2 kilometers as shown in Fig. 3. This long distance contributes to low price of their birds when selling them because they opt to go for middlemen come to their homes to buy their birds. This is similar with our neighboring country Kenya where it was reported that many farmers sell at the farm gate yet prices here are lower than they could get if selling at the local market but distance can be a hindrance to the development of the market Mailu *et al.* (2012).

Average Flock Composition

The results indicated that the average flock composition showed a downward trend line from chicks to cocks. The illustration on the figure hens were seen to have a higher average of 12.74 than the other remaining composition of the flocks since chicks, pullets, cockerels and cocks had the following respective averages of 6.51,0.44,0.23 and 0.4.

Average Poultry Composition per Surveyed Sector

The results of the survey as presented by the Table 2 indicating the average composition of the flock according to sectors shows that Karangazi has many chicks and hens than the other remaining sectors. This is confirmed by the fact that on average there was around fifty five (55 chicks) whereas Rukomo and Nyagatare were the sector with fewer chicks and hens with 2.13

chicks and 1.78 hens on average. By taking a look at pullets; Nyagatare was the first one by descending order with 0.73 chicks on average while the sector with a few numbers of pullets was Karangazi with no one. The results also indicated that in Karangazi and Rwimiyaga there were no poultry farmers with cockerels but on the other hand there was a higher quantity and equality in number of cockerels in Nyagatare and Rukomo. The large quantity also was found in Matimba and Nyagatare where the poultry farmers preferred to grow many cocks than the other remaining surveyed sectors. Finally, in terms of flock size Karangazi comes at the place to have a big number animal in the flock.

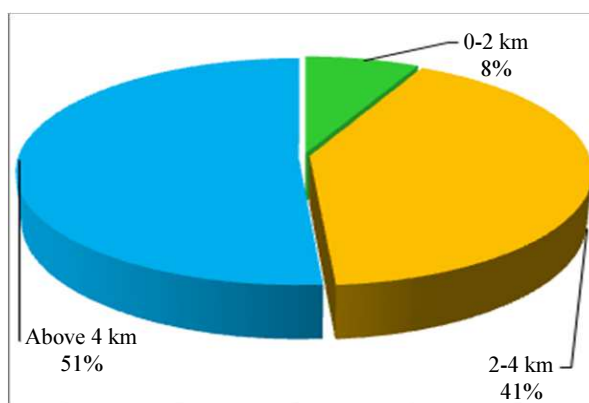


Fig. 3: Distance to market source of birds; Source: Primary data, Nov. 2018

Table 2: Current status of poultry cages using among the poultry farmers

Type of poultry Production	Cage usage					P-value [95%CI]
	Battery	DLS	Baskets	FUS	Other	
Extensive	NA	4(57.1%)	42(85.7%)	38(84.4%)	16(88.9%)	0.538[-0.075-0.223]
Semi-intensive	NA	2(28.6%)	6(12.2%)	8(17.8%)	2(11.1%)	0.709[-0.203-0.108]
Intensive poultry	NA	1(14.3%)	1(2%)	0(0%)	0(0%)	0.554[-0.084-0.243]
Breed of poultry						
Local chicken	NA	4(57.10%)	43(87.80%)	39(86.70%)	16(88.90%)	0.928[-0.143-0.178]
Mixed breed	NA	2(28.60%)	4(8.20%)	3(6.70%)	2(11.10%)	0.796[-0.203-0.110]
Exotic breed	NA	1(14.3%)	2(4.10%)	3(6.70%)	0(0%)	0.711[-0.116-0.081]
Source of birds						
Market	NA	7(100%)	41(83.70%)	37(82.20%)	15(83.30%)	0.899[-0.173-158]
Outside the country	NA	NA	0%	1(2.20%)	0%	0.975[-0.099-0.186]
From a friend/ neighbour	NA	0%	7(14.30%)	7(15.60%)	3(16.70%)	0.812[-0.147-0.192]
Others	NA	0%	2(4.10%)	5(11.10%)	4(22.20%)	0.002[-.018 -0.39]
Poultry House						
Absence	NA	6(85.70%)	40(81.60%)	38(84.40%)	15(83.30%)	0.901[-0.195-0.113]
Presence	NA	1(14.30%)	9(18.40%)	7(15.60%)	3(16.70%)	
Source of Information						
Radio	NA	NA	NA	NA	NA	-
Television	NA	NA	NA	NA	NA	-
Newspapers	NA	NA	NA	NA	NA	-
Colleague	NA	1(14.30%)	10(20.40%)	18(40%)	6(33.30%)	0.000[0.490-0.470]
Veterinarians	NA	3(42.90%)	18(36.70%)	14(31.10%)	4(22.20%)	0.000[-0.435-(-0.189)]

Source: Primary data, Nov. 2018

Chicks, pullets and hens constituted the largest proportion of the total flock size. Chicks constituted the biggest proportion (37.8%). In support Ochieng *et al.* (2013) established that in western Kenya, 80% of the flock structure was dominated by chicks, hens and pullets as shown in the Table 3 above. Also Addis and Malede (2014) noted that in Ethiopia, flock structure was dominated by chicks and hens. These flock types were mainly retained for production purposes through hatching of own chicks.

Challenges on Cages use by Poultry Farmers from Each Sector

As shown in the Table 4, diseases, mainly Newcastle and predation were both incidence of chicken attacks that was found to be higher in the wet season (May to November) than in the dry season (October to April). Newcastle disease (Mungube *et al.*, 2008) and predator attack (Mutombo, 2015) have also been reported as a major constraints to chicken production in central and Northwest Ethiopia. Predators were reported (32%) to be the main challenge followed by ectoparasite and enteric diseases (23%). From the results in the Table 4, disease and parasites, chicken predators courses significant loss of poultry in each sector. These finding is similar to that of (Nduthu, 2015). Working in North-western Ethiopia also reported. It is noteworthy that the majority of respondents (76.1%) reported poultry confinement as the method used to prevent predation. Others use trap nets (11.2%) and scarecrows (4.2%) while others do nothing. Other challenges included poor access to credit (20%), lack of veterinary services (14%) and quality breeding materials (11%).

In comparison to other countries, in southern Ethiopia, critical constraints of the smallholder poultry production in the study area were partly due to the

prevailing poor management practices, in particular predation, lack of proper health care and poor housing (Mekonnen, 2007). Efforts of low cost poultry farmers in Rwanda should therefore be consolidated into cooperatives for easy access to services (technologies, credit, inputs etc.) thereby easing most of the prevailing challenges this also is similar as the report by Kyule *et al.* (2016) on performances and constraints in poultry production in Ethiopia. Special attention should be given to sourcing of genuine improved genotypes through farmer cooperatives.

Animal Health Management and Husbandry Practices

A large number of respondents (98.1%) reported cleaning of poultry shelters as a bio-security measure, 73.2% of them clean the shelters once a day while 22.2% clean twice a week. This shows a good tendency to improved animal health by ensuring animal hygiene and sanitation this result is similar to that of Mbuza *et al.* (2017) on modern broiler poultry production in Eastern Province of Rwanda. The overall management of poultry health was reportedly still very low as 41.4% of the respondents left their sick chicken for self-cure and 37.2% used indigenous knowledge of treatment (traditional, vein piercing and defeathering).

Modern approaches to poultry disease management were still very low as only 15.7% of respondents reportedly to consult veterinarians in case of outbreaks of poultry diseases, this result agrees with report by Ochieng *et al.* (2014) on poultry challenges in Western in Kenya. This may explain the often very high morbidity and mortality among indigenous poultry flocks and the resultants low productivity and profitability (Msoffe *et al.*, 2010; Garbi *et al.*, 2015).

Table 3: Average animal composition within sectors

Growth levels	Karangazi	Matimba	Nyagatare	Rukomo	Rwimiyaga	Mean ± SE (n = 160)
Chicks	54.60	4.43	2.71	2.13	5.19	15.42±1.4
Pullets	0.00	0.34	0.73	0.36	0.38	15.62±2.0
Hens	58.10	25.86	1.78	3.87	4.06	7.97±0.7
Cockerels	0.00	0.23	0.29	0.29	0.00	9.97±1.2
Cocks	0.20	0.27	0.27	0.58	0.75	4.26±0.4
Flock size	112.90	30.98	5.78	6.73	10.38	40.71±4.0

Table 4: Possible challenges on cages use by poultry farmers from each surveyed sector

Constraints	Karangazi	Matimba	Nyagatare	Rukomo	Rwimiyaga	P-value[95%CI]
Cost initial input/Lack of housing	1(0.625%)	9(5.625%)	5(3.125%)	8(5%)	6(3.75%)	0.216[-0.068-0.278]
Others	1(0.625%)	9(5.625%)	8(5%)	10(6.25%)	3(1.875%)	0.653[-0.110-0.169]
Lack of stocking Facilities	*0(0%)	*6(3.75%)	5(3.125%)	8(5%)	11(0.625%)	*0.710[-0.180-0.132]
Land/production technology	0(0%)	6(3.75%)	7(4.375%)	8(5%)	2(1.25%)	0.627[0.093-0.180]
Marketing/ price fluctuation	1(0.625%)	6(3.75%)	3(1.875%)	5(3.125%)	2(1.25%)	0.929[-0.172-0.151]
Lack of capital/access to credit	1(0.625%)	5(3.125%)	4(2.5%)	4(2.5%)	1(0.625%)	0.585[-0.190-0.108]
Lack of information/skills and extension services	1(0.625%)	4(2.5%)	3(1.875%)	6(3.75%)	2(1.25%)	0.519[-0.109-0.223]
Diseases and parasites	10(6.25%)	39(24.375%)	33(20.625%)	30(18.75%)	15(9.375%)	0.098[-0.260-(-0.008)]
Predators	1(0.625%)	26(16.25%)	24(15%)	17(10.625%)	5(3.125%)	0.318[-0.227-0.090]
Theft/insecurity	3(1.875%)	21(13.125%)	12(7.5%)	14(8.75%)	2(1.25%)	0.042[-0.310-0.013]
Feeds availability/shortage and costs	8(5%)	18(11.25%)	18(11.25%)	18(11.25%)	3(1.875%)	0.025[-0.323-(-0.024)]

Source: Primary data, Nov. 2017

Purposes of Chicken Production

The results from this study showed that purposes of chicken production were for cash income (94.6%), household consumption (95.2%), extra farm activity (82.8%), job opportunity (60%), use of chicken for cultural/religious ceremonies (39.3%) and to use them as a gift (20%). According to Mbuza *et al.* (2017) sale of live chicken was the first important function of rearing chicken in Rukomo (77.8%) sector Nyagatare districts of Rwanda.

The use of Poultry and their Products

The results on use of poultry and their products were indicative of a reasonable shift from subsistence to commercial production as 75.2% of the respondents reported selling their chickens and eggs nearby or at local market to raise household income or resolve other family problems. This result is in agreement with other researchers who while working in Ethiopia concluded that selling of live birds for income generation was the primary goal of keeping low input poultry in developing countries (Sohn *et al.*, 2011).

Production Parameters

The production parameters derived from the study population were characteristic of a system with very low production and productivity. The average flock size was 8 birds per household, clutch size varied between 5 to 18 eggs with an average of 12 eggs per cycle and with mean of 13 ± 2 hatchability, this is similar to the report by Jalal *et al.* (2006) on cage spacing to increase poultry production. Chick's mortality was very high with average chicks surviving/hen/batch to be four and growth rate was also reportedly low as age at maturity was cited to be 7 months for female birds and 6 for cockerels (with mean of hen maturity age averaged was 7 ± 2.1 month). This was similar to the situation in southern Ethiopia

where average clutch size was 14 eggs and duration to first egg was 6 months (Mekonnen, 2007). In similar study in Butre district, North West Ethiopia, the average age of cockerels at first mating and pullets at first egg were 24.6 weeks and 27.5 weeks, respectively. The average number of eggs laid/clutch was 16 (ranged 8 to 28) and the number of total clutch periods/hen/year was 4 (ranged 2 to 6). The annual egg production performance of local hens, under farmer's management condition, was 60 eggs/hen (ranged 24 to 112) Moreki (2010).

Housing Management of Village Chicken

Housing is essential to chickens as it protects them against predators, theft, inclement weather (rain, sun, cold wind, dropping night temperatures) and to provide shelter for egg laying and broody hens. The present study showed that only 14% of the respondents have separate sheds for chickens. The common housing facilities for chickens in the surveyed area were cartoons and baskets made of bamboo or a round stick placed in the main house (58%) and perch (26.6%) (Fig. 4).

Feeding and Housing Practices

The results in the Table 5 indicated that the main feed resource was scavenging except few case of supplementation in Nyagatare (11.9%) may be due to being urban area, majority use sun candling as the main ways to identify spoiled eggs. These results are consistent with Moreki (2010) who reported that only 22.1% of farmers provide separate overnight houses for village chickens and no supplements to the birds. Asghar Saki *et al.* (2012) reported that almost all farmers provided night shelter for their chickens either in part of the kitchen (1.36%) or in the main house (39.07%), in hand-woven baskets (7.29%), in bamboo cages (1.51%) or in separate sheds purpose-made for chickens (50.77%).



Fig. 4: Common poultry house present in the study area; Source: Photo from field farm at Nyagatare Sector

Table 5: Feeding and housing practices of village chickens

Variables	Sectors					Over all
	Karangazi	Matimba	Nyagatare	Rukomo	Rwimiyaga	
<i>Feeding system practiced, %</i>						
Partial supplementation	00.0	09.0	11.9	00.0	00.0	156.0
Scavenging	100.0	81.0	88.1	100.0	100.0	4.0
<i>Overnight shelter, %</i>						
Kitchen	4.9	7.0	7.4	53.7	93.6	33.4
Main house	0.1	29.0	0.0	29.2	1.4	11.9
Perch or Kraal	94.8	22.0	3.7	9.7	4.4	26.9
Separate poultry house	0.2	42.0	88.9	7.4	0.6	27.8
<i>Frequency of cleaning shelter, %</i>						
Once per day	100.0	43.8	100.0	80.0	-	81.0
Every two days	0.0	37.4	0.0	20.0	-	14.0
Every 3 to 6 days	0.0	18.8	0.0	0.0	-	5.0
Identify spoiled eggs, %	60.0	66.0	56.0	74.0	48.0	61.0
<i>Means of identifying spoiled eggs, %</i>						
Putting in water	36.0	46.0	21.0	17.4	22.2	28.0
Sun candling	36.0	30.0	39.5	43.6	44.4	39.0
Shaking	28.0	24.0	39.5	39.0	33.3	33.0
Average eggs hatched per clutch	4.0	4.0	6.0	6.0	5.0	5.0
Any time	87.5	37.5	40.7	53.3	50.0	54.0

* The F statistic is significant at the $p < 0.05$ level.

In the current study, the role of men in poultry production was in the construction of poultry shelters (57.5%). This is in agreement with Mapiye *et al.* (2008) from Zimbabwe who reported that men were dominant in shelter constructions (60%) and treatment of chickens (40%). Asghar Saki *et al.* (2012) also reported that chicken cage use construction was the responsibility of men (53.1%) and male youth (9.4%) while women take the lion share in accomplishing other perspectives of poultry management activities including cleaned house (74.4%), provided supplementary feeding (65%) and water (73.8%). It was indicated by Asghar Saki *et al.* (2012) that farmers confine chickens only during the night and that 74.02% of the households clean chickens' house once per day while 11.66% twice per day. In the present study, 81% of the households cleaned chicken houses once per day and 14 % twice per day

Conclusion

The indigenous chicken of various types were the most common and all the bird types had low production parameters with minimal use of cages in all surveyed area. Designated houses for night poultry confinement were still rare, birds were not confined during the day; allowed free scavenging that prevailed causing high predation of chicks due lack of cages use. A larger number of farmers did not treat sick birds whereas but used traditional treatments, leading to high mortality and reduced productivity. It is therefore evident that low cost poultry production in Rwanda is characterized by small flocks, low levels of

production, lack of cages, lack of treatment, lack of Veterinary services and information among others. With the reported small flock sizes it is difficult for local poultry production to make adequate income and getting loans could be impossible. Based on all the findings, poultry production in Rwanda still lacks attention to achieve their potential in helping poor families with an income and food source.”

Summary and Recommendations

The following recommendations are suggested based on the result of the current study:

1. Control of diseases could be achieved through improvement in veterinary and advisory services. Since several traditional (ethno veterinary) medicines are being used in the study area against NCD, studies under controlled conditions are needed to determine the efficacy and veterinary properties of these medications
2. The problem of predators could be reduced by convincing farmers to construct and housing birds in predator proof separate chicken houses, especially during the night
3. As most of village chicken production activity is managed by women, provision of successive trainings on modern chicken husbandry practices to women would be essential for the improvement of chicken production and productivity
4. Provision of credit facilities to chicken owners and linking the production with marketing will

encourage chicken owners and contribute to the improvement of the sector

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Author's Contributions

Eugene Mazimpaka: Designed the research methodology, coordinated the data-analysis and contributed to the writing of the manuscript.

Mahoro Javier: Data analysis description of data, interpretation and paper reading and correction.

Tuyisenge Edmond Nicolas: Data correction, sorting, entering, discussion, reading and arrangement.

Ojok Lonzy: Conception, design and data interpretation Critical review of the manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

All procedures performed in study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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