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Assessing the productivity of indigenous chickens in an extensive management system in southern Nyanza, Kenya

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Abstract The present study was conducted to assess the performance of indigenous chickens under extensive system in southern Nyanza, Kenya. The study was carried out in two phases in Komolorume and Kawere villages in Rongo and Rachuonyo districts, respectively. The first phase was a cross-sectional study in 81 farms selected by cluster sampling to get the overview of the indigenous chicken production. A four-month prospective longitudinal study in 60 farms randomly selected from the previous 81 farms followed. Mean flock sizes per household were 20 and 18 birds in Komolorume and Kawere, respectively. Overall mean flock size was 19 birds ranging from 1to 64. The mean clutch size, egg weight and hatchability were 12 eggs, 48 g and 81% respectively in Komolorume and 10 eggs, 45 g and 70%, respectively, in Kawere. The chick survival rates to the age of eight weeks were 13% and 10% in Komolorume and Kawere, respectively. Mean live weights for cocks and hens were 2096 g and 1599 g in Komolorume and 2071 g and 1482 g in Kawere, respectively. The mean household cock to hen ratio was 2:5 and 2:4 for Komolorume and Kawere, respectively. The mean chick to grower to adult ratio per household was 8: 6:6 in Komolorume and 8:4:6 in Kawere. Clutch sizes and hatchability rates were significantly higher in Komolorume village ($P<0.5$). The productivity of the indigenous chickens was shown to be low compared to that of the improved chickens in other parts of the world.

Keywords Productivity of indigenous chicken · Production and reproduction parameters · Extensive management system · Dynamics of indigenous chickens · Egg utilization

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Introduction

The world basically has two distinct poultry production systems, namely intensive and extensive. Intensive system that uses improved breeds is usually found in the urban and semi-urban areas. The extensive or scavenging system is common in rural

areas and usually keeps indigenous chickens. The indigenous chickens are important source of quality meat and eggs as food and cash income for the majority of the people living in the rural areas (Okuthe 1999; Njenga 2005). Indigenous chickens are generally multicoloured, long legged and smooth feathered with a few fizzled feathered, naked necked and dwarf birds (Njenga 2005; Mogesse 2007). The challenge of fighting poverty and malnutrition can be effectively met to a large extent by strengthening indigenous chicken production (Sharma 2007) that is practised in many developing countries.

In Kenya, the indigenous chickens comprise 70% of approximately 30 million domesticated birds and are mainly kept by the resource-poor living in the rural areas whilst the improved chickens are approximately 25% and mainly found in urban and peri-urban areas (Ministry of Livestock Development 2008).

Low inputs associated with the indigenous chicken production results in low productivity. Extra effort in the management of the indigenous chickens in the area of housing, feeding, animal health care and genetic selection will be able to improve among others flock and clutch sizes, egg and body weights and hatchability, body weight gain and chick survival rates. Some indigenous chickens have actually proved to be having higher laying capabilities than commercial ones (Bebora et al. 2005).

The present study was conducted in order to get information on the performance of indigenous chickens as a build up to previous work done by African Institute of Capacity building and Development (AICAD). The study by AICAD identified indigenous chicken as the major poultry production system contributing to the livelihood and food security of resource poor farmers in the study area. It was expected that the results from the study would form a basis for the formulation of strategies for improvement of indigenous chickens' productivity.

Materials and methods

Study areas

The study was conducted in Komolorume and Kawere villages of Rongo and Rachuonyo districts, respectively, in southern Nyanza, Kenya.

Study design

A cross-sectional study aimed at getting an overview on production of the indigenous chicken was conducted in 81 farms selected by cluster sampling method, 40 in Komolorume and 41 in Kawere. A four-month longitudinal study in 60 farms (30 in each study village) randomly selected from the 81 farms followed. The productivity indices that included clutch and flock sizes, egg and body weights, hatchability, body weight gain and chick survival rates were followed. Structured questionnaires were used to interview members of the household directly responsible for care of chickens in both study phases. Additional data were obtained by actual measurements of the productivity indices and on-spot observations depending on the availability of such indices at the time of farm visits. During the longitudinal study, each farm was visited twice a month by the local enumerators and the author. The enumerators had field notebooks to record other observational data and any other miscellaneous findings. Farmers were given hard covered field notebooks to record any events that occurred between visits.

Data management and statistical analysis

All the data obtained from the field were entered in Microsoft access programme (Microsoft Corporation 2000). Statistical analysis was done using Statistical Package for Social Scientist (SPSS for windows 10) and Microsoft Excel (Microsoft Corporation 2000).

Results

Overview information

Most of the household heads (70%) were men. Over 90% of the people depended on subsistence farming for their livelihood and the majority practised mixed farming. Maize, sorghum, finger millet, pineapples and vegetables were being grown in both villages, while sugar cane and sweet potatoes were mainly grown in Komolorume and Kawere villages, respectively. Indigenous chickens were the most popular type of livestock kept by the interviewed farmers. This was followed by cattle, goats and lastly, sheep. Majority of the farmers managed their indigenous

chickens under scavenging/ extensive system. Chicken breeding was never controlled and hens were used for incubation and brooding of eggs and young chicks, respectively. All interviewed farmers provided supplement feeds (mainly cereal grains) with large amounts provided during the harvest seasons. Komolorume farmers were slightly more consistent in providing supplement feeds compared to Kawere farmers. All farmers provided night shelter for their chickens either in the human dwellings (94% of the farms) or in separate shelters (6 % of the farms), purposely made for chickens. Women and children were responsible for most of the indigenous chickens' daily management activities, and most decision to dispose indigenous chickens and their products was done by women. The animal health service delivery was generally poor with less than 5% of the farmers served by either Government or private animal health service providers in both villages. Majority of the farmers (60%) used herbs (mainly Aloe vera, pepper and sisal leaves) for the treatment and control of indigenous chicken diseases. About 40% of the farmers, on their own, bought veterinary products for the chickens from agro-veterinary shops. The major veterinary products bought were Newcastle disease (ND) and fowl typhoid vaccines and oral antimicrobials and multivitamins. About 5% of the farmers in Kawere used human antibiotics (mainly tetracycline capsules) for the treatment of their chickens. All farmers in the study area were aware of fowl pox but applied no control measures. Fewer farmers knew about Gumboro disease (20%) and helminthosis (15%) but never took any action.

Production and reproduction parameters

There was great variation in flock size of indigenous chickens among households ranging from 1 to 64. The overall mean flock size was 19.The flock structures in the two study villages are given in Table 1. The cock and hen ratio was 2:5 and 2:4 in Komolorume and Kawere villages, respectively. There were a lot of variations in egg production, egg weight, adult body weights, and hatchability of individual chickens. Pullets and cocks reached sexual maturity at ages ranging from 6 to 10 months. About 45% of interviewed farmers reported the maturity age of their indigenous chickens to be from 6 to 8 months. About 26% of the farmers reported maturity age of 9–10 months while 29% of the farmers could not remember. The mean clutch size and hatchability rate were higher in Komolorume than in Kawere (Table 2). Farmers used broody hens for incubation in both villages. Farmers in both study villages reported 2–3 clutches per hen per year. Egg weighed 48.2 g and 45.5 ranging from 44 to 53 g and 37 to53g in Komolorume and Kawere villages, respectively. The chick survival rates to the age of eight weeks were 13.43% and 9.73% for Komolorume and Kawere, respectively. The mean growth rates to the age of 10 weeks were 4.3 and 4.7 g/day for female and male chicks in Komolorume village and 3.8 and 4.3 g/day for female and male chicks in Kawere, respectively. The average weight of adult cocks and hens in Komolorume was 2096 g and 1599 g with a range of 1200 to 2500 g and 1000 to 2250 g, respectively. In Kawere village, the mean weight of cocks and hens was 2071 g and 1481 g with a range of 1500 to 2500 g and 1000 to 2000 g, respectively.

Table 1 Indigenous chicken flock composition in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Category	Statistics	Komolorume	Kawere
Chicks	Mean	7.48	8.02
	Range	0–40	0–27
	Percentage	38	45
Growers	Mean	6.28	4.12
	Range	0–37	0–16
	Percentage	32	23
Hens	Mean	4.58	4.32
	Range	0–13	1–17
	Percentage	23	24
Cocks	Mean	1.53	1.49
	Range	0–6	0–8
	Percentage	7	8

Dynamics of the indigenous chickens

Deaths from diseases mainly Newcastle and fowl typhoid and predation (mainly in chicks) accounted for over 50% of the total indigenous chicken exits and emerged to be the most important across the various age groups in both villages. Other important diseases causing deaths were Gumboro and fowl pox that accounted for about 10% of the total exits. Consump-

Table 2 The productivity parameters of indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Means with different superscript in the same row are statistically different ($P<0.05$)

Variables	Komolorume		Kawere	
	Mean	Range	Mean	Range
Eggs per clutch	12.48[a]	6–16	10.44[b]	7–16
Egg weight (g)	48.22	44–53	45.5	37–53
Eggs incubated per hen	11	10–15	9.83	10–15
Hatchability (%)	80.61[a]	40–100	70.16[b]	30–95
Adult cock live body weight (g)	2096	1200–2500	2071	1500–2500
Adult hen live body weight (g)	1599.37	1000–2250	1481	1000–2000

tion, sales and theft/ straying away were other important modes of exits accounting for 20%, 14% and 6%, respectively of the total exits in the study area. Hatchings were the main mode of entries and accounted for over 80% of all the entries. Other important modes of entry were gifts and purchase that accounted for about 8% and 7%, respectively of all entries.

Utilization of indigenous chicken eggs

The largest proportion of the eggs produced in both Komolorume and Kawere villages were incubated. Consumption was second while sales ranked last in the two villages (Table 3).

Discussion

Indigenous chicken productivity parameters were evaluated in this study. The study clearly shows that indigenous chicken keeping is an important undertaking in the southern Nyanza, largely contributing to household income and protein malnutrition alleviation. Several study findings including Msoffe et al. (2002); Mogesse (2007); Okuthe (1999); Njenga (2005) in Tanzania, Ethiopia and Kenya, respectively, indicated similar results. The current study results revealed low indigenous chicken egg weight, clutch and flock sizes and hatchability, body weight gain and chick survival rates compared to that of the improved chickens. Agreeing with Okuthe (1999); Bebora et al. (2005) in Kenya, Mwalusanya (1998) in Tanzania, Mandal et al. (2006) in India and Sekeroglu and Aksimsek (2009) in Turkey. The low productivity could be associated with the extensive system that is preferred by most farmers in the study area. The indigenous chickens fed mainly through scavenging with irregular and inconsistent supplementation (mostly cereal grains).Housing was mainly provided at night in human dwellings, very little animal health care was offered, hens were used for incubation and brooding and no breed selection was practised as hens and cocks were allowed to mate without any control. This compares with findings by Okitoi et al. (2002) in Kenya, Missohou et al. (2002) in Senegal and Muchadeyi et al. (2004); Mapiye and Sibanda (2005) in Zimbabwe. Although extensive management system is preferred due to its low input requirement, it exposes chickens to harsh conditions such as inadequate feeding, diseases, predation, extreme weather changes and uncontrolled breeding (Ondwasy et al. 2006; Bebora et al. 2005). Such unfavourable conditions lead to high mortality rates that result from diseases and predation (mainly in chicks) as revealed by the study findings. Other losses are usually due to thefts and straying away and delayed maturity (Okuthe 1999). The high production losses partly explain why very few chickens and eggs were available for home consumptions and sales as revealed by the study. Most of the chickens that survived to adulthood and eggs laid were used mainly for breeding and incubation, respectively, in order for

Table 3 Number and proportion (in brackets) of egg utilization in Komolorume and Kawere. Prospective observational studies (November 2007 - February 2008)

Egg use	Komolorume	Kawere
Consumption	270 (16.4%)	287 (22.7%)
Sales	123 (7.5%)	74 (5.9%)
Incubation	1249 (76.1%)	902 (71.4%)
Total	1642 (100%)	1263 (100%)

the farmers to maintain their breeding flocks. This is typical of indigenous chicken production under extensive system and agrees with the findings by Siamba et al. (2002) and Ondwasy et al. (2006) in Kenya and Missohou et al. (2002) in Senegal. Improving feeding, health care and housing and proper breeding selection could therefore reduce these losses and improve productivity. The current study indicated that Pullets and cocks reached sexual maturity at an age ranging from 6–10 months, this is delayed maturity compared to 5 months seen in the improved (commercial) chickens (Ministry of Livestock Development 2008). In Ethiopia, Mogesse (2007) reported pullet and cock sexual maturity of 7–8 months, Wilson (1979) in Sudan reported 8 months, Mandal et al. (2006) in India reported 7.6 months and Katule (1992) reported the sexual maturity age of 7 months in Tanzania. The delayed maturity was due to poor management and contributed to production losses; a lot of production time is lost during the extra time before maturity (Sonaiya and Swan 2004). Although the use of hens for incubation and brooding of young chicks was reported by the current study as preferred practice and compares with the finding by others including Okuthe (1999) in Kenya, Sonaiya and Swan (2004) in Ethiopia, Swai et al. (2007) in Tanzania and Mandal et al. (2006) in India. This practice is another cause of production losses since the broody hens usually spent a lot of production time either lying on eggs or taking care of young chicks (Ndegwa et al. 1998; Okuthe 1999; Mwalusanya et al. 2002). The study revealed that Komolorume farmers were slightly more consistent in providing supplement feeds to their chickens than Kawere farmers and they reported higher clutch sizes and hatchability rates compared to the later ($P<0.05$). This agrees with the findings by Gondwe and Wollny (2005) in Malawi and El Zubeir (1997) in Sudan. The finding by Gondwe and Wollny (2005) reported that better feeding management could contribute to 30% of chicken growth potential confirming the positive effect of better feeding on clutch size and hatchability rates reported by the current study. The current study results showed a lot of variation within various productivity traits agreeing with the findings by Msoffe et al. (2002); Siamba et al. (2002); Njenga (2005); Mogesse (2007) who reported the heterogeneous nature of indigenous chicken population and further suggested that the variations in the individual chicken performances might form criteria for improving indigenous chickens productivity by selection. If indigenous chickens with better performance ability in certain productivity traits were selected for breeding, better performance would be recorded in relation to those particular traits. Bebora et al. (2005) reported that some indigenous chickens have higher laying capacities than the respective improved chickens. Indicating that with a little extra effort in management in terms of feeding and genetic selection, indigenous chickens have the potential of increasing their egg yields.

Conclusions

Indigenous chicken production, which is practiced by almost every household, is an important undertaking in both Rongo and Rachuonyo districts in southern Nyanza of Kenya and largely contributes to household income and protein malnutrition alleviation. The major production system was extensive management whereby all age groups fed together by scavenging with irregular and inconsistent supplementation (mostly cereal grains) and housing mainly provided at night in human dwellings. The productivity of the indigenous chickens was low compared to that of the improved chickens. The indigenous chicken production suffers from the constraints of disease (mainly Newcastle and fowl typhoid diseases), predation (mostly in chicks), and poor management in relation to feeding, housing, breeding and disease control. Housing, feeding, disease control and breed selection are therefore the opportunities for the improvement of indigenous chicken production in southern Nyanza.

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