Higher weight gain by Kuroiler chickens than indigenous chickens raised under scavenging conditions by rural households in Uganda

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Abstract

A field trial was conducted in which Kuroiler chickens (KC) and indigenous chickens (IC) were vaccinated against common poultry diseases and held in confinement for 11 weeks and then raised simultaneously by village households in Uganda under identical scavenging conditions. The trial villages were located in five districts in geographically diverse parts of the country. The KC thrived in all trial locations of the country with a 7-month survival rate of 85% compared 83% for IC (p>0.05). At intervals between 11 and 43 weeks of age, total body weights were recorded on 343 male KC, 169 male IC, 285 female KC and 339 female IC. The results showed that KC gained body weight more rapidly and to a higher level than IC (P <0.05). At 25 weeks of age, the average body weight of male KC was 2.6 Kg compared to 1.6 Kg for IC; at 43 weeks, the respective body weights were 3.0 Kg and 2.2 Kg. Significantly (P <0.05) faster weight gain by KC compared to that by IC under scavenging conditions in rural settings indicates that returns from village poultry in Uganda may be improved by the introduction of KC.

Keywords: african poultry, backyard poultry, backyard poultry production, chicken flocks, cross-bred chickens, egg production, family nutrition, family income, hybrid chickens, indigenous chickens, improved village poultry, poultry meat production, value chain, village chicken distribution

Introduction

Kuroiler chickens (KC) are dual-purpose scavenger chickens developed in India (Ahuja et al 2008). Several pure genetic lines of chickens were crossed to select for a high-performance dual purpose hybrid chicken that would thrive in village environment under scavenging or semi-scavenging conditions. Further, the selection included phenotypic similarity to the local backyard chickens called ‘Desi’ raised by most rural farmers in India. KC became commercially available in the early 1990s and are currently being sold to an increasing number of village households in India. This chicken is preferred by some rural small-holder farmers because of higher egg and meat production in comparison with Desi chickens. A field analysis revealed that at 5 months of age, Desi birds had an average body weight of 800g compared to the KC body weight of 2.5Kg (Ahuja et al 2008). At 9 months, the body weights were 1.23 Kg and 2.70 Kg respectively for Desi chickens and KC. These observations indicated that under village management conditions, KC gained weight more rapidly and to a higher level than Desi chickens. It has been estimated that a Kuroiler hen produces 150-200 eggs in a laying cycle compared to 35-40 eggs produced by a Desi hen (Isenberg 2007). In addition, because the broodiness gene is poorly expressed, the production by the Kuroiler hen is continuous through the laying cycle; Desi hens lay eggs in clutches of 5-10 eggs per clutch. After each clutch, the hens get broody and stop laying until the progeny chicks hatch and are of several weeks of age (Sarkar et al 2006).

Because of superior meat and egg production under rural scavenging or semi-scavenging conditions, KC have been considered a suitable replacement for Desi chickens in India (Ahuja et al 2007, Ahuja et al 2008). Indeed over the last two decades, over one million rural households in diverse parts of the country have raised KC. A field evaluation involving extensive interviews with KC farmers in four districts of West Bengal, India, revealed that KC rearing improved family nutrition and income (Ahuja et al 2008).

In most countries in Africa, as in India, small scale poultry farming by rural households is a cultural norm and over 80% of total poultry production is attributed to family flocks. In Uganda, approximately 46M chickens are produced annually; 86% of this production is in small village backyard or free-range flocks owned by individual rural households (Anonymous 2013). The indigenous chickens (IC) that populate these flocks do not produce adequate meat or eggs to meet the needs of an average household. Because KC have shown great promise in increasing returns from backyard flocks in India, we explored the possibility of introducing this chicken to Uganda. Our objective in this study was to compare body weight gain of KC with that of IC raised under identical scavenging conditions in rural households in several districts of Uganda. Further, at the end of the trial, the participating farmers responded to a questionnaire regarding their experiences in rearing and consumption of KC versus IC. Our results indicated that KC thrived in Ugandan villages and performed better than the IC under scavenging conditions.

Materials and methods

Chickens and Vaccinations
Fertile KC eggs were purchased from Keggfarms Pvt. Ltd., Gurgaon, India and shipped to Entebbe, Uganda by air. Fertile IC eggs were purchased from local rural farmers. KC and IC eggs were hatched simultaneously in a common incubator in the hatchery at the National Animal Genetic Resources Centre and Data Bank (NAGRC), Entebbe, Uganda. At hatch, chicks were vaccinated subcutaneously with turkey herpes virus (Marek’s disease vaccine) and intraocularly with infectious bronchitis virus (Massachusetts strain), Newcastle disease virus (B1 strain) and a mild infectious bursal disease virus vaccines. At 3 weeks of age, chickens were given intraocularly Newcastle disease virus (LaSota strain) and an intermediate infectious bursal disease virus vaccines. All vaccines were purchased commercially and administered according to manufacturer’s instructions.

**Trial Protocol**

All chickens were wing-banded and raised in confinement until 11 weeks of age. Ten IC and 10 KC were distributed to each of the trial households in villages. The chickens were of mixed sex and, presumably, each household received approximately an equivalent number of males and females. The trial villages were located in five districts of Uganda: Apac, Gulu, Kabale, Mayuge and Wakiso. The number of trial villages in each district was 11, 1, 8, 2 and 4 respectively. The number of households that participated in the trial in each district was 18, 20, 19, 20 and 19 respectively. The weight gain data were obtained from 13, 9, 19 and 20 trial households in the districts of Apac, Gulu, Kabale and Mayuge respectively. Serial recordings of body weight gain were obtained from a total of 1,126 chickens of which 616 were KC. The mortality data were collected from 13, 9, 19 and 20 trial households in the districts of Apac, Gulu, Kabale and Mayuge respectively. The management conditions in all participating households included availability of facilities for night shelter. Chickens were allowed to scavenge freely around the house and most farmers sprinkled a fistful of seasonal grains or chicken feed for the entire flock once or twice a day. Chickens also had access to kitchen leftovers whenever provided by the farmer. Each household was advised to use identical management conditions for IC and KC.

Between 11 and 43 weeks of age, at intervals, the family chicken flocks were visited by field extension agents and total body weight of individual male and female chickens were recorded. The body weight data were analyzed to identify differences in the performance of IC and KC. At each observation point, chickens rather than the household or the village were considered as an experimental unit and body weight of all chickens within a group was averaged and compared with the opposing group average. This method was chosen to increase the sample size for analysis and because we expected a high level of uniformity in management of scavenging chickens between households and villages.

At the end of the trial, village family farmers were asked to respond to the questions regarding comparison of meat and eggs from KC and IC.

**Statistical Methods**

Mortality between KC and IC were compared using a Chi-squared test and t-tests were used to compare the weights of KC and IC. Significance was determined at the 5% level. Stata MP Version 13.1 was used for all data manipulation and statistical analysis (StataCorp 2012).

**Results and discussion**

Data from 77 farmers in the districts of Apac, Gulu, Kabale and Mayuge indicated that under village conditions, the survival until 7 months of age was 85% for KC (n=713) and 83% for IC (n=667). These survival rates were found not to be significantly different according to a Chi-square test (p=0.327). All mortality was management related; there was no evidence of an infectious disease outbreak because of prior vaccination of all chickens used in the trial.

As shown in Figs. 1, male KC gained body weight more rapidly and to a higher level than IC. At 25 weeks of age, the average body weight of KC was 2.6 Kg compared to 1.6 Kg for IC. At 43 weeks of age, the body weight was 3.0 Kg for KC and 2.2 Kg for IC. KC gained weight rapidly until 27 weeks of age; subsequently, the body weight gain leveled off. These differences in body weight between KC and IC were statistically significant (p<0.001).

![Figure 1](http://lrrd.cipav.org.co/lrrd27/9/shar27178.html)

The body weight gain by female chickens is also shown in Figs. 1. As in males, female KC gained body weight more rapidly and to a higher level than the IC and the differences were statistically significant (p<0.001 at both 25 and 43 weeks of age). The body weight gain occurred progressively until egg laying began around 25 weeks of age.
As shown in Table 1, of 76 responders, 78.9% reported the KC meat tasted better than that of IC; 75% reported that KC meat was softer than that of IC and 90.8% reported that KC had better meat to bone ration than IC. Ninety one percent reported the meat-to-bone ratio was higher in KC and 92% reported that visually, the KC eggs were larger in size than the IC eggs.

**Table 1.** Farmer assessment of comparison between Kuroiler chickens (KC) and indigenous chickens (IC) (n=76)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>% Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste of meat</td>
<td></td>
</tr>
<tr>
<td>KC meat tastes better than IC meat</td>
<td>78.9</td>
</tr>
<tr>
<td>KC meat and IC meat taste the same</td>
<td>9.2</td>
</tr>
<tr>
<td>IC meat tastes better than KC meat</td>
<td>3.9</td>
</tr>
<tr>
<td>Not sure</td>
<td>7.9</td>
</tr>
<tr>
<td>Texture of meat</td>
<td></td>
</tr>
<tr>
<td>KC meat is softer than IC meat</td>
<td>75.0</td>
</tr>
<tr>
<td>KC meat is more firm than IC</td>
<td>5.3</td>
</tr>
<tr>
<td>Not sure</td>
<td>5.2</td>
</tr>
<tr>
<td>Meat to bone ratio</td>
<td></td>
</tr>
<tr>
<td>KC better meat to bone ration than IC</td>
<td>90.8</td>
</tr>
<tr>
<td>IC better meat/bone ratio than KC</td>
<td>3.9</td>
</tr>
<tr>
<td>No difference between KC and IC</td>
<td>5.3</td>
</tr>
<tr>
<td>Not sure</td>
<td>0.0</td>
</tr>
<tr>
<td>Size of KC eggs</td>
<td></td>
</tr>
<tr>
<td>KC eggs larger than IC eggs</td>
<td>92.0</td>
</tr>
<tr>
<td>IC eggs larger than KC eggs</td>
<td>3.0</td>
</tr>
<tr>
<td>No difference between KC and IC</td>
<td>4.0</td>
</tr>
<tr>
<td>Not sure</td>
<td>1.0</td>
</tr>
</tbody>
</table>

This field trial covering diverse geographic regions of Uganda indicated that KC thrived in all regions and under identical scavenging conditions gained body weight more rapidly than IC. The vast majority of the participating farmers preferred raising KC to IC because of better weight gain, texture and taste of meat and larger egg size. Although KC have been estimated to produce 4-5 times the number of eggs produced by indigenous chickens in India (Isenberg 2007), the egg production data were not quantitated in this study because KC and IC were raised together as one flock in each participating household and on occasion, it was difficult to clearly distinguish the eggs produced by the two types of chickens. Because of rapid body weight gain, KC would be desirable as a backyard chicken in Uganda and possibly in other countries in the African continent. Male KC may be consumed and marketed at a younger age than male IC and thus provide improved household nutrition and income.

Small backyard family chicken flocks raised under scavenging and semi-scavenging conditions are the backbone of the poultry industry in Uganda and many other developing countries worldwide. In Uganda and most other countries in Africa, village poultry accounts for over 80% of total poultry production. The flocks are small, generally less than 20 chickens (Okot 1990, Kugonza D R et al 2008) and the productivity is low; hens produce approximately 40 eggs during the laying cycle and male chickens gain body weight slowly and attain a total weight of approximately 2.0 Kg. Despite low productivity, village households rely on these flocks for family nutrition and income from selling surplus eggs and meat to neighbors or at the village market.

It is well accepted that increasing productivity of backyard flocks would improve nutrition and income of rural households and result in a better quality of life. Over the decades, a number of strategies have been employed to improve performance with little sustainable success. The strategies used in the past include control of Newcastle disease by a thermo-stable vaccine (Alders et al 2001), weaning the chicks early to reduce the brooding period of the hen (Hossain 1993, Tadelle et al 2003), creep feeding to reduce early chick mortality (Dwinger et al 2004) and introducing exotic breeds of chickens that have typically performed poorly under village conditions (Oluymesi et al 1979, Kaiser 1987, Adegbola 1988, Katula 1989, Katule et al 1990, Swan 1996, Safalaoh 1997). Cross-bred chickens expressing specific genes associated with improved production (Mathur et al 1989, Horst et al 1992) have not had widespread or sustainable positive impact on rural poultry. The results of this trial indicate that KC have the potential of improving returns from backyard flocks in Uganda as they have in India. KC are phenotypically indistinguishable from indigenous chickens and have no new management requirements. Smallholder rural farmers who raise IC under scavenging or semi-scavenging management conditions can raise KC without additional investment of capital or altering existing management practices.

Kuroiler chickens are hybrids derived by cross-breeding genetically uniform lines of chickens and only F1 generation is most productive; in subsequent generations, productivity both in egg production and body weight gain progressively diminishes. In India, an economically sustainable distribution system of F1 KC has been used to reach farmers in remote rural locations. A similar system would be needed to distribute KC in rural Africa. Despite the cost associated with purchasing new flocks of F1 KC for each production cycle, small-holder farmers are liable to realize sizeable gains in family nutrition and income by raising KC as household flocks in comparison with IC.

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