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A comparison of the growth performance of exotic and indigenous chickens in Lesotho

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Abstract

A study was conducted on growth performance of the Lesotho indigenous chicken (LES) compared to two exotic lines, the New Hampshire (NH) and Rhode Island Red (RIR), from 3-days to 70 weeks of age, when moulting occurred. Growth traits that were under study included 3-day weight, 26-week weight, 70-week weight, average daily gain (ADG), average weekly gain (AWG) and mean feed conversion ratio (FCR). Although the mean body weight, ADG and FCR for the LES were significantly poorer than those for the NH and RIR for all traits except for the FCR and hen weight at 70 weeks of age, the LES hens compared fairly well with the exotic lines for the growth parameters considered. No significant differences were observed in hen weight at 70 weeks of age between the lines. The LES, like the NH showed potential for being a good dual-purpose breed under a semi-intensive production system, as they were able to achieve an acceptable body weight at the end of the egg laying period. However, the LES cocks recorded lower body weight gains and body weight at 70 weeks of age, compared to the exotic breeds. This contributed to the significantly lower weight gains observed in the LES line between three days and 26 weeks of age. Intensive selection in males and the implementation of a planned breeding and an adequate husbandry program could result in an improvement of the traits studied in the LES.

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Introduction

Indigenous chickens remain prominent in African villages, despite the introduction of exotic high-yielding chicken breeds since the 1920's (Bourzat & Sounders, 1990). This is largely due to the fact that farmers are not able to afford the higher input requirements of these high-yielding exotic breeds. In Lesotho 84% of the households in the rural areas are dependent on indigenous chickens for their livelihoods (Lebajoa, 2001). Unfortunately the huge potential of the indigenous chickens has not been fully realized and utilized in Lesotho, possibly because there is little data available on their productive performance. No breed identification, specification or description of any of the Lesotho indigenous chicken lines exist. The breed composition of these chickens has also become questionable due to large-scale introduction of exotic breeds under various rural development programmes undertaken by the government and NGO's in Lesotho. There is very little information available regarding description, morphological characteristics and production traits of the Lesotho indigenous chicken lines. Due to pressure from high yielding exotic genetic stock these lines are on the verge of extinction. Therefore, studies on these chicken breeds/lines are essential for the assessment of their production potential. However, in the goals and objectives for poultry development in Lesotho, there are no specific objectives and concrete activities for evaluating and improving the predominantly small-scale scavenging production system of indigenous chickens (Lebajoa, 2001). Through breeding and improved management, this system could be transformed from merely subsistence to a semi-commercial production system.

The aim of the study was to access the production potential of the Lesotho indigenous line compared to two exotic lines, New Hampshire and Rhode Island Red, under semi-intensive conditions.

Materials and Methods

The indigenous Lesotho (LES), New Hampshire (NH) and Rhode Island Red (RIR) chickens were raised in two batches. Batch one comprised of 25 birds per line, and batch 2 of 50 birds per line. Lack of

availability of hatchlings forced the acquisition and raising (under similar conditions) of two separate batches of chicks four weeks apart. Chickens were reared at the University of the Free State (UFS), South Africa in a completely randomized block design and were fed *ad libitum* a commercial broiler starter mash for the first four weeks. Males and females were raised together. Thereafter a commercial grower mash was fed to the chickens up to the age of 10 weeks. After this stage up to moulting chickens were all fed yellow maize and managed semi-intensively at the National University of Lesotho (NULFOA). In this system the chickens had free access to feed and watered indoors, and given freedom to roam about in adjoining paddocks. This was done to simulate more or less the conditions under which the LES is kept in subsistence or semi-commercial production systems in the region. This system made it impossible to accurately determine the mean feed intake of the animals for this period of the study.

Body weights were recorded weekly and this data was used to calculate linear and quadratic regression coefficients for growth up to 70 weeks of age. Variance analyses for 3-day, 26- and 70-week weights (the crucial stages in a chicken's life) were also performed. These measurements were also used to determine average daily gain (ADG). Feed conversion ratio (FCR) was calculated as the quantity of feed consumed as a ratio relative to body weight for the first 35 days of the chicken's life. The quantity of feed consumed by each group was recorded daily. Recording of body weights ended as the birds showed signs of moulting accompanied by a decrease in body weight.

Analysis of variance on components for growth traits and feed efficiency was done using the GLM procedure of SAS (1996). Significant differences between the mean treatments (chicken lines) were compared using Tukey's test for multiple comparisons at a 95% probability level. The following models were fitted:

$Y_{ijm} = \mu + a_i + s_j + l_m + e_{ijm}$ (for the 1st batch)
$Y_{ijkm} = \mu + a_i + s_j + b_k + l_m + e_{ijkm}$ (for the 2nd batch)
$Y_{ijm} = \mu + a_i + s_j + l_m + e_{ijm}$ (for 70 weeks weight)

Where:

Y_{ijkm} = an observation of a trait on the i^{th} animal of the j^{th} sex of the k^{th} block of the m^{th} chicken line.
μ = Least square mean
a_i = random effect of the i^{th} chicken
s_j = fixed effect of the j^{th} sex (1-2)
b_k = fixed effect of the k^{th} block (1-2)
l_m = fixed effect of the m^{th} chicken line (1-3)
e_{ijkm} = random error of the environment

Sex: 1- male, 2- female; Chicken lines: 1-Indigenous Lesotho, 2-New Hampshire, 3-Rhode Island Red. A block effect was included in the model for batch 2 to account for possible pen effects.

Results and Discussion

Results for three days, 26- and 70 week weights are presented in Table 1. There were significant differences between LES and the NH and RIR for Batch 1 for 3-day weight. However, LES only differed significantly from NH in Batch 2. The lowest average 3-day weight was recorded for the LES, *viz*. 33.8 ± 0.80 g and 40.4 ± 0.95 g for the batches, respectively. At this stage the NH line was the heaviest with individual weights ranging from 30.3 to 62.7 g. Missohou *et al*. (2002) reported an average weight of 31.7 ± 5.3 g for a Senegal native chicken line at the same age and under similar management system.

No significant differences were observed between the exotic lines for mean body weight during the first 26 weeks. Lowest mean weight was recorded in the LES (1283.3 ± 45.0 g and 917.0 ± 44.2 g) for Batches 1 and 2, respectively. This is in agreement with the results obtained by Aini (1990) who reported mature weights of between 1.0 and 1.5 kg in a Tswana chicken line raised under a semi-intensive system. The lower performance of all the breeds from Batch 2 could be attributed to a lower level of nutrition (growers mash for five weeks instead of six weeks) fed in this batch.

Data for 70 week weight from Batches 1 and 2 were pooled as no significant differences were observed between them in a preliminary analysis. Similarly, no significant differences were observed for sex during the first three weeks of the chickens' growth. However, significant differences in weights were observed for different sexes from 26-weeks onwards. Males grew faster and attained higher ($P < 0.05$)

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Table 1 Mean body weights (± s.e.) at 3-day, and 26- and 70 weeks of Lesotho (LES), New Hampshire (NH) and Rhode Island Red (RIR) chickens raised under a semi-intensive production system

Line	3-day weight (g)		26-day weight (g)		70-week weight (g)	
	Batch 1	Batch 2	Batch 1	Batch 2	Cocks	Hens
LES	33.8 ^{c} ± 0.8	40.4 ^{b} ± 0.9	1283.3 ^{b} ± 75.0	917.6 ^{b} ± 48.2	2350.0 ^{b} ± 50.0	2047.5ab ± 65.6
NH	50.3 ^{a} ± 0.8	46.4 ^{a} ± 0.9	1897.2 ^{a} ± 83.7	1376.0 ^{a} ± 64.7	3572.9 ^{a} ± 4.1	2328.0 a ± 14.3
RIR	42.5 ^{b} ± 0.6	42.8 ^{ab} ± 0.8	1795.5 ^{a} ± 64.6	1192.0 ^{ab} ± 46.9	2962.0 ^{b} ± 49.0	1778.3 b ± 29.3

^{a,b,c} Means with different superscripts in the same column are significantly different at $P < 0.05$

mature body weights and were significantly heavier than females at 70 weeks of age in all breeds. This is in contrast to Missohou *et al*. (2002) and Aganga *et al*. (2003), who showed in studies on local Tswana chickens that both sexes exhibit similar growth rates and mature weights. Gunaratne (1999) reported a lower mature weight (1227.0 ± 17.0 g) for Nigerian village cocks reared under semi-intensive conditions at 26 weeks old compared to the LES.

A substantial increase in body weight in both sexes was observed in the LES from 26 to 70 weeks of age. Despite the fact that NH hens recorded the highest mean weight at 70 weeks, no significant weight differences were observed between the NH and the LES hens at this age.

Detailed tests reported by Choprakarn *et al.* (1998) have shown that practically all individual chickens have periods of weight gain followed by intervals of no weight gain. According to Missohou *et al.* (2002), an increase in body weight occurs two or three weeks prior to and one week after the production of a hen's first egg. During the following 10-12 weeks the young pullet gains weight very slowly. In fact, many birds lose weight. A similar trend was observed in this study.

The LES had the lowest ADG (6.6 ± 0.2 g/day and 4.6 ± 0.2 g/day) from three days to 26 weeks (Table 2). There were no significant differences in ADG between the NH (9.8 ± 0.4 g/day and 7.0 ± 0.3 g/day) and RIR (9.2 ± 0.3 g/day and 6.1 ± 10.2 g/day), for both Batches (1 and 2, respectively).

The best FCR was recorded in the NH (3.2 ± 0.4 & 3.3 ± 0.1, respectively, for batches 1 & 2). However, no significant differences between breeds/lines were observed.

Table 2 Mean average daily gains (± s.e.) and feed conversion ratios between three days and 70 weeks for Lesotho (LES), New Hampshire (NH) and Rhode Island Red (RIR) chickens raised under semi-intensive conditions

Line	Average daily gain (g/day)		Feed conversion ratio (feed/gain)	
	Batch 1	Batch 2	Batch 1	Batch 2
LES	6.6 ^{c} ± 0.2	4.6 ^{c} ± 0.2	3.7 ^{ns} ± 0.2	4.2 ^{ns} ± 0.1
NH	9.8 ^{a} ± 0.4	7.0 ^{a} ± 0.3	3.2 ^{ns} ± 0.4	3.3 ^{ns} ± 0.1
RIR	9.2 ^{ab} ± 0.3	6.1 ^{ab} ± 0.2	3.5 ^{ns} ± 0.3	3.7 ^{ns} ± 0.1

^{a,b,c} Means with different superscripts in the same column are significantly different at $P < 0.05$

In Table 3 the linear and quadratic polynomial regression equations for each breed/line with their respective R^2 on weekly weight gain from 3-days old to 70 weeks of age are presented. The LES cocks were the worst performers in terms of weight gain (29.9 g per week) for the duration of the experiment. The highest weight gain for cocks was observed in the NH (50.8 g per week). However, during this period, the mean weight gain in the LES hens was higher (25.5 g per week) than that of the RIR (23.8 g per week).

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Table 3 Prediction equations for average weekly gain (AWG) and R^2 for each sex per line

Line	Sex	Prediction Equations		R^2	
		Linear	Quadratic	Linear	Quadratic
LES	Cock	Y=29.9x + 334.1	Y= -0.23x^2 + 48.0x + 116.7	0.95	0.99
	Hen	Y=25.5x + 339.9	Y= -0.28x^2 + 44.5x + 112.0	0.96	0.99
NH	Cock	Y=50.8x + 552.3	Y= -0.47x^2 + 59.0x + 108.0	0.96	0.99
	Hen	Y=30.3x + 452.7	Y= -0.53x^2 + 59.0x + 108.0	0.93	0.99
RIR	Cock	Y=40.3x + 598.1	Y= -0.50x^2 + 80.4x + 117.4	0.93	0.99
	Hen	Y=23.8x + 418.1	Y= -0.40x^2 + 52.9x + 68.6	0.90	0.99

LES – Lesotho; NH - New Hampshire; RIR - Rhode Island Red

Conclusions

The growth rate of LES hens up to 70 weeks of age compared fairly well with that of the exotic lines (RIR and NH). The fact that there were no significant differences in terms of body weight and FCR between the LES hens and the other lines at 70-weeks weight is an indication that with proper selection and management this indigenous line could be established as a dual purpose breed for semi-intensive management conditions in Lesotho.

A further benefit is the fact that the line can be slaughtered in a good condition at the end of a laying period, hence presenting an added advantage for food security at household level. However, intensive selection should be done on males to improve the growth traits considered in this study.

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