

## **Evaluation of Growth Performance of Kuchi Indigenous Chicken Ecotype Fed with Three Levels of Energy Diets in Three Different Systems of Management**

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### **Abstract**

*A study was conducted to evaluate the growth performance of Kuchi indigenous chicken (IC) ecotype of Kenya. This ecotype has become popular for its high mature body weight. From week 12 to 17, growth performance of the Kuchi growers was evaluated on the effects of three levels of energy diets: High (HE) 2700.5 MEKcal/Kg, Low (LE) 2564 MEKcal/kg and milled Maize Grain (MG); all managed under three systems of management: Extensive (ES), Extensive with Supplementation (ESS) and Intensive (IS). The HE and LE rations were specifically formulated for the experiments which were fed to the Kuchi growers on a two week change-over basis from week up to week 17. The experiment was laid under a Randomized Completely Block Design (RCBD); with three treatments (energy diet), three Blocks with two replicates (period in weeks) each with six experimental animals. Mean weekly weights were computed and analyzed by ANOVA using SAS (2011) software tool. Both Fisher's LSD and Duncan Student's Range were applied in separating means where differences were observed. Differences among management systems were not ( $p > 0.05$ ) statistically significant. Diet LE 2564 MEKcal/kg had significant effect ( $p < 0.05$ ) on Kuchi growers; While diets HE and MG had no significance ( $p > 0.05$ ). It is concluded that Kuchi does not need an intensified management. Furthermore, a grower's supplementation ration of about 2564.5 MEKcal/Kg is optimal under an extensive production system.*

**Key Words:** Indigenous Chicken, Kuchi, Supplementation, Ecotype, Kenya

### **INTRODUCTION**

Indigenous chicken (IC) is any flock of chicken (*Gallus domesticus*) that have originated from the Red jungle fowl (*Gallus Gallus*) and kept under free-range management system with no selection for breeding or improvement (Ondwasi, 2009). One of these IC is the Kuchi ecotype whose phenotypic attributes have made it popular in terms of mature body weight (Lwelamira, 2008). Kuchi is mainly found in Lamu County, Faza Island and other coastal regions of Kenya such Kikambala and Mombasa (Mwanza, 2010; Mutua, 2008). Generally, IC lay between 8-15 eggs per clutch depending on feed availability and they

express broodiness, hatching about 80% of the eggs they sit-on. They attain two to three clutches in a year. The few chicks that attain 20-30% maturity make most of the replacement stock. These birds, though under poor management, live within families for many years forming an important part of the family life by playing a crucial socio-economic role besides being a valuable source of animal protein (Ondwasi, 2009). Despite these roles, IC has not attained their full production potential due to exposure to risks that militate against their survival and productivity. The constraints to production include diseases, predators and notably poor nutrition. If managed well, indigenous chicken can be profitable and can obviously serve as a good source of animal protein. Based on its performance, studies have revealed that Kuchi ecotype can be a good starting genetic material for improving on meat production under semi-intensive management conditions (Lwelamira, 2008).

However, animal protein intake in developing countries has been very low compared to the recommended levels (Pedersen, 2002; Nielsen *et al.*, 2003). The situation is further worsened by high incidence of poverty in these countries, Kenya included. Due to their short generation intervals, chicken have high potential to off-setting this problem of low protein intake, and they can as well act as a source of income and hence one means of alleviating poverty. Since majority of the people in developing countries live in rural areas (villages), in which most of them are keeping IC, it is obvious that putting an emphasis on local chicken would have an immediate positive impact on animal protein intake and income by most of the people in these countries. The low genetic potential for production traits and frequent outbreaks of diseases specifically New castle Disease have been noted in significant number of studies to be among the major factors limiting productivity of the local chickens in the tropics, both under intensive and extensive management systems (Katule & Mgheni, 1990; Alexander, 2001; Msoffe, 2003). Crossbreeding programmes with specialized meat type or egg type chickens had been shown by several workers to improve their productivity significantly (Ali *et al.*, 2000; Pedersen, 2000; Thechai *et al.*, 2003, Segula – Correa *et al.*, 2004). However, these cross breeding programmes are threatened by the current global move on conservation of indigenous genetic resources which campaign against genetic dilution of indigenous genetic resources (Msoffe, 2003; Kosgey, 2004). This therefore calls for a need to look for an alternative approach towards genetic and nutritional improvement of local chicken ecotypes such as the Kuchi. Based on its performance, studies revealed Kuchi ecotype to be a good starting genetic material for improving on meat production under semi-intensive management conditions (Lwelamira, 2008).

The Kuchi IC ecotype is known for its heavy mature weight and aggressiveness towards predators. However, the performances of this ecotype in terms of growth under Extensive with Supplementation, Extensive and Intensive systems fed with different levels of energy diets have not been established so as to pave way for interventions and appropriate management systems and nutrition for recommendation for IC keepers in Kenya and other rural households in developing countries (Chesoo *et al.*, 2012, 2013).

## MATERIALS AND METHODS

### Research Site

The study was carried out at the poultry farm, Animal Science Department of the University of Eldoret (UoE), Chepkoilel Main Campus, Uasin Gishu County, Kenya. The farm is situated at latitude 0° 31'N, Longitude 35° 17' E, with an elevation of 2154 M, Above Sea Level (Kareri, 1992). An average unimodal rainfall pattern of 1000mm to 1520mm per annum has been recorded over the last ten years. The rains span from February to August and the temperatures of the site range from 23.6°C day to 9.6°C night.

### Source of Kuchi Chicken

The experimental birds were derived from 209 fertile randomly bought Kuchi eggs sourced from three sites, two in Kerio Valley–Sambalat and Muskut in Elgeyo Marakwet County, and the others collected from pure Kuchi flock kept for research at the UoE in Uasin Gishu County. This IC ecotype had earlier been introduced into Kerio Valley from Lamu County, courtesy of the Ministry of Livestock Development in collaboration with the Community Agricultural Development in Semi Arid Lands (CADSAL), in 2010.

The collected eggs were taken for hatching through artificial process using a commercial incubator at Iten Youth Polytechnic. Required hatchery sanitation processes were followed and the hatched chicks were put in a brooder for three weeks before transferring them to the experimental site at the UoE. The chicks were vaccinated against Marek's, New castle, Gumboro, Fowl pox and Fowl typhoid diseases.

A commercial chick and grower's mash were fed *ad libitum* to the chicks from day old to 11 weeks of age.

### Experimental Kuchi Chicken and Diets

At 12 weeks of age, the Kuchi growers were subjected to a feeding experiment of three levels of energy diets under three systems of management: High energy, (HE) Low energy (LE) and ordinary maize grain (MG). The energy levels in the three diets were made of 2700.5 MEKcal/Kg, 2554 ME Kcal /Kg and milled Maize Grain (MG) respectively.

The HE and LE rations were specifically formulated (Tables 1 and 2) for the experiment and fed to the growers from week 12 to 17. The initial weights of the Kuchi growers were recorded and their means computed. Weekly mean weights were taken for each system of management (treatment) on a change – over period (replicates) of 2 weeks under each ration (HE, LE and MG) respectively. The experiment was carried out for a period of six weeks (each taking two) ending at week 17 of the Kuchi growers. The layout procedure was arranged as shown in Table 3.

Table 1. Formulated ration for HE energy diet, 2700.5 ME kcal/kg

Ingredient	Qty(kg)	MEKcal/kg	%CP	%Lysine	%Methionine	%C F	%Ca <sup>++</sup>
Maize Grain	30	1005	2.55	0.0075	0.06	0.6	0.06
Maize Germ	20	450	4.2	0.19	0.076	2.1	0.012
Wheat pollard	20	460	2.6	0.1	0.04	1.5	0.01
Sun flower	5	75	1.5	0.05	0.035	0.13	0.045
Cotton cake	11	203.5	4.51	0.05	0.066	1.43	0.0165
Fish meat	5	155	2.75	0.209	0.275	1.3	0.3
Vegetable oil	4	352	-	0.275	-	-	-
Iodized salt	0.3g	-	-	-	-	-	-
Limestone	0.3g	-	-	-	-	-	0.114
Sand	0.2g	-	-	-	-	-	-
Grower Premix	3	-	-	-	-	-	-
<b>Total</b>	<b>100.0</b>	<b>2700.5</b>	<b>18.11</b>	<b>0.899</b>	<b>0.55</b>	<b>7.06</b>	<b>0.5033</b>

Table 2. Formulated ration for LE energy diet, 2564 ME Kcal/kg

Ingredient	Qty(kg)	MEKcal/kg	%CP	%LYS	%Meth	%CF	%Ca <sup>++</sup>
Maize Grain	28	938	2.38	0.07	0.56	0.56	0.0056
Maize Germ	20	450	4.2	0.19	0.074	2.1	0.012
Wheat pollard	20	460	2.6	0.1	0.04	1.5	0.01
Sun flower	5	75	1.5	0.02	0.014	0.052	0.018
Cotton cake	12	222	4.92	0.228	0.072	1.56	0.018
Fish meat	5	155	2.75	0.275	0.08	1.3	0.3
Vegetable oil	4	264	-	-	-	-	-
Iodized salt	0.3	-	-	-	-	-	-
Limestone	0.3	-	-	-	-	-	0.114
Sand	0.2	-	-	-	-	-	-
Grower mix	3	-	-	-	-	-	-
<b>Total</b>		<b>2564</b>	<b>18.35</b>	<b>0.883</b>	<b>0.336</b>	<b>7.012</b>	<b>0.4776</b>

Table 3. Layout procedure for experimental diets: HE, LE and MG under ES, ESS and IS

PERIOD (Rows)	SYSTEM (column) Treatment		
Replications	IS	ES	ESS
Week 12 – 13	MG	HE	LE
Week 14- 15	IE	MG	HE
Week16 – 17	HE	LE	MG

### Experimental Design and Model

The experiment was executed in a Randomized complete Block Design (RCBD), with 3 treatments/Diets (HE, LE, MG), 2 replications (period in weeks) per treatment with 6

animals per replicate. The systems of management (ES, ESS, IS) were taken as the blocks.

The general linear model used was:

$$Y_{ijk} = \mu + T_i + B_{ij} + e_{ijk}$$

Where;

$Y_{ijk}$  = Observation on the  $k^{\text{th}}$  IC grower of the  $i^{\text{th}}$  treatment of the  $j^{\text{th}}$  block.

$\mu$  = Overall population mean

$T_i$  = Effect due to  $i^{\text{th}}$  treatment (Deviation of each treatment mean from the overall mean ( $\mu_i - \mu$ ))

$B_{ij}$  = Effect due to  $J^{\text{th}}$  block (Deviation of each Block mean from the overall mean ( $\mu_j - \mu$ ))

$e_{ijk}$  = Random error term associated with  $Y_{ijk}$

### Data Source

The weekly mean weights for the Kuchi growers were generated from both the energy diets (HE, LE and MG) and the management systems (ES, ESS and IS) during the study period. Table 4 shows the means for the experiment.

### Data Analysis

All weekly mean weights per diet/system were analyzed for significant difference through ANOVA, using SAS 2011, software tool; Proc. GLM. Duncan's Multiple Range grouping, t-test and LSD were used to separate treatment means; at ALPHA 0.05.

## RESULTS

### Effect of Three Energy Diets on Growth of Kuchi Growers Fed Three Levels of Energy Diets under Three Different Management Systems

Table 4. Mean weight gains g/chick of chicks given three energy diets(HE,LE,MG) in the three systems of management (ES,ES,IS)

SYSTEM/BLOCKS	DIET (TREATMENTS)				SYSTEM MEANS	SEM
	HE	LE	MG	TOTAL(BLOCKS)		
ES	190.97	227.5	138.87	557.34	185.78	9.7
ESS	172.67	281.33	94.33	548.33	182.78	
IS	150.00	269.70	46.3	466.00	155.33	
TOTAL(DIETS)	513.64	778.53	279.5			
DIET(MEANS)	171.21	259.51	93.17			
SEM	48.5					

The LE 2564/kg ME was significantly ( $p>0.05$ ) different from HE and MG. The effects of HE and LE were not ( $p<0.05$ ) significant on the growth of Kuchi growers.

## DISCUSSIONS

### Metabolizable Energy Requirements of Kuchi IC Growers

The energy diet of 2564.5 MEKcal/Kg which had significant effect on the growth Kuchi growers was falling between the range of 2378-3082MEKcal/Kg recommended by Okitoi *et al.* (2010). A diet specification of low energy diet could be used to formulate diets to be offered as supplements for scavenging chicken. Thus the choice of a scavenger feed concentrate containing moderate energy is a valuable supplement for Kuchi as this indigenous ecotype is one of the scavenging chickens of Kenya.

The growth Kuchi IC at wk 12-17, performed significantly well when fed on an energy diet of 2564ME KCal/Kg. This observation is closer to what was reported by Chemjor (1998) of 2400Kcal/Kg ME for IC, as the energy requirement during the same growth period, cited in Kingori (2010). The finding from current study are consistent to recommendation made by Okitoi *et al.* (2010) that an energy diet of 2378 Kcal of ME optimizes growth performance scavenging IC.

### Mean Weight Gain

During the three weeks of the study mean weight gain of LE was 259.51g (Table 4) ;where as HE and MG showed no significant effect on the growth of Kuchi growers. Both HE and MG had showed mean weight gains of 171.21g and 93.17g respectively. This means that the higher (2700.5MEKcal/Kg as in this study) the concentration of energy level in a chicken diet, feed intake decreases. And therefore growth performance is affected. Similarly, MG whose AME is 2693±339 (Chemjor, 1998) had the same effects as HE on the growth of Kuchi growers. This is consistent to reports by Smith (1990).

Mean weights of Kuchi growers under ES, ESS and IS, fed on HE, LE and MG had no ( $p<0.05$ ) significant difference during the three weeks of the study. This agrees to the results of Chesoo *et al.* (2014) which indicates that the three management systems ES, ESS and IS have no effect on the growth of Kuchi growers.

## CONCLUSIONS AND RECOMMENDATIONS

### Energy Diet for Kuchi Growers

Kuchi IC growers performed equally well in growth regardless of the management system under an energy level of 2564.5Kcal/kg. Both diets 2700.5 MEKcal/kg and Maize Grain did not match energy level of 2564MEKcal/kg in terms of growth effect on the Kuchi growers and therefore the latter could be recommended for Kuchi IC and by extension other scavenging indigenous chicken in rural households of Kenya.

The low energy diet of 2564.5MEKcal/kg is better for the growth of Kuchi between ages 12 to 17 weeks. High energy diet of 2700MEKcal/kg and ordinary Maize grain is not a better dietary energy supplement for Kuchi at grower stage of between 12 to 17 weeks. It is therefore concluded that an energy diet of about 2564 MEKcal/Kg is optimal for Kuchi

IC at the age of between 12 -17 weeks old under any of the following systems of management: ES, ESS or IS. However, some essential dietary requirements should be available in adequate quantities in any given ration; it is recommended that a Kuchi ration should have energy level of about 2564MEKcal/Kg,18.35CP,0.883 Lysine, 0.336 Methionine, 7.072 Crude Fibre and 0.4776 Calcium (Table 2).

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### **BIO-DATA**

Ben Chesoo holds a Bachelor of Science (Animal Production) and a Master of Science (Animal Production). He is currently a Livestock production specialist with the Ministry of Agriculture, Livestock and Fisheries in Elgeyo Marakwet Conty, Kenya. In addition, he is pursuing a PhD (Animal Breeding) in the department of Animal Science, School of Agriculture and Biotechnology in University of Eldoret. He is very much involved in researches pertaining to animal science, animal breeding and health where he has published several papers.