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Assessment of Morphological Characteristics of Kuchi Indigenous Chicken Ecotype of Kenya

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Abstract

Kenya has a rich diversity of Indigenous Chicken (IC).One of them is the Kuchi ecotype whose phenotypic attributes have made it popular in terms of high mature body weight. However, characterization on the phenotypic traits of this chicken ecotype has not been adequately studied. Thus, this study was carried out to assess the morphological characteristics, namely: Feather Colours, Comb Type, Shank Colours and the Meat yield (Killing Out percentage-KO %) of Kuchi IC ecotype kept under a Scavenge System with Supplementation (SSS) from week 17 to 30 of age. The experimental birds were derived from randomly collected pure Kuchi eggs which were bought, hatched artificially and managed intensively using commercial chick and growers mash from day old to 17weeks.From 18 weeks of age, 18 chickens were subjected to a scavenge feeding with cafeteria supplementary ration of commercial layers mash for a period of 12 weeks. The experiment was executed at week 30, involving descriptive statistics and visual appraisals. Generated data was analyzed using an Excel (2007) Soft ware tool. Results revealed three categories for Feather colours: Solid–One, Mixed-Two and Heterogeneity (several-including Frizzled) as: 27.8%, 33.4% and 39%, respectively. Frizzled trait constituted 11.2%. Comb types of Kuchi were categorized into three phenotypic characteristics: Pea (55.6%, Single (22.2%) and Rose (22.2%) types. Shank colours fell into two categories: Yellow (77.8%) and White (22.2%).Kuchi at 30weeks of age had a KO % of 67.8% and 65.9%, for cock and hen respectively. This indicates that a Kuchi cock at 30 weeks old is heavier by 1.9KO%, than a hen of same age. Results from this study can be utilized during selection and breeding of Kuchi and in determining correlations of traits of economic importance in other IC ecotypes.

***Key Words**: Kuchi, Morphological Characteristics, Ecotype, Killing Out Percentage (KO %), Kenya.*

INTRODUCTION

Indigenous chicken(IC) is any flock of chicken *(Gallus domesticus)* whose progenitor is the Red jungle fowl (*Gallus Gallus*). This chicken is mostly kept under free-range management system with no selection for breeding or improvement (Ondwasy, 2006).Their egg production ranges between 8-15 eggs per clutch depending on the availability of feed. Broodiness is a well expressed trait during the egg laying period they hatch about 80% of the eggs that they sit-on. About 20-30% of the hatched IC chicks attain maturity due to mortalities that are occasioned by predation, poor nutrition, diseases and parasites (Maclean, 1997).These birds, though under poor management, live within rural households for many years contributing a crucial socio-economic role besides being a valuable source of animal protein.

Despite these roles, IC has not attained their full production potential due to exposure to risks that militate against their survival and productivity. However, if managed well, indigenous chicken can be profitable and may serve as good source of animal protein which has been a chronic challenge in developing countries (Pedersen, 2002; Nielsen, Roos & Thilsted, 2003). The situation is further aggravated by high poverty incidence these rural households. Due to their short generation intervals, chickens have a high potential to off-set the low protein intake and a means of alleviating poverty. Since the majority of the people in developing countries live in rural areas where IC is predominantly kept, putting an emphasis on local chickens 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 outbreak of diseases particularly New castle Disease(NCD) has been observed in significant number of studies to be among the major factors limiting productivity of local chickens in the tropics, both under intensive and extensive management

systems(Alexander,2001;Msoffe,2003).Crossbreeding programmes with specialized meat or egg type chickens has been shown by several workers to improve productivity significantly (Ali *et al*., 2000).However, these cross breeding programmes are threatened by the current global initiatives on conservation of indigenous genetic resources which campaign against genetic dilution of indigenous genetic resources (Msoffe, 2003; Kosgey, 2004).

Kuchi has proved to be a viable source of income to the farmers who rear it. For instance, farmers in Elgeyo Marakwet County consider this chicken a gateway out of poverty. The disease resistant chicken that weighs twice as much as conventional breeds is currently enjoying impressive uptake among poultry farmers in the county for economic empowerment. According to the residents, the chicken sells at Shs1500 and Shs2000 for the pullet and cockerel respectively when fully matured while eggs retail at Sh30 compared to Sh8 to Sh10 of other breeds (Wesonga, 2013). However, owing to high demand, the prices of the chicken and eggs have shot up. Currently a pullet is being sold at Ksh.2000 while a cockerel is selling for Ksh. 2500. The eggs are currently Ksh.100 each.

Research geared towards improving this ecotype is vastly missing. This therefore calls an alternative approach towards genetic improvement of local chicken ecotypes such as the Kuchi whose phenotypic attributes have shown that it can to become a good starting genetic material for meat production under Semi-Intensive management conditions (Lwelamira, 2008). Thus, this research sought to establish morphological characteristics of Kuchi indigenous chicken ecotype of Kenya.

MATERIALS AND METHODS

The study was carried out at the poultry farm, Animal Science Department of the University of Eldoret (UoE), Uasin Gishu County, Kenya. The farm is situated at Latitude 0^{o} 31"N, Longitude 35^{o} 17" E, with an elevation of 2154M, above sea level (Kareri, 2010)

The experimental birds were derived from 209 one to five day old fertile randomly bought Kuchi eggs that were sourced from three sites, two in Kerio Valley (Sambalat and Muskut) of Elgeyo Marakwet County. Other eggs were collected from pure Kuchi flock kept for current study at the UoE in Uasin Gishu County. This Indigenous chicken 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 with strict adherence to the incubator's manual. Then the hatched chicks had their day old weights taken and put into a brooder for three weeks before transferring them to the study site at the UoE. Following disease control requirements, the chicks were vaccinated against Gumboro, Marek's, New castle, Fowl pox and Fowl typhoid diseases. A commercial chick and Grower's mash were fed *ad libitum* to the chicks from day old to 8 weeks of age. From week 9, the Kuchi were fed with formulated grower's rations up to week 17.

Assessment of Morphological Characteristics of the Kuchi Indigenous Chicken Ecotype

From week 18 of age, 18 Kuchi Indigenous chicken were allowed to scavenge throughout the day under a cafeteria feeding system (Chemjor, 1998).The amount of supplementation that was given daily to Kuchi chicken up to 30 weeks of age was 1000g of commercial layers mash. A weekly wheelbarrow load of sheep and goat manure was spread within the scavenging area to allow the chicken exploit their innate characteristics of always scratching the ground searching for insects as always observed among indigenous chicken in rural households. Water was provided *ad libitum.* The housing dimension was made of $12m^2$floor pens. This feeding system was done for a period of 12 weeks. When the chickens were 30 weeks of age, the morphological characteristic of Kuchi were studied. The traits that were studied included: feather colours, comb type, shank colours and the Killing Out percentage (**KO %).**

Feather Colour: (n=18); 10 Females (F), **8** Males (M)

The phenotypic characteristics of Kuchi Indigenous chicken ecotype were observed and recorded using visual appraisal of the appearance following the Standard Chicken descriptors (Halima *et al.,* 2007). Feather colours were categorized into: Solid-one (exclusively Solid- One white or black), Mixed-two (a mixture of both white and black feather colours), and several-heterogeneity (a combination of multi-colour) including the recessive frizzled type.

Comb Type: (n= 18), 10 F, **8** M

This trait in Kuchi Indigenous chicken ecotype were observed and categorized into Pea, Rose and Single comb types (Jadhav and Siddiqui, 1999).

Shank Colour: (n=18), 10 F, **8** M

The shank colours were observed using the Standard Chicken descriptors (Halima *et al.*, 2007).The shank colours were categorized into two: yellow and white.

Killing out Percentage (KO %):(n=6) 3 F**, 3** M

At week 30 of age, 6 out 18 Kuchi chicken were randomly selected for slaughter and used for the Killing Out Percentage (KO %) assessment between mature cock and hen. The average weights for the cocks and hens were recorded after 1p2 hours after an over-night deprivation of feed (Tougan *et al.*, 2013).The Live body weights (Lbwts) were recorded and means computed.

Slaughtering Process:

The six 30 week old Kuchi chicken were manually de-feathered when still alive then their mean de-feathered weights taken to arrive at the mean weights of the feathers for both sexes. Then their jugular veins were cut and bled, and blood volumes taken. Evisceration was done and mean weights for the heart, kidney, crop, gizzard, visceral and offal organs separated. The legs were then sectioned at *tibiotarsus-metatarsal* articulation (Tougan *et al*., 2013).The mean weights and blood for feathers, legs, wing breast meat, thigh, back, neck, heart, liver, gizzard and shank were computed for KO% assessment for each sex in relation to their Live Body Weight (Lbwts).

Data Analysis

The data generated were analyzed using descriptive statistics using Excel (2007) Software tool. The data generated on the live body weights and carcass were analyzed using Excel 2007 Software package for mean assessment and summarized into percentage in relation to live body weights(Lbwt).The KO% for Kuchi male and Female at 30 weeks of age were assessed.

RESULTS AND DISCUSSION

Feather Colours

At week 30 of age, three categories of phenotypic characteristics on feather colours were observed (**Table 1**).A large variation of feather colours were exhibited which were grouped into three categories:(A) Solid (one) colour (B) Mixed (two) colours and (C) Heterogeneity (several) colours were: 27.8%, 33.4% and 27.8% respectively. Solid one colour (white) was predominantly seen in hens which was twice as those of cocks. Similarly, Solid (brown) colour was also a hen colour and was not observed in cocks. Mixed (two) feather colours were exclusively hen trait, while Heterogeneity for both several and Frizzled feather colours (11.2%) were exclusively exhibited in cocks.

Table 1: Categories of Feather colours (**n=18**): M=8, F=10.

Category	**%**	**Sex**		**Ratio**	**Total**
		F	M	F/M	
(A).Solid -**one** colour:					
▪ White	16.5	2	1	2:1	3
▪ Brown	11.1	2	-	2:0	2
Total	**27.6**	**4**	**1**		**5**
(B).Mixed-**two** colours:					
• Brown/Grey	11.1	2	-	2:0	2
• Brown/Black	16.7	3	-	3:0	3
• White/Black	5.6	1	-	1:0	1
Total	**33.4**	**6**	**0**		**6**
(C).Heterogeneity(**several)** colours:					
▪ Silky/grey/black/white/brown	11.1	-	2	0:2	2
▪ Grey/brown/black	11.1	-	2	0:2	2
▪ White/black/grey/brown	5.6	-	1	0:1	1
	27.8	0	5		**5**
▪ Frizzled:	5.6	-	1	0:1	1
white/grey/brown/black	5.6	-	1	0:1	1
▪ Frizzled: white/grey/black					
Total	**11.2**	0	2		**2**
Total	**100.2**	**10**	**8**		**18**

Figure 1.Solid **one**-colour feather

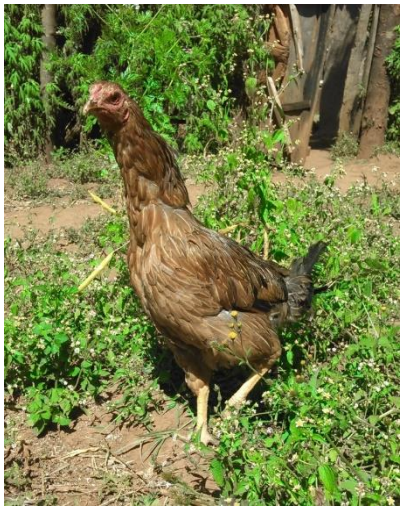

Figure 2. Mixed-**two** colours feather

Figure 3.Heterogeneity**(Several**)feather colours

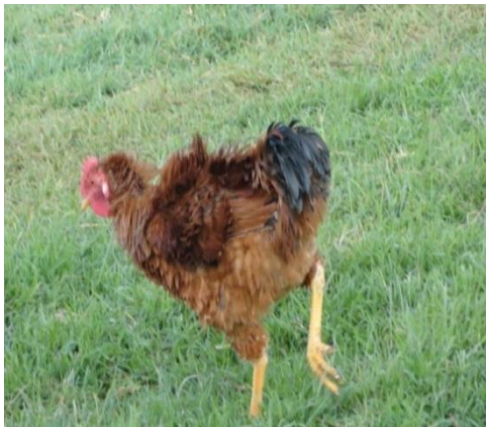

Figure 4.Heterogeneity(**Several**)Frizzled feathers

The feather colour frequencies :One-colour brown,two-colours:brown/grey,brown/black, or white/black and several ;combinations of both Frizzled feather colours: white/grey/brown/black and white/grey/black, all constituted 55.5%, each feather category contributing about 11.1%.While one colour white and two colour brown/black feather had nearly similar frequencies of 16.5% and 16.7%,respectively.

Several phenotypic variations existed in the feather colours (Table 1/Figures 1,2,3 &4) of Kuchi IC ecotype: Solid-one colour (white/brown) was 27.8%, with male/female ratio of 1:4; Mixed- two colours was 33.6%, and Heterogeneity (several colours) was 39%, which included Frizzled feathers exhibiting 11.2%.These results are slightly above the findings (Heterogeneity, 35.76%) reported by Halima *et al.*, (2007), on mature indigenous chicken of Ethiopia. The Frizzled feather colours of 11.2% were also slightly above those reported (8.33%) by Adomake (2009) of Local domestic Fowl of Ghana. According to Adomake (2009), Frizzle feather trait is a thermoregulatory gene which in this study, was predominantly expressed in Kuchi males (Table 1).Frizzled feather trait has been reported to be under the blink of extinction (Fayeye and Oketoyin, 2006) cited in Adomake (2009).Solid-one colour reported by Halima *et al.* (2007) of white and grey (22.3%) is above that found in this study of 16.7% and 11.1% for white and grey feathers respectively. This slight difference in Kuchi Indigenous chicken may be attributed to the small population size in this study or several other factors like random genetic drift (Adomake 2009), diseases and selection by man against/for this (frizzled).The native chicken for Bangladesh (Faruque *et al*., 2010), exhibited 33.33%, 28.33% and 18.33%, for black brownish, white with black strips and red brownish plumage colours respectively. This relates well with results in the current study on Kuchi Indigenous chicken. The slight variations are most likely as a result of several other variables such as genetic intermixing under panmixia, human migration, exchanges in trade, mutation and genetic drift.

Mixed-two colours (Brown/Grey, Brown/Black and White/Black) were predominant in Kuchi females while Heterogeneity-several colours (Silky Grey/Black/White/Brown; Grey/Brown /Black; and White/Black/Grey/Brown were exclusively a male feather colour. Similarly, frizzle feathers: white/grey/brown/black and white/grey/brown were a male colour in Kuchi Indigenous chicken ecotype. These great variations in feather colours agree to observations by (Alemu and Tadelle, 1997; Halima *et al*., 2007 and Mcainsh *et al.,* 2004; Bhuiyan *et al*., 2005; Msoffe *et al.,* 2005) of other indigenous chicken. Results from present study may be utilized in Indigenous chicken populations during breeding scenarios to predict phenotypic characteristics of feathers and their correlations with other traits of economic importance.

Comb Type

The comb types of adult Kuchi were categorized into three phenotypic characteristics (**Table 2**).Pea type (55.6%) was more than twice as those of Single (22.2%) and Rose (22.2%) types. The latter was predominantly observed in females while Pea and Single types exhibited in males with a male/female ratio of 4:1 and 1:1, respectively. Rose type was exclusively a female comb.

Table 2: Categories of Comb type (n=18) M=8, F=10.

Comb Type: Category	**%**	**Male**	**Female**	**M/F Ratio**	**Total**
• Pea	55.6	8	2	4:1	10
• Single	22.2	2	2	1:1	4
• Rose	22.2	-	4	0:4	4
Total	**100.0**	**10**	**8**		**18**

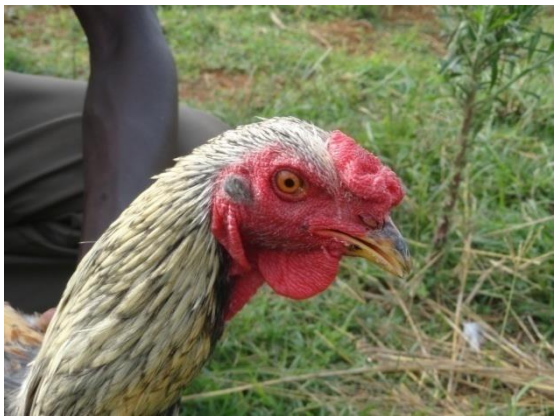

Figure 5.Pea comb

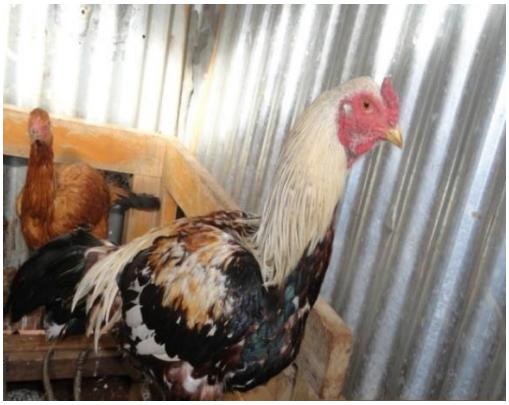

Figure 6.Rose comb

Figure7.Single comb

Three comb types were observed (Table 2/Figures 5,6&7), Pea, Single and Rose as: 55.6%, 22.2% and 22.2%, respectively. The male/female ratios were 4:1, 1:1 and 0:4 for Pea, Single and Rose comb types respectively. Rose comb type was pre dominantly expressed in females while other known types such as the Strawberry and Walnut (Mogesse, 2007) were not observed in current study. The Walnut comb is exhibited in First generation(***F1***) cross between the Rose and Pea comb chicken genotypes(Khan and Singh,2002).This observation(absence of walnut) may have been brought about by the small sample size(n=18) used in this study. However, Pea comb type of 55.6% was closer to that reported by Halima *et al.,* (2007) in IC of Ethiopia which had 50.72%.Single and Rose comb types were not observed in the Ethiopian IC. The native chicken of Bangladesh predominantly exhibited 100%, Single comb type; Pea and Rose comb types were not reported (Faruque *et al.,* 2010),as were observed in the current study.

Shank Colour

The Shank colours of Kuchi adults were categorized into two (**Table 3**).Yellow colour (77.8%) was predominantly observed in cocks (male/female ratio of 4:3), whereas white shank colour (22.2%) was predominately observed in hens.

Table 3: Categories of Shank colour (**n=18**) M=8, F=10.

Shank Colour: Category	**%**	**Sex**		**Ratio**	**Total**
		Male	**Female**	**M/F**	
• Yellow	77.8	8	6	4:3	14
• White	22.2	-	4	0:4	4
Total	**100.0**	**8**	**10**		**18**

Figure 8.White shank colour

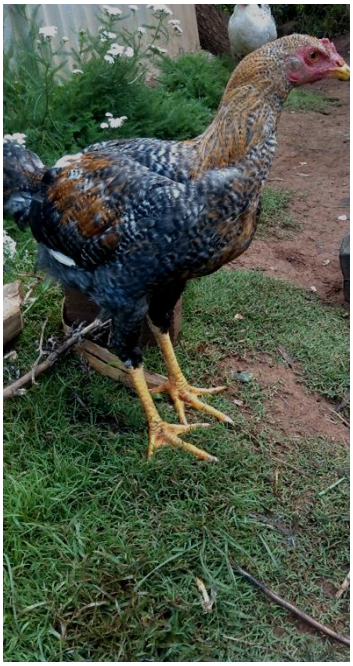

Figure 9.Yellow shank colour

Two shank colours: Yellow and White (Table 3/Figures 8&9) were observed in this study as 78.8% and 22.2% respectively. The Male/Female ratio was 0:4 for white shank and 4:3 for yellow shank. White shank colour was not observed in Kuchi males as was predominantly seen in females. This was may be due to loss of carotene contained in the egg yolk. A third of the female Kuchi hens were laying at this age (30 weeks) hence the white shank colour in this study. The yellow shank colour of 77.8% in this study was far above that reported (64.42%) by Halima *et al.,* (2007) in Ethiopian Indigenous chicken. White shank colour was not reported in the Indigenous chicken of Ethiopia as was observed in Kuchi ecotype. Native chicken of Bangladesh (Faruque *al.,* 2010) predominantly had 35% and 31.68%, for white and yellow shank colours respectively. The two shank colours (yellow and white) confirm the report given by (Eriksson *et al.,* 2008), that the present indigenous chicken is a descendant of hybridization between the Grey and Red jungle fowls. In the present study, Kuchi showed more than twice the frequency of yellow shank colour to that reported on Bangladesh native chicken. An obvious assumption may be inferred that the Kuchi in current study is having the grey jungle fowl as its main progenitor. The presence of yellow legs in the majority of chickens used for commercial egg and meat production in the Western world are genotypic for homozygous yellow skin allele thus the phenotypic appearance of yellow legs. This therefore brings the assumption that Indigenous chicken has the desirable commercial traits to be selected for both egg and meat breeding objectives.

Killing-out Percentage of Kuchi Cock and Hen

At week 30, the meat yield expressed in Killing Out percentage (KO %) for both Kuchi male and female were as in Tables 4 and 5. Kuchi cocks had a Mean Live Body Weights (Lbwts) of 2242.67g and Killing (Dressed) weight of 1520.33g, which translated to a Killing Out percentage (KO %) of 67.8%.

The live body weight (Lbwts) of Kuchi hen was 1683.33g and the Killing weight of 1109.22g which is 65.9% KO%.

This indicated that the KO% of Kuchi cock at 30 weeks of age was higher than Kuchi hen of the same age by a KO% of 1.9%.

The Killing Out% (Table 5) for the 6 Kuchi Indigenous chicken was calculated by the following equation:

$$KO\% = Lbwts\ (g) - \left\{ \frac{(Legs + head + neck + feathers + blood + liver + gizzard + heat + others)}{Lbwts\ (g)} \right\} \times 100$$

Table 4: Morphological characteristics of Kuchi chicken at 30weeks of age (n=6), M=3; F=3.

Parameter	Sex(M/F)	Range(g)/(cm)		Mean ±	SD
		minimum	Maximum		
• Lbwts(g)	M	12047	2465	2243	±210.3
	F	1487	1913	1683	±214.2
• Bwt(de-feathered)(g)	M	1941	2340	2144	199.6
	F	1414	1799	1600	±192.8
• Feathers(g)	M	100	125	115.7	±9.5
	F	60	114	83	±27.9
• Legs(g)	M	84	116	105.3	±18.5
	F	47	61	52.7	±7.4
• Neck(g)	M	95	117	104	±11.5
	F	39	53	47.3	±7.4
• Blood(ml)	M	80	120	100	±20
	F	50	100	66	±28.9
• Wing-Bone muscle(g)	M	501	670	595.7	±86.3
	F	394	492	441.3	±49.1
• Head(g)	M	51	86	72	±18.5
	F	47	93	63.7	±25.5
• Back bone(g)	M	300	377	334	±39.3
	F	238	350	293	±56.03
• Shank length(cm)	M	14	15	14.67	±0.53
	F	10	13	11.33	±1.53
• Drumstick(thigh)(g)	M	547	632	591.33	±42.62
	F	311	385	346.3	±37.11
• Gizzard(g)	M	38	48	42.33	±5.13
	F	39	64	48.7	±13.43
• Heart(g)	M	12	16	14	±2.00
	F	6	13	9.33	±3.51
• Liver(g)	M	25	38	30.67	±6.7
	F	31	39	35	±4.0

Table 5: Killing Out (KO %) for Kuchi chicken (n=6); M=3, F=3.

Cock	**Age**(30weeks)	Replications			Total	Mean(g)±SD	KO%
		1	2	3			
	Lbwts(g)	2047	2216	2465	6728	2243.67±210.3	**67.8**
	Dressed wt(g)	1346	1536	1679	4561	1520.33	
Hen	Lbwts(g)	1646	1489	1913	5050	1618.33±214.2	**65.9**
	Dressed wt(g)	1073	1028	1227	3328	1109.33	

The Live body weight (Lbwts), 2442.67g of Kuchi cock was higher (**Table 4**) than the ranges of 600-800g reported by Payne (1999), and lower than the mean adult weights of 2708g, at same weight that was reported in Yongolo (1996) under On-Farm Free range/roaming management system.
Kuchi male at 30 weeks had a Live body weight(Lbwt) of 2244g.This is closer to those recommended by Jadhav and Siddiqui (2007), for egg type Leghorn 2000g at 30 weeks of age. A Kuchi hen at the same age was weighing 1683.33g, which is similar to 1600g recommended for the same egg type Leghorn. Moreover, the presence/absence of statistical significance between mature Kuchi cock (1.9%, heavier) and hen in terms of carcass yield was not determined in the present study. The results from current study are in agreement with findings of many workers that males of all IC are significantly heavier than females of the same age, for example :the Tswana male and female naked neck, Iranian naked neck, Ghanaian strains, the dressed weight of Bangladesh naked neck and the Malawian local chicken(Moreki *et al.*,2012;Vali,2008;Badubi *et al*.,2006;Adebambo,2003;Safalaoh,1998).

Additionally, the Killing Out percentage (KO%), of adult Kuchi :Cock 67.8% and Hen 65.9%,(**Table 5**) are lower than, but consistent with reports of MoLD (1994), that Cold Dressed Weight (CDW) of broilers and culled hybrid layers are 82% and 75%,respectively.

CONCLUSION

The observation of different morphological characteristics within the Kuchi IC ecotype has revealed the existence of some level of phenotypic diversity in the Kuchi population. This implies that the Kuchi ecotype constitute a pool of diverse genetic variability that can be utilized for selection on desirable characters within and between the ecotypes. This will certainly pave way towards significant progress in IC improvement programmes in Kenya and other tropical countries.

RECOMMENDATIONS

- ***To Poultry Breeders:*** To avoid genetic dilution and erosion of local chicken genetic resource, it is recommended that further characterization of the Kuchi ecotype is made(phenotypic and molecular), through within and between ecotype selection in order to utilize and conserve these indigenous genomes in a sustainable way,
- ***To Policy Makers:*** It is recommended that the line department in the Ministry of Agriculture, Livestock and Fisheries, collaborates with Animal Scientists who are interested in researching into indigenous chicken, particularly the Kuchi, for the purpose of patenting, conservation (Gene-banking) and production since this ecotype has the potential of being harnessed towards rural livelihood improvement, not only in Kenya but also in other developing tropical countries; and ,
- ***To Farmers:*** Findings from this study, the researcher recommends that the farmers select and line breed ecotypes which have high body weight gain and plumage colours not attractive towards predators. Kuchi IC ecotype satisfies all these attributes, thus the researcher highly recommends it to the farmers.

REFERENCES

Adebambo, O. A. (2003). Animal Breeds: A Nation heritage. *An Inaugural lecture delivered at University of Agriculture, Abeokuta, Nigeria. Delivered on 8th October*.

Adomake, K. (2009). *Local chicken Domestic chicken: Their potential and Improvement*; PhD Thesis; Kwame Nkrumah University. Pp115-11.

Alemu, Y., &Tadelle, D. (1997).The status of poultry research and development in Ethiopia, research bulletin No. 4, poultry commodity research program Debrezeit Agricultural research center. *Alemaya University of agriculture, Ethiopia*, 62.

Alexander, D. J. (2001).Newcastle disease.*British Poultry Science*, *42*(1), 5-22.

Ali, K. O., Katule, A. M., &Syrstad, O. (2000). Genotype× environment interaction in growing chickens: comparison of four genetic groups on two rearing systems under tropical conditions. *Acta Agric Scand (A)*, *50*(2), 65-71.

Badubi, S. S., Rakereng, M., &Marumo, M. (2006).Morphological characteristics and feed resources available for indigenous chickens in Botswana.*Livest.Res. Rural Dev*, *18*(1).

Bhuiyan, A. K. F. H., Bhuiyan, M. S. A., & Deb, G. K. (2005). Indigenous chicken genetic resources in Bangladesh: Current status and future outlook. *Animal Genetic Resources Information*, *36*, 73-84.

Chemjor, W. (1998).*Energy and protein requirements of the growing indigenous chickens of Kenya* (Doctoral dissertation, M. Sc. Thesis, Egerton University, Njoro, Kenya).

Faruque, S., Siddiqui, N. U., Afroz, M. A., & Islam, M. S. (2010). Phenotypic characterization of Native Chicken reared under intensive management system. *Journal of the Bangladesh Agricultural University*, *8*(1), 79-82.

Fayeye, T. R., &Oketoyin, A. B. (2006).Characterization of the Fulani-ecotype chicken for thermoregulatory feather gene.*Livestock Research for Rural Development*, *18*(3), 98-102.

Halima, H., Neser, F. W. C., van Marle-Koster, E., & de Kock, A. (2007).Phenotypic variation of native chicken populations in northwest Ethiopia. *Tropical animal health and production*, *39*(7), 507-513.

Jadhav, N. V., &Siddiqui, M. F. (1999).*Handbook of poultry production and management*.Jaypee Brothers Medical Publishers (P) Limited.

Kareri, R. (2010).Some aspects of the geography of Kenya.In *Proceedings of the 2010 Indiana University-Perdue University Indianapolis (IUPUI) Fulbright Hays Group Projects Symposium, Eldoret, Kenya* (Vol. 9).

Khan,F.K.,&Ashok Singh.(2002).*Principles of Genetics and Animal Breedings*.Jaypee Brothers Medical Publishers(P)Ltd.24-25

Kosgey, I. S. (2004).*Breeding objectives and breeding strategies for small ruminants in the tropics*.Wageningen Universiteit.

Lwelamira, J., Kifaro, G. C., &Gwakisa, P. S. (2008).On station and on-farm evaluation of two Tanzania chicken ecotypes for body weights at different ages and for egg production. *African Journal of Agricultural Research*, *3*(12), 843-851.

McAinsh, C. V., Kusina, J., Madsen, J., &Nyoni, O. (2004).Traditional chicken production in Zimbabwe. *World's Poultry Science Journal*, *60*(02), 233-246.

Mogesse, H. H. (2007). *Phenotypic and genetic characterization of indigenous chicken populations in Northwest Ethiopia* (Doctoral dissertation, University of Free State).

Moreki, J. C., Tiroesele, B., &Chiripasi, S. C. (2012). Prospects of utilizing insects as alternative sources of protein in poultry diets in Botswana: a review. *Journal of Animal Science Advance*, *2*(8), 649-658.

Msoffe, P. L. M. (2003). Diversity among the local chicken ecotypes in Tanzania. *Unpublished PhD thesis, Sokoine University of Agriculture, Morogoro, Tanzania), 223pp*.

Nielsen, H., Roos, N., &Thilsted, S. H. (2003).The impact of semi-scavenging poultry production on the consumption of animal source foods by women and girls in Bangladesh.*The Journal of nutrition*, *133*(11), 4027S-4030S.

Ondwasy, H., Wesonga, H., &Okitoi, L. O. (2006).Indigenous chicken production manual.*Kenya Agricultural Research Institute technical note*, (18).

Payne, W. J. A., & Wilson, R. T. (1999).*An introduction to animal husbandry in the tropics*. Oxford etc.: Blackwell science.

Payne, W. J. A., & Wilson, R. T. (1999).*An introduction to animal husbandry in the tropics*. Oxford etc.: Blackwell science.

Pedersen, C. V. (2000). Farmer-driven research on village chicken production in Sanyati, Zimbabwe. In *Improvement of Health and Management of Family Poultry in Africa, Improvement of Health and Management of Family Poultry in Africa, Second Research Co-ordinating Meeting, Morogoro, Tanzania* (pp. 179-186).

Safalaoh, A., Jesemani, K., & Phoya, R. (1998).A survey of broiler production in the Blantyre Agricultural Development Division, Malawi.*Development Southern Africa*, *15*(2), 235-250.

Tougan, P. U., Dahouda, M., Salifou, C. F. A., Ahounou, G. S., Kpodekon, M. T., Mensah, G. A., ... &Youssao, I. A. K. (2013). Relationships between carcass traits and offal components in local poultry populations (*gallus gallus*) of Benin.*Journal of Applied Biosciences*, *69*, 5510-5522.

Vali, N. (2008). Indigenous chicken production in Iran: a review. *Pakistan Journal of Biological Sciences*, *11*(22), 2525.

Wesonga, M. (2013, August). Standard Digital News: Business Kuchi chicken offers solution to Marakwet poultry farmers. Retrieved February 17, 2015, from http://www.standardmedia.co.ke/business/article/2000091693/kuchi-chicken-offers-solution-to-marakwet-poultry-farmers?pageNo 3

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