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Research Article

Phenotypic Characterisation of Indigenous Chickens in Rushinga District

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Abstract

Study sought to phenotypically characterise indigenous chickens in Rushinga district. Samples were drawn from three wards with the highest number of chickens. Purposive sampling was initially carried to select indigenous chicken farmers followed by snowball sampling to identify more farmers with at least ten adult chickens. A total of 65 questionnaires were administered randomly to assess on production environment. Data was analysed using SPSS version 16 for frequencies, descriptive statistics and multivariate analysis of variance to differentiate chicken populations in wards on quantitative traits. The study showed that more females (67.7%) where involved in indigenous chicken production compared to males (32.3%). Mean flock size was 23.07 and flock composition was mainly characterized by chicks, pullets and cockerels. Neck lengths, shank length, comb height, wattle length and wing span were significantly different amongst all wards ($p < 0.05$). Pelvic width; back length; body circumference, body weight and body length, were similar in all the wards investigated. Production environment in Rushinga is characterized by resource poor farmers who rely on erratic rain fed farming for income. Phenotypically, chickens exert adaptive characteristics to harsh climatic and production environment. There is need to design and implement a national research program to collect, conserve and improve indigenous chicken breeds.

Keywords: Indigenous Chickens; Production Environment; Phenotype

Introduction

Indigenous chickens (Gallus domestica) accounts for about 80% of the world's poultry population and 90% are in developing countries [1]. Generally kept under scavenging production systems, with limited resources [2]. Most of the breeds are well adapted to the local climatic conditions, scarce feed resources, and are highly disease tolerant [3]. Indigenous chickens play an integral role in smallholder farming systems [4] as they are used to meet the multiple household, socio cultural and economic needs [5]. In addition, they are a source of cheap protein in form of meat and eggs in developing countries due to simple ownership patterns [6,7] postulate that, consumer interest in favour of meat from slow-growing chickens is increasing in many countries in the world despite its relatively high price. Due to the nature of production systems in smallholder farms indigenous chickens are a function of natural selection [8], as a result the production potential and efficiency under communal areas remain generally low [2].

Indigenous chickens are known to possess desirable characters such as thermo tolerance, resistance to some diseases, good egg and meat quality, hard eggshells, high fertility and hatchability as well as high dressing percentage [4,9] reported that the identification and characterization of the chicken genetic resources generally requires information on their adaptive capacity to a specific environment, possession of unique traits of socio-cultural and economic value which are crucial inputs to decision on conservation and utilization. Lack of information on phenotypic characters of indigenous chicken population in most developing countries has led to reduced productivity. Study aimed at characterising production environment and phenotypic features of indigenous chickens in Rushinga district.

Phenotypic characterization of indigenous chickens at micro levels will assist in assessing the state of diversity and adaptability of existing breeds to the harsh impacts of climatic variability [10] perceived that lack of sufficient information is one of the major hindrances in the chicken improvement programs.

Material and Methods

Study site

Study was conducted in Rushinga District which lies in Region IV of Mashonaland Central Province. Annual rainfall ranges from 350 mm – 450 mm, with an average temperature of 28.6°C. Vegetation type dominated by combretumm species, acacia species and sparse baobab trees in communal rangelands.

Sampling procedure

Samples were drawn from three wards with the highest number indigenous chicken. Purposive sampling was initially carried to select farmers rearing indigenous chickens followed by snowball sampling to identify more farmers with at least ten adult indigenous chicken per household until a sufficient sample of 200 indigenous chicken's was reached.

A total of 65 questionnaires were administered randomly to the selected farmers to assess on production environment.

Data collection

Production environment

Data on production environment was collected using a pretested semi structured questionnaire and farmers who took part in pretesting were not included in the actual survey. A total of 65 questionnaires were administered to households with at least of 10 adult indigenous chicken. Data on flock characteristics, flock composition and management practices was collected. Closely adjoining households were also skipped to avoid the risk of sampling chickens sharing the same cock.

Phenotypic characterization

The field survey design and data collection procedure for phenotypic characteristics was done according to procedure described by [13]. Phenotypic characterization was done through measuring conformational traits of matured chickens approximately 36 weeks of age and was determined by measuring the plumage size.

Quantitative data was collected on body length, back length, body length, pelvic width, body weight, comb length, comb height, wattle length, wing span, and keel length. Qualitative data collected included feather morphology, feather distribution, leg feathers, plumage colour, plumage pattern, comb type, comb size, shank colour, skin colour and earlobe colour. Measurements on quantitative data were taken using measuring tapes and scale. Chicken phenotypic descriptors [13] were used to assess qualitative traits.

Data analysis and presentation

Data was analysed using SPSS version 16 for frequencies, descriptive statistic, graphs and charts. Bonferroni test was done for comparison of means after analysis of variance at 5% significance level.

Multivariate analysis of variance to differentiate chicken populations in different wards on linear body measurements was done using the following model:

$$Yij = u + wi + eij$$

Where Yij is observed phenotypic value

U is overall mean due to condition common to all animals

W is the effect of ith ward (1, 2, and 3)

Eij are random residue

Results and Discussion

Household demographics and Socio economic factors

The study indicated that more females (67.7%) where involved in indigenous chicken production compared to males (32.3%). Majority of the households (78%), all family members were involved in the chicken management practices. Level of education was very low and a significant percentage of 23.1 never attended any level of education, about 9.1% of the respondents had post -secondary level of education. The main source of livelihood was farming (76.9%), informal employment and formal employment contributed only 15.4% and 7.7% respectively. According to [14], over 80% of rural population is depended on agriculture for income and up keep. However, due to current climatic uncertainties other non-agricultural opportunities like informal mining are now fast becoming major income contributors in communal areas. Farmers in Rushinga kept indigenous chickens for sale (60%), consumption (35.4%) and for prestige (4.6%). The rearing indigenous chickens was mainly for food, cash income, production of breeding stock and cultural ceremonies [15].

Flock dynamics

Study showed a mean flock size was 23.07 in terms of the population structure and flock composition was as shown in figure 1. About (64.6)% of the respondents owned only one cock per household with a cock to hen ratio of 1:4 and this concurs with the findings of [16]. A lower proportion of the cocks are maintained in a flock for breeding and sharing of cocks among neighbors is a breeding strategy in a community [17]. Keeping a relatively high number of pullets could be a copping mechanism to replace the number of adult chickens reduced by selling, consumption and loss due to other various reasons such as predators, parasites and diseases. According to [18] in any poultry set up, the proportion of mature hens in the flocks is used to estimate flock productivity. The mean chicken flock size per household and flock structure are in agreement with [19,20] where mean flock size is between 10 and 24 per household, with chicks constituting the largest proportion. However [16], states that flock size of indigenous chicken can be up to 57 birds per household as small flock sizes, makes it difficult for households to depend on village chicken production for income.

Figure 1: Indigenous chicken flock composition in Rushinga district.

Indigenous chicken management

Study showed that 67.7% of the farmers housed their birds at night and 32.3% provided no housing for their chickens. During the day, birds were left to free range in search of food making them easy targets for predators. [22] states that scavenging is the main source of feed for indigenous chickens however, supplementary feeding can be done occasionally. Free range production system

results in low chicken productivity [23]. Studies done in Ghana and Mozambique showed that supplementing feeds to indigenous chickens increased egg production, encourage growth and maintained flock health [24].

Most farmers ranked predators (43.1%) as the major cause of chicken mortality, followed by diseases (38.5%) and this is in agreement with [25,26] reported that mortalities due to diseases are the main cause of low productivity in chicken rearing.

Majority (73.8%) of the farmers treated and vaccinated their chicken when sick this is in agreement with [14]. However, 24.6% of the households sold their birds when sick to avoid losses. The availability of vaccines and their acceptance by farmers was generally higher in the studied area. The practice of not vaccinating livestock in most rural setup is mainly due to lack of resources and proper extension advice. Most of the farmers (75%) lacked knowledge on marketing of their birds and had no proper markets. Lack of markets within most smallholder farmers is the major contributor to low viability and profitability.

Phenotypic characterization of indigenous chicken

Qualitative traits

Three plumage colours were observed in indigenous chicken populations black (36.5%), red (33.5%), white (29%) [4] identified similar plumage characteristics in Ethiopia. The proportion of single comb type chickens was dominant (68%), compared to the pea (19.5%) and walnut (12.5%). The high presence of single comb birds suggested a selection advantage of the strain over the other [28-30] states the single comb type have a greater adaptability to harsh production environments, as combs are important for heat loss. Majority of the chicken presented a normal (89%) feather morphological pattern silky and frizzled constituted 26.0% and 5% respectively. Naked- neck chicken constituted 26% and this was in line with findings by [29] who concluded that this can be an adaptation mechanism as it is desirable for heat tolerance.

The dominant shank color was yellow (40.5%), black and white shank colors were also present constituting 23.55 and 36% respectively. [30] states that shank colour is affected by the plane of nutrition mainly food sources containing carotene. In the current study, three skin color diversities were observed namely yellow (48.5%), white (45%) and blue (6.5%) this accedes with [29] and state that skin color is a function of feed composition.

Qualitative traits

Average weight of the chicken was 1.390kgs and according to [29] indigenous chickens weigh (1.41 kgs). The mean value for neck length was (12.77 cm) and shank length (7.84 cm) [30] states that there is a strong correlation of shank length and body weight and shank length is regarded as a good indicator of skeletal development, which can be related to meat yield as concluded by [4]. Neck and shank length can also be associated with birds active walking potential to cover long distance in search of feed [4]. The study showed a mean body length (36.88 cm), wing span (53.8 cm) and chest circumference (25.41 cm). However, these results differed from findings [31-33]. This can be attributed to variation in genotype, feed availability and other environmental factors [31] states that chest circumference can be used as an accurate estimate of body weight. Comb height (1.3 cm), comb length (2.5 cm) and wattle length (1.95 cm) were comparable to those obtained by [32] for Horro and Jarso chicken population [33] states that large combs and wattles are important morphological traits that allow better heat dissipation in the tropical hot environment. Most of the indigenous chickens showed adaptive features to the high temperature within the study area.

Table 3 shows that birds in ward 13 had neck length which was significantly different ($p < 0.05$) from those in ward 12. In addition, ward 24 birds also had neck lengths, shank length, comb height, wattle length and wing span significantly different ($p < 0.05$) from those for ward 13 However, pelvic width; back length; body circumference, body weight and body length, were similar in all the wards investigated. Birds in ward 24 had longest wattle lengths. The finding that birds in wards nearer to urban set-ups had phenotypic traits that depict size which were bigger than wards distant to urban areas. Farmers within peri-urban areas had commercial tendencies mostly influenced by ready markets for produce.

Phenotypic variable	Minimum	Maximum	Mean	Std. Deviation	Variance
Neck length (cm)	9.00	18.00	12.7705	1.78952	3.202
Back length (cm)	4.00	24.00	19.9800	1.81966	3.311
Body length (cm)	26.00	45.00	36.8870	3.35974	11.288
Pelvic width (cm)	7.00	13.00	8.6780	1.19938	1.439
Body weight (kgs)	1.26000	1.59500	1.3956	62.90892	3.958
Comb length (cm)	13.00	38.00	2.58200	4.78246	22.872
Comb height (cm)	7.00	30.00	1.73000	5.08520	25.859
Wattle length (cm)	8.00	32.00	1.95145	5.06925	25.697
Wings span (cm)	450.00	495.00	47.460	11.67353	136.271
Keel length (cm)	88.70	120.00	10.971	9.43193	88.961
Shank length (cm)	6.00	9.50	7.8415	.77669	.603
Body circumference (cm)	22.00	29.00	25.4110	1.67970	2.821

Table 1: Descriptive statistics for quantitative data for indigenous chickens in Rushinga district.

Phenotypic Variable	Df	Mean Square	F	Sig.
Neck length (cm)	2	31.785	9.734	***
Back length (cm)	2	3.422	1.034	NS
Body length (cm)	2	25.706	2.307	NS
Pelvic width (cm)	2	2.740	1.923	NS
Body weight (grams)	2	86443.798	3.725	NS
Comb length (mm)	2	456.840	14.956	***
Comb height (mm)	2	159.593	5.084	***
Wattle length (mm)	2	864.794	50.341	***
Wings span (mm)	2	10354.186	5.295	***
Keel length (mm)	2	1150.772	8.727	***
Shank length (cm)	2	2.139	3.641	***
Body circumference (cm)	2	9.773	3.553	***

Table 2: Multiple Analysis of Variance showing difference in linear measurements amongst wards.

Not significant at p < 0.05- NS / Significant at p>0.05-***a

Ward	Neck length (cm)	Pelvic width (cm)	Back length (cm)	Mean trait value Body circumference (cm)	Body weight (kgs)	Comb length (mm)	Shank length (cm)	Comb height (mm)	Body length (cm)	Wattle length (mm)	Wings span (cm)
12	12.09^{a}	8.86^{a}	19.90^{a}	25.32^{a}	1.41^{a}	26.66^{c}	7.87^{a}	16.56^{a}	36.71^{a}	16.30^{a}	52.95^{a}
13	13.06^{b}	8.57^{a}	20.24^{a}	25.86^{a}	1.45^{a}	23.20^{a}	8.01^{b}	19.08^{b}	37.57^{a}	20.03^{b}	53.57^{b}
24	13.32^{b}	8.58^{a}	19.98^{a}	25.41^{a}	1.47^{a}	28.55^{b}	7.84^{a}	15.80^{a}	36.88^{a}	23.33^{c}	55.38^{b}

Table 3: Comparison of mean table amongst wards for linear body measurements.

Values with different super scripts (a, b, c) differ significantly at p <0.05.

Conclusion and Recommendations

Production environment in Rushinga is characterized by resource poor farmers who rely on erratic rain fed farming for income. Indigenous chicken production is mainly affected by gender, economic factors and ownership patterns. Production system is characterized by poor management practices as shown by small flock size and low body weight. Phenotypically, chickens exert adaptive characteristics to harsh climatic and production environment. There is need to improve on management practices done by farmers so as to improve productivity and conserve existing desirable genotypes within the population. There is need to design and implement a national research program to collect, conserve and improve indigenous chicken breeds. In addition, upgrade of existing genotypes to improve on quality and yield of meat.

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