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A Survey Study on Productive and Reproductive Performance of Indigenous Poultry

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Abstract: A survey study was conducted to analyze the reproductive and productive performances of four indigenous chicken breeds (Potchefstroom Koekoek, Venda, Naked Neck and Ovambo) under different rearing system. Six villages located in Eastern Cape, South Africa were used for the study from July 2017 to June 2018. Data on Clutch Per Year (CPY), hatchability (HATCH), Egg Per Clutch (EGC), survivability at 10-12 weeks (SURV), Egg Per Year (EPY), Recovery Period (RP), average age at production (AA), Duration of Rearing (DR), mortality, egg laying length (EGL), Natural Brooding Period (NBP) and Natural Incubating Period (NIP) were obtained from Seven thousand, five hundred and thirty eight (7538) indigenous chicken. Four different breeds were sampled such as Venda breeds (2748), Potchefstroom Koekoek (2088), Ovambo (1838) and Naked Neck (864) breeds respectively. Potchefstroom Koekoek is observed to be a good egg producing breed with 15.11±0.25 eggs per clutch. Venda breed possess good mothering ability (hatchability) and high survivability with 86.03±0.31days and 82.70±0.26 days respectively. Naked Neck is known to be more prone to diseases with least (survivability) 60.08±0.25 days. Village was positively correlated with EGC and HATCH, EGY and SURV at $p \leq 0.01$ and $p \leq 0.05$ respectively. Rearing system was positively correlated with EGC. Rearing system was positively correlated at $p \leq 0.05$ on EGC than CPY, HATCH, EGY and SURV. Breed and village interactions were significant at $p \leq 0.05$ on RP, AA, DR, EGL, NBP and NIP. Therefore, productive and reproductive traits of indigenous chicken differ across different rearing systems, breeds and villages.

Keywords: Poultry Performance, Indigenous Breeds, Economic Traits

Introduction

Indigenous poultry production plays a vital role in national economy with approximately 80% poultry products gotten from local communities (Sharma, 2010). Chicken meat is known to be the most consumed among other poultry products (Sharma, 2010). Chicken consumption is expected to increase yearly due to high demand rate, low price, little or no religious limitation, high digestibility, good taste and low calorie (Raphulu *et al*., 2015). There are different types of indigenous breeds recognized in South Africa poultry production. Such breeds are Ovambo, Venda, Potchefstroom Koekoek and Naked Neck (Mtileni *et al*., 2012; Idowu *et al*., 2018). They are regarded as conservative breeds with divergent productive traits capacity but not documented (Mtileni *et al*., 2012). Egg production among other poultry products in South Africa has contributed greatly to National gross income up to R2.7 million at producer level (Alabi *et al*., 2012). But mortality, predator, accident and diseases are among threats faced by farmers (Krishna *et al*., 2012). Poultry production success can be greatly attributed to constant supply of day old chicks mostly from the hatchery. However, indigenous poultry farmers' embrace natural hatching system (Abdurehman and Urge, 2016; Idowu *et al.,* 2018). Despite the low turnover from indigenous chicken most rural farmers prefer to raise them than exotic breeds. These are due to high resistant to disease, great resilient ability to diseases, high adaptability, good scavenging ability and ability to live without structured feeding (Ajayi, 2010). In an attempt to improve poultry production; hatchability and survivability cannot be over looked (Ajayi and Agaviezor, 2016). Hatchability and

fertility determine levels of reproduction from the quantity of breeding stock within a phase of time (Obike *et al*., 2014; Ajayi and Agaviezor, 2016). As such, they vary across different breeds and diversified within same breed depending on genetic and environmental influence (Ajayi and Agaviezor, 2016). Indigenous chickens are capable of exhibiting 7-9 major genes in their gene pool which are genetically preserved for harsh environment. Due to presence of this "utility" gene they are preferred to be used for genetic exploration and easily managed by indigenous poultry farmers (Ajayi, 2010). Matured hen are expected to lay thirty (30) dozen eggs in a life time (DOA, 2012). In a similar study conducted in Nigeria, egg per clutch ranges from 4 to 14 eggs but averagely 9 eggs (Onasanya and Ikeobi, 2013). Ikeobi *et al*., (1996) explained that 8 to 9 eggs are laid between 2 to 14 days within 32 to 36 weeks during laying stage. It is assumed that villagers have more access to great quality protein through consumption of meat and eggs from their chickens (Ndofor *et al*., 2015). Perhaps, this may enhance their wellbeing status, ease ailing health and enhance food security. Nevertheless, the productive performance of breeds available in indigenous poultry production in South Africa has been vaguely evaluated. Therefore, this study aims at determining the reproductive and productive performance of indigenous poultry in different rearing system, villages and breeds.

Materials and Methods

Study Site Description

The experiment was conducted in three towns (Willowvale, Idutywa and Mthatha) in Eastern Cape Province. Six different villages (Falakalha, Ciko, Gosani, Dokodela, Nqabarha and Ludondolo) were randomly sampled using snow ball sampling techniques. These villages were selected in different geo-political zones but aimed at farmers practicing indigenous poultry production. A pre-visit test was done to interview the deputy director of rural development and agrarian reform.

Sampling of Chicken and Household

Indigenous chickens were sampled using one hundred and sixty (160) questionnaires and total number of seven thousand, five hundred and thirty eight (7538) indigenous chicken data was computed. The available breeds are Venda (2748), Potchefstroom Koekoek (2088), Ovambo (1838) and Naked Neck (864) breeds respectively. In addition to questionnaire used, focal discussion and group discussion were conducted to acquire information with the help of poultry farmers and extension officer. All sampled farmers were practicing indigenous poultry production.

Data Collection

Data on some productivity and reproductive traits were collected within a timeframe of 12 months (July 2017-June 2018). Productive and reproductive parameters taken were average eggs per clutch, average egg per year, clutch per year, survivability at 10-12 weeks, recovery period, age to reach productivity, clutch length per year, average age at first lay, chicks, pullet, cock, laying hen, layers incubating, layers brooding, duration of rearing, natural incubation period and natural brooding period. The number of chicks hatched per sampled hen was recorded. Mortality and survivability at 10-12 weeks of chicks were recorded. Hatchability was determined as the proportion of eggs laid to the hatched chicks.

Determination of Sexual Maturity

To determine sexual maturity, day old chick's age to production of first egg was calculated from the hatching date of the hen to the production of the first egg.

Determination of Total Number of Eggs Produced Per Production Cycle

$$\text{Average of two production cycles} = \frac{\text{Total number of eggs produced per hen per production cycle}}{\text{Total number of hen alive during production cycle}}$$

Determination of Mortality Rate

$$\%\ \text{of Mortality as calculated by} = \frac{\text{Number of dead birds}}{\text{Total number of birds nurtured}} \times 100$$

Statistical Analysis

The data collected were stored in Microsoft excel sheets. SAS (2003) software was used for analyzing data on reproductive and productive traits performances. Mean comparison of traits was achieved using Tukey's Kramer Least Significant Difference. Least square means was computed using GLM procedure of SAS. The significance level selected on the mean differences was 5 and 1% respectively.

Results

Effect of Breed of Chicken on Egg Production

Effect of breeds on traits (Table 2) CPY and EGY were non- significant at $p \leq 0.05$. However, the effect of breed on EGC, HATCH and SURV of indigenous chickens were significant.

Effect of Village on Egg Production

Effect of village on egg production (Table 2) CPY was non-significant at $p \leq 0.05$. Nevertheless, the effect of

village on EGY, HATCH, EGC and SURV were significant across all villages sampled.

Effect of Rearing System on Egg Production

Effect of rearing system on egg production (Table 2) EGC was significant ($p \leq 0.05$) while CPY, HATCH, EGY, SURV were non-significant across different rearing system method in all villages sampled**.**

Correlations among Productive Traits of Indigenous Chickens

Correlations of EGC, HATCH, SURV, CPY and EGY were 0.81±0.02, 0.50±0.04, 0.25±0.06, 0.66±0.04 respectively (Table 3). Correlation between survivability and CPY is 0.05±0.02 and EGY and CPY is 0.11±0.03.

Discussion

Flock Size and Structure in Different Villages

Average household has 26 hens, 9cocks, 6 laying hens, 4 chicks and 2 lay-incubating in this study. This finding is against the finding of Hailemichael *et al*. (2017) who reported 7.66 hens, 2.84 cocks, 1.85 for pullets and chicks in a similar study. Average flock size for each breeds in each villages are shown in Table 1a. The recorded changes could be attributed to different sample size and different agro ecological zone. This study observed cock: hen ratio of 1:3. This is in accordance to national ratio in Ethiopia 1:3. Nevertheless, there was a slight variation from the ratio of hen and cock of 1:4 reported by Dessie and Ogle (2001). In addition, there was low number of male (cock) compared to female (hen) in this study. Reasons accorded for this variation are palatability, taste preference of cock, more profit at point of sales and purpose for rearing (mating). These reasons were also reported by Dessie and Ogle (2001; Hailemichael *et al*., 2017). As temperature, rainfall and atmospheric humidity changes, metabolic and physiological activities of fertile eggs are affected. Such activity leads to infertility and reduction in hatchability of indigenous eggs. Onasanya and Ikeobi (2013) also reported similar situation in their finding. It was observed that thickness of the egg shell influence permeability of water vapour which thus affects hatchability. Success and effectiveness of indigenous poultry production can be attributed to number of egg laid and number of fertile egg hatched. Rearing systems for different ages has no particular differences in all sampled villages. There is no structure for different ages they are all raised in same poultry housing structure irrespective of breeds.

Productive Traits of Indigenous Chicken

Effect of Breeds on Productive Traits

Effect of breed (Table 2) on EGC, HATCH and SURV was significant. This could be attributed to genetic disparity existing across the rearing system regarding different place and stage of purchase. HATCH is determinant of EGC. It means hatchability has a correlation with breeds available and its level differs across the breeds. Nevertheless, seasonal variation has effect on hatchability across all villages sampled. It was observed that high ambient temperature and low humidity lowers the rate of hatchability. Such environmental changes thus reduce hatchability levels during summer period contrasted to winter, summer and spring. Survivability is based on disparity in mortality, theft and disease infection across different breeds sampled. EGY is mostly dependent on age of the hen, rearing system and feed. This study reveals that Potchefstroom Koekoek has the highest EGC (15) averagely while Venda breeds has highest (4) CPY. This finding is in agreement with Hossen (2010) and Masaire *et al*. (2018) who reported 3-4 CPY. This could be as result of similar feeding and rearing system adopted. But in deviation with Lañada *et al*. (2004) who reported 8 eggs per clutch. This study recorded average of 48 eggs per year. This finding is in agreement with Sears *et al*. (2011) but slightly higher than report by Dessie and Ogle (1996) who reported 40 eggs. Based on this study, VN, PK, OV and NN had 58, 60, 42 and 34 EGY respectively. This study observed EGC varying from 9 to 15 eggs. This finding is similar to the described 9-19 eggs in North West Ethiopia (Halima *et al*., 2007; Moges *et al*., 2010). There could be association between low productivity, ability to withstand harsh temperature and late maturity in the genetic pool of indigenous chicken. This study reported that hatchability varies across different seasons and nutrition has influence on hatchability levels of indigenous chickens.

Table 1a: Shows average flock size and structure of each breeds in different villages

Breeds	Hen	LayingHen	Chicks	Cock	Lay-Incubating
Potchefstroom Kooekok	5	2	3	10	2
Ovambo	17	8	10	4	6
Venda	14	6	8	6	3
Naked Neck	9	4	5	2	3

Average flock size of each breeds in all villages sampled

Table 1b: Flock size across households that practice indigenous poultry (N = 7538**)**

	Villages (Mean± SE)					
Chicken age group	Falakahla	Ciko	Gosani	Dokodela	Nqabarha	Ludondolo
Chicks	4.16±1.1^{NS}	5.83±1.1^{a}	6.37±1.2^{b}	6.80±1.2^{b}	6.50±1.4^{b}	7.09±1.9^{NS}
Cock	6.12±1.3^{a}	7.16±1.3^{a}	9.14±1.4^{ab}	11.38±1.4^{b}	9.80±1.6^{ab}	9.36±2.1^{ab}
Laying	2.74±0.9 ^{NS}	4.26±1.0^{a}	4.51±1.1^{a}	5.92±1.1^{b}	5.81±1.2^{b}	4.81±1.6^{NS}
Hen	18.67±4.1^{a}	23.36±4.2^{a}	26.0±4.4^{ab}	32.23±4.4^{b}	26.10±5.1^{ab}	25.9±6.9^{ab}
Lay- Incubating	1.38±0.6^{NS}	2.60±0.6^{a}	2.74±0.7^{a}	3.15±0.7^{a}	2.65±0.8^{NS}	2.45±1.0^{NS}

SE = Standard error, NS means Not significant; (*) means significant at 0.05; (**) means significant at 0.01
There are variations in flock size with hen having the highest (4094), followed by cock (1413), chicks (960), laying hen (684) and incubating layers (387). The mean of chicks (23.13), cock (8.82), chicks (7.46), lay incubating (4.78) and laying hen (2.9).

Table 2: Least square means ± standard error of productive traits of indigenous chicken

		TRAITS				
Factors		EGC	CPY	HATCH	EGY	SURV
Breed	VN	13.36±0.31^{b}	4.17±0.16	86.03±0.31^{c}	55.71±2.14	68.70±0.26^{c}
	PK	15.11 ±0.25^{b}	3.22±0.13	81.83±0.39^{b}	60.28±1.75	75.48±0.21^{b}
	OV	11.37±0.30^{ab}	3.71±0.15	79.61±0.41^{a}	42.18±2.04	71.13±0.25^{ab}
	NN	9.69±0.30^{a}	3.56±0.15	80.26±1.81^{ab}	34.49±2.65	60.08±0.25^{a}
		**	NS	**	NS	**
Village	Falakahla	13.37±0.24^{c}	3.66±0.12	73.94±0.48	39.96±1.66	66.08±0.20^{c}
	Ciko	10.69±0.34^{ab}	4.33±0.17	72.19±0.44	40.41± 2.31	58.33±0.28^{b}
	Gosani	10.69±0.36^{ab}	3.96±0.18	75.58±0.50	30.20±2.50	49.49±0.29^{a}
	Dokodela	9.43±0.35^{a}	4.80±0.18	73.24±0.50	36.38±2.40	47.30±0.29^{a}
	Nqabarha	11.76±0.41^{b}	3.91±0.21	72.80±0.55	33.61±2.83	58.59±0.35^{b}
	Ludondolo	11.10±0.76^{b}	3.63±0.36	75.83±0.67	33.23±4.80	56.65±0.59^{ab}
		***	NS	NS	NS	**
Rearing System	Cage Con.	12.77±0.5^{b}	3.81±0.46	72.86±0.44	36.45±2.79	59.27±0.35
	S.I	12.36±0.3^{b}	3.99±0.27	70.06±0.27	36.92±1.64	57.26±0.21
	U.S	11.33±0.5^{ab}	3.90±0.46	74.61±0.46	33.09±2.85	48.85±0.36
	Scavengers	10.70±0.5^{a}	4.80±0.47	73.80±0.47	40.95±2.92	49.80±0.37
		**	NS	NS	NS	NS

NS means Not significant; (**) means significant at 0.05; (***) means significant at 0.01. NN: Naked Neck. OV: SE = Standard error, NS means Not significant; (*) means significant at 0.05; (**) means significant at 0.01
Ovambo, VN: Venda, PK: Potchefstroom Kooekok, Cage Conf: Cage Confinement S.I: Semi Intensive, U.S: Unimproved Scavengers, EGC: Egg per clutch, CPY: Clutch per year, HATCH: hatchability, EGY: Egg per year, SURV: Survivability

Table 3: Correlation among productive traits of indigenous poultry

	Correlation ± SE of correlation				
Traits	EGC	HATCH	SURV	CPY	EGY
EGC	1	0.81±0.02**	0.50±0.04***	0.25±0.06**	0.66±0.04***
HATCH	0.81±0.02**	1	0.54±0.03***	0.28±0.07***	0.47±0.05**
SURV	0.50±0.04***	0.54±0.03***	1	0.05±0.02^{NS}	0.36±0.07***
CPY	0.25±0.06**	0.28±0.07***	0.05±0.02^{NS}	1	0.11±0.03^{N}
EGY	0.66±0.04***	0.47±0.05**	0.36±0.07***	0.11±0.03^{NS}	1

Note: NS = Not significant, (**) significant at 0.05% level of probability (p≤0.05), (***) significant at 0.01% level of probability (p≤0.001), EGC- egg per clutch, CLY- clutch per year, HATCH- hatchability, SURV- Survivability. SE: Standard error

Effect of Villages on Productive Traits

Effect of village (Table 2) on EGC and SURV were significant. EGC varies from Dokodela to Falakahla village (9.43±0.35) to (13.37±0.24) respectively. Such variation is due to differences in poultry genetic makeup (gene pool) across all villages sampled. Indigenous poultry chicken exhibited different phenotypic and genotypic expression. This is due to different parents and generation intervals recorded in each village. In addition, SURV varies across different villages and are significant. SURV varied from Dokodela to Falakahla village (47.30±0.29) to (66.08±0.20) respectively. Level of survival was determined by varied ability to withstand diseases and body conformation to escape from predators.

Effect of Rearing Systems on Productive Traits

Effect of rearing system (Table 2) on CPY, HATCH, EGY and SURV was non-significant. Rearing system was significant on EGC. Rearing system adopted by farmers has a direct effect on EGC. In an enclosed chicken house, poultry animals tend to lay eggs without fear of theft or predators. EGC can be more precise and accurate depending on rearing system adopted. EGC varied across all villages sampled from scavengers 10.70±0.5 to cage confinement 12.77±0.5. Some farmers recorded that few of the animals lay eggs outside the housing structure provided and such eggs are mostly unavailable for hatching.

Correlation Among Productive Traits

This finding reveals high level of significance across all the productive traits in area of study. EGC and HATCH (0.81±0.02) and EGC and SURV (0.50±0.04) has high level of significance respectively, EGC and CPY (0.25±0.06 medium level) and EGY and EGY (0.66±0.04 medium level) respectively. Based on this finding, selection for advanced positive value of any traits will affects other traits. This reveals high level of dependency across all reproductive traits like EGC, HATCH, SURV, CPY and EGY.HATCH is reliant on broody hen's health status, environment temperature, maternity instinct, mothering ability, commitment to incubation activities broody. Different levels of correlation were observed such as (high and medium level). It can be statistically induced that interest in improving any trait will simultaneously improve the other traits and otherwise. This result agrees with Jahan *et al*. (2017).

Reproductive Traits of Indigenous Chicken Production

Effect of reproductive traits (Table 4) on AA, EGL, NBP and NIP was significant. This finding reveals high level of significance across AA, EGL, NBP and NIP. All these factors are positively correlated to each other. There is a strong correlation between AA, EGL, NBP and NIP across all villages sampled. Broodiness is explained as manipulated environmental inhibiting self-induced stimuli that facilitate nesting behavior (Xu *et al*., 2010). Motivations like constant removal of fertilized eggs and bridging a gap between chicks and mother were adopted by farmers has these practices caused reduction in mothering instinct of the hen and levels of hatchability.

Effect of Breed and Interaction Between Breed and Village

Effect of breed on RP, AA, DR, EGL, NBP and NIP of indigenous chicken (Table 4) was significant ($p \leq 0.05$). However, effect of CL and mortality were non-significant. High significant levels were observed between breeds and village interactions RP, AA, DR, EGL, NBP and NIP, while breeds and CL and mortality have no significance CL, DR and mortality. Differences in AA may be due to unstructured mating system adopted by farmers. Genetic differences exist within the breeds from one generation to another. Venda breed is known to have small body size, which could be responsible for early attainment to sexual maturity. Among other factors like nutrition, day length and other environmental induced factors.

Table 4: Least square means ± standard error of reproductive traits of indigenous chicken

		TRAITS							
Factors		RP	CL	AA	DR	Mortality	EGL	NBP	NIP
Breed	NS	NS	**	NS	NS	**	**	***	
	VN	19.64±0.2^{ab}	16.89±0.2	124.08±0.2^{a}	82.36±0.4^{a}	30.51±0.4	158.89±3.1^{b}	56.330±0.1^{b}	21.17±0.8^{a}
	PK	18.55±0.2^{a}	16.86±0.2	128.15±0.2^{b}	82.06±0.4^{a}	55.60±0.4	141.50±3.3^{a}	56.84±0.1^{a}	21.05±0.9^{a}
	OV	19.18±0.2^{ab}	16.72±0.2	127.98±0.2^{b}	82.81±0.4^{a}	36.40±0.5	147.93±3.4^{ab}	56.25±0.1^{a}	21.29±0.9^{a}
	NN	20.09±0.3^{b}	16.69±0.2	126.09±0.3^{a}	83.70±0.6^{b}	70.94±0.7	150.72±4.7^{ab}	56.09±0.2^{a}	21.42±0.1^{a}
	Breed x village	**	NS	**	**	NS	**	**	**
Village		NS	NS	**	NS	NS	**	NS	**
	Willow-vale	19.16±0.2^{a}	16.63±0.2	126.80±0.2^{a}	83.29±0.9	40.82±0.5	158.98±3.5^{b}	56.28±0.1^{a}	21.10±0.1^{a}
	Ciko	21.55±0.3^{b}	16.74±0.2	128.41±0.2^{b}	81.74±0.4	57.91±0.5	160.51±3.5^{b}	56.14±0.1^{a}	21.12±0.1^{a}
	Gosani	18.03±0.3^{a}	16.94±0.2	124.27±0.2^{a}	81.68±0.5	47.89±0.5	147.12±3.6^{a}	56.61±0.1^{a}	21.42±0.1^{b}
	Dokodela	20.32±0.4^{b}	17.04±0.2	125.31±0.2^{a}	82.56±0.5	46.32±0.5	149.26±3.6^{ab}	56.38±0.1^{a}	21.41±0.1^{b}
	Nqabarha	19.60±0.3^{a}	16.65±0.2	126.67±0.2^{a}	83.79±0.6	37.30±0.6	157.07±4.2^{b}	56.32±0.1^{a}	21.33±0.1^{a}
	Ludondolo	19.70±0.7^{a}	16.80±0.3	126.56±0.2^{a}	82.71±0.8	47.71±0.2	142.90±5.8^{a}	56.32±0.1^{a}	21.28±0.2^{a}
	Village x rearing	**	NS	**	NS	NS	**	**	**
Rearing System		**	**	***	**	NS	***	***	**
	Cage Con.	19.49±0.3^{a}	16.99±0.2	128.05±0.3^{b}	81.94±0.7	36.18±0.7	158.19±5.3^{b}	56.38±0.2^{a}	21.19±0.1^{a}
	Semi- Intensive	19.76±0.2^{a}	16.88±0.1	123.32±0.1^{a}	82.28±0.3	57.96±0.3	160.06±2.5^{b}	56.20±0.1^{a}	21.29±0.0^{a}
	Un. Scavengers	20.65±0.2^{b}	16.74±0.2	124.67±0.2^{a}	82.40±0.4	67.61±0.4	142.85±3.0^{a}	56.67±0.1^{a}	21.02±0.1^{a}
	Scavengers	21.49±0.3^{b}	16.85±0.2	128.71±0.2^{b}	82.89±0.5	69.43±0.5	147.75±3.9^{a}	56.29±0.1^{a}	21.19±0.1^{a}
	Breed x rearing	**	NS	**	NS	NS	***	**	**

NS means Not significant; ** means significant at 0.05; *** means significant at 0.01 **N. B All results are represented using days except mortality which is in (%).** RP: Recovery period. CL: clutch length days. AA: Average age at first lay. DR: duration of rearing. EGL: Egg laying length. NBP: Natural Brooding Period. NIP: Natural Incubating Period. Cage con: cage confinement. Un. Scavengers: Unimproved Scavengers

Effect of Rearing System and Interaction Between Breed and Rearing System

High significance correlation was observed between breed and rearing system RP, AA, EGL, NBP and NIP but non-significant between CL, DR and Mortality (Table 4). This study recorded 16 days for length of clutch. This agrees with Aganga *et al*. (2000). Recovery period of this study was 18-21 days. Duration of Rearing of this study was 82 days. This is slightly different by +3 days (85 days) in similar study by Aganga *et al*. (2000). This study observed 141-160 days for EGL. This disagrees with Gueye (1998) who reported 168-224 days for EGL. Natural incubating period and natural brooding period of this study is 21 and 56 days respectively. This finding agrees with Aganga *et al*. (2000; Moges *et al*., 2010; Zewdu *et al*., 2013). In this study, average age of at first lay is 126 days. This approves with Farooq *et al*. (2002). This finding is in discrepancy to projected age of 28 weeks reported in Tanzania (Halima *et al*., 2007), 32 weeks in Nigeria and Sudan (Bobbo *et al*., 2013) and 25 weeks in Senegal (Halima *et al*., 2007). The differences observed could be attributed to geographical location, germline differences, nutrition or feeding plan and management practices.

Conclusion and Recommendation

There was a significant correlation between all chicken ages of group across all villages sampled, breeds and rearing systems. Potchefstroom Koekoek breed is known as egg producing breed with high survivability level, Venda breed has highest hatchability level and Venda breed is known to lay eggs four (4) times in a year. Correlations between productive traits were positively correlated across all villages sampled. Significant correlation was recorded among RP, AA, DR, EGL, NBP and NIP among the reproductive traits. This study showed that most of the traits are positively correlated to others. This depicts that selection of one traits may improve other traits as they are positively correlated to each other. Therefore it can be concluded that productive and reproductive traits vary across different rearing system, breeds and villages.

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Author's Contributions

Peter Ayodeji Idowu: Proposed after envisioning the research, received funding for the project, analyzed data, interpreted the result, discussed and prepared the manuscripts

Maliviwe Mpayipheli: Supervised the project, provided grants for the research and went for data collection.

Voster Muchenje: Co-supervised the research and advised on research methodology.

Ethics

Ethical clearance was applied for before the commencement of this research under University of Fort Hare Research Ethics Committee with certificate reference number (MPA031SIDO01).

References

Abdurehman, A. and M. Urge, 2016. Evaluation of fertility, hatchability and egg quality of rural chicken in gorogutu district, Eastern Hararghe, Ethiopia. Asian J. Poultry Sci., 10: 111-116. DOI: 10.3923/ajpsaj.2016.111.116

Aganga, A.A., U.J. Omphile, P. Malope, C.H. Chabanga and G.M. Motsamai *et al*., 2000. Traditional poultry production and commercial broiler alternatives for small-holder farmers in Botswana. Livestock Res. Rural Dev., 12: 1-8. Ajayi, F.O., 2010. Nigerian indigenous chicken: A valuable genetic resource for meat and egg production. Asian J. Poultry Sci., 4: 164-172. DOI: 10.3923/ajpsaj.2010.164.172

Ajayi, F.O. and B.O. Agaviezor, 2016. Fertility and hatchability performance of pure and crossbred indigenous chicken strains in the high rainforest zone of Nigeria. Int. J. Livestock Product., 7: 141-144. DOI: 10.5897/IJLP2016.0308

Alabi, O.J., J.W. Ngambi, D. Norris and M. Mabelebele, 2012. Effect of egg weight on hatchability and subsequent performance of Potchefstroom Koekoek chicks. Asian J. Anim. Vet. Adv., 7 718-725. DOI: 10.3923/ajava.2012.718.725

Bobbo, A.G., M.S. Yahaya and S.S. Baba, 2013. Comparative assessment of fertility and hatchability traits of three phenotypes of local chickens in Adamawa State. IOSR J. Agric. Vet. Sci., 4: 22-28. DOI: 10.9790/2380-0422228

Dessie, T. and B. Ogle, 2001. Village poultry production systems in the central highlands of Ethiopia. Tropical Anim. Health Product., 3: 521-537. DOI: 10.1023/A:1012740832558

DOA, 2012. A profile of the South African egg industry market value chain.

Farooq, M., M.A. Mian, F.R. durrani and M. Syed, 2002. Egg production performance of commercial laying hens in Chakwal district, Pakistan. Livestock Res. Rural Dev.

Gueye, E.F., 1998. Village egg and fowl meat production in Africa. World's Poultry Sci. J., 54: 73-86. DOI: 10.1079/WPS19980007

Hailemichael, A., B. Gebremedhin and A. Tegegne, 2017. Status and drivers of village poultry production and its efficiency in Ethiopia. NJAS-Wageningen J. Life Sci., 83: 30-38. DOI: 10.1016/j.njas.2017.09.003

Halima, H.F.W., F.W.C. Neser, E. Van Marle-Koster and A. De Kock, 2007. Village-based indigenous chicken production system in north-west Ethiopia. Tropical Anim. Health Product., 39: 189-197. DOI: 10.1007/s11250-007-9004-6

Hossen, M.J., 2010. Effect of management intervention on the productivity and profitability of indigenous chickens under rural condition in Bangladesh. Livestock Res. Rural Dev.

Idowu, P.A., M. Mpayipheli and V. Muchenje, 2018. Practices, housing and diseases within indigenous poultry production in Eastern Cape, South Africa. J. Agric. Sci., 10: 111-121. DOI: 10.5539/JAS.V10N11P111

Ikeobi, C.O.N., M.O. Ozoje, O.A. Adebambo, J.A. Adenowo and O.A. Osinowo, 1996. Genetic differences in the performance of the local chicken in South Western Nigeria. Nigerian J. Genet., 11: 33-39.

Jahan, S., F. Islam, M.S.A. Bhuiyan and A.K.F.H. Bhuiyan, 2017. Productive and reproductive performances of indigenous chicken in the rural condition of Bangladesh. Bangladesh J. Anim. Sci., 46: 121-127. DOI: 10.3329/bjas.v46i2.34440

Krishna, D., S.V. Ramarao, B. Prakash and V.C. Preetham, 2012. Growth performance and survivability of rajasree birds under deep litter and scavenging systems. Int. J. Poultry Sci., 11: 621-623.

Lañada, E.B., M.F. Rola-Rubzen, Y. Edgar, C.P. Morbos and E.A. Espinosa, 2004. A longitudinal analysis of chicken production systems of smallholder farmers in Leyte, Philippines. Proceedings of the 22th World's Poultry Congress Book Abstracts, (CBA' 04).

Masaire, E., O. Madzingira, A. Samkange, E., Mushonga and B. Kandiwa *et al*., 2018. Characterization of poultry production and management systems in the communal areas of Namibia.

Moges, F., A. Mellesse and T. Dessie, 2010. Assessment of village chicken production system and evaluation of the productive and reproductive performance of local chicken ecotype in Bure district, North West Ethiopia.

Mtileni, B.J., F.C. Muchadeyi, A. Maiwashe, M. Chimonyo and K. Dzama, 2012. Conservation and utilization of indigenous chicken genetic resources in Southern Africa. World's Poultry Sci. J., 68: 727-748. DOI: 10.1017/S0043933912000852

Ndofor, H.M., V. Oleforuh, G.A. Musongong, J. Ohageni and U.E. Duru, 2015. Evaluation of growth and reproductive traits of Nigerian local chicken and exotic chicken. Indian J. Anim. Res., 49: 155-160 DOI: 10.5958/0976-0555.2015.00046.1

Obike, O.M., E.N. Nwachukwu and I.E. Ukewulonu, 2014. Effect of strain and associations of some fertility and hatchability traits of indigenous guinea fowls raised in the rain-forest zone of South-East Nigeria. Global Sci. Res. J., 2: 98-102.

Onasanya, G.O. and C.O.N. Ikeobi, 2013. Egg physical traits, performance, fertility and hatchability in exotic and Nigerian indigenous chicken. Standard Res. J. Agric. Sci., 1: 1-8.

Raphulu, T., C. Jansen van Rensburg and J.B.J. Van Ryssen, 2015. Assessing nutrient adequacy from the crop contents of free-ranging indigenous chickens in rural villages of the Venda region of South Africa. South African J. Anim. Sci., 45: 143-152. DOI: 10.4314/sajas.v45i2.5

SAS, 2003. Statistical Analysis System. 1st Edn., SAS Institute Inc., Carry, North Carolina, USA.

Sears, A., M.G. Baker, N. Wilson, J. Marshall and P. Muellner *et al*., 2011. Marked campylobacteriosis decline after interventions aimed at poultry, New Zealand. Emerg. Infect. Dis., 17: 1007-1015. DOI: 10.3201/eid1706.101272

Sharma, B., 2010. Poultry production, management and bio-security measures. J. Agric. Environ., 11: 120-125.

Xu, H., X. Shen, M. Zhou, M. Fang and H. Zeng *et al*., 2010. The genetic effects of the dopamine D1 receptor gene on chicken egg production and broodiness traits. BMC Genet., 1: 1-17. DOI: 10.1186/1471-2156-11-17

Zewdu, S., B. Kassa, B. Agza and F. Alemu, 2013. Village chicken production systems in Metekel zone, Northwest Ethiopia. Wudpecker J. Agric. Res., 2: 256-262.