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Breeding Practices and Trait Preferences of Indigenous Chicken Farmers at Madiga Village, Polokwane Local Municipality, South Africa

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ABSTRACT

Background: Understanding of breeding practices and traits preferences of the communal farmers is the bottom-up approach where livestock specialists assist farmers to identify and understand their production challenges before designing an improvement program. This study was conducted to identify the socio-economic status, breeding practices, production systems and trait preferences of chicken keepers at Madiga village, Limpopo province.

Methods: A total of 38 chicken farmers out of 62 were administered a well-structured questionnaire. Descriptive statistics and Chi-square test were used to analyse and test the significance among the gender respectively.

Result: The results showed that the breeding practices were not significantly affected by gender ($p>0.05$). Almost all the farmers in Madiga village were keeping indigenous breeds. The results indicated that the majority of the farmers were improving their indigenous chickens mainly by pure breeding. The most common trait preferences of farmers in breeding cocks were body size, mating ability and growth rate while in breeding hens they were mothering ability, hatchability and growth rate. This study indicated that pure breeding, culling and both controlled and uncontrolled mating system were the most common breeding practices in Madiga village. This study might help to attract animal scientists to develop a multipurpose chicken breed that will express the traits preferred by farmers under village production environment and promote chicken production and food security as a result.

Key words: Body size, Culling, Growth rate, Mating, Mothering ability of Indigenous chicken.

INTRODUCTION

Chicken farmers play a role in the social and economic state of their villages (Chebo and Nigussie, 2016). They reduce poverty, hunger, malnutrition and create jobs and generate income in their respective villages (Nigussie, 2011). Chicken farmers in South Africa utilize both indigenous and commercial breeds and they mostly integrate indigenous breeds in extensive system (Manyelo *et al*., 2020). According to Mujyambere (2021), communal chicken farmers have limited knowledge in livestock genetic improvements which supresses their chicken production. This study, therefore, focused on investigating breeding practices and trait preferences of communal farmers in Madiga village. Most rural communities use indigenous chicken breeds that mostly survive on disposed feeds (Hailu *et al*., 2014). Indigenous chicken breeds are well suited for a wide variety of environmental factors, which among many are extreme tolerance to diseases, adaptable to stress-causing agents in the form of high local temperatures and predators (Kassa *et al*., 2020). However, indigenous chicken farmers have low production resulting from limited knowledge in livestock genetic improvements (Mujyambere, 2021). The understanding of breeding practices and traits preferences of the communal farmers is the bottom-up approach where livestock specialists assist farmers to identify and understand their production challenges before designing an improvement program (Nandolo *et al*., 2016). Developing community-based breeding programmes will help to assess selection methods and traits preferred by the farmers, middlemen and consumers to confirm the presence of the genotype carrying those traits (Chebo and Nigussie, 2016). Hence the objectives of this study were to identify the socio-economic status of the chicken keepers with breeding practices, production systems and trait preferences of idigenous chickens reared at Madiga village, Limpopo province.

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MATERIALS AND METHODS

The study was conducted during 2022 in a small village called Madiga located within Polokwane Municipality,

Limpopo province, South Africa. The village is about 27 km away from Polokwane and a few kilometres from Mankweng Hospital. The altitude of the village is around 1260m and the latitude is 23°46′57″S and longitude is 29°45′55″E (Geoview.info, 2022). Madiga village has the highest mean temperature of 27°C in January and lowest mean temperature of 19°C in June. Cross-sectional study design was used to conduct this research. Questionnaires were used to perform the cross-sectional study design. Madiga village was purposively selected as a study area due to its many households keeping chickens. Simple random sampling was used to identify 38 out of 62 chicken farmers to be interviewed. This sampling technique was used because it is simple and unbiased (West, 2016). Cochran formula was used to calculate the sample size.

Cochran formula:

$$n = \frac{Z^2 (P \times Q)}{e^2}$$

Where,

n = Sample size.

e = Acceptable sample error.

P = Population proportion.

Q = 1-P

Z = Standard error.

Data about the breeding practices, production systems and trait preferences of chickens reared at Madiga Village was collected from each individual chicken keeper by interviewing them using a questionnaire (Shishay *et al*., 2016). The questions drafted in the questionnaire were based on farmer's socio-economic status, breeding practices and selection criteria. The questionnaire was translated into the local language (Sepedi) understood by the interviewed farmers. Descriptive statistics such as frequency, mean, cross tabulation and percentages were used to analyse trait preferences, breeding practices, breed preference, selection criteria and traits to be improved using Statistical Package for Social Sciences (IBM SPSS 2020) version 27.0 software. The preferred traits were ranked according to their importance to the interviewed farmers (Shishay *et al*., 2016).

RESULTS AND DISCUSSION

Socio-economic status

The results of the socio-economic status of indigenous chicken farmers in Madiga village are presented in Table 1. The socio-economic statuses of the farmers were not significantly affected (P>0.05) by gender.

Breeding practices

The results of the breeding practices of indigenous chicken farmers in Madiga village are presented in Table 2. The breeding practices of the farmers were not significantly affected (P>0.05) by gender.

Selection criteria

The results of the selection criteria of indigenous chicken farmers in Madiga village are presented in Table 3. The selection criteria of the farmers were not significantly affected (P>0.05) by the gender.

Table 1: Socio-economic status of indigenous chicken farmers in Madiga village, Capricorn district of Limpopo Province.

	Gender			
	Male	Female		
	N (%)	N (%)	Chi-square	P-value
Characteristics				
Age (years)				
<30	2 (11.1)	3 (15.0)		
30-50	6 (33.3)	5 (25.0)		
>50	10 (55.6)	12 (60.0)	0.368	0.832^{ns}
Marital status				
Single	6 (33.3)	4 (20.0)		
Married	9 (50)	14 (70.0)		
Widow	2 (11.1)	2 (10.0)		
Divorced	1 (5.6)	0 (0.00)	2.388	0.496^{ns}
Household size				
<5	7 (38.9)	7 (35.0)		
5-10	10 (55.6)	12 (60.0)		
>10	1 (5.6)	1 (5.0)	0.077	0.962^{ns}
Education				
Informal	2 (11.8)	1 (5.0)		
Primary	4 (23.5)	4 (20.0)		
Secondary	10 (58.8)	12 (60.0)		
Tertiary	1 (5.9)	3 (15.0)	1.280	0.734^{ns}

Table 1: Continue...

Table 1: Continue...

Farming experience (years)				
<5	6 (33.3)	9 (45.0)		
5-10	4 (22.2)	8 (40.0)		
>10	8 (44.4)	3 (15.0)	4.112	0.128^{ns}
Make money from chickens				
Yes	5 (27.8)	4 (20.0)		
No	13 (72.2)	16 (80.0)	0.317	0.573^{ns}
Breeding experience (years)				
<5	13 (72.2)	17 (85.0)		
5-10	3 (16.7)	3 (15.0)		
>10	2 (11.1)	0 (0.0)	2.435	0.296^{ns}
Have source of income				
Yes	4 (22.2)	0 (0.0)		
No	13 (72.2)	13 (65.0)		
No response	1 (5.6)	7 (35.0)	1.718	0.424^{ns}
What is the source of income				
Salary	3 (20.0)	1 (7.7)		
Pension	7 (46.7)	6 (46.2)		
Social grant	2 (13.3)	4 (30.8)		
Business profit	2 (13.3)	1 (7.7)		
Others	1 (6.7)	1 (7.7)	1.944	0.746^{ns}
Monthly household income				
< R1000	9 (50.0)	13 (65.0)		
R1000-5000	7 (38.9)	7 (35.0)		
R5000-10000	2 (11.1)	0 (0.0)		
> R10000	0 (0.0)	0 (0.0)	2.629	0.269^{ns}
Religion				
Christian	8 (44.4)	15 (75.0)		
Muslim	1 (5.6)	0 (0.0)		
African tradition	8 (44.4)	5 (25.0)		
Other	1 (5.6)	0 (0.0)	4.731	0.193^{ns}
Occupation				
Public	1 (5.6)	0 (0.0)		
Private	2 (11.1)	2 (10.0)		
Pensioner	6 (33.3)	6 (30.0)		
Other	9 (50.0)	12 (60.0)	1.327	0.723^{ns}
Work status				
Part-time	0 (0.0)	0 (0.0)		
Full-time	2 (11.1)	1 (5.0)		
Permanent	1 (5.56)	0 (0.0)		
Other	15 (83.3)	19 (95.0)	1.703	0.427^{ns}
Other livestock holdings				
Yes	11 (61.1)	9 (45.0)		
No	7 (38.9)	11 (55.0)	0.986	0.321^{ns}
Chicken production system				
Backyard	9 (50.0)	4 (20.0)		
Intensive	1 (5.6)	1 (5.0)		
Semi-intensive	8 (44.4)	15 (75.0)	3.959	0.138^{ns}

N = Number, % = Percentage, ^{ns} = Not significant.

Table 2: Breeding practices of indigenous chicken farmers in Madiga village.

	Gender			
	Male	Female		
	N (%)	N (%)	Chi-square	P-value
Breeding practices				
Chicken breed type				
Indigenous	20 (94.4)	20 (100.0)		
Exotic	0 (0.0)	0 (0.0)		
Others	1 (0.0)	0 (0.0)	1.141	0.285^{ns}
Purpose to keep chickens				
Meat production	11 (61.1)	6 (30.0)		
Egg production	1 (5.6)	1 (5.0)		
Social status	0 (0.0)	0 (0.0)		
Income generation	0 (0.0)	0 (0.0)		
Religion and culture	0 (0.0)	1 (5.0)		
Meat and egg production	0 (0.0)	4 (20.0)		
Meat production and social status	1 (5.6)	0 (0.0)		
Meat production and religion	1 (5.6)	4 (20.0)		
Meat production and income generation	0 (0.0)	1 (5.0)		
Meat, egg production and religion	3 (16.7)	3 (15.0)		
Meat production, social status and income generation	1 (5.6)	0 (0.0)	11.196	0.191^{ns}
Number of chickens kept				
<5	1 (5.6)	1 (5.0)		
5-10	4 (22.2)	8 (40.0)		
10-15	4 (22.2)	5 (25.0)		
>15	9 (50.0)	6 (30.0)	1.945	0.584^{ns}
Practice breeding				
Yes	12 (66.7)	16 (80.0)		
No	6 (33.3)	4 (20)	0.869	0.351^{ns}
Ways to improve indigenous chickens				
Importing exotic	1 (5.6)	0 (0.0)		
Improving indigenous	17 (94.4)	20 (100.0)		
Other	0 (0.0)	0 (0.0)	1.141	0.285^{ns}
Breeding practices used				
Crossbreeding	1 (5.6)	1 (5.0)		
Pure breeding	17 (94.4)	19 (95.0)	0.006	0.939^{ns}
Mating systems used				
Controlled	9 (50.0)	10 (50)		
Uncontrolled	9 (50.0)	10 (50)	0.000	1.000^{ns}
Controlled mating system technique				
Culling unproductive	3 (42.9)	4 (40.0)		
Culling disabled	0 (0.0)	0 (0.0)		
Others	2 (28.6)	1 (10.0)		
Cull unproductive and disabled	2 (28.6)	5 (50.0)	1.272	0.529^{ns}
Know inbreeding concept				
Yes	10 (55.6)	10 (50.0)		
No	8 (44.4)	10 (50.0)	0.117	0.732^{ns}
Practice culling				
Yes	16 (88.9)	15 (75.0)		
No	2 (11.1)	5 (25.0)	1.216	0.270^{ns}
Reasons for culling				
Old age	5 (31.3)	5 (33.3)		

Table 2: Continue...

Table 2: Continue...

Low production	6 (37.5)	7 (46.7)		
Others	2 (12.5)	2 (13.3)		
Old age and low production	1 (6.3)	1 (6.7)		
Old age and others	1 (6.3)	0 (0.0)		
Low production and others	1 (6.3)	0 (0.0)	2.047	0.843^{ns}

N = Number, % = Percentage, ^{ns} = Not significant.

Table 3: Selection criteria of indigenous chicken farmers in Madiga village.

	Gender			
	Male	Female		
	N (%)	N (%)	Chi-square	P-value
Selection criteria				
Growth rate	6 (33.3)	5 (25.0)		
Feather colour	4 (22.2)	5 (25.0)		
Conformation	2 (11.1)	2 (10.0)		
Number of chicks	0 (0.0)	1 (5.0)		
Others	0 (0.0)	0 (0.0)		
Growth, feather and conformation	3 (16.7)	0 (0.0)		
Growth and feather	2 (11.1)	2 (10.0)		
Feather and conformation	1 (5.6)	3 (15.0)		
Growth and conformation	0 (0.0)	2 (10.0)	7.116	0.417^{ns}
Breeding season				
Spring	0 (0.0)	0 (0.0)		
Autumn	0 (0.0)	0 (0.0)		
All seasons	18 (100.0)	20 (100.0)	-	-

N = Number, % = Percentage, ^{ns} = Not significant.

Traits preferred in breeding cocks

The results of the trait preferences in breeding cocks of indigenous chicken farmers in Madiga village are presented in Table 4. The body size trait was ranked as the most important trait, followed by mating ability in the second place and growth rate in the third place. Feather colour trait was ranked in fourth place and followed by the disease resistance trait.

Traits preferred in breeding hens

The results of the trait preferences in breeding hens of indigenous chicken farmers in Madiga village are presented in Table 5. The mothering ability trait was ranked as the most important trait, followed by hatchability in the second place and growth rate in the third place. The egg yield trait was ranked in fourth place and followed by the body size trait. Feather colour and broodiness traits were placed in the same rank in the fifth place.

The identification of breeding practices and trait preferences of livestock farmers is an essential step used for developing a successful breeding program for farmers (Tyasi *et al*., 2022). The objectives of the current study were to identify socio-economic status, breeding practices, production systems and trait preferences of indigenous chicken farmers at Madiga village, Limpopo province. The socio-economic characteristics of the indigenous chicken farmers were identified and the results showed that there were no significant differences between the males and females in terms of the socio-economic status, breeding practices, selection criteria and trait preferences. The results indicated that high percentage of the respondents were females, which was not in agreement with the findings of Tilahun *et al*. (2021) and Kassa *et al*. (2020) who revealed that high percentage of respondents were males. However, Bekele (2018) obtained results similar to the present research. This could be due to the different study areas used. Younger people are less interested in communal livestock farming as compared to older people since they do not see monetary returns out of it (Maswana *et al*., 2022). Tyasi *et al*. (2022) obtained results that showed that most farmers were older than 50 years and this was the same as the present study. However, Bekele (2018) and Hailu *et al*. (2018) showed that high proportion of farmers were under 50 years old. This can be because old people still prefer indigenous chicken meat as compared to young people who are highly exposed to processed foods made from commercial chicken breeds. In this study, it was observed that breeding practices of the farmers were not significantly affected by gender. Meat production was the main objective for the farmers to keep chickens. Similar results were obtained by Shishya *et al*. (2016) and Manyelo *et al*. (2020). However, these findings were disagreeing with a study conducted by Kassa *et al*. (2020) in Western Amhara, Ethiopia, who reported that egg

Table 4: Ranks and indices for trait preferences in breeding cocks.

Trait	Madiga village (n = 38)			
	Rank 1	Rank 2	Rank 3	Index
Mating ability	11	4	10	0.224
Body size	10	9	4	0.228
Disease resistance	1	4	4	0.066
Feather colour	4	12	7	0.189
Growth rate	11	6	4	0.215
Temperament	1	0	1	0.018
Fighting ability	0	3	8	0.061
Others	0	0	0	0.000

n = Sample size.

Table 5: Ranks and indices for trait preference in breeding hens.

Trait	Madiga village (n = 38)			
	Rank 1	Rank 2	Rank 3	Index
Body size	3	4	4	0.092
Disease resistance	0	0	1	0.004
Feather colour	4	3	2	0.088
Growth rate	6	2	2	0.105
Temperament	0	1	1	0.013
Mothering ability	16	8	9	0.320
Egg yield	5	1	5	0.096
Egg size	0	1	2	0.018
hatchability	3	12	7	0.175
Broodiness	1	6	5	0.088
Others	0	0	0	0.000

n = Sample size.

sales and adult chicken sales were the primary reasons for farmers to keep chickens. These differences may be due to different social statuses of the study areas. Most farmers in the Madiga village owned more than 15 chickens and a study published by Bwalya and Kalinda (2014) found comparable results showing that Households in Zambia's Lusaka and Central Provinces owned average of 29 chickens. Bekele (2018) reported that most farmers kept 4 chickens which was disagreeing with the results of this current study. These variations may be a result of limited feeds resources and breeding objectives of farmers in the areas. According to studies conducted by Shishay *et al*. (2016) and Hailu *et al*. (2014) in Ethiopia, high percentage of respondents were practicing breeding and improving their local chickens mostly through pure breeding. Similar results were obtained by the present study. Results of a study performed by Fitsum (2017) differed from the current study since they found that 60% of farmers in Central Zone of Tigray, Northern Ethiopia, were improving their chickens through crossbreeding. About 50% of the respondents were using uncontrolled mating and these results were arguing with those of a study conducted by Kassa *et al*. (2020) who found that a larger proportion (70%) of farmers were using uncontrolled mating system. These could be a result of keeping both cocks and hens in the same area under housing or roaming freely in backyard system. Majority of farmers who were practicing controlled mating and they were mostly culling unproductive chickens and such results were comparable with a study published by Shishay *et al*. (2016). However, a study conducted by Hailu *et al*. (2014) showed that a high percentage (41%) of farmers who practiced controlled mating were retaining best cock and hen while only 26% were culling unproductive chickens. In this study, it was shown that many farmers in Madiga village knew the inbreeding concept and these results were disagreeing the results of a similar study conducted by Hailu *et al*. (2014), Shishay *et al*. (2016) and Fitsum (2017) in Ethiopia who reported that, a high proportion of farmers had no knowledge about the inbreeding concept. A similar study by Bekele (2018) has supported the results of this study, indicating that majority of farmers had knowledge about the inbreeding concept. This high knowledge of the inbreeding concept Madiga village could be a result of previous researchers who were conducting their studies in the village. The households who practiced culling chickens from their flocks were mostly culling based on productivity. These had similarities with a study performed by Fitsum (2017) and Kassa *et al*. (2020). According to the results obtained by Bekele (2018), high number of farmers were culling chickens with diseases.

Traits are considered as criteria for selecting breeding chickens (Kassa *et al*., 2020). The ranking of trait preferences in cocks showed that body size, mating ability and growth rate were the highly ranked traits when selecting breeding cocks. The findings of a study presented by Fitsum *et al*. (2017) varied with the results of the current study since they reported that comb type, plumage colour and disease resistance were the highly ranked traits. However, another study by Tilahun *et al*. (2022) obtained results agreeing with to those of the current stating that body weight was highly preferred trait in cocks. In breeding hens, mothering ability, growth rate and hatchability were the most important traits. The results of other studies (Chebo and Nigussie, 2016; Kassa *et al*., 2020) are in line with the current study as they indicated that mothering ability and hatchability were among the highly preferred traits in breeding hens. These results showed that farmers have high preference of performance traits.

CONCLUSION

This study concludes that meat production was the major reason for village chicken production followed by egg production and religion and culture. Indigenous chicken breeds were the most common breeds in the village. However, most females in the village were keeping 5-10 chickens while males were keeping more than 15 chickens. Pure breeding, culling and both controlled and uncontrolled mating system were the most common breeding practices in Madiga village. However, the farmers had a background information about inbreeding and its complications. Body size, mating ability and growth rate in cocks and mothering ability, hatchability and growth rate were the traits preferred in hens by farmers to be improved. Growth rate was the most preferred trait in

both cocks and hens among other traits such as adaptive, reproductive, behavioural and economic.

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Conflict of interest

All authors declared that there is no conflict of interest.

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