

Original Research Paper

Smallholder Duck Farmers' Breeding Practices and Trait Preferences in Nasarawa State, Nigeria

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Abstract

Duck keeping is a very important sector in resource-constrained families as it provides for family proteins and income and other social needs. The present study was carried out to determine the influence of gender on livestock breeding practices of duck farmers in Nasarawa State, Nigeria. A total of 100 duck keepers (36 males and 64 females) were randomly sampled. Primary data were collected through individual structured questionnaire administration. Chi-square (χ^2) statistics were used to compare categorical variables based on gender. Arithmetic means of continuous variables between gender were tested using the T-Test. Rank means were also calculated for between-gender comparisons of the continuous variables. On the choice of traits of preference (body size, body conformation, mothering ability, survival, heat tolerance, disease resistance, birth interval, plumage color, fertility, hatchability, egg number and size, meat taste, ease of sale, and cultural significance) for breeding, the non-parametric Kruskal–Wallis test followed by Mann–Whitney U tests ($P \leq 0.05$) was used for comparison between gender. Age of respondents, household size, and personal savings were significantly ($P < 0.05$) higher among the male than female farmers. Flock size was also higher (40.33 ± 7.06 vs. 22.70 ± 2.55 ; $P < 0.05$) in farms owned by males compared to their female counterparts. However, both sexes ranked income, meat, egg, and cultural/religious significance the same as reasons for keeping ducks. The number of foundation stock and feed quantity per day (kg) were higher ($P < 0.05$) in male flocks. Productivity measure in terms of the number of death of ducks was significantly ($P < 0.05$) in the direction of male farmers (0.03 ± 0.03 vs. 0.23 ± 0.08). The ranking of the traits preferred in the choice of breeding stock of ducks was the same for both sexes except for cultural/religious significance which the female farmers rated lower (1.14 vs. 1.56; $P = 0.030$). Breeding programs and development interventions targeting the improvement of indigenous ducks should focus on gender equality to boost production and stimulate sustainability.

Keywords: Ducks; gender; breeding practices; ranking; Nasarawa State.

Introduction

Agriculture plays an essential role as a source of economy and employment in Nigeria. Domestic ducks are important in the world poultry market. Their number in the structure of commercially slaughtered poultry has increased. From the perspective of industrial meat processing, the uniformity of the carcass and its parts is desirable. Hence, breeders' efforts have mainly been focused on the improvement of carcass and meat quality traits and their uniformity. Ducks are successfully used for the intensive production of duck meat all over the world. For many years, their selection mainly aimed at increasing carcass weight and meat yield, and decreasing fat content (Yakubu, 2011, Wencek *et al.*, 2015).

Research to date on fattening ducks (Pekin, Muscovy, and their crosses) has shown that many characteristics of their slaughter value and meat quality are related to species, breed, selection, and sex (Farhat *et al.*, 2000; Baeza *et al.*, 2002; Yakubu, 2013). When subjected to sensory evaluation by a

panel of experts, breed (Pekin, Muscovy, and Rouen) was shown to influence dressing percentage and meat colour (Omojola, 2007) whereas breed and sex did not affect the texture and overall sensory acceptability of the meat. In a study characterizing meat traits and meat quality of Pekin-type duck strains A-44 and A-55, selected in Poland, the meat of A-55 ducks was found to have higher culinary value (Mazanowski *et al.*, 2003; Mazanowski & Książkiewicz, 2004; Adamski *et al.*, 2005).

For a long time, the market gave preference to whole carcasses without giblets. Duck parts are currently a growing poultry market segment because consumers are willing to pay more for fresh or frozen breast fillets and hind- or forequarter rather than buying cheaper whole carcasses. Raw meat preparations are generally bought by consumers based on overall appearance, with special consideration of colour and drip loss (Makała and Olkiewicz, 2004; Mucha *et al.*, 2014; Moliński *et al.*, 2015).

As a result of the adaptive traits of indigenous livestock breeds which permit their survival as well as reproduction under harsh environmental and management conditions typical of the low-input smallholder farmers (Yakubu *et al.*, 2020), they have been shown, under such circumstances, to do better than the crossbreds (Ayalew *et al.*, 2003). However, the indigenous breeds are under serious threat occasioned by certain factors which include the changing production systems and unplanned crossbreeding (Desta *et al.*, 2011). The development of appropriate and sustainable animal breeding programs for rural farmers needs a proper definition of the production environments; identification of the production objectives and breeding practices; and trait preferences for selection and breeding (Yakubu and Achapu 2017; Abraham *et al.*, 2018; Yakubu *et al.*, 2019; Yakubu and Joshua, 2020; Tesfalem *et al.*, 2021). When such breeding programs are applied in duck production, they may lead to increased productivity and high yield.

There is inadequate understanding of the genetic potentialities and capabilities of ducks in Nasarawa State, Nigeria as well as the associated productive factors at the village level. This knowledge is needed to design appropriate breeding schemes for smallholder duck farmers. The possible outcome includes the production of more vigorous animals with better meat yields. The main objective of this study, therefore, was to assess the breeding practices and trait preferences of duck farmers based on gender in Nasarawa State to gain insight into the production system and traditional breeding methods.

Materials and Methods

Description of the study area

The study was carried out in Nasarawa South Agricultural Zone, Nasarawa State, and north-central Nigeria. The State is located within the guinea savannah agro-ecological zone and is found between latitudes 7° 52' N and 8° 56' N and longitudes 7° 25' E and 9° 37' E, respectively (Lyam, 2007).

Sampling Procedure

Preliminary information was sought to identify areas where duck farmers are located. A total of 140 duck farmers were identified out of which 100 duck farmers (36 males and 64 females) were randomly sampled in selected villages of the study area. The sampling was done based on gender (sex of the farmer) and willingness to participate in the study. Random number generator was used for randomization.

Data collection procedure

The questionnaires contained information on the socio-economic characteristics of the respondents, livestock ownership, flock sizes and structure, and knowledge on feed, health, and other management practices. They were then administered on individual farmers. Male and female ducks' farmers were asked separately to list the production objectives and rank them from the most important (1), more important (2), important (3) to the least important (4). They were also asked to list the selection and culling criteria for breeding female and male ducks and ranked them using ratings of 1 for very poor, 2 for poor, 3 for average, 4 for good, and 5 for very good.

Statistical analysis

The categorical variables between gender were compared using Chi-square (χ^2) statistics. The strength of the association between categorical variables and gender was tested using Phi and Cramer's V tests. T-Test was used to separate the arithmetic means of continuous variables of both sexes (gender). Rank means were also calculated for between-gender comparison of the continuous variables as described by Yakubu *et al.* (2020). The non-parametric Kruskal–Wallis test followed by the Mann–Whitney U test for post hoc separation of group means and mean ranks was used for comparison between gender. SPSS (2017) statistical package was employed in all analyses.

Results

Socio-economic characteristics of respondents

Results of socio-economic characteristics are shown in Table 1. Among the categorical variables, education, primary occupation, personal savings were significantly ($P \leq 0.01$) influenced by gender. The female farmers had higher percentage value (75.5 vs. 24.5%) for primary education while their male counterparts had higher value (61.3 vs. 38.7%) for secondary education. While more females were into crop farming and civil service, more males (66.7%) were artisans. Males also had personal savings than their female counterparts. However, both sexes did not significantly ($P > 0.05$) vary in marital status, access to credit and type of landholdings. With respect to continuous variables, the average age of male farmers (37.08 ± 1.40 versus 31.89 ± 0.98) and their household size (6.03 ± 0.65 versus 4.55 ± 0.27) were significantly ($P \leq 0.05$) higher compared to the opposite sex.

Reasons for duck farming

The ranking of meat, egg, income, and cultural/religious purpose as reasons for keeping ducks was not significantly ($P > 0.05$) different in both sexes (Table 2).

Flock structure of ducks kept by farmers in the area of study

The flock size kept by male farmers was higher than that kept by female farmers (40.33 ± 7.06 versus 22.70 ± 2.55 ; $P \leq 0.05$) (Table 3). The flock composition indicated that the number of drakes (6.44 ± 1.08 vs. 3.45 ± 0.47) and the number of ducks (10.39 ± 1.63 vs. 6.57 ± 0.79) were significantly ($P \leq 0.05$) higher in male-owned flocks compared to those being managed by females.

The management practices of ducks in the study area

Application of herbs significantly ($P < 0.05$) varied between male and female farmers (Table 4). More male farmers were in the habit of applying herbs for medication and disease treatment. However, source of foundation stock, management system, feed supplementation, breeding control and access to veterinary services were not significantly ($P > 0.05$) affected. The number of foundation stock (6.86 ± 1.44 vs. 3.67 ± 0.52) and quantity of feed per day (3.027 ± 0.43 vs. 1.929 ± 0.22) were significantly ($P < 0.05$) higher in flocks owned by male farmers.

Table 1. Socio-economic characteristics of Muscovy keepers in the Southern Agricultural Zone of Nasarawa State.

Characteristics	Sex		Pearson Chi-square	P-value	Phi and Cramer's V values
	Male	Female			
	N (%)	N (%)			
Categorical variables					
Marital Status					
Married	26 (34.7) ^a	49 (65.3) ^a			
Single	10 (52.6) ^a	9 (47.4) ^a			
Widowed	0 (0.0) ^a	6 (100.0) ^a	5.714	0.057 ^{ns}	0.239, 0.239 ^{ns}
Education					
None	2 (18.2) ^b	9 (81.8) ^a			

Primary	12 (24.5) ^b	37 (75.5) ^a			
Secondary	19 (61.3) ^a	12 (38.7) ^b			
Tertiary	3 (33.3) ^a	6 (66.7) ^a	12.967	0.005*	0.360, 0.360*
Primary Occupation					
Livestock rearing	16 (48.5) ^a	17 (51.5) ^a			
Crop farming	1 (8.3) ^b	11 (91.7) ^a			
Trading	4 (66.7) ^a	2 (33.3) ^a			
Artisan	14 (66.7) ^a	7 (33.3) ^b			
Civil Service	1 (3.6) ^b	27 (96.4) ^a	30.020	0.001*	0.548, 0.548*
Access to Credit					
Yes	15 (34.1) ^a	29 (65.9) ^a			
No	21 (37.5) ^a	35 (52.5) ^a	0.124	0.724 ^{ns}	-0.035 ^{ns} , 0.035 ^{ns}
Personal savings					
Yes	20 (69.0) ^a	9 (31.0) ^b			
No	16 (22.5) ^b	55 (72.5) ^a	19.265	0.001*	0.439, 0.439*
Type of landholding					
Individual ownership	26 (44.1) ^a	33 (55.9) ^a			
Communal farming system	1 (33.3) ^a	2 (66.7) ^a			
Rent	9 (23.7) ^a	29 (76.3) ^a	4.178	0.124 ^{ns}	0.204, 0.204 ^{ns}
Continuous variables					
	Mean \pm S.E.	Mean \pm S.E.	T-value	P-value	
Age of Respondent	37.08 \pm 1.40 ^a	31.89 \pm 0.98 ^b	3.039	0.003*	
Household size	6.03 \pm 0.65 ^a	4.55 \pm 0.27 ^b	2.097	0.041*	
Experience (years)	4.04 \pm 0.45 ^a	3.39 \pm 0.24 ^a	1.272	0.209 ^{ns}	

N= number*= significance ; ns = not significant; S.E.=Standard error; Means followed by different superscripts in rows are different at $P \leq 0.05$

Table 2. Mean ranks of reasons for keeping ducks and their significance level according to Kruskal Wallis test^y

	sex			
	Male	Male		
Traits	Mean	Mean	Kruskal-Wallis test	Asymptotic significance
Meat	1.58 ^a	1.44 ^a	2.007	0.157 ^{ns}
Egg	2.92 ^a	2.86 ^a	0.506	0.477 ^{ns}
Income	1.56 ^a	1.78 ^a	2.789	0.095 ^{ns}
Cultural/Religious	3.89 ^a	3.92 ^a	0.040	0.842 ^{ns}

y=The lower the mean, the more important the trait; ns=Not significant

Table 3. Flock structure of ducks kept in the Southern Agricultural Zone of Nasarawa State

Parameters	sex		P-value
	Male	Female	
Flock size	40.33 \pm 7.06 ^a	22.70 \pm 2.55 ^b	0.024*
No of male ducklings	5.33 \pm 1.99 ^a	2.14 \pm 0.42 ^a	0.125 ^{ns}
No of female ducklings	3.72 \pm 0.96 ^a	2.22 \pm 0.44 ^a	0.160 ^{ns}
No of male growers	7.61 \pm 2.31 ^a	3.70 \pm 0.69 ^a	0.112 ^{ns}
No of female growers	6.86 \pm 1.54 ^a	4.58 \pm 0.84 ^a	0.199 ^{ns}
No of drakes	6.44 \pm 1.08 ^a	3.45 \pm 0.47 ^b	0.014*
No of ducks	10.39 \pm 1.63 ^a	6.57 \pm 0.79 ^b	0.040*

S.E. = standard error; *= significance; ns= Not significant; Means followed by different superscripts in rows are significantly different at $P \leq 0.05$

Table 4. Management systems of ducks kept in the Southern Agricultural Zone of Nasarawa State

Characteristics	sex		Pearson Chi-square	P-value	Phi and Cramer's V values
	Male	Female			
N (%)	N (%)				
Categorical variables					
Source of Foundation Stock					
Inherited	0 (0.0)	6 (100.0)			
Purchase from market	24 (38.7)	38 (61.3)			
Purchase from neighbour	12 (37.5)	20 (62.5)	3.604	0.165 ^{ns}	0.190, 0.190 ^{ns}
Management system					
Semi-intensive	23 (39.0)	36 (61.0)			
Intensive	0 (0.0)	0 (0.0)			
Extensive	13 (31.7)	28 (68.3)	0.556	0.456 ^{ns}	0.075, 0.075 ^{ns}
Supplementary feed Provision					
Once daily	17 (45.9)	20 (54.1)			
Twice daily	14 (28.6)	35 (71.4)			
Thrice daily	5 (35.7)	9 (64.3)	2.763	0.259 ^{ns}	0.166, 0.166 ^{ns}
Feed type					
Commercial only	5 (29.4)	12 (70.6)			
Kitchen waste only	12 (31.6)	26 (68.4)			
Both Commercial and Kitchen waste	19 (42.2)	26 (57.8)	1.399	0.497 ^{ns}	0.118, 0.118 ^{ns}
Breeding Control					
Yes	0 (0.0)	0 (0.0)			
No	36 (36.0)	0 (64.0)	na	na	na
Provision of nest boxes					
Yes	2 (40.0)	3 (60.0)			
No	34 (35.8)	61 (64.2)	0.037	0.848 ^{ns}	0.019, 0.019 ^{ns}
Common signs of diseases					
Diarrhea/watery droppings	6 (30.0)	14 (70.0)			
Twisting of the neck	1 (20.0)	4 (80.0)			
Lack of coordination/irregular movement	4 (23.5)	13 (76.5)			
Nasal discharge/swelling of the face	1 (25.0)	3 (75.0)			
Others	24 (44.4)	30 (55.6)	3.897	0.42 ^{ns}	0.197, 0.197 ^{ns}
Access to Vet					
No	17 (41.5)	24 (58.5)			
Yes	19 (32.2)	40 (67.8)	0.900	0.343 ^{ns}	0.095, 0.095 ^{ns}
Application of herbs					
Yes	5 (71.4) ^a	2 (28.6) ^b			
No	31 (33.3) ^b	62 (66.7) ^a	4.101	0.043*	0.202, 0.202*
Continuous variables					
	Mean ±S.E.	Mean ±S.E.	T-value	P-value	
No of foundation stock	6.86±1.44 ^a	3.67±0.52 ^b	2.085	0.043*	
Quantity of feed per day (kg)	3.027±0.43 ^a	1.929±0.22 ^b	2.266	0.027*	

N= number; *S.E.* = standard error; *na* = not applicable; * = significance; *ns* = not significant ; Means followed by different superscripts in rows are significantly different at $P \leq 0.05$

Performance of ducks in the study area

From the productive records over time (Table 5) and based on mortality, only the number of deaths of drakes was significantly ($P < 0.05$) lower in flocks of male duck-owners compared to their female counterparts (0.03 ± 0.03 vs. 0.23 ± 0.08). There were no significant ($P > 0.05$) sex differences in the average life span of ducks, season of highest egg production, hatchability, and mortality.

Table 5. Productivity indices of ducks kept in the Southern Agricultural Zone of Nasarawa State.

sex

Parameters	Male	Female	t test	P-value
Continuous variables				
Average age of hen at first hatch (months)	10.42±0.44	10.53±0.30	-0.216	0.830 ^{ns}
Average life span of duck (years)	7.28±0.45	7.41±0.35	-0.223	0.824 ^{ns}
No of eggs in a clutch	14.03±1.07	12.34±0.88	1.217	0.227 ^{ns}
No of eggs hatched in a clutch	12.25±0.92	11.19±0.91	0.819	0.415 ^{ns}
No of deaths of male ducklings	1.19±0.85	0.42±0.12	0.896	0.376 ^{ns}
No of deaths of female ducklings	0.44±0.19	0.23±0.08	1.007	0.319 ^{ns}
No of deaths of male growers	0.69±0.16	0.47±0.12	1.114	0.269 ^{ns}
No of deaths of female growers	0.14±0.07	0.45±0.16	-1.792	0.077 ^{ns}
No of deaths of drakes	0.03±0.03 ^b	0.23±0.08 ^a	-2.544	0.013*
No of deaths ducks	0.33±0.14	0.20±0.10	0.757	0.45 ^{ns}
Categorical variables				
	N (%)	N (%)	Chi-square Value	P-value
Season of highest egg production				
Wet	31 (35.2)	57 (64.8)		
Hot-dry	5 (45.5)	6 (54.5)		
Harmattan	0 (0.0)	1 (100.0)	1.012	0.603 ^{ns}
Season of highest of highest hatchability				
Wet	33 (36.3)	58 (63.7)		
Hot-dry	3 (33.3)	6 (66.7)		
Harmattan	0 (0.0)	0 (0.0)	0.031	0.861 ^{ns}
Season of highest of highest mortality				
Wet	14 (30.4)	32 (69.6)		
Hot-dry	20 (39.2)	31 (60.8)		
Harmattan	2 (66.7)	1 (33.3)	2.072	0.355 ^{ns}

N= number; S.E. = standard error; *= significance; ns= not significant; Means followed by different superscripts in row are significantly different at $P \leq 0.05$

Traits preferred for selection and breeding of ducks by farmers in the study area

The two sexes varied only in the ranking of cultural significance, where male farmers rated it higher compared to their female counterparts (1.56 vs. 1.14; $P \leq 0.05$) (Table 6). Other traits such as body size, body conformation, mothering ability, survival, heat tolerance, disease resistance, birth interval, plumage color, fertility, hatchability, egg number and size, meat taste, and ease of sale were not significantly ($P > 0.05$) influenced by sex.

Table 6. Mean ranks of factors preferred in the choice of breeding stock of ducks and their significance level according to Kruskal-Wallis test^w.

Traits	sex		Kruskal-Wallis test	Asymptotic significance
	Male	Female		
Body size	4.31	4.08	3.725	0.054 ^{ns}
Body conformation	2.86	2.59	1.425	0.233 ^{ns}
Mothering ability	4.19	4.23	0.135	0.713 ^{ns}
Survivability	4.31	4.25	0.050	0.823 ^{ns}
Heat tolerance	3.56	3.66	0.046	0.831 ^{ns}
Disease resistance	4.17	4.05	1.240	0.265 ^{ns}
Birth interval	3.08	2.75	2.959	0.085 ^{ns}
Plumage color	2.28	1.89	2.437	0.118 ^{ns}
Fertility	4.50	0.81	0.377	0.539 ^{ns}
Hatchability	4.69	4.64	0.087	0.768 ^{ns}
Egg number	4.47	4.59	0.778	0.378 ^{ns}
Egg size	2.61	2.44	0.427	0.513 ^{ns}
Meat taste	2.36	2.28	0.067	0.796 ^{ns}
Ease of sale	2.22	1.83	2.511	0.113 ^{ns}
Cultural significance	1.56	1.14	4.686	0.030*

w = The higher the mean, the more important the trait; * = significance; ns = Not significant; Means followed by different superscripts in row are significantly different at $P \leq 0.05$

Discussion

Females were more into duck production than males in the present study. Gender influences the nature or type of work/tasks that men or women perform, and those roles may vary per country, group, or generation. Those defined roles may thus confer specific opportunities, challenges, and status for individuals (Blackstone, 2003). In developing countries, the gender differences in livestock production activities mainly arise from customary or traditional roles that view certain activities as more suitable for males or females (Walugembe, 2017; Banda and Tanganyika 2021). Hence, there is a need for a reorientation towards an explicit gender-equality focus (Chanamoto and Hall, 2015) and gender-responsive programming and interventions (Tavener *et al.*, 2019) to guarantee sustainable duck production. Duck production in the area of study was mostly operated by relatively younger people that are still in their economic active age, as the average age distribution of farmers was found to be 33.7 years. This is congruous with the submission of Pervin *et al.* (2013), who reported that 55.5% of duck farmers in the Coastal area of Bangladesh belonged to the middle age group (36 – 50 years). The educational status revealed that the literacy level of the majority (60%) of the farmers in the present study was low which could affect their production level. Access to education could boost the capacity of farmers to use appropriate technologies for the development of their agricultural enterprises (Adeleye *et al.*, 2016) which may eventually contribute positively to the generation of more income.

The present study revealed the multi-functionality (income, meat, egg, religious/cultural) of ducks in the study area. Meat and eggs help in meeting the nutrient needs of the farmers and members of their households to guarantee a healthy living. Income is generated from the sale of live animal and animal products. Its choice is quite unsurprising considering the veritable role money plays in meeting the obligations of the farmers, including the purchase of food items that expand their dietary diversity (Hossain *et al.*, 2021). This is in consonance with the submission of Bebe *et al.* (2003) and Henning *et al.* (2016) where farmers gave cash income as primary reason for keeping livestock. The higher ranking of cultural significance by men might not be unconnected with the fact most communal taboos and stigma are in favour of the male folks. Kadurumba *et al.* (2019) also reported that in a male-dominated setting, ducks were mainly kept for rituals and traditional medicine.

The average flock size of 28.5 birds per household as reported in the present study is congruous with the findings of Daikwo *et al.* (2016) who reported a flock size of 26 birds, but higher than the value of

6-9 ducks per household of Kadurumba *et al.* (2019). It is, however, lower than an average of 32 birds per flock obtained in Vietnam (Delabougliise *et al.*, 2019). The larger flock size of male farmers may be attributed to their larger household size as more hands will be involved in the routine husbandry and health care of the birds.

Most of the foundation stocks were purchased from the markets indicating this source as being important in establishing the breeding stock. Since most farmers did not control the breeding of their stock, this might affect the production level and productivity of the duck. The high number of farmers involved in the semi-intensive and extensive management system of duck suggests that duck business is still primarily in the hands of resource-poor livestock owners, which could have a negative effect on the production level. The cost implication of rearing ducks intensively might have limited most duck farmers to adopt low-cost semi-intensive and extensive systems. Besides economic factors, some respondents claimed never to have seen or heard about the permanent confinement of ducks like chickens. Some also expressed fear about their water-loving habit which may not allow them to breed or mate if confined. In northern Nigeria, some duck keepers practicing extensive system hinged their choice on the complaint that confinement of ducks would be a herculean task considering the watery nature of their droppings (Duru *et al.*, 2006). Contrary to the current findings, Oguntunji and Ayorinde (2015) found that 86.8% of the farmers practiced extensive system while only 9% managed their birds semi-intensively. In the present study, it was revealed that both male and female farmers fed ducks once or twice a day with kitchen left-over which include tuwo, cooked rice, cooked beans, cooked yam, grains and grain residue (Dusa in Hausa language) while some utilized both commercial feeds and grains. The popularity of fermented grain residue (dusa) as duck feed in the study area could be attributed to its low cost and availability. This result is consistent with the findings of Oguntunji and Ayorinde (2015).

Regarding the production indices, the higher drakes' mortality rate may be attributed to differential management practices. The habits of feeding ducks with higher feed quantities and the application of herbs could have influenced a lower mortality rate in flocks owned by male farmers. However, interventions that will reduce mortality to the bearest minimum will boost production. According to Otiang *et al.* (2020), programs to reduce the capital and opportunity costs of vaccination and supplemental feed for the local birds will be beneficial to poultry production.

In the current study, considering the outcome of the Kruskal–Wallis test, both sexes perceived body size, mothering ability, survivability, disease resistance, fertility, hatchability, egg number as being of utmost importance. This might not be unconnected with the direct and indirect relationship of these traits with the market value and profitability of the duck enterprise. The appearance of animals in terms of size and fertility; proper nurturing and their ability to withstand environmental hazards and diseases may influence the amount of revenue generated by the farmers. Body size in livestock has been proposed as a signature for selection (Reimer *et al.*, 2018). It has also been suggested that selection for disease resistance and tolerance might improve the health and welfare of livestock with a concomitant increase in production (Guy *et al.*, 2012). In a related study, Daikwo *et al.* (2016) found that farmers preferred body size, egg number, hatchability, mothering ability and heat tolerance in the selection of the breeding stock. Similar trait preferences have been reported in smallholder tropically-adapted chickens (Yakubu *et al.*, 2020).

Conclusion

Duck production in the study area was operated mostly by female farmers and relatively younger people that are still in their economic active age. The primary reasons for keeping ducks by both sexes in the study area were for source of income, meat, and eggs. Management systems were strictly semi-intensive and extensive. Flock size was higher in male flocks. As perceived by both sexes, body size, body conformation, mothering ability, survival, heat tolerance, disease resistance, birth interval, plumage colour, fertility, hatchability, egg number and size, meat taste and ease of sale were of utmost importance, although men rated cultural significance higher than females. The observed variations in

the present study might be exploited in improving management strategies to boost duck production in the area of study.

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Author's Contributions

AY and HEM designed the work. HEM carried out the fieldwork. Both AY and HEM analyzed the data. The first draft was written by HEM and proofread by AY. Both authors approved the final draft.

Ethics

There are no ethical issues associated with the publication of this manuscript.

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