Breeding objectives and farmers' perceptions for indigenous chicken ecotypes in Southern Ethiopia

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Abstract

The aim of the study was to identify the breeding objectives and selection criteria of farmers for indigenous chickens in southern region of Ethiopia. Data were subjected to GLM procedures of Statistical Analysis System (SAS 2012, ver. 9.4) by fitting zones as independent variable to analyze the chicken population composition. Moreover, ranking analyses were used for computing data on breeding objective and selection criteria of indigenous chicken. Indexes were used to calculate data collected from rankings using weighed averages. Hens and chicks showed significantly ($p<0.05$) higher in number for Wolaita; however, the number of cockerels is significantly ($p<0.05$) higher in Hadiya followed by Wolaita zone. The results of this study suggested that farmers have different breeding objectives for their chicken. Across all the three studied zones, egg production was ranked first; however, rearing chickens for the cultural purpose is documented as less across all the three studied zones of the southern Ethiopia. The selection criteria used for selection of breeding hen; egg number, plumage color, hatchability, broodiness and egg size were the traits of highest importance for selection purpose with an index values of 0.365, 0.129, 0.129, 0.120 and 0.102 respectively. The highest selection criteria used to select breeding cock were body size, growth rate, plumage color and comb type. Development of a breeding programs for improvement of indigenous chicken strains should focus on the traits prioritized by farmers because of breeding goals developed without considering the needs of all the stakeholders have high chances of failerity by end users.

Key Words: breeding objectives; farmers' perception; indigenous chicken; Southern Ethiopia

Introduction

Traditional farming system is typically characterized by extensive type of management where growers and adult birds fulfill the bulk of their nutritional requirements from scavenging feed resources. The types of production inputs used in this system are few and are also poor in quality and low in quantity. However, low level of risk of scavenging chickens farming has made it a choice of livelihood strategy for subsistence farmers (Sonaiya 2009; Desta and Wakeyo, 2012). Moreover, indigenous chickens are tolerant to disease and seasonal fluctuation in feed quantity and quality, are caring and are protective, and they had the special ability of flying away from and/or fighting against predators. Their inherent behaviour to incubate and hatch eggs and brooding of chicks has sustained this system in its own without the need for modern facilities.

Indigenous chickens have played role in capital build up, poverty, malnutrition, and hunger reduction among the resource poor rural households in developing countries because of their low input requirements for production, short generation intervals, scavenging ability and adaptability to harsh environment conditions. Village poultry are readily available assets to local populations throughout Africa and they contribute to food security, poverty alleviation and promote gender equality, especially in the disadvantaged groups, (HIV and AIDS infected and affected people, women, and poor farmers) and less favored areas of rural Africa where most of the poor people reside. On top of these merits, village poultry can provide the start of the owner climbing the "livestock ladders'' leading to other livestock species such as goats and cattle or serve as "transport (transitional) bridge" from small livestock to large livestock species production (Melesse and Negesse, 2011; Melesse, 2014; Bekele et al. 2020).

According to the study conducted by Aboe et al. (2006), although indigenous village chicken is the most prominent class of livestock and constitutes about 60-80% of the total poultry population, their productivity is low because of poor nutrition and low genetic potential. The indigenous chicken production systems in Africa are mainly based on scavenging indigenous chickens found in almost all households in the rural areas. They are an integral part of the farming systems requiring low inputs with outputs accessible at both inter-household and intra-household levels. Village chickens also fulfill several other functions for which it is difficult to assign any monetary value.

Village chickens make significant contributions to the nutrition, economy and socio-cultural roles of households in the world, especially to those below poverty line. The impact of village chicken in the national economy of developing countries and its role in improving the nutritional status, income, food security and livelihood of many smallholders is significant, due to its low cost of production (Abdelqader et al. 2007; Markos et al. 2021). Furthermore, village chickens serve as transitional bridge from small livestock to large livestock species production and considered as the first step of the ladder to get out of poverty (Aklilu et al. 2007; Markos et al. 2021). Recurrent natural selections under scavenging conditions have made indigenous chickens robust and tolerant to various diseases and parasites. Farmers prefer to rear indigenous chickens than exotic breeds as indigenous chickens have a better survival rate than exotic ones under extensive scavenging conditions with very low levels of inputs (Minga et al. 2004; Bekele et al. 2020; Markos et al. 2021).

Identifying farmers breeding objectives, breeding practices, and trait preference of local chickens' producers with people centered perspective. This will serve as a foundation for proper conservation, utilization and phenotypic diversity improvement program (Hassen et al. 2007). Chicken population improvement program has been initiated for increasing productivity of indigenous chickens of Ethiopia through selective breeding as a means to improve the livelihood of poor people and conserve the existing chicken genetic resources through wise utilization (Khandait et al. 2011).

The traditional poultry production system is characterized by small flock sizes, low input, low output, and periodic devastation of the flock by disease. With a number of challenges, backyard poultry production is still important in low-income, fooddeficit production systems to supply the fast-growing human population with high demand for quality protein (Dessie et al. 2003; Fitsum, 2017). Backyard poultry is also a source of employment for under privileged groups in many local communities (Mengesha et al. 2008; Fitsum, 2017). According to Aklilu (2007), village poultry is the first step on the ladder for poor households to climb out of poverty and is a source of self-reliance for women, since poultry and egg sales are decided by women and provide women with an immediate income to meet household expenses.

Given the high potential for poultry production and the presence of diverse ecotypes, it is imperative to conduct comprehensive studies that can cover different indigenous chicken strains in study sites. Hence this study was undertaken with the aims of identifying the breeding objectives and selection criteria of farmers for indigenous chickens in southern Ethiopia.

Materials and methods

Description of the study area

The study was conducted in three Zones (Wolaita, Hadiya and Kembata-Tambaro) of Southern Ethiopia. Three districts from Wolaita zone (Duguna Fango, Humbo and Kindo Koysha), two districts from Hadiya (Gibe and Ameka) and two districts from Kembata Tambaro (Damboya and Tambaro) were purposively selected for the study. Sodo town is the administrative center of Wolaita zone and is located at a distance of 383 km far from Addis Ababa. Wolaita zone has an altitude ranging from 1,200 to 2,950 m above sea level (masl); annual rainfall vary between 800 and 1400mm; and minimum and maximum temperatures of 15 and 20°C, respectively.

Hadiya zone is located at western margin of the Great Ethiopian Rift Valley and at the fringe of the Gurage Mountains in the northern part of the Southern Regional State. The zone is situated between 7°07'-7° 52'N and 37°29'-38°13'E. According to the data collected from National Metrological Service Agency Hossana branch, nearly two-thirds (64.7%) of the Zone lies in the midland agro-climatic zone whereas 23.7% and 11.6% of the total land area of the zone lies in the highland and lowland agro-climatic zones, respectively. In general, the zone has a predominantly undulating topography and a pleasant climate which makes it highly suitable for human habitation as well as agricultural production. The area receives seasonal rainfall amount ranging between 470 and 1567 mm annually. The respective maximum and minimum mean annual temperature is 22.54^{0}C and 10.35^{0}C.

Kembata-Tambaro zone is one of the zones that form the administrative structure of the SNNPR. It borders Halaba Zone to the east, Omo River and Dawuro Zone to the west, Hadiya and Wolaita Zones to the south, and Hadiya Zone to the north. The mean annual temperature of the zone ranges from 12.6^{0}C to 27.5^{0}C. The mean annual rainfall, on the other hand, ranges from 1001 mm to 1400 mm.

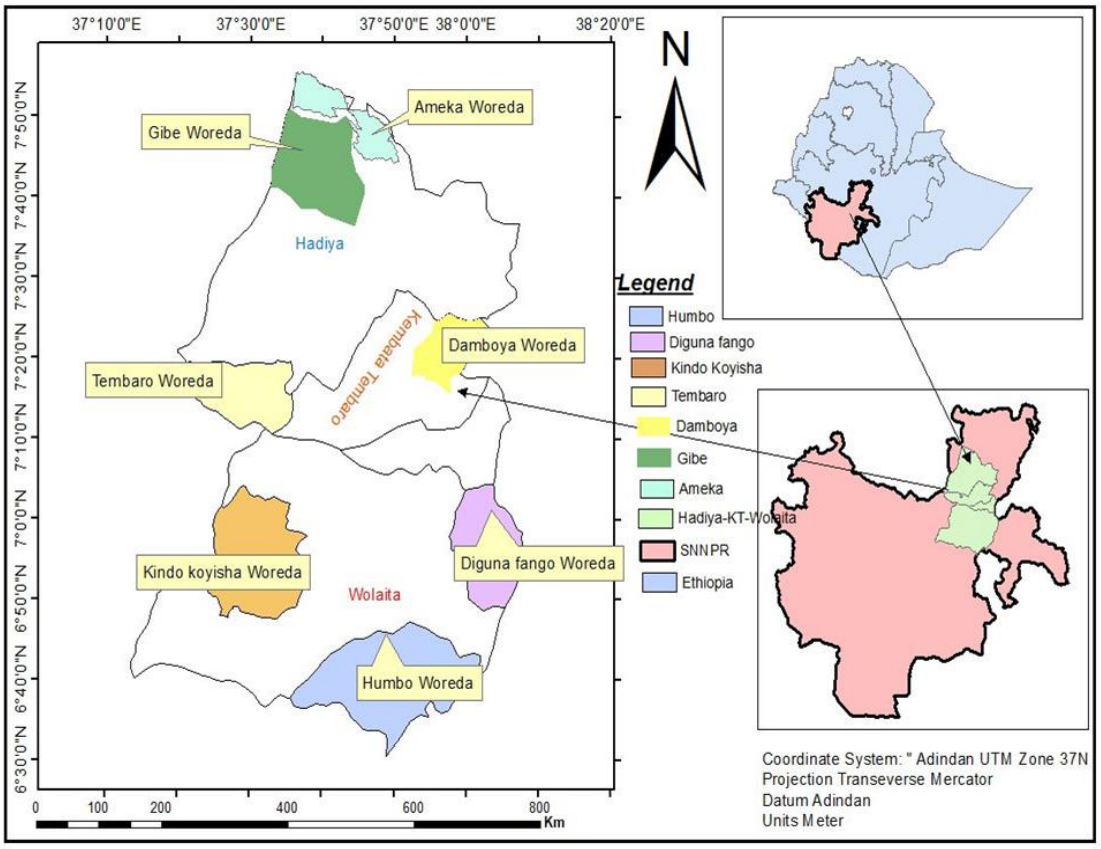

Fig 1. Map of the study sites

The southern region was found to be appropriate for poultry production. The majority parts of the all the three studied zones of Southern region is midland agro-ecology that favour the poultry production better than the other agro-ecologies.

Data collection

For the information on the flock structure, population determination and breeding objectives of the farmers for the indigenous chicken populations across the study zones of southern region, 420 households (180 from Wolaita, 120 from Hadiya and 120 from Kembata Tambaro zones) those have more than pure indigenous chickens were randomized.

Data analysis

Data were subjected to GLM procedures of Statistical Analysis System (SAS 2012, ver. 9.4) by fitting zones and sex as independent variables. When F-test declared significance, Duncan multiple range test was used to separate the fixed effect means.

Ranking analyses were used for computing data on breeding objective and selection criteria of indigenous chicken. Indexes were used to calculate data collected from rankings using weighed averages by the following formula employed by Musa et al. (2006).

Index= sum of (3*ranked first + 2*ranked second + 1*ranked third) given for each variable divided by sum of (3*ranked first + 2*ranked second + 1*ranked third) for all variables.

The following model was used for body weight and nine linear body measurements per individual chicken.

$Y_i = \mu + Z_j + + e_i$

Where: Y_i= individual observation; μ= fixed overall mean; Z_j = effect of zone (j = Wolaita, Hadiya, Kembata-Tambaro); e_i = random residual error.

Results and Discussion

Chicken population size

Mean values for the indigenous chickens per household across the studied zones in southern region are presented in Table 1. The result of the survey revealed that the mean indigenous hens, pullets, cockerel and chicks per household was significantly ($p<0.05$) different in the studied sites. However, the mean indigenous cocks per household did not differ significantly among the study zones of Southern region.

Hens and chicks were significantly ($p<0.05$) higher in number in Wolaita zone compared to the remaining study zones. The number of cockerels is significantly ($p<0.05$) higher in Hadiya zone followed by Wolaita Zone. Chicken farming is commonly practiced as a sideline activity, and none of the respondents specialized in this activity (Desta and Wakeyo, 2012). Clear definition of breeding objectives might be difficult under the subsistence level of managements with a wide range of production objectives and marketing strategies (Fitsum, 2017). In general, the results of this study suggested that farmers have different breeding objectives for chicken. In this study, in all the three studied zones, egg production was ranked first (for 0.381 farmers in Wolaita, 0.454 in Hadiya and 0.371 in Kembata Tambaro) follwed by keeping the chickens for both egg and meat across all zones (Table 2). This not inline with the report of (Fitsum, 2017) who revealed that the meat for consumption is ranked first followed by egg for consumption in Central Zone of Tigray, Ethiopia. The variation might reported for the infulence of the environment and cultutre of the studied regions. Keeping of the chickens for the cultural purpose is recoreded less across the three studied zones of the southern region.

Farmers' decisions on choice of breeding stock are shown in Table 3. Chicken owners in the studied zones considered both morphological and production selection criteria. The selection criteria used for selection of breeding hen; egg number, plumage color, hatchability, broodiness and egg size were the traits of highest importance for selection purpose with an index values of 0.365, 0.129, 0.129, 0.120 and 0.102 respectively; while comb type, body size and disease resistance were ranked lowest for breeding hen selection. The highest selection criteria used to select breeding cock were body size, growth rate, plumage color and comb type with an index values of 0.325, 0.272, 0.244 and 0.144 respectively; whereas fighting ability and disease resistance were rank lowest with an index value of 0.022 each. In the current study for selecting breeding female and male chicken, farmers target was not only for breeding purposes but also they take into consideration the traits that affected the market value.

The results in this study for cock are inconsistent with the reports of Duguma (2010) and Fitsum (2017) who reported that body size traits are important criteria of selection under traditional livestock breeding practices in different parts of Ethiopia. This is because size heavily determines live bird prices in traditional poultry markets. Similarly the high rating of plumage colour in the present study for both sexes of birds is in line with the report of Dana et al. (2010) where this trait was used as a selection criterion. The present reports for layes are also agrees with the findings of

Table 1. Flock composition of indigenous chicken strains across the studied zones (LSM ± SE)

Flock structure	Wolaita	Hadiya	Kembata Tambaro	p-value
Hen	3.91±0.07[a]	3.49±0.09[b]	3.30±0.09[b]	<.0001
Cocks	1.12±0.04	1.00±0.06	1.07±0.05	0.2314
Pullets	2.17±0.06[a]	2.26±0.07[a]	1.97±0.07[b]	0.0014
Cockerels	1.14±0.04[b]	1.32±0.03[a]	0.98±0.06[c]	<.0001
Chicks	4.67±0.09[a]	3.89±0.11[b]	4.04±0.10[b]	<.0001

LSM = Least square mean; SE = Standard error; different superscripts (a, b, c) at the same row indicate the significant difference.

Table 2. Breeding obejectives of the farmers towards the indigenous chicken strains in the study zones of southern region

Objectives	Zones											
	Wolaita (N=180)				Hadiya (N=120)				Kembata Tambaro (N=120)			
	Rank 1	Rank 2	Rank 3	Index	Rank 1	Rank 2	Rank 3	Index	Rank 1	Rank 2	Rank 3	Index
Egg	35	11	10	0.381	21	17	12	0.454	14	19	9	0.371
Meat	8	12	9	0.158	5	9	4	0.154	2	2	8	0.075
Egg and meat	12	28	10	0.283	11	13	7	0.275	20	5	8	0.325
Culture	0	0	2	0.006	0	0	0	0.000	0	0	1	0.004
Income	5	8	24	0.153	3	1	16	0.113	4	14	12	0.217
Easly managed	0	1	5	0.019	0	0	1	0.004	0	0	2	0.008

N = number of households

Table 3. Selection criteria used for selecting indigenous breeding hen and cock in the study zones of southern region

Variables	Zones											
	Wolaita (N=180)				Hadiya (N=120)				Kembata Tambaro (N=120)			
	Rank1	Rank2	Rank3	Index	Rank1	Rank2	Rank3	Index	Rank1	Rank2	Rank3	Index
Breeding hen												
Egg number	27	13	18	0.365	19	12	13	0.392	21	13	10	0.413
Egg size	5	9	2	0.102	4	5	1	0.096	1	1	1	0.025
Body size	1	6	3	0.053	0	2	2	0.025	0	2	2	0.025
Plumage color	9	4	9	0.129	2	0	5	0.046	2	6	6	0.100
Growth rate	0	2	6	0.029	0	1	2	0.017	1	1	2	0.029
Hatchability	7	7	9	0.129	4	8	7	0.146	7	8	7	0.183
Comb type	0	0	4	0.012	0	0	2	0.008	0	0	1	0.004
Broodness	5	11	4	0.120	9	9	5	0.208	8	7	3	0.171
Mothering ablity	6	7	2	0.047	2	3	1	0.054	0	2	4	0.033
Disease resistance	0	1	3	0.015	0	0	2	0.008	0	0	4	0.017
Breeding cock												
Fighting ablity	0	2	4	0.022	0	0	5	0.021	0	0	2	0.008
Body size	23	18	12	0.325	13	14	8	0.313	16	13	7	0.338
Plumage color	15	13	17	0.244	17	16	13	0.400	16	16	16	0.400
Growth rate	17	17	13	0.272	10	8	7	0.221	7	7	5	0.167
Disease resistance	0	3	2	0.022	0	1	1	0.013	0	1	1	0.013
Comb type	5	7	12	0.114	0	1	6	0.033	1	3	9	0.075

(Okeno et al. 2011; Fitsum 2017) who reported chickens traits of economic significance such egg number and hatchabilty were highly rated.

Development of a breeding programs for improvement of indigenous chicken strains should focus on the traits prioritized by farmers (Okeno et al. 2011; Bekele et al. 2020). This is because breeding goals developed without considering the needs of all the stakeholders have high chances of failerity by end users. The discussions held with farmer's shows that morphological traits, particularly plumage colour and comb type determined the market values. Moreover, breed variation is considarable variable on the chicken for the farmers either to prefferer or not and have

different performance level. This is inline with the study conducted by Ekka et al. 2016 who revealed the same aged chickens have differently weighying potential in India for their variation in breed.

Conclusion

This shows the multi-functional roles of indigenous chickens in the life of the rural poor. Egg production is the principal function of chickens. The selection criteria used for selection of breeding hen; egg number, plumage color, hatchability, broodiness and egg size were the traits of highest importance for selection purpose; while comb type, body size and disease resistance were ranked lowest for breeding hen selection. The highest selection criteria used to select breeding cock were body size, growth rate, plumage color and comb type. For selecting breeding female and male chicken, farmers target was not only for breeding purposes but also they take into consideration the traits that affected the market value. Since the egg production is prioritized by the farmers followed by both meat and egg, therefore the number of eggs should be increased with the consideration of meat production. Therefore, the ultimate breeding goal should be to develop a productive dual-purpose breed that can survive and reproduce under the production environment of village farmers.

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