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Characterization of smallholder poultry production systems in Mezhenger, Sheka and Benchi -Maji zones of south western Ethiopia

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The study was conducted in Sheka and Benchi-Maji of SNNPR and Mezhenger zone of Gambella Regional State, Ethiopia to characterize poultry production systems, identify major constraints and opportunities in poultry production. From each zone two districts and from each district two kebeles were selected randomly based on poultry production experiences of the farmers and the potentiality of each kebeles. A total of 120 households were individually interviewed. The result of the study revealed that, the dominant flock structure of chicken in the study area was hens followed by chickens of 0-8 weeks of age. Most of the respondents in Mezhenger, Sheka and Benchi-Maji zones, practice scavenging and seasonal supplementation with cereals crops. June, July and August were classified as months of feed shortage whereas from November to April feed availability is sufficient to surplus. More than half (56.4%) of the respondents keeping the chicken in separate house away from human being. Almost all of the respondents were practice culling of their chickens mostly due to old age of the chicken, low production of egg, unwanted plumage color, disease problem and bad temperament. About 96% of the respondents reported that poultry diseases were one of the production constraints and the common poultry diseases in the study areas include Nucastle, Tekimat, gunfan and majirat kolmim. Therefore, appropriate intervention focusing on chicken management, breed improvement, chicken disease and predator control and providing extension services through training are highly recommended for the study areas for further improvement of the chicken production.

Key words: Characterization, Smallholder poultry production systems, SNNPRs

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INTRODUCTION

Family poultry production has been widely perceived as a fast way to ensure food security, generate employment income, and promote women's empowerment at a relatively low investment (FAO, 2014). The total chicken population in Ethiopia is estimated at 49.3 millions and of this 97.3 percent, 0.38 percent and 2.32 percent of the total poultry was reported to be indigenous, hybrid and exotic, respectively (CSA 2011). Indigenous chicken production systems contribute greatly to human supply of eggs and meat in tropical and subtropical countries (Al-

Atiyat, 2009). These indigenous chickens (97.3%) in Ethiopia were distributed across different agro-ecological zones CSA (2011) under a traditional family-based scavenging management system (Alemu and Tadelle 1997). This indicates that poultry is highly important farm animals kept as a good source of animal protein and income to most of the rural populations by producing 78,000 metric tons egg and 72,300 metric tons meat, which accounts for 98.5 and 99.2% of the national egg and chicken meat production, respectively, of this more than 90% of the national chicken meat and egg output is obtained from indigenous chickens (Fisseha, 2009; Nigussie, 2011;Tadelle and Ogle, 1996). The Ethiopian indigenous chickens are none descriptive breeds closely related to the jungle fowl and vary in color, comb type, body conformation, weight and may or may not possess shank feather and broodiness is pronounced (Demeke, 2008).The mean annual egg production of indigenous chickens is estimated to be at 60 small-size eggs per year with a thick shell and deep yellow yolk color (Yami and Dessie, 1997). Egg laying period and number of eggs laid per period were to some extent higher in urban than in rural areas (CACC, 2003). The majority (98%) of the feed for village chicken is obtained through scavenging, which includes the household cooking waste, cereal and cereal by-products, pulses, roots and tubers, oilseeds, shrubs, fruits and animal proteins (Mulugeta and Tebkew, 2013). Despite the large contribution of village chicken production to food security, protein supply, income generation and employment opportunity in Ethiopian rural households, there were little information on characterization of poultry production systems, their husbandry practice and constraints in Southern Nation's Nationalities and Peoples Regional State in general and Mezhenger, Sheka and Benchi-Maji zones in particular. In addition to characterization of the production systems, understanding the socio-economic implications are crucial to design appropriate development intervention programs on village chicken production (Pedersen, 2002). Therefore, the objective of this study was to characterize poultry production systems, identify major constraints and opportunities in poultry production in the study zones.

MATERIALS AND METHODS

Description of the study areas

The study was conducted in two zones (Sheka and Benchi-Maji) of SNNPR and one zone (Mezhenger) of Gambella Regional State, Ethiopia (Figure 1). Sheka zone has a total area of 2,134.13 sq km and lies between 7.12-7.89 latitude and 35.24 to 37.90 longitudes, with an elevation ranging 1001-3000 meters above sea level. The zone has 3 Woredas with a total population of 198,406. Regarding the Agro – Ecology of the zone, out of the total land size 55.6% is kolla, 41.4% Weinadega and 3% Dega. The annual mean temperature ranges between 15.1-27.5 ^{o}C and the annual mean rainfall ranges 1201-1800mm SNNPRSIEMP (2011).

Bench maji zone has a total area of 19,965.90 sq. km and lies between 5.33-7.21 latitude and 34.88 to 36.14 longitudes with an elevation of 2500 meters above sea level. The zone has 10 woredas with a total population of 489,448.

Regarding the agro-Ecology of the zone, out of the total land size 28.04% is kolla, 15.44% weinadega and 56.74% dega.

The annual mean temperature ranges between 15.1-27 °C and the annual mean rain fall ranges 400-2000 mm SNNPRSIEMP (2011).

Godere and Mengish are the two woredas and part of the Mezhenger Zone. Godere is bordered on the south and east by the SNNPR, and on the west by Mengesh. Goder has a total population of 39,090 (10.9%) whereas Mengish has a total population of 24,587 (6.8% of the total population of the region).

SAMPLING AND DATA COLLECTION

From each zone two districts and from each district two kebeles were selected randomly based on poultry production experiences of the farmers and the potential of each kebeles. From each of the selected kebeles, 10 households possessing at least 5 poultry were randomly selected and a total of 120 households were individually interviewed. Data were collected in formal survey using pre-tested structured questionnaires which include: - household characteristics, livestock and chicken holding size, productivity of chicken and flock performance (number of clutches per year, clutch length, eggs/hen per year and inter clutch); chicken management practices including (housing, feeding, feed availability and types), and culling and selection practices) and diseases and predators. Secondary data was also collected from livestock and fishery development office. Qualitative and quantitative data sets were analyzed statistically using Statistical Package for Social Sciences (SPSS) software, version 20.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

The average age of the respondents in the study area was ranging from 28.8 to 36.8 years with mean age of 35.7 years (Table 1). The mean age of the respondents in Bemchi-Maji zone was relatively smaller than the other study zones. According to Solomon *et al.* (2013) the

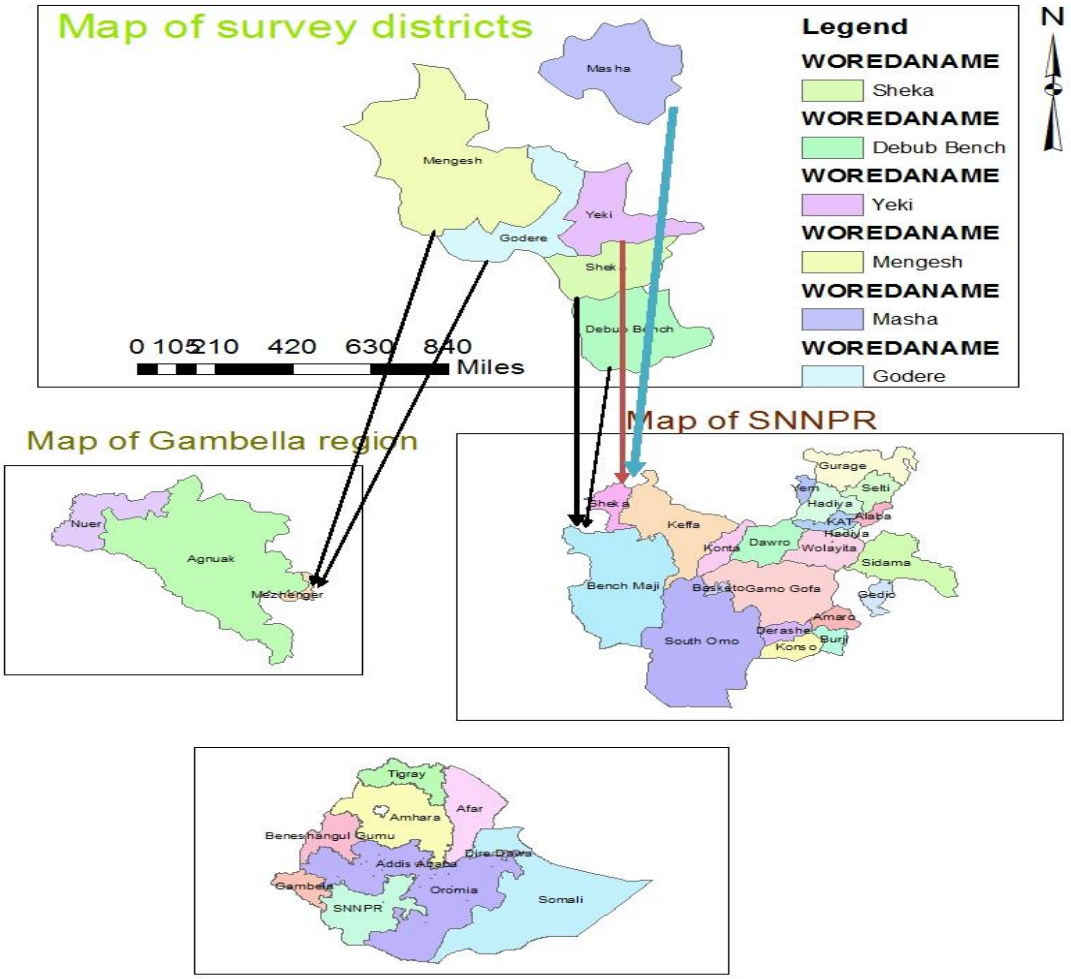

Figure 1: Map of the study areas

Table 1: Age, sex and family size of the respondents

Variable		Zones			
		Mezhenger Mean±SD	Sheka Mean±SD	Benchi-Maji Mean±SD	Overall mean Mean±SD
Age of the respondents (yrs)		36.87±12.06	35.55±10.86	28.85±15.38	35.71±11.75
Average family size (no.)		5.85±2.42	5.53±2.47	7.85±4.81	5.85±2.67
Sex of respondents (%)	Male	66	58.5	85.7	63.6
	Female	34	41.5	14.3	36.4

average age of the respondents participating in village poultry production in Metekel zone, Northwest Ethiopia was a bit higher (41.02 years) as compared to the current finding. The overall average family size in the study zones was 5.8 head per household and ranging from 5.5 to 7.8 head per household. The mean family size in Benchi-Maji zone was relatively higher than the two zones and this is mostly due to the labor demanding agricultural activities in the area. In agreement to this study Aman *et al*. (2015) reported higher (6.8) average

family size in Kambata Tambaro and Wolaita Zones, SNNPR, Ethiopia. Generally, in the study areas, the average family size of the respondents is higher than national average family size of rural areas (4.9) per household (CSA, 2011) and this is mainly due to labor demanding agricultural activities in the area contributed for such higher family size. Results showed that from the total of 120 households interviewed 63.6% were males and 36.4% were females. This indicates that the participation of female in poultry production is encouraging in the study areas. In agreement to this study Solomon *et al.* (2013) also reported that about 69% of the respondents participating in village poultry production Metekel zone, Northwest Ethiopia were males and 31% were females whereas in Amaro district, SNNPRS of Ethiopia, about 70.2% were males and 29.8% were female respondents (Matiwos *et al*.,2015).

Livestock holding size and composition of the respondents

The total population of livestock in the study areas is presented in table 2. The overall average number of livestock per household in the study zones was 4.7, 2.1, 1.5, 0.9, 2.3, 2.3, 0.03, 0.3 and 11.2 for cattle, cow, oxen, heifer, sheep, goats, horses, donkeys, and chickens, respectively. The mean livestock holding size of the respondents in Benchi-Maji zone is higher than the two areas and this could be mostly due to the production of food crops as the area is suitable for cereals production as compared to Sheka and Mezhenger zones which are dominated by forest, coffee and spices. In other parts of the region, the number of cattle, sheep, goats and local chicken reported is lower than the current study (Matiwos *et al*., 2015)

Flock size and structure of the respondents

The mean chicken flock size of the respondents is presented in table 3. The dominant flock structure of chicken in the study area was hens followed by chickens of 0-8 weeks of age. In the study areas the overall mean hens, cocks, pullets (8-20 weeks), Cockerels (8-20 weeks), Chicks (0-8 weeks) and total chickens population were 5.95±1.38, 1.99±0.55, 0.80±0.42, 0.33±0.21, 3.71±1.30 and 11.22±2.06, respectively. As other livestock species, chicken flock in Benchi-Maji zones are higher than the other study areas and this could be related to the production of cereals that is a dominant feed resources. The total chicken population of the study area was by far lower than (16.43 chickens/hh) the result of Addis and Malede (2014) in North Gondar Zone but comparable (12 chickens/hh) with the result of Samson and Endalew (2010) in Mid Rift Valley of Oromia, Ethiopia.

Poultry production systems in the study areas

The different poultry production systems in the study areas are presented in figure 2. Most of the respondents in Mezhenger, Sheka and Benchi-Maji zones, practicing scavenging and seasonal supplementation with cereals crops followed by scavenging only. Scavenging only was very rear in Mezhenger and Sheka zones and totally absent in Benchi-Maji zone. In agreement to this finding Samson and Endalew (2010) investigated the dominant chicken production system in Rift Valley of Oromia region is a free range system managed mainly on scavenging with conditional feed supplementation. Addisu *et al.* (2013) also reported that in North Wollo, Amhara region, Ethiopia all of the chicken owners were found to keep their chicken in free range/scavenging type of production system with occasional supplementary feeds.

Feed resources, availability and sources in the study zones

The commonly available feed resources in the study areas are presented in table 4. In overall study areas about 97% of the respondents supplementing their chicken with different feed source either seasonally or regularly. According to this study result, the commonly used feed types to supplement the chicken were wheat (35.5%), barley (11.9%), maize (92.7%), sorghum (90%), household wastes (88.2%). Similar to this study in Amaro district, SNNPRS of Ethiopia, the supplementary feeds used were combinations of maize and small grain (67.6%), maize (17.6%), cassava (5.9%), Household wastes and food leftover had the highest contribution (8.8%) Matiwos *et al.* (2015). In other study area greater than 90% of the feed types were obtained from maize, wheat, sorghum and household waste products as the main supplement of chicken feed and 60% of village chicken keepers cultivate feed suitable for poultry like maize, wheat and sorghum Samson and Endalew (2010).

Respondents classified months of the year according to feed availability (Figure 3). Accordingly, June, July and August were classified as months of feed shortage whereas during November to April feed availability is sufficient to surplus. According to respondents view during wet season the availability of cereal crops at home was limited but during grain production months feed scarcity is not a problem. As indicated in figure 3, most (73.6%) of the respondents produce the feed for poultry feeding whereas about 19% purchased the feed from local market and only 7.3% of the respondents supply the feed from market and household sources.

Poultry housing system

Figure 5 below indicates the type of poultry housing in the

Table 2: Livestock holding size and livestock composition of the respondents

Livestock Species	Zones			
	Mezhenger Mean±SD	Sheka Mean±SD	Benchi-Maji Mean±SD	Overall mean Mean±SD
Cattle	3.95±2.04	4.87±2.50	8.71±6.34	4.70±2.89
Cow	1.79±1.22	2.05±1.20	4.71±3.63	2.10±1.60
Oxen	1.36±0.75	1.44±0.98	3.14±1.61	1.51±1.21
Heifer	0.79±0.44	1.01±0.73	1.14±0.69	0.92±0.40
Sheep	1.89±1.72	2.33±1.79	5.28±4.27	2.32±1.81
Goat	2.16±1.74	2.27±1.61	3.57±2.25	2.30±1.70
Horses	0.00±0.00	0.03±0.02	0.28±0.18	0.03±0.02
Donkeys	0.24±0.24	0.44±0.25	0.42±0.26	0.35±0.24
Chicken	9.97±2.67	11.75±5.05	15.85±4.33	11.22±4.13

Table 3: Chicken flock size of the respondents

Chicken type	Zones			
	Mezhenger Mean±SD	Sheka Mean±SD	Benchi-Maji Mean±SD	Overall mean Mean±SD
Hens	4.89±0.97	6.46±1.52	9.42±1.47	5.95±1.38
Cocks	1.40±0.26	2.51±0.70	2.00±0.50	1.99±0.55
Pullets (8-20 weeks)	1.02±0.36	0.37±0.20	2.71±1.18	0.80±0.42
Cockerels (8-20 weeks)	0.24±0.15	0.29±020	1.28±0.42	0.33±0.21
Chicks (0-8 weeks)	3.81±4.37	3.64±6.00	3.57±5.06	3.71±1.30
Total chickens	9.97±5.34	11.75±10.10	15.85±8.66	11.22±2.06

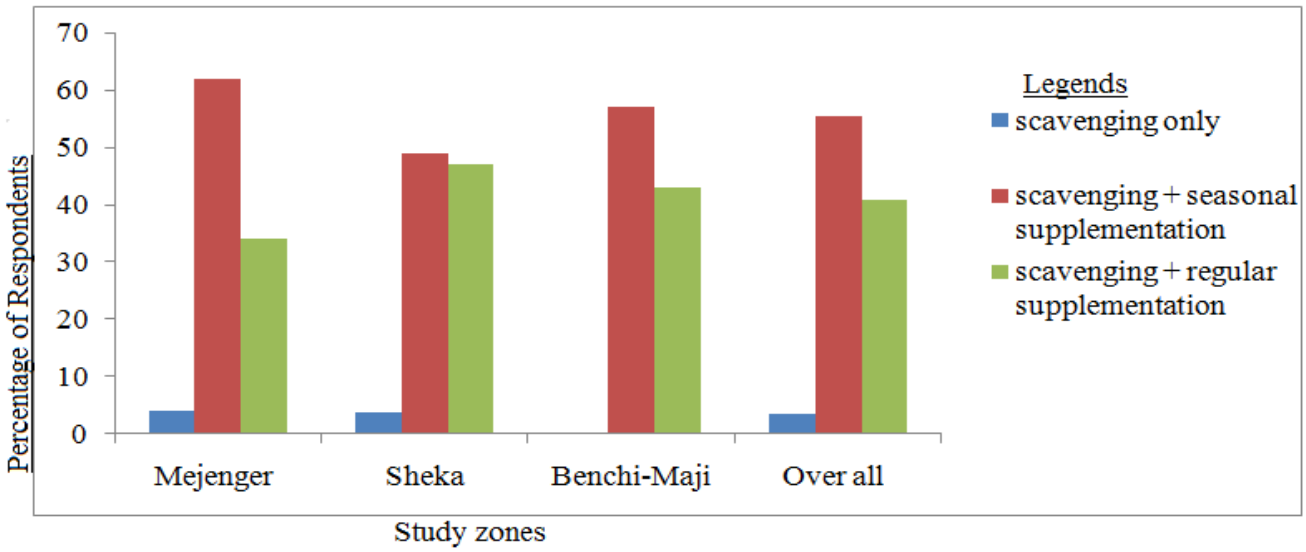

Figure 2: Poultry Production systems practiced in the study areas

study zones. In the study areas in general, 56.4, 31.8, 4.5 and 7.3 percent of the respondents were housing their chicken in separate housing, perches in the same house with the humans, perches in the kitchen and perches under veranda, respectively. As indicated above, most of the respondents practice keeping the chicken in separate house away from human being and this imply that poultry owners in the study areas were aware of the important of

Table 4: Feed types used for supplementing chickens (% of respondents)

Feed types	Zones			
	Mezhenger (%)	Sheka (%)	Benchi-Maji (%)	Overall (%)
Wheat	32.0	37.7	42.9	35.5
Barley	10.0	9.6	42.9	11.9
Maize	92.0	92.5	100.0	92.7
Sorghum	100.0	84.9	57.1	90.0
*HH wastes	98.0	79.2	85.7	88.2
Rice	-	1.9	-	0.9

*HH- household

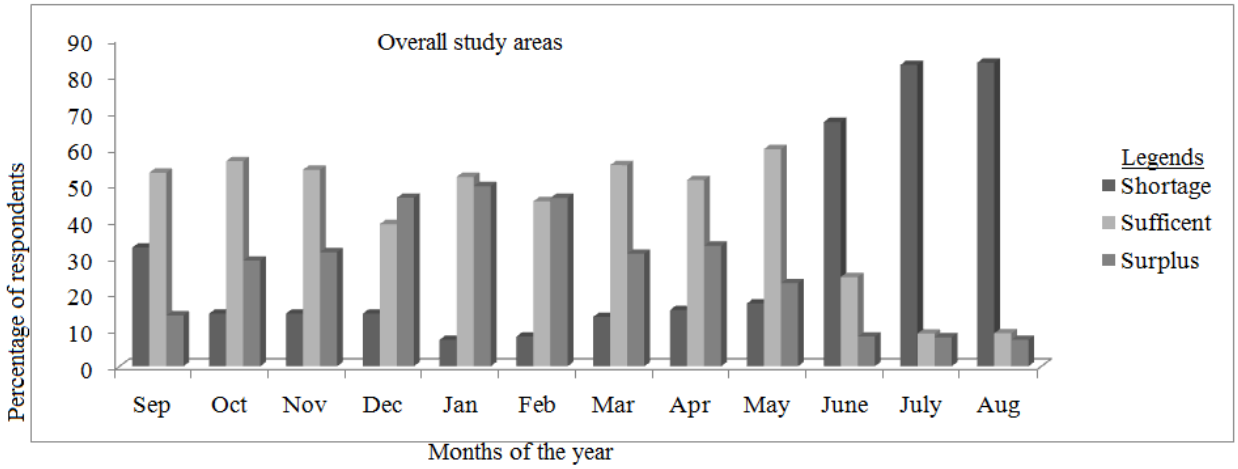

Figure 3: Feed availability throughout the year in the study areas

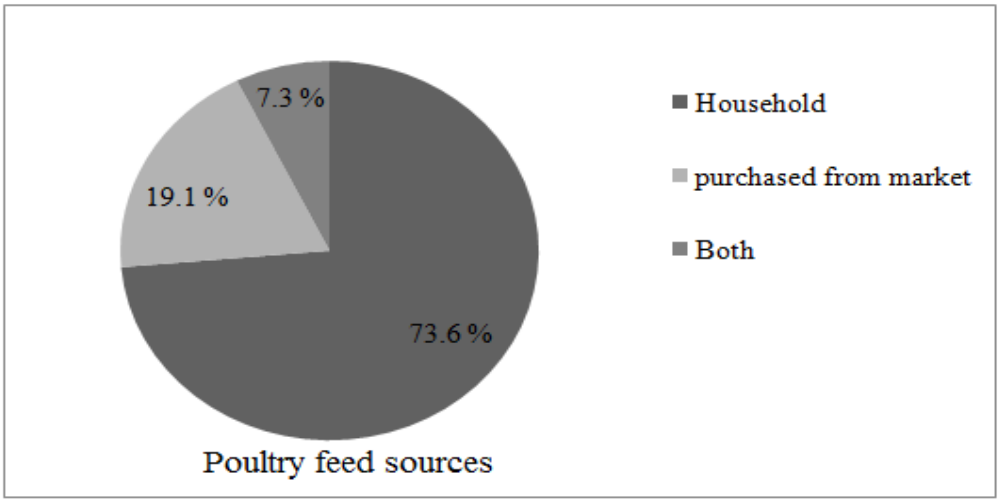

Figure 4: Sources of feed in the study areas

separate house for their chicken. Mulugeta and Tebkew (2013) reported that farmers provided night shelter for their chickens either in part of the kitchen 8.53% or in the main house 67.7% in separate sheds, while purpose-made for chickens were 23.77%. Contrary to this finding Addisu *et al.* (2013) reported that in Alefa district of

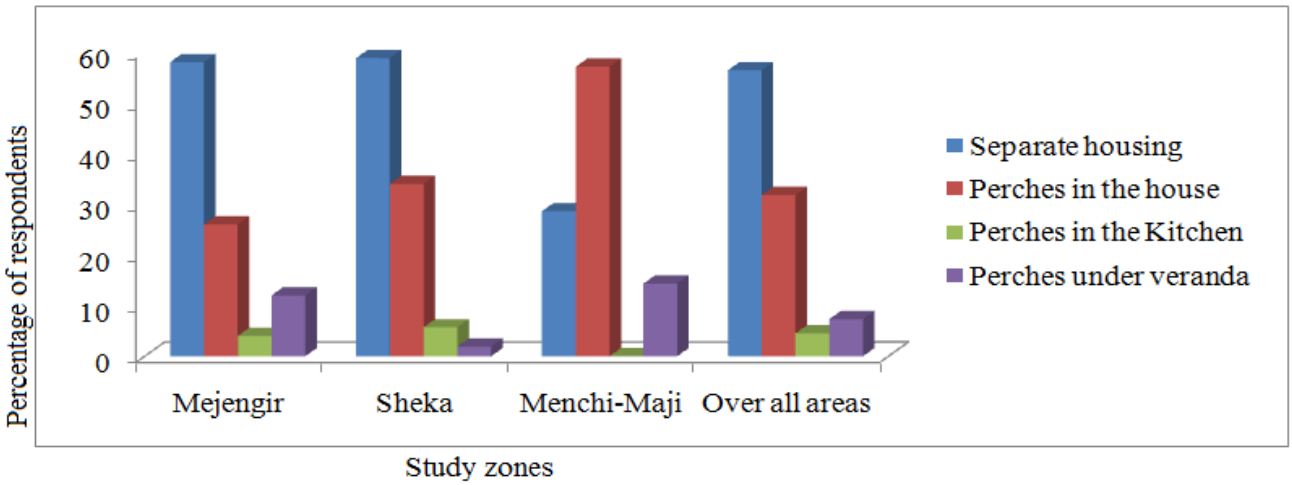

Figure 5: Poultry housing types in the study zones

Amhara region, about 97.6% of the respondents kept their chicken at night sheltering places within the family house and placed on the floor covered by ventilated bamboo made materials.

Production and reproductive performance of local chicken

The Production and reproductive performance of local chicken in the study zones is presented in table 5. According to this study, the mean age of hen at first mating is ranging from 4.9 to 5.1 months with mean of 5.06 months whereas age of hen at first laying is 5.8 months. This finding is comparable with the findings of Solomon *et al.* (2013) in which the average age of indigenous pullets at first mating was 5.2±1.16 months. Contrary to this study, indigenous village chickens in Eastern Gojjam zone, Ethiopia attain their sexual maturity at an average of seven months Melkamu and Andargie (2013).

The overall mean age of cock at first mating in months was 4.9 but in benchi-Maji zone higher value is recorded (5.2 months). This finding is comparable with the findings of Solomon *et al.* (2013) and Melkamu and Andargie (2013) in which the average age of the cock at first mating was 5.44±1.3 and 4.7±0.58 months, respectively.

The average number of clutches per year (in weeks), average length of inter-clutches periods (in weeks), average length of single clutch period (in weeks) and average number of eggs per clutch (in number) in overall study zones were 3.8, 2.4, 2.9 and 14.3, respectively. A comparable result was reported by Solomon *et al.* (2013) in which under existing farmer management condition, number of eggs produce per clutch was 13.56±0.26. The same authors reported the number of clutch periods recorded per year was 4.29±0.17. Melkamu and Andargie (2013) reported relatively higher Number of eggs (17±1.53) per clutch.

Indigenous chickens in the study areas produced 53-57 eggs per year per hen. The average number of eggs produced per hen per year was 54.5. Relatively smaller number of eggs (49.51) per hen per year was reported by Addisu *et al.*(2013) in North Wollo, Amhara Region, Ethiopia. Solomon *et al*.(2013) also reported similar results that a hen produced 59.5 eggs per year in Metekel zone,Northwest Ethiopia .

The total number of incubations per year by local chicken and average number of eggs sets to a broody hen were 1.8 and 9.7, respectively. The current finding is not in agreement with Solomon *et al*. (2013) in which the average number of eggs set per hen was 14.74±0.25 with a hatchability of 84.7%.

The average number of eggs hatched during dry seasons (8.4) is greater than those hatched during wet seasons (7.1). Melkamu and Andargie (2013) reported almost similar results that chicks hatched from 8 set eggs and hatchability percentage was 59.6.The average number of chicken stayed alive up to 8 weeks during wet season (5.1) is less than those chicken stayed alive up to 8 weeks (6.2) during dry season. According to Alemayehu *et al.* (2013) chicken stayed alive up to 8 weeks during wet season was range from 5.6 to 6.8 in Benishangul Gumuz. The average number of days eggs stored before incubation during dry season is 10 days whereas during wet season eggs stored for 12 days.

Selection and culling criteria for chicken

Most of the selection criteria of chicken by the respondents in the study zones are presented in table 6.

Table 5: production and reproductive performance of local chicken in the study areas

Poduction/reproductive Traits	Study zones			Overall areas Mean±SD
	Mezhenger Mean±SD	Sheka Mean±SD	Benchi-Maji Mean±SD	
Age of hen at first mating (month)	4.92±1.03	5.19±1.13	5.14±0.37	5.06±1.06
Age of cock at first mating (month)	5.00±0.76	4.90±0.85	5.28±0.95	4.97±0.81
Age of hen at first laying (month)	5.59±1.15	6.03±0.77	6.00±0.57	5.83±0.97
Average number of clutches per year (week)	3.71±1.25	3.94±0.89	4.14±0.37	3.85±1.05
Average length of inter-clutches periods (weeks)	2.24±0.69	2.60±0.63	2.71±0.48	2.44±0.67
Average length of single clutch period (week)	2.85±0.86	3.03±0.72	3.14±0.37	2.96±0.77
Average number of eggs per clutch (number)	13.04±2.55	15.42±4.44	15.42±4.42	14.36±3.87
Average number of eggs per hen per year (no)	53.00±0.64	53.33±0.64	57.31±0.64	54.51±0.39
Number of incubations per year by local chicken	1.85±0.64	1.79±0.56	1.71±0.48	1.81±0.59
Average number of eggs sets to a broody hen	9.81±2.00	9.66±1.80	9.85±1.06	9.74±1.84
Average number of eggs hatched during dry seasons	8.32±1.49	8.48±1.80	8.57±1.51	8.41±1.64
Average number of eggs hatched during wet seasons	7.02±1.76	7.24 ±1.52	7.57±1.51	7.16±1.62
Number of chicken stayed alive up to 8 weeks during wet season	5.18±1.50	5.16±1.81	4.71±1.60	5.14±1.66
Number of chicken stayed alive up to 8 weeks during dry season	6.20±2.26	6.42±2.08	5.28±3.35	6.25±2.25

Table 6: Selection criteria of chicken in the study areas

Variables		Zones			
		Mezhenger (%)	Sheka (%)	Benchi-Maji (%)	Overall (%)
Most preferred plumage color for cock	White	15.7	13	-	12.6
	Red	66.7	53	75	61.5
	Golden	-	6.2	-	2.7
	Black	17.6	27.8	25	23.4
Most preferred plumage color for hen	White	21.6	18.5	18.7	18.9
	Red	54.9	63	62.5	60.4
	Golden	23.5	18.5	18.7	19.8
Reasons for plumage color selection	Aesthetic value	82	5.6	87.5	80.9
	Market demand	14	60.4	12.5	11.8
	Culture/Religious value	4	34	-	7.3
Preferred shank color	Yellow	84	83	85.7	83.6
	White	13.7	17	14.3	14.5
	Black/Gray	2	-	-	1.9
Types of comb preferred	Single	52	47.2	42.9	48.2
	Double	48	57.8	57.1	51.8

The most preferred plumage color for cock in overall study zones was red (61.5%), black (23.4%), white (12.6%) and golden (2.7%) whereas the most preferred plumage color for hen was red (60.4%), golden (19.8%) and white (18.9%). According to Alemayehu *et al.*(2013), plumage color preference of the respondents for cocks was red, white and red, red and black, white and mixed color in its descending order. The same authors also described the most preferred plumage color for hens were red and red and white. Most respondents of the study area mentioned that aesthetic value, market demand and culture/religious value accounted for 80.9, 11.8 and 7.3% for plumage color preferences.

The most preferred shank colors are yellow (83.6%), white (14.5%) and black/gray (1.9%) whereas the types of comb preferred was single (48.2%) and double

(51.8%). According to Shishay *et al.* (2016) 97.4% of the respondents preferred to retain chickens with double comb types (rose and pea) while 0.5% of them favored to maintain chickens with single comb types for breeding and production purposes in Tigray region.

In the study zones almost all (99.1%) of the respondents were practicing culling of their chickens mostly due to old age of the chicken (98.2%), low production of egg (66.4%) ,unwanted plumage color (63.6), disease problem (70.9%) and bad temperament (54.5%). Common purposes of culling in the study areas were selling (87.3), home consumption (65.5%) and scarifies (44.5). In Haramaya district, eastern Ethiopia, farmers mostly cull their chicken for the purpose of selling (94.17%) and consuming at Home (5.83%) Bosenu and Takele (2014).A similar result was reported by Shishay *et al.* (2016) that 100% of the respondents practicing culling for improvements of their chicken and poor productivity, old age, sickness, lack of broodiness behavior. The overall mean culling age of the chicken in the study areas was 3.37±1.24 years. Relatively smaller (2.7 years) average culling age for local cocks was reported in Bure district, North west Ethiopia Fisseha *et al.*(2010).

The broodiness nature of the chicken in the study areas was pronounced and about 78% the respondents reported that broodiness nature was very common in their chickens. To prevent this behavior about 38.2, 37.3 and 23.6% of the respondents practicing hanging hen upside down, disturbing its nest and inserting feather through nostril. The Interval between two consecutive brooding periods (months) reported by the respondents was 3.60±1.14. In Rift Valley of Oromia region farmers practiced hanging up down (21%), changing house (30%), providing additional feed (13%) and no interference (36%) to control broodiness of their chicken Samson and Endalew (2010).

Poultry diseases and predators in the study areas

About 96% of the respondents reported that poultry diseases were one of the production constraints in those areas. The commonly reported poultry diseases in the study areas include Newcastle disease (Fungle), Tekimat, gunfan and majirat kolmim. A similar result was reported by Matiwos *et al.* (2015) in which majority of the respondents in Amaro district of SNNPRS, Ethiopia indicated that cholera, kisen Fengel were the major poultry diseases. In the study areas 80.9% of the respondents replied that as poultry disease outbreak was frequently occur. As commonly reported in other areas, the most commonly reported poultry predators reported by respondents were wild bird, wild cat and dog. Most (61.8%) respondents reported that extension service is available in their area whereas 38.2% responded that no extension services. The majority (67.3%) of the respondents reported that the extension worker visiting them once per month whereas 32.7% reported as the extension worker visit them twice per month.

CONCLUSION AND RECOMMENDATIONS

- The dominant flock structure of chicken in the study area was hens followed by chickens of 0-8 weeks of age. As other livestock species, chicken flock in Benchi-Maji zones were higher than the other study areas and this could be related to the production of cereals that is a dominant feed resources.
- Most of the respondents in the study zones, practice scavenging and seasonal supplementation with cereals crops such as wheat, barley, maize, sorghum, household wastes.
- June, July and August were classified as months of feed shortage whereas November to April feed availability is sufficient to surplus.
- More than half (56.4%) of the respondents practice keeping the chicken in separate house away from human being and this imply that poultry owners were aware of the important of separate house for their chicken.
- Almost all of the respondents were practice culling of their chickens mostly due to old age of the chicken, low production of egg, unwanted plumage color, disease problem and bad temperament.
- About 96% of the respondents reported that poultry diseases were one of the production constraints and the common poultry diseases in the study areas include Newcastle (Fungle), Tekimat, gunfan and majirat kolmim.
- Therefore, appropriate intervention focusing on chicken management, breed improvement, chicken disease and predator control and providing extension services through training are highly recommended for the study areas for further improvement of the chicken production system under farmer's management condition

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