Village Chicken Production Systems in Selected Areas of Benishangul-Gumuz, Western Ethiopia

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ABSTRACT
The study was conducted in Benishangul-gumuz regional state, western Ethiopia, to characterize village chicken production systems in these areas, identify the major constraints limiting chicken production and suggest the required development interventions for future improvement. One special district (Mao-komo) and two zones (Assosa and Kamash) representing the highland, mid-altitude and lowland areas of the region, respectively were selected for the study. A total of 144 households were selected from the three sites and individually interviewed using pretested structured questionnaire in their respective farms. Stratified sampling technique was used to select the households. Data was analyzed using descriptive statistics, chi-square test and one-way ANOVA of SPSS software. The results revealed that an average chicken flock size per household in the study areas was 7.7. Maize, sorghum and house-wastes were the main supplementary feed resources used by chicken and farmers noted that they face feed shortage problem for feeding their chicken during the wet season, feed availability was relatively better during dry season. About 54.9% of the sample respondents had separated shelters made of locally available materials for housing chicken. There were no significant differences (p>0.05) in productive and reproductive performances of chicken in the study areas. The average ages of chicken at first egg production were 29.6, 28 and 28.8 weeks, respectively at Assosa, Kamash and Mao-komo. The overall average number of clutch per year was 2.6, length of inter-clutch was 2.9 weeks and eggs per clutch were 9.9 (ranging from 11-16). Newcastle was the most prevalent economically important disease affecting chicken in the study areas. In conclusion, the chicken production system in the study areas is extensive where feeding is mainly scavenging with occasional supplementation with cereals with consequent low production and reproductive performances.

Key words: Village chicken production, production, reproduction performances, Benishangul-gumuz

INTRODUCTION
The importance of rural poultry in national economies and its role in improving the nutritional status and incomes of many small farmers and landless communities in developing countries has long been recognized by various scholars and rural development agencies. However, rural poultry does not rate highly in the mainstream national economies because of the lack of measurable indicators of its contribution to macroeconomic indices such as Gross Domestic Product (GDP)
Based on the findings of Permin (1997), rural poultry production provides valuable protein through a low input system and 20% of the protein consumed in developing countries originates from poultry products.

The local chickens of Ethiopia are estimated to be over 56 million and traditional chicken rearing is practiced by virtually every family in rural Ethiopia, indicating that chicken is an affordable source of animal protein. Traditional chicken rearing fits quite well to the conditions of rural households by creating employment and generating family income. The relative small feed cost and space requirement and the low price of the animals make chicken rearing a suitable farming activity for the rural poor. Unfortunately, despite the fact that more than 99% of the Ethiopian poultry production system consists of local chickens, traditionally considered to be disease resistant and adaptive to their environment, their contribution to human nutrition, gross domestic products and export earnings are disproportionately low (Demeke, 2003).

Rural poultry production suffers from disease constraints, particularly Newcastle disease, insufficient feeding and lack of housing. If these constraints could be removed then productivity would be increased to the direct benefit of the marginal farmer. Chick mortality accounts for high losses in most village chicken production systems. Therefore, management factors that would have a positive impact on chick survival and egg production are required to increase output from the village chicken flocks.

Scarcity of studies on rural chickens and their production systems is a feature of many developing countries (Kondombo et al., 2003). Ethiopia is not exceptional from this situation and although limited studies have been conducted on the distribution, identification, characterization and classification of indigenous non-descriptive chicken types in some areas. So far such studies have not been done in Benishangul-Gumuz regional state. But, for any developmental strategy that support rural chicken production, a full characterization and understanding of the production system is very essential. Therefore, this study was conducted to characterize village chicken production systems in these areas, identify the major constraints limiting chicken production and suggest the required development interventions for future improvement.

**MATERIALS AND METHODS**

**Description of the study areas:** The study was conducted in two zones (Assosa and Kamash) and one special district (Mao-komo) in Benishangul-Gumuz regional state in western Ethiopia. The two zones and the special district were selected to represent the three agro-ecologies of Benishangul-Gumuz. Assosa zone represented mid-altitude, Kamash low-altitude and Mao-komo represented high-altitude. Assosa town is located 670 km west of Addis Ababa. Mao-komo is located about 105 km south of Assosa town and Kamash is located 255 km north east of Assosa town. Benishangul-Gumuz regional state is located between geographical coordinates: 9°30'N-11°39'N latitude and 34°20' E to 36°30' E longitude with altitude ranging from 1272-1573 masl. Mean annual rainfall and temperature in the region range between 700-1450 mm and 21-35°C, respectively (AMS., 2008).

**Sampling method:** A three stage stratified sampling technique was used to select woredas, peasant associations and farmers. Two districts from Assosa zone (Assosa and Sherkole), three districts from Kamash (Kamash, Agalo-meti and Yaso) and Mao-komo special district were selected as the focal study sites. Peasant associations were randomly chosen from each district in a way that reflects the existing settlements. The information was collected using a pre-tested questionnaire in a field survey conducted during January to May, 2011 involving a total of 144 poultry keeping households selected for the study (84 from Assosa, 36 from Kamash and 24 from Mao-komo).
Data collected: The questionnaire was designed to cover a wide range of topics and variables including:

- Demographic characteristics (age, education level of household head and family size)
- Livestock holding
- Chicken flock size and composition
- Production systems (feeds and feeding, housing, production and reproductive parameters, culling and selection practices, diseases and predators)
- Market information

Data analysis: Both the qualitative and quantitative variables collected in the survey were entered into SPSS (version-20) and coded for analysis. Descriptive, one-way ANOVA, chi-square test and correlations were used for data analysis. Zones representing the three agro-ecologies (highland, Mid-altitude and lowland) were used as fixed factors for most of the dependent variables in one-way ANOVA model. The Model used for the analysis was:

\[ Y_i = \mu + A_i + \epsilon_i \]

where, \( Y_i \) is dependent variable, \( \mu \) is the overall mean, \( A_i \) is the fixed effect of zones; \( i = \) Assosa, Kamash and Maokomo; \( \epsilon_i \) is a random error. Chi-square test was used to determine differences in percent frequencies of nominal data. Correlation analysis was done to determine the degree of relationship among random variables. For all analysis, the level of significance was set at 5%.

RESULTS
Demographic characteristics of respondents: The mean age and family size of the sample respondents in the study areas were presented in Table 1. The differences in mean age and family sizes of the sample households were not significant (p>0.05) in the three zones. The mean age of the household head in the study areas was 35.2 years indicating that all the respondents were within the active age groups. The average total family size per household was 6.4 persons, which was closer to the national average figure of about 5.9.

Livestock holding: The average livestock holding and composition per household in the study areas is shown in Table 2. Livestock holdings per households were generally small except goats and chicken. Significantly (p<0.05) larger number of oxen, heifers, calves and goats per households were reported in Kamash zone than Assosa zone and Mao-komo special district. The number of cows, sheep and chicken owned per household were not different across the study areas.

Chicken flock size: The overall average chicken flock size per household was 7.7 heads (3.4 hens, 0.7 cock, 2.1 pullets, 1.0 cockerel and 7.5 chicks (Table 3).
Table 2: Livestock composition the sample households

| Variables | Assosa (N = 84) | Kamash (N = 36) | Mao-komo (N = 24) | F    | p     |
|-----------|----------------|----------------|------------------|------|-------|
| Cow       | 0.4±0.06       | 0.8±0.25       | 0.4±0.10         | 3.187| 0.485 |
| Ox        | 0.3±0.07       | 0.9±0.21       | 0.5±0.16         | 5.567| 0.005 |
| Heifer    | 0.1±0.00       | 0.5±0.19       | 0.3±0.10         | 6.567| 0.002 |
| Calf      | 0.0±0.00       | 0.1±0.09       | 0.0±0.04         | 3.139| 0.046 |
| Sheep     | 0.3±0.12       | 0.5±0.22       | 0.2±0.15         | 0.821| 0.443 |
| Goat      | 2.1±0.56       | 4.2±1.05       | 1.2±0.35         | 3.598| 0.031 |
| Horse     | 0.0±0.00       | 0.0±0.00       | 0.0±0.00         | -    | -     |
| Donkey    | 0.0±0.00       | 0.0±0.00       | 0.0±0.00         | -    | -     |
| Chicken   | 7.4±0.37       | 8.1±0.48       | 7.9±0.78         | 0.739| 0.479 |

Different letters in the rows are significantly different at p = 0.05, values are (Mean±SE)

Table 3: Chicken flock size per household in the survey areas (Mean±SE)

| Variables                     | Survey areas |
|-------------------------------|--------------|
|                               | Assosa (N = 84) | Kamash (N = 36) | Mao-komo (N = 24) |
| Hens                          | 3.5±0.19     | 4.0±0.28       | 2.1±0.25         | 10.090 | 0.000 |
| Cocks                         | 0.6±0.10     | 0.8±0.16       | 0.9±0.15         | 1.219  | 0.299 |
| Pullets (8-20 weeks)          | 2.1±0.18     | 2.3±0.19       | 2.0±0.32         | 0.317  | 0.729 |
| Cockerels (8-20 weeks)        | 1.1±0.10     | 1.0±0.12       | 0.5±0.13         | 4.610  | 0.012 |
| Chicks (0-8 weeks)            | 7.4±0.37     | 8.2±0.48       | 6.8±0.65         | 1.305  | 0.274 |
| Total birds                   | 7.4±0.37     | 8.1±0.48       | 7.9±0.78         | 0.739  | 0.479 |

Table 4: Feed resources used for supplementing chicken according to the respondents in the study areas

| Feed resource | Assosa | Kamash | Mao-komo |
|---------------|--------|--------|----------|
| Maize         | 59     | 70.2   | 33       | 91.7    | 23       | 95.8    |
| Sorghum       | 57     | 67.9   | 32       | 88.9    | 22       | 91.7    |
| House waste   | 60     | 71.4   | 33       | 91.7    | 22       | 91.7    |
| Wheat         | 5      | 6.0    | 4        | 11.1    | 3        | 12.5    |
| Finger millet | 11     | 13.1   | 7        | 19.4    | 6        | 25.0    |

Production system: All the sample respondents reported that the chicken production system in the study areas was mainly scavenging type with occasional supplementation using some home grown supplements. According to the respondents, chicken were mainly reared to generate income followed by use of the products (eggs and meat) for home consumption. No any other cultural and/or religious reasons were reported for keeping of chickens. Moreover, there were no taboos which prevent either consuming or marketing of chickens and their products in the study areas. Most of the sample respondents reported to begin village chicken production by acquiring the initial stock through purchase from the local markets.

Feeds and feeding: The feeding system of chickens in the study areas was mainly based on scavenging on the backyard. The type and amount of feeds used for supplementation depend on agro-ecology and season. Maize, sorghum and house waste were the main feed resources used for supplementing chicken in the study areas (Table 4). The availability of the supplementary feeds was reported during the dry season (November to March) following the grain harvest while the grains/grain by-products were in short supply leading to feed scarcity during the rainy reason.

Housing: About 54.9% of the sample respondents reported to house chicken in separate shelters during the night while the rest reported to keep chicken at night on some fixed perches prepared within the family house. Among the interviewed farmers, 51.2, 52.8 and 70.8% of them reported to use separate chicken shelters in Assosa, Kemash and Mao-komo areas, respectively (Fig. 1).
Fig. 1: Chicken housing conditions and types used in the study areas

Fig. 2: Materials used for chicken house construction in the study areas

shelters were made of locally available materials such as bamboo, wood wall and thatched roof. From respondents using separate chicken shelter, 41.8, 63.9 and 16.7% reported to use shelter made of bamboo wall and thatched roof in Assosa, Kamash and Mao-komo, respectively. On the other hand, 3.6 of the respondents in Assosa and 58.3% of the respondents in Mao-komo reported to use wood wall and thatched roof (Fig. 2).

Production and reproductive performance of chicken: The average ages at first mating and start of egg production were given in Table 5. The overall mean ages at first mating for male and female chicks in the study areas were 5.9 and 5.9 months, respectively. While the overall mean age at first laying was 7.2 months. There were no differences in average ages at first mating and start of egg production across the zones (p>0.05).

The assessment showed that the production and reproductive performances of chickens did not significantly (p>0.05) vary in the different study areas except mortality of chicks within age of 8 weeks. The chicken mortality was significantly (p<0.05) lower in Mao-komo than Assosa and Kamash (Table 5).
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Village chicken keepers in the survey areas had traditional practices that prevent broodiness of local chickens, which include hanging upside down of broody hen, disturbing of nesting place, putting feather in the nostril of broody hen, taking the broody hen other places from the nest. The majority of chicken keepers in Assosa zone (44%) and Mao-Komo special district (41.7%) reported as they disturb the nesting places where chicken keepers in Kamash zone mentioned as they practice all options proportionally (Fig. 3).

Culling and selection practices: The sample respondents reported to practice culling of chicken mainly for consumption, income generation and religious festivals. Egg production performance, broodiness behaviour, size and colour of birds were some of the major criteria for culling chicken. The criteria used for selecting chicken for the different important traits as reported by the sample respondents were presented in Table 6. The most desirable traits considered for laying hens by the farmers was egg productivity in Assosa zone and Mao-komo special district whereas bird’s size in Kamash zone. Poultry keepers in the Kamash zone rated smaller size of birds as the most desirable
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Table 6: Selection criteria of sample respondents for chickens in the study areas

| Variables                        | Assosa          | Kamash         | Mao-komo       |
|----------------------------------|-----------------|----------------|----------------|
|                                  | No.  | %    | No.  | %    | No.  | %    |
| Desirable traits of laying hens  |      |      |      |      |      |      |
| Smaller size                     | 16   | 19.0 | 17   | 47.2 | 6    | 25.0 |
| Egg productivity                 | 44   | 52.4 | 11   | 30.6 | 10   | 41.7 |
| Both size and egg laying ability | 24   | 28.6 | 8    | 22.2 | 8    | 33.3 |
| Desirable traits of broody hen   |      |      |      |      |      |      |
| Ability to clutch large size     | 17   | 20.2 | 17   | 47.2 | 5    | 20.8 |
| Long and wide wing               | 35   | 1.7  | 8    | 22.2 | 11   | 45.8 |
| Mothering ability                | 16   | 19.0 | 5    | 13.9 | 5    | 20.8 |
| Good hatching ability            | 16   | 19.0 | 6    | 16.7 | 3    | 12.5 |
| Desirable traits of cock         |      |      |      |      |      |      |
| Size                             | 67   | 79.8 | 30   | 83.3 | 17   | 70.8 |
| Plumage color                    | 5    | 6.0  | 1    | 2.8  | 1    | 4.2  |
| Size and plumage color           | 12   | 14.3 | 5    | 13.9 | 6    | 25.0 |
| Most preferred plumage color for cock |      |      |      |      |      |      |
| White                            | 10   | 11.9 | 0    | 0.0  | 1    | 4.2  |
| Red                              | 71   | 84.5 | 36   | 100.0| 16   | 66.7 |
| White and red                    | 2    | 2.4  | 0    | 0.0  | 4    | 16.7 |
| Mixed color                      | 1    | 1.2  | 0    | 0.0  | 1    | 4.2  |
| Red and black                    | 0    | 0.0  | 0    | 0.0  | 2    | 8.4  |
| Most preferred plumage color for hen |      |      |      |      |      |      |
| Red                              | 84   | 100.0| 36   | 100.0| 22   | 91.7 |
| Red and white                    | 0    | 0.0  | 0    | 0.0  | 2    | 8.3  |
| Reason for plumage selection     |      |      |      |      |      |      |
| Beauty/satisfaction              | 84   | 100.0| 36   | 100.0| 23   | 95.8 |
| Beauty/satisfaction and market demand |      |      |      |      |      |      |
| Preferred shank colour           |      |      |      |      |      |      |
| Yellow                           | 33   | 39.3 | 15   | 41.7 | 6    | 25.0 |
| White                            | 51   | 60.7 | 21   | 58.3 | 17   | 70.8 |
| Bird type preferred              |      |      |      |      |      |      |
| Fully feathered                  | 84   | 100.0| 36   | 100.0| 20   | 83.3 |
| Necked neck                      | 0    | 0.0  | 0    | 0.0  | 4    | 16.7 |
| Availability of neck necked chicken | 84   | 100.0| 36   | 100.0| 24   | 100.0|

trait for laying hens as they reported that birds with smaller size had high egg production performance. Long and wide wings were ability of the bird to clutch a large size of eggs were the most desirable traits for broody hen in the study areas. Large size was reported to be the most desirable trait for cocks.

Moreover, the sample respondents indicated that they prefer both cocks and hens with red plumage colour. According to the respondents, chickens of this colour were attractive and have higher demand in the market. Majority of the respondents also reported to prefer laying hens with white shank than yellow shank but they had no preference for birds with necked necks. The sample respondents in the study areas reported that birds with necked necks are not attractive.

**Diseases and predators:** Wild cat (locally known as shelemetmat), eagle and foxes were the common chicken predators identified by the sample respondents in the study areas. Eagle is a serious problem in dry season while the rest are commonly attacking chicken during wet season. As reported by the sample respondents, in wet season the scavenging areas are covered by vegetations and this make a conducive environment for wild cat and foxes to attack chickens. In dry seasons, the vegetation of scavenging areas are less dense and chickens are vulnerable to eagle. Newcastle disease the most prevalent and economically important disease affecting chicken in the study areas mainly during the rainy season. Shortage of supplementing feeds during rainy season makes the chickens more vulnerable to diseases.
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Table 7: Prices of chicken and their products in the three study zones in Ethiopian Birr (Mean±SE)

| Zone                      | Assosa (N = 84) | Kamash (N = 36) | Mao-komo (N = 24) | F      | p      |
|---------------------------|-----------------|-----------------|------------------|--------|--------|
| Price of matured male during holiday | 118±3.11 a | 88.9±2.11 b | 89.1±2.99 b | 27.977 | 0.000  |
| Price of matured female during holiday | 87.9±3.11 a | 58.9±2.11 b | 58.3±2.82 b | 27.202 | 0.000  |
| Price of matured male during normal day | 75.7±3.72 | 81.5±4.40 | 67.1±2.99 | 1.683  | 0.190  |
| Price of matured female during normal day | 72.9±3.11 a | 43.9±2.11 b | 43.3±2.80 b | 27.220 | 0.000  |
| Price of grower male during holiday | 82.1±1.96 a | 66.5±2.46 b | 66.0±2.37 b | 16.429 | 0.000  |
| Price of grower female during holiday | 67.1±1.96 a | 51.5±2.46 b | 50.8±2.44 b | 16.528 | 0.000  |
| Price of grower male during normal day | 72.1±1.96 a | 56.5±2.46 b | 55.2±2.59 b | 16.888 | 0.000  |
| Price of grower female during normal day | 57.1±1.96 a | 41.5±2.46 b | 40.2±2.58 b | 16.910 | 0.000  |
| Egg price of local egg during holiday | 2.4±0.04 a | 1.8±0.04 a | 2.0±0.02 a | 44.187 | 0.000  |
| Egg price of local egg during normal day | 1.9±0.03 a | 1.4±0.02 a | 1.8±0.03 a | 60.462 | 0.000  |
| Egg price of exotic egg during holiday | 2.9±0.04 a | 2.3±0.04 a | 2.5±0.03 a | 44.139 | 0.000  |
| Egg price of exotic egg during normal day | 2.4±0.04 a | 1.8±0.04 a | 2.1±0.03 a | 41.381 | 0.000  |

Means in rows with different letters are significantly different at α = 0.05

Market: The market prices of chicken and their products as reported by the sample respondents were presented in Table 7. Prices were higher during holidays than normal days and chicken and eggs had significantly (p<0.001) higher prices in Assosa Zone than Mao-komo special district and Kamash zone due higher urban demand. Prices were also reported to be higher for males than female chickens. The average unit prices of matured male in the study areas during holidays and normal days were 105.5 (ranging from 60-250) and 75.8 (ranging from 35-230) Ethiopian birr, respectively. On the other hand, the average unit prices of matured female during holidays and normal days were 75.7 (ranging from 30- 220) and 60.7 (ranging from 15-205) birr, respectively. As reported by the sample respondents, eggs from exotic (crossbred) chickens had higher prices than eggs from local chicken. The average unit prices of eggs of exotic chickens were 2.7 and 2.2 birr during holidays and normal days, respectively. The average unit prices of eggs from local chickens were 2.2 and 1.8 birr during holidays and normal days, respectively.

DISCUSSION

The overall mean flock size per household in this study (7.7) was lower than the figures reported by Assefa (2007) in Awassa zuria (8.8), by Mekonnen et al. (2010) in Ada’a district of Ethiopia (12.4) comparable to the figure reported by Halima et al. (1997) in north-west Ethiopia (7.13). This study showed that almost all chickens were of local breed types indicating that the study areas had limited access to improved technologies with regard to poultry production. In fact, local breeds are preferred for their tolerance to harsh environments sub optimal management conditions in some areas of the region. However, introduction of improved dual purpose breeds like ‘Fayoumi’ and ‘Koekok’ in potential areas could increase productivity and may help in meeting the huge demand for chicken and chicken products by the urban centers like Assosa.

The primary purpose of keeping chicken in the study areas was to generate income which in turn is used for purchasing cheaper food items to feed the family. Moreover, chicken were used for home consumption mainly during holidays and some special occasions. The difference in types of supplementary feeds used in the study areas is attributed to the types of crops grown in a particular agro-ecology and the relatively better availability of feeds during the dry season is associated with production of higher grain and/or grain by-products following harvesting of crops. This finding is in agreement with Desta and Wakeyo (2012) who reported similar scenario in Southern Ethiopia.

The shelters in separate chicken housing system were designed in such a way to prevent predators and allow easy removal of waste but the space required per unit animal was not taken
in to account so that the flock size and the size of shelter was not proportional in most cases. The recommended floor space for chickens is 3 birds m$^{-2}$ for layers, 4 birds m$^{-2}$ for dual purpose and 4-5 birds m$^{-2}$ for broilers. Considerable proportion of the sample respondents did not have separate shelters for their chicken which is mainly attributed to the lack of awareness on the importance of separate shelter. This requires the attention of the extension workers and other concerned bodies to help farmers in constructing separate chicken shelters using locally available materials. In contrary to this finding, Dessie and Ogle (2001) and Mekonnen et al. (2010) reported that the majority (>80%) of village poultry producers had no separate shelters for their chicken and instead, chicken were sharing the family house in the highlands of Ethiopia.

The average age at maturity of cocks and pullets recorded in this study (23.6 months), is in agreement with the range (20-24 months) reported by Halima et al. (1997) in North-Western Ethiopia. But, the average age at first egg laying obtained in this study (28.8 months), is higher than of the range (20-24 months) reported by the same authors. The average numbers of clutches per year (2.6) and eggs per clutch (6-10) observed in this study were lower than the figure (3.4 clutch and 15-20 eggs per clutch) reported by Dessie and Ogle (2001). The discrepancy may be attributed to the genetics of birds, feed type and availability and disease conditions of the study areas.

Chickens were culled mainly for consumption, income generation and religious festivals in the study areas. Halima et al. (1997) also reported similar observations in village-based indigenous chicken production in North-Western Ethiopia. The selection criteria used by poultry keepers were mainly associated with economically important traits such as size and plumage colour which directly determine the market demand and price. But, there were some misunderstandings that poultry keepers preferred chickens with white shank to yellow shank which should be on the other way round. White shank is a sign that the chicken has already started egg production and less egg is remained to be produced compared to chicken with yellow shank. This requires further works in the areas of awareness creation.

Newcastle was the most prevalent and economically important disease affecting poultry production in the study areas which entails the need for regular vaccination services. Negussie (1999) also reported that Newcastle disease is accountable for the largest proportion of flock mortality in the country. The reported higher loss of flock due to Newcastle is probably related with uncontrolled movement of flock due to scavenging production system as the disease is contagious. This loss can be controlled by limiting the movement and contact of chickens using simple fences (Desta and Wakeyo, 2012).

The prices of chickens were affected by location of the study areas, sex and weight of birds and the time of sale (holidays vs ordinary days). The higher unit price of eggs and chicken in Assosa is attributed to presence of high market demand as is the capital city of the region.

CONCLUSION

Chicken are mainly kept for subsistence income generation and home consumption in the study areas. The production system is extensive system where feeding is mainly based on scavenging with occasional supplementation with cereals and their by-products. Chicken production in areas is constrained by genetics, poor managements like feeding and housing, diseases and predators with the consequent low productivity. Hence, improved technologies like breeds and proper management interventions need to be introduced to improve productivity and enhance the contribution of chicken to household livelihoods in the study areas.
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