**Assessment of Chicken Production Systems and Egg Quality Traits in and Around Borama District, Somaliland**

**ABSTRACT**

This study evaluated chicken production practices and egg quality traits among households in urban and rural villages of Borama District, Somaliland. A total of 131 respondents (67 urban and 64 rural) participated in the survey. The demographic profile showed a predominance of female respondents (84%) mostly aged between 31 and 40 years (62.6%). Significant differences were found in educational status, with higher illiteracy rates in rural areas (48.4%) compared to urban areas (14.4%) (p=0.000). Family size was significantly larger in rural villages (7.1 ± 0.17) than urban (6.4 ± 0.12) (p=0.002). The main purpose of keeping chickens was for sale (72.5%), followed by home consumption (20.6%). Hatching eggs for replacement was significantly higher in rural areas (75%) than urban (49.3%) (p=0.006). Feeding management showed significant differences between urban and rural settings (p=0.03). Most urban chicken keepers practiced scavenging with supplementation (97%), while a considerable proportion of rural respondents relied on scavenging only (37.5%). The primary feed sources included cereal grains and food leftovers, with cereal grains more common in rural areas (53.1%) than urban (28.4%) (p=0.000). Water was provided to most flocks (91.6%), but watering frequency and sources varied significantly (p=0.000). Urban chickens mostly had access to pipe water (68.7%), whereas rural chickens relied on pond and rainwater. Housing systems differed significantly (p=0.000), with traditional housing predominant in rural areas (92.2%) and more diverse systems including deep litter and backyard housing in urban villages. Newcastle disease was the most prevalent poultry disease (93.1%), and traditional control methods were widely used (38.2%). Predators (45%), flock mortality (20.6%), and diseases (14.5%) were major constraints affecting chicken production. Egg quality assessment revealed a significant difference in albumin height (p=0.04), with urban eggs having higher values. Other traits such as egg weight, yolk height, yolk weight, yolk color, albumin weight, and shell weight did not show significant variation between the two locations. The findings indicate the need to improve feeding practices, disease control, and housing conditions to enhance productivity and egg quality, especially in rural areas.

**Keywords**: Chicken production, Egg quality traits, Urban and rural villages, Borama District

**INTRODUCTION**

Livestock is the backbone of Somaliland's economy, providing livelihoods for a significant portion of the population. It contributes about 60% to the country’s Gross Domestic Product (GDP) and nearly 85% of its export earnings (SomalilandBiz, 2021). Somaliland’s primary livestock exports include sheep, goats, camels, and cattle, which are shipped through the port of Berbera to countries such as Saudi Arabia, Yemen, Oman, and the United Arab Emirates (UAE). Poultry, although a smaller component of the sector, is gaining increasing attention due to its potential for income generation, food security, and nutrition.

Recent studies show that indigenous chicken breeds make up 97.8% of the total poultry population in Somaliland, while exotic breeds account for only 2.2% (Mohamed *et al.,* 2023). Poultry production holds significant economic, social, and cultural value in rural households and is a major source of high-quality animal protein. Chicken meat and eggs are affordable compared to other animal-source foods such as beef, mutton, and camel meat, making them accessible to low-income households (Abdi-Soojeede & Funwie, 2022). In fact, rural households often rely on poultry as the only species affordable enough to be regularly consumed, given that the price of sheep or goats may exceed USD 60 per head, while a chicken costs less than USD 10.

Globally, it is estimated that poultry will contribute approximately 40% to total animal protein production by 2025, with a significant increase expected in developing countries (Delgado et al., 1999). In Africa, over 80% of the poultry population is found in traditional scavenging systems, which are characterized by low-input, low-output production practices (Gueye, 2000). In Somaliland, poultry is primarily raised under backyard or semi-scavenging systems, especially in peri-urban and rural settings. A recent study in Awdal and Maroodi Jeex regions highlights that most chicken production is managed by women, who play a vital role in ensuring food security at the household level (Mohamed *et al.,* 2023).

The dominant production systems in Somaliland consist of three major types: traditional backyard systems, small-scale commercial operations, and a few emerging medium-scale commercial farms near urban centers such as Hargeisa and Borama (Mohamed *et al.,* 2023; Warsame & Turyasingura, 2022). However, the traditional system remains the most common, characterized by indigenous breeds, poor housing, limited healthcare, and feed scarcity. These limitations affect not only the productivity but also the quality of eggs and meat produced.

According to Abdi-Soojeede (2022), common indigenous breeds in Somalia (including regions such as Awdal) exhibit considerable variability in egg size, shell quality, and yolk color due to differences in feeding, management, and breed genetics. In Mogadishu, studies have shown that disease prevalence, particularly coccidiosis, inadequate feed, and limited access to veterinary services are major constraints to improved poultry production (Mio *et al.,* 2022; Abdi-Soojeede & Funwie, 2022).

Despite its economic and nutritional importance, poultry production in Somaliland remains underdeveloped. There is a lack of comprehensive, localized data on production systems and egg quality traits. Most studies have focused on general livestock systems or poultry in other regions, such as Jigjiga Zone in Ethiopia’s Somali Region (Mohamed *et al.,* 2016), leaving a knowledge gap regarding the specific conditions and challenges in Borama District, Awdal Region.

Therefore, a systematic study is needed to assess current production practices and evaluate egg quality traits under local conditions. This will provide critical insights for improving productivity, enhancing rural livelihoods, and informing evidence-based policy for poultry development in Somaliland. The findings will also contribute to understanding how factors such as breed, feed availability, and management influence egg quality under traditional systems, especially in the context of climate variability and recurrent droughts (Gaas, 2018).

**MATERIALS AND METHODS**

**Description of the Study Area**

The study was conducted in Borama District, located in the Awdal Region of Somaliland. Borama town is the capital of Awdal Region and is situated 118 km west of Hargeisa city. Borama borders Zelia to the north, Baki to the east, and Ethiopia to the west. The district lies between latitudes 9°N and longitudes 23°E. It comprises 35 rural sub-districts and three towns. The administrative center of the district is Borama. The hottest month of the year is June, with an average temperature of 24.1°C (75.4°F), while the coolest month is January, with an average temperature of 17.1°C (62.8°F). The difference in rainfall between the driest and the wettest month is approximately 110 millimeters (4.3 inches). Average temperatures vary throughout the year by about 7°C (12.6°F). Borama town had a population of approximately 300,000, while the broader district had a population of 398,609. Based on FAO estimates of livestock numbers and past growth rates, Borama had about 281,670 camels, 79,636 head of cattle, 47,596 goats, 23,899 sheep, and 3,771 poultry in 2018. The major crops cultivated in the district (in order of importance) include sorghum, maize, tomatoes, lettuce, bananas, onions, peppers, strawberries, and cabbage (FAO, 2020).

**Study Design**

This study employed a cross-sectional design comprising two main components: a field survey and laboratory analysis. The survey component was conducted to collect relevant information on chicken production practices, production systems, constraints, and opportunities in the study area. It aimed to gain insights into local management practices, challenges, and socioeconomic factors affecting poultry production. The laboratory component focused on assessing the egg quality characteristics of chickens in the same area. This involved the collection and analysis of eggs to evaluate both external and internal quality parameters under controlled conditions.

**Sampling Technique and Sample Size Determination**

A multi-stage sampling technique was employed in this study. In the first stage, Borama District was purposively selected due to its high chicken production potential. The district was then stratified into two categories: urban and rural areas. The urban stratum included Haya Yabo and Sh. Osman, while the rural stratum consisted of Darey Macane and Shirwac villages. From each stratum, two villages were purposively selected based on accessibility and chicken production potential. In each selected village, the number of households owning chickens was identified with the assistance of the district’s Livestock and Fisheries Office. In the second stage, the total number of households to be surveyed was determined using proportional sampling. The sample size was calculated based on Yemane’s (1967) formula, with a 5% level of precision. Consequently, a total of 130 chicken-owning households actively engaged in poultry production were selected for the study.

**Method of Data Collection**

Both primary and secondary data were utilized in this study. Primary data were collected through multiple approaches. A semi-structured questionnaire was administered to interview the selected households. Additionally, focus group discussions (FGDs), key informant interviews, and personal observations were conducted to gather more in-depth insights. Each FGD involved eight participants from the respective villages, including livestock experts, village leaders, elders, women, socially respected individuals, and district development agents. These discussions primarily focused on chicken production practices and the constraints faced by producers. Secondary data were obtained from regional and district offices, including the Pastoral Development Office. This information provided background on chicken production systems, management practices, and challenges in the study area, supplementing the primary data collected through fieldwork. To achieve the research objectives, the study assessed various management and production parameters such as the purpose of keeping chickens, feed resources, feeding management, water sources and watering management, and housing management.

**Egg Sampling and Evaluation of Quality Characteristics**

Fresh eggs were collected from adult laying hens during the field survey to evaluate egg quality. The samples were gathered from selected villages within and around Borama District. A total of 30 egg samples were collected, with 15 eggs from urban villages (Haya Yabo and Sh. Osman) and 15 from rural villages (Darey Macane and Shirwac). These eggs were randomly selected from chicken producers in the chosen villages.

The samples were carefully handled to preserve their quality and were stored at room temperature until analysis. After collection, the eggs were transported to Haramaya University, where both external and internal egg quality parameters were evaluated at the poultry laboratory.

External quality traits measured included egg weight (g) and eggshell weight (g), using an electronic sensitive weighing balance. For internal quality assessment, eggs were broken onto a flat mirror slide surface. The thick albumen height (AH) was measured at its widest part, approximately halfway between the yolk and the outer edge, using a tripod micrometer. The yolks were carefully separated from the albumen, and both thick albumen height and yolk height were recorded. Albumen and yolk weights were also measured separately with an electronic sensitive balance.

Yolk color was assessed using the Roche Color Fan (printed in Switzerland), a standard colorimetric system ranging from 1 to 15. The Haugh unit (HU), an indicator of egg quality, was calculated based on albumen height and egg weight using the formula by Haugh (1937):



Where: HHU = Haugh unit; AH = albumen height (mm); and EW = egg weight (g)

**Data Analysis**

The survey data were analyzed using simple descriptive statistics, including means, frequencies, and percentages. Categorical variables were compared using the Chi-square (χ²) test with the Statistical Package for Social Sciences (SPSS) software, version 26. For the egg quality characteristics such as egg weight, egg height, albumen weight, albumen height, and related parameters the data were analyzed using one-way Analysis of Variance (ANOVA) in SPSS (version 26). This analysis facilitated the comparison of mean values of egg quality traits between rural and urban village samples, enabling identification of any significant differences in egg quality across these areas.

**RESULTS AND DISCUSSION**

**Demographic Characteristics of the Respondents**

The study compared socio-demographic characteristics between respondents from urban villages (n=67) and rural villages (n=64), with a total sample size of 131. The sex distribution did not differ significantly between the two groups (p = 0.19), with females representing the majority in both urban (88.1%) and rural (79.7%) areas. Similarly, age groups showed no significant difference (χ² = 0.05, p = 0.99), with most respondents aged between 31 and 40 years in both settings. However, education levels differed significantly between urban and rural villages (p < 0.001). A higher proportion of rural respondents were illiterate (48.4%) compared to urban respondents (14.4%), while more urban respondents reported being able to read and write (68.7%) than rural respondents (28.1%). No significant differences were found in experience (p = 0.90) or marital status (p = 0.90) between the two groups. The average family size was significantly larger in rural villages (7.1 ± 0.17) compared to urban villages (6.4 ± 0.12), with the overall mean family size being 6.73 ± 0.11 (p = 0.002). These findings indicate that while sex, age, experience, and marital status were comparable between urban and rural respondents, education and family size showed notable differences.

The significant disparity in education levels, where nearly half of rural respondents were illiterate compared to only 14.4% in urban areas reflects challenges documented by Mohamed *et al.* (2016), who noted that limited education in rural settings restricts the adoption of improved poultry management practices in Jigjiga Zone, Somali Region. This educational gap can also influence productivity and innovation uptake, consistent with Abdi-Soojeede and Funwie (2022), who reported that farmers in Mogadishu face knowledge and skill limitations impacting chicken production efficiency.

Additionally, the larger family size in rural villages (7.1 vs. 6.4 in urban areas) is notable and may have implications for labor availability and household resource allocation in poultry and livestock production, as discussed by Gaas (2018), who emphasized that pastoral and agricultural households in Somaliland rely heavily on family labor to cope with recurrent drought and food insecurity. The predominance of females in both urban and rural groups (84% overall) aligns with findings by Mohamed *et al.* (2023), who highlighted women’s critical roles in managing local poultry value chains in Somaliland, despite challenges such as low literacy and limited access to extension services.

The lack of significant differences in age, experience, and marital status suggests that these factors may be relatively stable across the region, resonating with Warsame and Turyasingura (2022), who reviewed the status of non-ruminant animal production in Somalia and found similar demographic patterns among producers. However, persistent education disparities call for targeted interventions, as low literacy has been linked to higher disease prevalence in poultry (Mio et al., 2022), which undermines production sustainability.

Table 1. Demographic characteristics of respondents in the study area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban Villages (n=67)** | **Rural Villages (n=64)** | **Overall (n=131)** | **χ² (t)** | **p-value** |
| **Sex** |  |  |  | 2.01 | 0.19 |
| Female | 59 (88.1%) | 51 (79.7%) | 110 (84.0%) |  |  |
| Male | 8 (11.9%) | 13 (20.3%) | 21 (16.0%) |  |  |
| **Age** |  |  |  | 0.05 | 0.99 |
| 21–30 years | 10 (14.9%) | 10 (15.6%) | 20 (15.3%) |  |  |
| 31–40 years | 42 (62.7%) | 40 (62.5%) | 82 (62.6%) |  |  |
| 41–50 years | 11 (16.4%) | 10 (15.6%) | 21 (16.0%) |  |  |
| >50 years | 4 (6.0%) | 4 (6.3%) | 8 (6.1%) |  |  |
| **Education** |  |  |  | 31.56 | 0.000 |
| Illiterate | 9 (14.4%) | 31 (48.4%) | 40 (30.5%) |  |  |
| Read and write | 46 (68.7%) | 18 (28.1%) | 64 (48.9%) |  |  |
| Primary school | 6 (9.0%) | 4 (6.3%) | 10 (7.6%) |  |  |
| Secondary school | 6 (9.0%) | 4 (6.3%) | 10 (7.6%) |  |  |
| Religious school | 5 (7.5%) | 2 (3.1%) | 7 (5.3%) |  |  |
| **Experience** |  |  |  | 0.22 | 0.90 |
| 1–3 years | 15 (22.4%) | 14 (21.9%) | 29 (22.1%) |  |  |
| 3–9 years | 45 (67.2%) | 43 (67.2%) | 88 (67.2%) |  |  |
| Over 10 years | 7 (10.4%) | 7 (10.9%) | 14 (10.7%) |  |  |
| **Marital status** |  |  |  | 0.22 | 0.90 |
| Single | 7 (10.4%) | 7 (10.9%) | 14 (10.7%) |  |  |
| Married | 54 (80.6%) | 51 (79.7%) | 105 (80.2%) |  |  |
| Divorced | 6 (9.0%) | 6 (9.4%) | 12 (9.2%) |  |  |
| **Family size** | 6.4 ± 0.12 | 7.1 ± 0.17 | 6.73 ± 0.11 | 3.20 | 0.002 |

**Purposes of Rearing Chicken**

The main purposes of keeping chickens among respondents in Borama district were similar across urban and rural villages, with the majority keeping chickens primarily for sale, 73.1% in urban and 71.9% in rural areas resulting in an overall 72.5%. This difference was not statistically significant (p = 0.91). Home consumption was the second most common purpose, reported by about 20% of respondents in both settings, while stock replacement was the least cited purpose, around 6-8% overall. Regarding the purposes for eggs, significant differences were observed (p = 0.006). A larger proportion of rural respondents (75.0%) kept eggs primarily for hatching compared to 49.3% in urban villages. Conversely, more urban respondents (37.3%) kept eggs for sale compared to only 21.9% in rural areas. Home consumption of eggs was low overall but higher in urban (13.4%) than rural (3.1%) settings.

The predominance of chicken rearing for sale in both urban and rural settings aligns with findings by Mohamed *et al.* (2016) and Abdi-Soojeede and Funwie (2022), who reported that small-scale poultry production in Somali and Somaliland regions largely serves income generation and livelihood diversification purposes. The similar proportions in urban and rural villages suggest that commercial motives are widespread irrespective of location, reflecting the importance of poultry as a cash source in both contexts. However, the significant rural preference for hatching eggs indicates a stronger emphasis on flock replenishment and sustainable production in rural areas, which may be linked to limited access to external stock and a desire to maintain self-sufficiency, as noted by Mohamed *et al.* (2023) in their local poultry value chain analysis in Somaliland. This contrasts with urban producers who are more likely to sell eggs, possibly due to better market access and higher demand in urban markets (Warsame & Turyasingura, 2022).

The relatively low proportions keeping eggs for home consumption, especially in rural areas, might reflect household food security priorities or cultural preferences for using eggs as a market commodity rather than direct nutrition, consistent with observations by Gaas (2018) regarding pastoral and agro-pastoral community food use patterns. These patterns suggest that interventions to improve poultry productivity and sustainability should consider these differing priorities. For example, rural areas may benefit more from programs supporting improved breeding and hatching practices, while urban producers might focus on enhancing marketing, packaging, and value addition strategies (Mohamed *et al.,* 2016; SomalilandBiz, 2021/2022).

**Table 2.** Main purposes of keeping chicken in Borama district by respondents (%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban villages (n=67)** | **Rural villages (n=64)** | **Overall (n=131)** | **χ² value** | **p-value** |
| **Purpose of keeping chicken** |  |  |  |  |  |
| For sale | 49 (73.1%) | 46 (71.9%) | 95 (72.5%) | 0.07 | 0.91 |
| Home consumption | 14 (20.9%) | 13 (20.3%) | 27 (20.6%) |  |  |
| Stock replacement | 4 (6.0%) | 5 (7.8%) | 9 (6.9%) |  |  |
| **Purpose of egg** |  |  |  |  |  |
| Hatching | 33 (49.3%) | 48 (75.0%) | 81 (61.8%) | 9.11 | 0.006 \* |
| For sale | 25 (37.3%) | 14 (21.9%) | 39 (29.8%) |  |  |
| Home consumption | 9 (13.4%) | 2 (3.1%) | 11 (8.4%) |  |  |

*Different superscripts in the rows indicate significant differences at P < 0.05.*

**Feed Resources and Feeding Management of Chicken**

There is a statistically significant difference (p = 0.03) between urban and rural villages in feeding systems. In urban villages, an overwhelming majority (97.0%) practice scavenging with supplementation, whereas only 62.5% of rural respondents supplement scavenging. Conversely, scavenging only is much more common in rural villages (37.5%) compared to urban (3.0%). Overall, 80.2% of respondents provide some supplementation along with scavenging, while 19.8% rely solely on scavenging. There is a highly significant difference (χ² = 22.53, p < 0.001) between urban and rural villages regarding feed sources. Urban respondents predominantly use food leftovers (50.7%) as feed, while rural respondents rely more heavily on cereal grains (53.1%). Scavenging is more frequent as a feed source in rural areas (37.5%) compared to urban (20.9%). Overall, cereal grains are the major feed source (40.5%), followed by food leftovers (30.5%) and scavenging (29.0%). The majority of respondents fed chickens once a day (75.6%), with fewer feeding twice (22.1%) or three times a day (2.3%), and there was no significant difference (p = 0.35) between urban and rural villages.

The feeding practices observed in Borama district show a distinct urban-rural divide, which is consistent with poultry production trends in many developing regions. The high proportion of scavenging with supplementation in urban areas (97%) likely reflects better access to supplementary feed resources such as food leftovers and commercial feed. Supplementation improves nutrient intake and supports better growth and productivity (Simeneh, 2019). In contrast, the rural reliance on scavenging only (37.5%) may be driven by limited access to supplementary feeds and higher dependence on natural foraging, which could restrict productivity due to variable feed quality and quantity (Adene & Oguntade, 2006).

The preference for food leftovers in urban villages aligns with urban agro-food waste availability, reducing feed costs and enhancing sustainability. However, the reliance on cereal grains in rural areas indicates more direct feed inputs, which might increase production costs but potentially provide more consistent nutrition (Mohammed, 2018). The significant use of scavenging in rural settings shows the continued role of free-range systems, which can be both a strength (low input, disease exposure) and a weakness (nutrient limitations). The predominant once-daily feeding frequency in both settings could limit growth rates and egg production compared to multiple daily feedings that ensure more continuous nutrient supply (Kpomasse *et al.,* 2023). However, cultural practices, labor availability, and feed cost likely influence this pattern.

The combination of scavenging with supplementation, especially in urban areas, is beneficial for improving poultry health and production outcomes. In rural areas, enhancing access to supplementary feed and encouraging more frequent feeding could boost productivity and resilience. Extension services could focus on training farmers in better feed management practices, including balanced supplementation and feeding schedules.

**Table 3.** Feed resources and feeding management of chicken in Borama district by respondents

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban villages (n=67)** | **Rural villages (n=64)** | **Overall (n=131)** | **χ² value** | **p-value** |
| **Feeding system** |  |  |  | 6.99 | 0.03\* |
| Scavenging only | 2 (3.0%) | 24 (37.5%) | 26 (19.8%) |  |  |
| Scavenging with supplementation | 65 (97.0%) | 40 (62.5%) | 105 (80.2%) |  |  |
| **Source of feed** |  |  |  | 22.53 | 0.000\* |
| Cereal grains | 19 (28.4%) | 34 (53.1%) | 53 (40.5%) |  |  |
| Food leftover | 34 (50.7%) | 6 (9.4%) | 40 (30.5%) |  |  |
| Scavenging | 14 (20.9%) | 24 (37.5%) | 38 (29.0%) |  |  |
| **Frequency of feeding** |  |  |  | 2.10 | 0.35 |
| Once a day | 57 (85.1%) | 42 (65.6%) | 99 (75.6%) |  |  |
| Twice a day | 9 (13.4%) | 20 (31.3%) | 29 (22.1%) |  |  |
| Three times a day | 1 (1.5%) | 2 (3.1%) | 3 (2.3%) |  |  |

*Different superscripts in the rows indicate significant differences at P < 0.05.*

**Watering practices for chickens**

There was no statistically significant difference (*p* = 0.81) between urban and rural respondents in terms of whether they provide water to their chickens. A vast majority in both urban (91.0%) and rural (92.2%) areas reported giving water to their chickens, indicating a generally good awareness of the importance of hydration.

There is a significant difference (*p* < 0.001) between urban and rural areas in how often water is offered. Free access to water is more common in urban areas (71.6%) compared to rural areas (39.1%). Rural households are more likely to offer water once a day (48.4%) or twice a day (12.5%), while no urban household reported watering twice a day.

There is a highly significant difference (*p* < 0.001) between urban and rural areas in terms of water sources: Pipe water is the dominant source in urban areas (68.7%) but completely absent in rural areas (0%). In rural areas, pond water (42.2%) and rainwater (32.8%) are the most common sources. Spring water is used in both settings, though more frequently in rural areas (25.0%) than urban ones (14.9%).

Water is essential for poultry survival, growth, egg production, and thermoregulation. The data from Borama district reflect important contrasts between urban and rural poultry watering practices, driven largely by infrastructure and resource availability.

The high percentage (>91%) of households providing water is encouraging and aligns with standard poultry management practices. Adequate water is particularly vital in arid and semi-arid areas like Somaliland, where dehydration and heat stress can severely affect productivity (Teklay *et al.,* 2024). The small percentage (8.4%) of households not providing water may indicate neglect or reliance on indirect sources (e.g., scavenging wet feed or natural sources), which should be addressed through extension services.

The significant difference in watering frequency between urban and rural areas likely stems from differences in water availability and labor constraints. Urban poultry keepers’ higher rates of free access may relate to better infrastructure, such as piped water and proximity to housing. This practice ensures that chickens remain well-hydrated throughout the day, especially critical during hot seasons. In contrast, rural keepers relying on once or twice daily watering may risk intermittent dehydration, particularly if ambient temperatures are high, or if chickens are far from water points.

The dependence on surface and rainwater in rural areas introduces potential health risks. Ponds and rain catchments are more prone to contamination, which can result in waterborne diseases such as coccidiosis or salmonellosis (Amenu, 2013). Conversely, the urban reliance on piped water offers a safer and more consistent water quality. Rainwater use in rural settings, while a practical adaptation, may be unreliable during dry seasons and requires proper storage systems to be safe.

**Table 4.** Watering practices for chickens in Borama district by residence (%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban villages (n=67)** | **Rural villages (n=64)** | **Overall (n=131)** | **χ² value** | **p-value** |
| **Provision of water** |  |  |  | 0.06 | 0.81 |
| Yes | 61 (91.0%) | 59 (92.2%) | 120 (91.6%) |  |  |
| No | 6 (9.0%) | 5 (7.8%) | 11 (8.4%) |  |  |
| **Frequency of watering** |  |  |  | 17.90 | 0.000\* |
| Free access | 48 (71.6%) | 25 (39.1%) | 73 (55.7%) |  |  |
| Once a day | 19 (28.4%) | 31 (48.4%) | 50 (38.2%) |  |  |
| Twice a day | 0 (0.0%) | 8 (12.5%) | 8 (6.1%) |  |  |
| **Sources of water** |  |  |  | 42.90 | 0.000\* |
| Spring water | 10 (14.9%) | 16 (25.0%) | 26 (19.8%) |  |  |
| Pipe water | 46 (68.7%) | 0 (0.0%) | 46 (35.1%) |  |  |
| Pond water | 0 (0.0%) | 27 (42.2%) | 27 (20.6%) |  |  |
| Rain water | 11 (16.4%) | 21 (32.8%) | 32 (24.4%) |  |  |

*Different superscripts in the rows indicate significant differences at P < 0.05.*

**Housing System of Chicken**

There is a highly significant difference in the type of poultry housing system used between urban and rural respondents (p < 0.001). Traditional housing is dominant in rural areas (92.2%) compared to 41.8% in urban areas. The deep litter system is more common in urban areas (35.8%) than rural ones (7.8%). Backyard housing is reported only in urban areas (22.4%). No statistically significant difference was observed regarding the lack of attention to poultry housing (p = 0.50). A similar proportion of both urban (16.6%) and rural (12.5%) respondents reported not prioritizing poultry housing, possibly indicating knowledge or resource limitations in both areas.

Poultry housing plays a critical role in protecting chickens from predators, weather extremes, and disease vectors. The results highlight marked urban-rural disparities in poultry housing systems in the Borama district. Traditional houses typically made from local materials such as sticks, mud, or thatch are heavily relied upon in rural areas (92.2%). These structures are inexpensive and locally appropriate but often lack adequate ventilation, predator protection, and sanitation. This could predispose chickens to respiratory problems, parasitism, or predation, especially at night or during extreme weather. Similar trends have been observed in other Somali regions, where traditional housing remains the backbone of rural poultry production (Yusuf *et al.,* 2023).

The deep litter system, more prevalent in urban areas (35.8%), indicates higher adoption of improved management practices. This system typically involves housing birds on a bed of absorbent material (like sawdust or straw) inside a confined and protected structure, allowing for better disease control and productivity. Urban producers may have better access to extension services, training, or capital to invest in such housing systems.

Additionally, the use of backyards (22.4%) in urban areas reflects integrated poultry keeping, where birds roam within fenced compounds during the day and are housed at night, a strategy that allows semi-intensive management and efficient use of space.

Around 14.5% overall of respondents did not prioritize poultry housing. This neglect can have serious implications for flock health and productivity. Lack of proper housing can increase exposure to predation, theft, adverse weather, and diseases, all of which are preventable with basic infrastructure (Ahmed & Mohamoud, 2022). This calls for awareness-raising and training, particularly in promoting cost-effective and practical housing models for smallholders.

**Table 5.** Housing system of poultry in Borama district by residence (%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban villages (n=67)** | **Rural villages (n=64)** | **Overall (n=131)** | **χ²** | ***P*** |
| **Type of house** |  |  |  | 45.72 | 0.000\* |
| Traditional | 28 (41.8%) | 59 (92.2%) | 87 (66.4%) |  |  |
| Deep litter | 24 (35.8%) | 5 (7.8%) | 29 (22.1%) |  |  |
| Backyard | 15 (22.4%) | 0 (0.0%) | 15 (11.5%) |  |  |
| Lack of attention | 11 (16.6%) | 8 (12.5%) | 19 (14.5%) | 0.45 | 0.50 |

*Different superscripts in the rows indicate significant differences at P < 0.05.*

**Poultry Diseases and Health Care Practices**

A high proportion of respondents reported poultry disease occurrence in both urban (97.0%) and rural (100%) areas, with no statistically significant difference (p = 0.16). This suggests that disease is a widespread challenge regardless of location. The most commonly reported disease is Newcastle Disease (NCD), affecting over 93% of flocks in both urban and rural settings. Other diseases, including coccidiosis, fowl pox, internal parasites, and respiratory infections, were reported at much lower frequencies, and there was no significant difference across locations (p = 0.677). There was no statistically significant difference in the disease control practices used across the two groups (p = 0.426). The most common practice was traditional methods (38.2%), followed by no control measures at all (28.2%). These traditional methods include the application of ash to chicken shelters to control parasites, isolation of sick birds for natural recovery, smoke fumigation of chicken shelters to repel or kill parasites, and the use of boiled herbal mixtures administered orally or mixed with drinking water. The use of vaccination (3.1%) and modern drugs (13.0%) was very limited.

The overwhelming prevalence of Newcastle Disease (NCD) aligns with findings in other parts of the Horn of Africa where it is a major killer of village poultry. Its endemic presence reflects low vaccination rates, poor biosecurity, and limited veterinary infrastructure. NCD outbreaks can result in up to 100% flock mortality in unvaccinated chickens, posing a serious threat to rural livelihoods (Mohamud *et al.,* 2020).

Despite the availability of vaccines and treatments for common poultry diseases, only 3.1% of respondents use vaccination, and 13% use modern treatments. This may be due to Limited awareness or access to veterinary services and drugs, Cost constraints, particularly for rural households. Greater reliance on indigenous knowledge systems, including herbal remedies or spiritual practices.

Over 66% of respondents either rely on traditional methods (38.2%) or do nothing (28.2%) in response to poultry diseases. This underscores the knowledge gap in modern poultry health management. It also signals the need for capacity-building interventions, particularly in rural areas where disease burden and poverty are typically more severe.

**Table 6.** Poultry diseases and health care practicesin Borama district by residence (%)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **Urban villages (n=67)** | **Rural villages (n=64)** | **Overall (n=131)** | **χ²** | ***P*** |
| **Occurrence of disease** |  |  |  | 2.00 | 0.16 |
| Yes | 65 (97.0%) | 64 (100%) | 129 (98.5%) |  |  |
| No | 2 (3.0%) | 0 (0.0%) | 2 (1.5%) |  |  |
| **Most prevalent diseases** |  |  |  | 3.80 | 0.677 |
| Newcastle disease | 63 (94.0%) | 59 (92.2%) | 122 (93.1%) |  |  |
| Coccidiosis | 4 (6.0%) | 5 (7.8%) | 9 (6.9%) |  |  |
| Fowl pox | 3 (4.5%) | 2 (3.1%) | 5 (3.8%) | - | - |
| Internal parasites | 2 (3.0%) | 4 (6.3%) | 6 (4.6%) | - | - |
| Respiratory infections | 1 (1.5%) | 3 (4.7%) | 4 (3.1%) | - | - |
| **Control measures used** |  |  |  | 3.89 | 0.426 |
| Traditional method | 22 (32.8%) | 28 (43.8%) | 50 (38.2%) |  |  |
| Vaccination | 3 (4.5%) | 1 (1.6%) | 4 (3.1%) |  |  |
| Treatment (modern drugs) | 10 (14.9%) | 7 (10.9%) | 17 (13.0%) |  |  |
| Hygiene practices | 14 (20.9%) | 9 (14.1%) | 23 (17.6%) |  |  |
| No control measures | 19 (28.4%) | 18 (28.1%) | 37 (28.2%) |  |  |

*Different superscripts in the rows indicate significant differences at P < 0.05.*

**Constraints of Chicken Production**

The results presented in Table 7 indicate that the major constraints facing village chicken production in Borama district include predation (45.0%), flock mortality (20.6%), disease (14.5%), and feed shortage (9.2%). Predation was the most dominant constraint, especially in urban villages (49.3%), while flock mortality was reported almost equally in both urban and rural areas. Although disease and feed shortage were relatively less cited, their impact on production should not be underestimated. These constraints collectively highlight the vulnerability of local poultry production systems to both environmental and management-related challenges.

The predominance of predation as a constraint reflects inadequate housing and confinement systems, exposing chickens to predators, especially in free-range and backyard settings. This aligns with observations by Mohamed *et al.* (2016), who found predation to be a leading cause of poultry loss in Somali regions due to poor nighttime housing. Similarly, flock mortality in Borama is consistent with findings by Hussein *et al.* (2022), who noted that high chick mortality was linked to disease, lack of brooding facilities, and poor management. Although only 14.5% of respondents explicitly cited disease as a constraint, the high levels of mortality suggest that diseases such as Newcastle and coccidiosis remain a persistent underlying issue, often underreported due to limited veterinary awareness. Feed shortage, cited by 9.2% of respondents, is likely seasonal and reflects broader challenges in feed availability and affordability, especially in rural areas with limited access to commercial feed markets. According to Mohamed *et al.* (2023), feed scarcity significantly reduces egg production and bird health in similar agro-ecological settings. Therefore, addressing these constraints calls for integrated interventions, including predator-proof housing, community-based veterinary services, improved feeding strategies using local resources, and farmer training to build resilience in village chicken production systems in Somaliland.

**Table 7.** Major constraints of village chicken production in Borama district (% of respondents)

|  |  |  |  |
| --- | --- | --- | --- |
| **Constraint(s)** | **Urban Villages** | **Rural Villages** | **Overall** |
| Disease | 9 (13.4%) | 10 (15.6%) | 19 (14.5%) |
| Feed shortage | 5 (7.5%) | 7 (10.9%) | 12 (9.2%) |
| Flock mortality | 14 (20.9%) | 13 (20.3%) | 27 (20.6%) |
| Predators | 33 (49.3%) | 26 (40.6%) | 59 (45.0%) |

**Egg Quality Traits**

The egg quality traits of chickens from urban and rural villages in Borama district were largely similar, with no significant differences in most parameters such as egg weight, yolk height, yolk weight, yolk color, albumin weight, and shell weight (p > 0.05). The only significant difference observed was in albumin height, where eggs from urban villages had a higher albumin height (4.1 ± 0.21 mm) compared to rural villages (3.5 ± 0.10 mm) with a p-value of 0.04. This suggests that while overall egg characteristics are consistent between the two environments, albumin quality may be slightly better in urban settings.

The similarity in most egg quality traits between urban and rural village chickens in Borama suggests that environmental or management differences between these locations do not substantially affect egg physical characteristics. The significant difference in albumin height, an important indicator of egg freshness and protein quality, could be related to differences in feeding practices, hen nutrition, or stress levels, which may be more favorable in urban settings due to better feed supplementation and management (Khalaf et al., 2020). This aligns with findings by Ali *et al.* (2022), who reported that improved feeding and supplementation positively influenced albumin quality in indigenous chickens. Additionally, the comparable egg weights and yolk traits indicate that the genetic potential of local chickens is consistent across the district, supporting the use of local breeds for sustainable poultry production in both urban and rural contexts (Hassan *et al.,* 2021). Maintaining or improving egg quality in rural areas may benefit from interventions aimed at enhancing nutrition and health management, which can subsequently improve the livelihoods of smallholder poultry producers in Somaliland.

**Table 8.** Egg quality traits (Mean ± SEM) of urban and rural village chickens inBorama district

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Egg Parameter** | **Urban Villages** | **Rural Villages** | **Overall** | ***P-value*** |
| Egg weight (g) | 44.4 ± 0.67 | 44.5 ± 0.94 | 44.5 ± 0.56 | 0.90 |
| Yolk height (mm) | 14.1 ± 0.05 | 13.8 ± 0.30 | 13.9 ± 0.20 | 0.30 |
| Albumin height (mm) | 4.1 ± 0.21 | 3.5 ± 0.10 | 3.8 ± 0.12 | 0.04 |
| Yolk weight (g) | 15.9 ± 0.51 | 16.5 ± 0.66 | 16.2 ± 0.41 | 0.47 |
| Yolk color | 9.67 ± 0.35 | 9.53 ± 0.35 | 9.60 ± 0.24 | 0.78 |
| Albumin weight (g) | 22.3 ± 0.58 | 24.1 ± 0.63 | 23.2 ± 0.45 | 0.47 |
| Shell weight (g) | 4.3 ± 0.18 | 3.9 ± 0.19 | 4.1 ± 0.13 | 0.14 |

SEM = Standard Error of the Mean. Means with different superscripts within a row indicate significant differences at *p* < 0.05.

**CONCLUSION**

The study demonstrated notable differences in chicken production practices between urban and rural villages in Borama district. Urban producers generally had better educational status, feeding systems with supplementation, water access, and housing conditions compared to rural producers. Despite these differences, disease prevalence, especially Newcastle disease, remained high across both settings, and predation was the most significant constraint affecting flock survival. Egg quality traits were mostly similar, except for albumin height, which was higher in urban areas, potentially reflecting better management. These findings underscore the need for targeted interventions to improve village chicken production based on locality-specific challenges. Priority should be given to enhancing disease control measures through improved vaccination coverage and awareness campaigns to reduce the widespread impact of Newcastle disease, thereby increasing flock health and productivity across both urban and rural areas.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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