

Chickens feed resources and feeding trends in Konso Zone and Derashe special district, Southern Ethiopia

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ABSTRACT

The study was conducted to assess locally available chicken feed resources and feeding trends in the Karat zuria district of the Konso zone and Derashe special district. Multi-stage sampling techniques were used and a total of 120 respondent farmers from the districts who possess chicken production were involved. The data were collected by questionnaire, personal observation, and interviews. Potential cereals: sorghum ($95.0 \pm 0.22\%$ and $86.7 \pm 0.34\%$), teff ($65 \pm 0.48\%$ and $66.7 \pm 0.48\%$) from pulses haricot bean ($58.3 \pm 0.50\%$ and $45.0 \pm 0.50\%$); as vegetables Moringa stenopetala locally: Halako (96.7 ± 0.18 and 91.7 ± 0.28) in Karat zuria and Derashe special districts, respectively were identified as commonly locally promising human food as well as chicken feeds. Cooked food scraps (Fosase, Kurkufa); kitchen wastes, and protein sources (growing worms, termites, insects, grasshoppers, flies) local brewery residues (Cheka residues) were highly ranked as potential scavengeable feed resources (SFR) in both districts. However, January to May is the major month of the year severity of feed shortage (90% of respondents) mostly occurred. About 2/3 of farmers spreading the grain on the bare ground together for the whole groups of chicken once per day mainly for egg yield (41.67% of respondents) in the area was a very common trend of providing supplementary feed. Consequently, efforts have to be made to design and implement interventions, aiming at improving chicken feed resource base and feeding trends.

Keywords: Chicken, Feed, Districts, Feeding trends, Season, SFR.

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Highlights of this paper

- This paper aimed to assess locally available chicken feed resources and feeding trends in the mandate area.
- Multi-stage sampling techniques were used and a total of 120 respondent farmers from the districts who possess chicken production were involved.
- In this investigation, various types of chicken feed resources dominantly; sorghum, *teff*, and maize followed by haricot bean, sunflower, plant materials, fruit leaves, vegetables (*Moringa stenopetala*, local name: *Halako*), and other SFRs were identified in promising conditions.

1. INTRODUCTION

Rising income and urbanization in many parts of the developing world caused a growing demand for animal products. The poultry sector has the potential to provide relatively cheap animal protein to the population and improve nutritional status, create both rural and urban employment, and generate income in times of economic difficulty [1]. In Ethiopia poultry production is an important part of the mixed crop-livestock farming system practiced by most households where it plays a vital function through the provision of meat and eggs for home consumption and the generation of cash income through market exchange [2].

The sector in the country can be characterized into three major production systems based on some selected parameters such as breed, production objectives, flock size, housing, feed, health, technology use, management level, and bio-security. These are large-scale (commercial/intensive), small-scale (semi-intensive, and extensive (scavenging/free-ranging/ backyard) production systems [1, 3]. At the national level in Ethiopia, the scavenging family poultry production systems are the principal providers for the domestic market; and contribute over 98% of most of the national marketable poultry products [4].

The Ethiopian chicken population is estimated to be about 60.5 million, of which 54.06, 2.61, and 2.83 million are indigenous, exotic, and hybrid chickens, respectively [1, 5]. However, the economic contribution of the Ethiopian poultry sub-sector is not proportional to the huge chicken population of the country, due to the presence of many production, reproduction, and infrastructural constraints [1, 6]. Both good quality and quantity feed scarcity, cost of feed, marketing constraints, diseases, predators, and biosecurity are the most important factors affecting chicken production systems [7].

Chicken feed sources in terms of quality and quantity are one of the most critical constraints to chicken production under both the rural smallholder and large-scale systems in Ethiopia [7, 8]. Feed costs for chicken production account for about 60-70% of production costs under intensive production systems [9]. However, in village chicken production systems, it is difficult to estimate the economic and/or physical value of this input because there are no direct methods of estimating the scavenged feed resource that constitutes most of the feed input [10]. To make full use of the productive potential of chicken, a feed that is sufficient in both quality and quantity has to be provided. According to the report of Goromela, et al. [11] both egg production and egg size vary with season, as the quality and availability of feed varies; that indicates scavenging feed resources for local birds are inadequate and variable depending on season [12].

To tackle the constraints, the problem is mainly associated with most farmers not using home-mixed ration due to lack of knowledge, cost of ingredients and unavailability of ingredients [8, 13], limited knowledge of the daily amount of feed given per chicken, limited knowledge about locally available feed resources and nutritional quality [8], farmers had no clear idea in terms of the quality and quantity of supplementary feeds, lack of processing facilities, inconsistent availability [14]. In addition, smallholder farmers from different corners of the country have limited access to the formulated rations and when available, purchase it with its high cost and transportation expenditure [15, 16] are major facts associated with chicken feed.

Even though there were various studies conducted on chicken feed resources and feeding practices in some specific locations of the country by some researchers [8, 15], due to the diverse agro-ecology and agronomic practice prevailing in Ethiopia, that may not necessarily represent the locally available feed resources of chickens in the whole country in general and in the study area of Ethiopia in particular. The amount of feed available for scavenging about the carrying capacity of the land areas and flock dynamics across the different seasons and agroecologies is still not adequately quantified. Hence, understanding the existing feed resources; and feeding trends used by chickens need to be identified to aid the rational utilization of locally available feed resources. Therefore, the present study was designed with the objectives of: Assessing locally available chicken feed resources and feeding trends of chickens in the mandate areas.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in two selected districts of the Konso zone (Karat Zuria district) and the Derashe special district of the South Ethiopia region. Konso zone is located 522 km south of Addis Ababa in the Great Rift Valley and bordered on the south by the Oromia region, on the west by the South Omo zone, on the northwest by the Alle special district, on the north by Derashe special district, on the northeast by Amaro special district, and on the east by Burji special district. The Sagan River, which flows south then west to join the Weyto, defines part of the district's boundary with Burji and the entire length of the boundary with the Oromia Region. The administrative center is Karat. The native Konso traditionally practices a distinct and sustainable form of agriculture that involves the building and maintaining of stone terraces, and fertilizing the fields with manure. A central feature of their fields is the endemic tree crop, *Moringa stenopetala*. The main crop is sorghum, *teff*, and maize. The main agricultural area ranges from 1400 m to 2000 m above sea level. This semi-arid, dry, and inhospitable place requires immense human effort to survive. Temperatures are not extreme and vary from 15°C to 33°C. However, the area is situated in a dry belt with very unreliable rainfall. Rainfall distribution follows a bimodal pattern; the average total annual rainfall is only 551 mm. The rains are split into two rainy seasons. The big rains are concentrated at the end of February until May and the small rains occur around September and November ([@June 2023](https://en.wikipedia.org/wiki/Konso_Zone)).

Derashe Special District is 490 km away from Addis Ababa and geographically bordered on the South by the Konso Zone, on the West by the Ale Special District on the North by the Gamo Zone, on the North-East by Lake Chamo, and on the East by Amaro Special Woreda [17]. The elevation of the district ranges from 1140m to 2640 meters above sea level and lies at 5°39'59" N Latitude and 37°19' 60" E longitude with a total land area of 69,938 ha. The climatic condition of the district is characterized as: 38.89% highland; 16.67% midland and 44.44 % lowland with the mean annual temperatures ranging between 15.1 and 27.5° C and whereas, the average annual rainfall ranges from 600 to 1600 mm [17]. The common agricultural production system overcome in the study area is the mixed crop-livestock production system. The major growing crops in the study area are maize, sorghum, *teff*, and wheat.

2.2. Sampling Procedures and Sample Size

A Multi-stage sampling procedure (purposive and random) was applied for the study; hence, two districts Karat Zuria district (Konso zone) and Dherashe special district were selected purposively based on criteria related to ease of accessibility and lack of published documents on the current issue. From each district, three kebeles (a total of six kebeles) were selected by simple random sampling technique for the survey based on their representation of the district, chicken production potential, and road accessibility. From each of the selected kebeles, 20 households were selected randomly from each kebele by giving equal chance to those farmers who possess chickens with different flock sizes,

chicken husbandry systems, accessibility, and other related practices. Hence, a total of 120 (2 districts x 3 kebeles x 20 Hhs) chicken owner households were used study.

2.3. Procedures of Data Collection

The Primary data were collected through field observation, administering pre-tested structured questionnaires, and organizing group discussions. Before the commencement of the survey, the questionnaires were pre-tested using sample HHs, and appropriate adjustments were made to specific contents. The interviews were conducted at farmers' houses with the assistance of local agricultural extension/development agents drawn from each kebeles'. Secondary data were collected from various sources including the Agricultural and Rural Development office of the district and online published materials. One focus group discussion that included 30 elderly members and districts' Agriculture office and Rural Development experts to have an overview of chicken feed resources and its challenges per district was carried out to collect data other than the individual interviews. Members of the focus groups were selected from the community known to have a good understanding of chicken feeding and husbandry. Data was collected on locally available chicken feed resources, crops grown in the area, chicken supplementary feeds, periods of supplementation and frequency, green feeds, non-conventional feed resources, feeding practices, and feed scarcity coping mechanisms were collected around the mandate area.

2.4. Data Analysis

Survey data were analyzed using descriptive statistics and statistics by [Statistical Package for Social Sciences \(SPSS\) \[18\]](#) version 20, software.

3. RESULTS AND DISCUSSIONS

3.1. Crops Grown in the Area

The result of the present study in the districts illustrates various crops available in the area for the chicken ([Table 1](#)). The main cereals intensively cultivated and serve as ingredients of diets for chickens in Karat zuria (Konso zone) and Derashe are sorghum ($95.0 \pm 0.22\%$ and $86.7 \pm 0.34\%$), maize (60 ± 0.49 and $65 \pm 0.48\%$), and teff ($65 \pm 0.48\%$ and $66.7 \pm 0.48\%$) of the respondents, respectively. The current result is in line with the report of [Lemlem, et al. \[19\]](#). From the pulses, about $58.3 \pm 0.50\%$ and $45.0 \pm 0.50\%$ of respondents have haricot beans in Karat zuria and Derashe districts, respectively. Among the oil crops, sunflower contains $28.3 \pm 0.45\%$ of respondents who produce it in each district.

Enset (*Ensete ventricosum*), as a root crop, is the most important cash crop in Derashe's highland parts; however, it isn't available in Konso. Its by-products amicho meal, bulla, and kocho were used as feeds for chicken [[8](#), [20](#)]. The *Moringa stenopetala* (local name: Halako), as a vegetable (green feed for chickens), contains the highest percent ([Table 1](#)) and is commonly found in all Kebeles of the study area the reason it was produced from their farm, and most common consumable food [[21](#)]. In all Kebeles of Konso and Derashe districts, people use the leaves of the *Moringa stenopetala* tree as a staple and nutritious vegetable in the semiarid rift valley, adding to the food system for the dietary requirements of children and mature people. The leaves are harvested every afternoon, added to the three meals, and mixed with sorghum or maize flour when cooking the local food "kurkufa" [[19](#)]. Due to the rich nutrient content of *Moringa stenopetala* leaves can be used as a crucial resource of dietary supplementation for livestock as well as chicken. It is used as an antimicrobial, has anti-coccidial effects, reduces cholesterol levels in eggs, better yolk color, and enhances growth performance and carcass traits in chickens. The Konso believe that God has given these traditional plants to their ancestors in the mythological past [[21](#), [22](#)].

Table 1. Major crops cultivated in the study area.

Crops grown	Districts		Crops grown	Districts	
	Karat zuria (% hh±SD)	Derashe (% hh±SD)		Karat zuria (% hh±SD)	Derashe (% hh±SD)
1. Cereals			4. Roots and tubers		
Sorghum	95 ±0.22	86.7±0.34	Sweet potato	8.3±0.28	21.7±0.42
Maize	60±0.49	65.0±0.48	Cassava	16.7±0.38	23.3±0.43
Teff	65±0.48	66.7±0.48	Potato	15.0±0.36	31.7±0.47
Wheat	3.3±0.18	13.3±0.34	Enset	0.0±0.00	11.7±0.32
Barley	1.7±0.13	8.30±0.28	Taro	10.0±0.30	16.7±0.38
2. Pulses			5. Vegetables		
Faba bean	1.7±0.13	6.7±0.25	Moringa	96.7±0.18	91.7±0.28
Haricot bean	58.3±0.50	45.0±0.50	Tomato	15.0±0.36	10.0±0.30
Chickpea	28.3±0.45	26.7±0.45	Cabbage	8.3±0.28	23.3±0.43
Pigeon pea	8.3±0.28	6.7±0.25	Pumpkin	3.3±0.18	5.0±0.22
3. Oil crops			6. Fruits		
Sunflower	28.3±0.45	28.3±0.45	Mango	30.0±0.46	28.3±0.45
Sesame	3.3±0.18	8.3±0.28	Avocado	16.7±0.38	23.3±0.43
Linseed	5.0±0.22	8.3±0.28	Coffee	18.3±0.39	23.3±0.43
Noug	0±0.00	0±0.00	Banana	5.0±0.22	16.7±0.38

Note: hh = Households per district (60); SD= Standard deviation; %=Percent of respondents.

Mango and avocado were identified as the dominant fruit crops (Table 1) under traditional production systems in the area. The fields of mango, avocado, and coffee were further intercropped with short-season crops such as millet and maize. Although the primary use of these crops produced from their farm was for human consumption, crops grown and their by-products can be used as a potential source of feed for smallholder chicken farmers as diet ingredients.

3.2. Chickens Scavenging Feed Resources (SFR)

Scavenging (obtaining their diets during the daytime mainly through scratching and foraging activities within the local environment) is the major feed resource in extensive village chicken production systems Minh, et al. [12] and Tadelle and Ogle [23]. Halima, et al. [6] also reported that 99.27% of the chickens were managed under a traditional or extensive chicken management (scavenging) system in North-west Ethiopia.

Different feeding materials are available for scavenging including crops as visually observed (Table 2). According to respondents' reactions, cooked food scraps/left-over (*Fosase, Kurkufa, injera*, pieces of bread); kitchen wastes (covering of tomatoes, egg shells, *kocho*, potatoes peels, other vegetables, and cooked foods); and Protein sources (growing worms, snails, termites, insects, grasshoppers, flies, and frogs) were highly ranked as potential SFR in both districts (Table 2). Furthermore, green edible leaf (grasses, weed leaf), *Moringa stenopetala* (Halako, local name), and brewery and alcohol residues (*Cheka* residues) were also locally available as well as accessible chicken feeds in the area. Study on effects of supplementation, breed, season, and location on feed intake and performance of scavenging chickens in Vietnam Minh, et al. [12] and Tadelle and Ogle [23] in the Central Highlands of Ethiopia reported that the main feed resources for village chicken were SFR from the immediate environment, food scraps or leftover and seeds, plant materials, worms, insects. In addition to that considerable chicken SFR was also obtained from grains from different crops through cultivating, harvesting, and processing cereals and pulse grains of maize, sorghum, and haricot bean [8]. However, the potential scavenging feed resources (SFR) is not constant, and the proportion that comes as a supplement and from the environment varies with activities such as season of the year, land preparation and sowing, harvesting, and grain availability in the household level, and the life cycle of insects and other invertebrates [23]. As a result, the nutritional

status of scavenging chicken in rural environments was expected below the nutrient requirements. Therefore, for increased production and productivity, it is important to supplement scavenging village chicken.

Table 2. Chicken Scavengeable feed resources (SFR) with ranks based on availability in the area.

Scavengeable feed resources by item	Districts					
	Karat zuria (% of respondents)			Derashe (% of respondents)		
	1 st	2 nd	3 rd	1 st	2 nd	3 rd
1. Cooked food scraps/Left-over (<i>Fosase, Kurkufa, injera</i> , pieces of bread)	91.67	8.33	0.00	95.00	5.00	0.00
2. Kitchen wastes (Covering of tomatoes, egg shells Kocho, potato peels, other vegetables, and cooked foods)	83.33	13.33	3.33	88.33	10.00	1.67
3. Protein sources (Growing worms, snails, termites, insects, grasshoppers, flies and frogs)	96.67	3.33	0.00	96.67	3.33	0.00
4. Grain products (Grains, cereal debris, and edible seeds)	56.67	30.00	13.33	65.00	23.33	11.67
5. Green edible leaf(Grasses, weed leaf)	80.00	18.33	1.67	83.33	15.00	1.67
6. Different fruit leaf, <i>Halako</i> or <i>Moringa stenopetala</i> , Cabbage, Pumpkin leaf	71.67	23.33	5.00	75.00	20.00	5.00
7. Improved forage leaf, grasses, herbs, fodder trees	61.67	31.67	6.67	61.67	31.67	6.67
8. Local brewery residues (<i>Cheka</i> residues)	90.00	6.67	3.33	86.67	10.00	3.33
9. Millhouse leftover, wheat bran	6.67	23.33	70.00	6.67	21.67	71.67
10. Sands and grits	98.33	1.67	0.00	96.67	3.33	0.00
11. Fish meal scraps	1.67	5.00	93.33	1.67	10.00	88.33

3.3. Status of Chicken Seasonal Feed Resource Availability

The report of Goromela, et al. [11] from central Tanzania and Minh, et al. [12] from Vietnam, shows, the season was a significant factor that determined the quantity and quality of the scavengeable feed resources and the way determine productivity of village scavenging chicken. Accordingly, most of the respondent farmers in the present study were challenged by seasonal feed shortages (Figure 1). The result is closely related to the report of Taddelle and Ogle [23]; Minh, et al. [12], and Goromela, et al. [11], in which feed resources for local birds, are inadequate and variable depending on season. The seasonal feed status result showed (Figure 1) that, January to May, is the major months of the year during which severity of feed shortage mostly occurs for village chicken as it is not the harvesting season of grain or cereal crops i.e. the extreme dry and/or rainy season of the year; more than 90% of the respondent farmers' chicken feed scarcity was serious. On the contrary, sufficient feed resources were available from July to August of the year (Figure 1) this is due to the harvesting season of *Belg* crops. The results of the mean percentage of respondents show that there was adequate feed availability during the short rainy season compared to the dry season i.e, green materials were the main components such as green edible leaves (*grasses, weed leaf*), different fruit leaves (*Halako* or *Moringa stenopetala*, cabbage, pumpkin leaf, forage leaf), Protein sources (growing worms, snails, termites, insects, grasshoppers, flies, and frogs) were common feed resources [15, 20].

There is a surplus availability of grains during harvesting of *Meher/hagaya* crops (November to end of December) were the months of crop harvesting seasons in the area in which surplus grain supplements were available although the quantities gradually decreased from January to May in which scavenging is the only sources of feed for back yard chicken. Therefore, to make full use of the productive potential of scavenging chicken, smallholder chicken farmers need to apply a means of feed scarcity coping mechanisms and fully exploit locally available surplus feed resources for

extremely dry seasons of the year moreover it is recommended that producers should use feed storage systems for scarce seasons and to balance/reduce flock size according to feed resources available in the environments in each season [8,20].

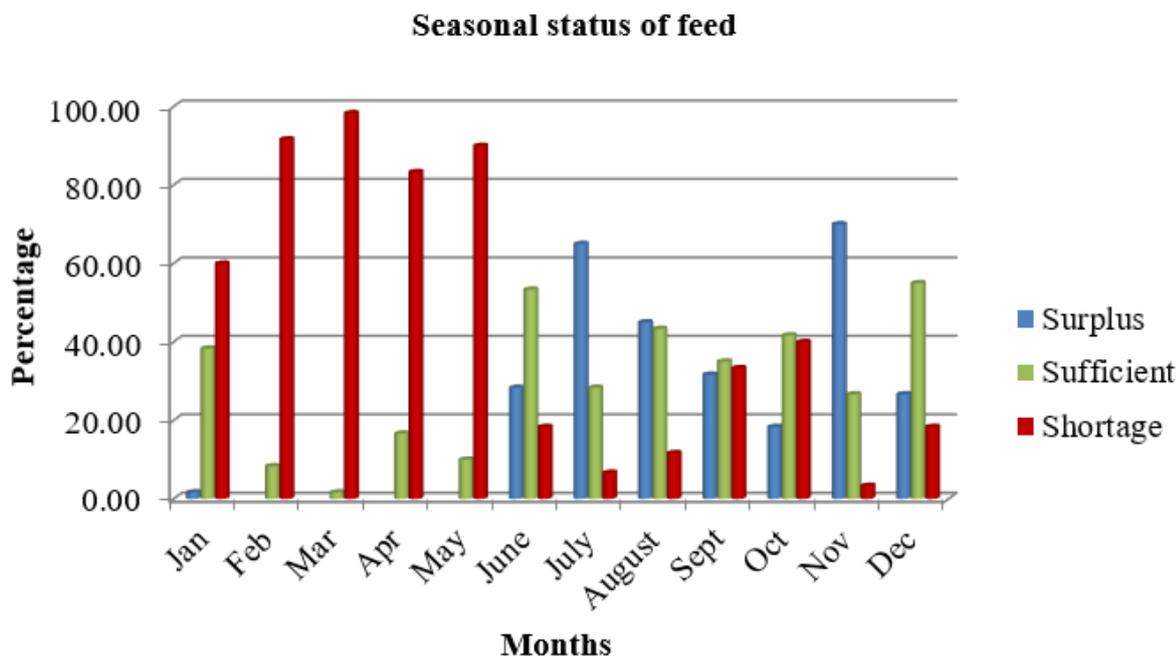


Figure 1. Seasonal availability of chicken feed resources.

3.4. Chicken Feeding Trends

In developing countries like Ethiopia, the overall standard of husbandry is mainly scavenging type and usually poor because of the low level of inputs [12, 23]. The trends of supplementary feeding and feeding systems of chickens are shown in Table 3. There are no planned feeding trends of chickens under traditional village production in Ethiopia in general in Konso and Derashe in particular [15].

The result of the present study showed that the study area is that, majority of the smallholder farmers about 68.33% and 71.67% in Konso and Derashe, respectively, were providing supplementary feeds on the bare ground which may cause adverse health problems due to contamination of feeds and increase competition among them. About 33.33% and 30% of the respondent farmers in Karat zuria and Derashe, respectively practiced providing separately to the different age classes which avoids competition among the different age groups whereas the remaining percentage in each district fed together for the whole groups of chicken. That is a good indication of feed wastage and stunted growth even death of chicks as a result it restricts whole productivity due to feed competition. About two-thirds percentage of the respondents in both districts were supplement feed only once per day while none of them were provided *adlibitum* other than scratching and foraging (Table 3). However, to make full use of the productive potential of scavenging chicken, a feed that is sufficient in both quality and quantity has to be provided [12, 23]. According to the report of Minh, et al. [12] on the effect of supplementation, breed, season, and location on feed intake and performance of scavenging chickens in Vietnam, productivity of the chicken could be affected by feeding frequency. Minh, et al. [12] indicated that twice and thrice a day feeding regimens rather than once a day improved egg production rate. Nearly half of the respondents were provided supplementary feed in the morning before they went out for scavenging while about one-third of them supplemented at any time during day times. The result is in line with the report of 50.8% [20] in the Sidama Zone and 42.86% [15] in the Kafa and Bench Maji Zone.

In the area, the basis for supplementary feeding of chicken at Konso and Derashe smallholder farmers was about 41.67% and 38.33% for egg production, respectively, followed by egg yield and broodiness. Similarly, Kibreab, et al. [15] reported 39.33% in Kafa and Bench Maji zones; however, Tekalegn, et al. [20] in the Sidama zone reported 54.6% for egg yield.

Table 3. Trends of supplementary feeding and feeding system of chickens.

Feeding practices	Status	Districts	
		Karat zuria	Derashe
Ways of feed provision (%)	In a feeder	31.67	28.33
	On the bare ground	68.33	71.67
Feeding system (%)	Separate into different classes	33.33	30.00
	Together for the whole groups	66.67	70.00
Frequency of feed supplementing (%)	Once	65.00	66.67
	Twice	28.33	26.67
	Thrice	6.67	6.67
	<i>Adlibitum</i>	0.00	0.00
Time of supplementing (%)	In the morning before they went out scavenging	45.00	48.33
	In the evening after scavenging	15.00	13.33
	In the afternoon while scavenging	8.33	10.00
	Any time during the times	31.67	28.33
Supplementing feed structure (%)	Mash	18.33	16.67
	Crumbled	0.00	0.00
	Pellet	0.00	0.00
Basis of supplementary feed providing (%)	Increase egg yield	41.67	38.33
	Increase meat yield	6.67	5.00
	Broodiness (During incubation)	18.33	18.33
	Increase egg and meat yield	11.67	6.67
	Incr. egg yield and broodiness	21.67	31.67

4. CONCLUSIONS AND RECOMMENDATIONS

It is a fact that different production factors determine chicken production and productivity. Among that, feed both in quality and quantity is one of the major inputs and its costs cover up to 60-70% of production costs. Ever-increasing demand and incorporation of conventional feed ingredients like maize, soybean meal, groundnut cake, fish meal, meat and bone meal, and extra in chicken feed are becoming expensive and inaccessible in the countries because of the spiraling cost of raw materials and ever-increasing competition with the human beings for the same food items. In this investigation, various types of chicken feed resources were locally available, and easily accessible resources were identified in promising conditions. Dominantly sorghum, *teff*, and maize followed by haricot bean, sunflower, plant materials, fruit leaves, and vegetables (*Moringa stenopetala*, local name: *Halako*) were available. Moreover, different SFRs of cooked food scraps (*Fosase*, *Kurkufa*, pieces of bread), kitchen wastes, Protein sources (growing worms, termites, insects, grasshoppers, flies, frogs), green edible leaves (grasses, weed leaf), and local brewery residues (*Cheka* residues) were highly ranked as potential SFR in the area. However, the amount of each depends on the seasons of the year and the quality and availability of the resources at the household level. There is no planned feeding of chickens under traditional village production in the area as well as in Ethiopia. Spreading the grain on the floor or bare land together for whole groups of chicken once per day mainly for egg yield was the very common trend of providing supplementary feed. Hence, to make full use of the productive potential of scavenging chicken related to feed is:

- The search for alternative feed resources has become encouraged and inevitable to reduce the feed cost which in turn can reduce enormously the total cost of production of meat and egg and making them easily available at cheaper cost in the country.

- Considerable efforts have been needed to fully utilize low-cost locally available surplus and cheap unconventional feed resources to reduce the feed cost which will benefit the end-users as supplement their chickens.
- Integration of chicken with crop-livestock production, as the chicken feeds on ticks on the cattle as well as on maggots grown in the cattle dung and grains debris.
- Farmers must attempt to balance stock numbers based on feed available in the environments in feed-scarce seasons.

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