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Chickens Feed Resources and Feeding Trends in Konso Zone and Derashe Special District, Southern Ethiopia

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Abstract

The study was conducted with the objective of assessing locally available chicken feed resources and feeding trends in Karat zuria district of 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±0.22% and 86.7±0.34%), teff (65±0.48% and 66.7±0.48%) from pulses haricot bean (58.3±0.50% and 45.0±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 mostly locally promising 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 months 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 very common trends 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.

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 time 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 makes a vital function through the provision of meat and eggs for home consumption and for 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].

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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 [1,4]. At national level in Ethiopia, the scavenging family poultry production systems are the principal providers for the domestic market; contributes over 98% of most of the national marketable poultry products [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 productions, 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 [8].

Chicken feed sources in terms of quality and quantity is one of the most critical constraints to chicken production under both the rural small holder and large-scale systems in Ethiopia [8]. Feed cost for chicken production account 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 which constitutes most of the feed input [10].To make full use of the productive potential of chicken, a feed which is sufficient in both quality and quantity has to be provided. According to the report of [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 do not use home-mixed ration due to lack of knowledge, cost of ingredients and unavailability of ingredients [13] limited knowledge of the daily amount of feed given per chicken, limited knowledge about locally available feed resources and nutritional quality 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 are major facts associated with chicken feed [15,16].

Even though there were various studies conducted on chicken feed resources and feeding practices in some specific locations of the country by some researchers [16], 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 in relation to the carrying capacity of the land areas and flock dynamics across the different seasons and agro-ecologies is still not adequately quantified. Hence, understanding the existing feed resources; feeding trends used by chicken are needed 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 chickens feed resources, and feeding trends of chickens in the mandate areas.

Materials and Methods

Description of the study area

The study was conducted in two selected districts of Konso zone (Karat Zuria district) and Derashe special district of 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 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 practice 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 15^0C to 33^0C. But the area is situated in a dry belt with very unreliable rainfall. Rainfall distribution follows a bimodal pattern; 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 (https://en.wikipedia.org/wiki/Konso_Zone).

Derashe special district is 490 km away from Addis Ababa and geographically bordered on the South by 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 lied at $5^0$39'59" N Latitude and $37^0$19' 60" E longitude with the total land with an 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 which ranges between 15.1 and 27.5^0 C and whereas, the average annual rain fall ranges from 600 to 1600 mm [17]. The common agricultural production system overcome into the study area is mixed crop-livestock production system. The major growing crops in the study area are maize, sorghum, *teff* and wheat.

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 districts', three kebeles (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 for those farmers possess chickens with different flock size, 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.

Procedures of data collection

The Primary data were collected through field observation, administering pre-tested structured questionnaires, and organizing group discussion. Before the commencement of the survey, the questionnaires were pre-tested using sample HHs and appropriate adjustments were made on specific contents. The interviews were conducted at farmers' houses with the assistance of local agricultural extension/development agent drawn

from each kebeles'. Secondary data were collected from various sources including Agricultural and Rural Development office of 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 about chicken feed resources and its challenges per districts 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. A 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.

Data analysis

Survey data were analyzed using descriptive statistics and statistically by Statistical Package for Social Sciences version 20, software [18].

Results and discussions

Crops grown in the area

The result of the current 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±0.22% and 86.7±0.34%), maize (60±0.49 and 65±0.48%), and teff (65±0.48% and 66.7±0.48%) of the respondents, respectively. Current result is in line with the report [19]. From the pulses, about 58.3±0.50% and 45.0±0.50% of respondents have haricot bean in Karat zuria and Derashe districts, respectively. Among the oil crops, sunflower contains 28.3±0.45% of respondents those produce it in each districts. Enset (*Ensete ventricosum*), as a root crop, is the most important cash crops in Derashe's highland parts; however, it doesn't available in Konso. It's by products amicho meal, bulla, kocho were used as feeds for chicken [20]. The *Moringa stenopetala* (local name: Halako,), as a vegetable (green feed for chickens), contains highest percent (Table 1) and commonly found in all Kebeles of the study area for reason that it was produced from their own farm and most common consumable food [21]. In all Kebeles of Konso and Derashe district, 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 rich nutrient content of *Moringa stenopetala* leaves can be used as a crucial resource of dietary supplementation for livestock as well as chicken. It used as antimicrobial, anti-coccidal effects, reduces cholesterol levels in eggs, better yolk color, and enhances growth performance and carcass traits in chicken. 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
Chick pea	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**		
Sun flower	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

Hh: households per district (60); SD: standard deviation; %: Percent of respondents.

Mango and avocado were identified as the dominant fruit crop (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 own 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.

Chickens Scavenging Feed Resources (SFR)

Scavenging (obtaining their own diets during the daytime mainly through scratching and foraging activities within the local environment) is the major feed resource in extensive village chicken production system [6, 3, 24] also reported that 99.27% of the chickens were managed under a traditional or extensive chicken management (scavenging) system in North-west Ethiopia.

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)		
	1st	2nd	3rd	1st	2nd	3rd
1. Cooked food scraps/left-over (*Fosase*, *Kurkufa*, *injera*, pieces of breads)	91.67	8.33	0.00	95.00	5.00	0.00
2. Kitchen wastes (covering of tomatoes, egg shells Kocho, potatoes 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, *Halako* or *Moringa stenopetala*, 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 (*Cheka* 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

Different feeding materials are available for scavenging including crops as visually observed (Table 2). According to respondents reaction, cooked food scraps/left-over (*Fosase*, *Kurkufa*, *injera*, pieces of breads); 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 effect of supplementation, breed, season and location on feed intake and performance of scavenging chickens in Vietnam [23, 24] in the Central Highlands of Ethiopia reported that the main feed resources for village chicken was SFR from immediate environment, food scraps or leftover and seeds, plant materials, worms, insects. In addition to that considerable chicken SFR was also obtained grains from different crops through cultivating, harvesting and processing cereals and pulse grains of maize, sorghum, and haricot bean. 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 the 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.

Status of chicken seasonal feed resource availability

The report [11] from central Tanzania and [24] from Veitnam, shows, season was significant factors that determine the quantity and quality of the scavengeable feed resources and on the way determine productivity of village scavenging chicken. Accordingly, most of the respondent farmers in the present study were challenged by seasonal feed shortages. The result is closely related with the report of [11,23,24], which feed resources for local birds, are inadequate and variable depending on season. The seasonal feed status result showed (Figure 1) that, from 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 harvesting season of grain or cereal crops i.e. the extremely 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 were 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 leaf (*grasses, weed leaf*), different fruit leaf (*Halako* or *Moringa stenopetala*, cabbage, pumpkin leaf, forage leaf), Protein sources (growing worms, snails, termites, insects, grasshoppers, flies and frogs) were common feed resources [16].

There is 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 decrease 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 and moreover its recommended to 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.

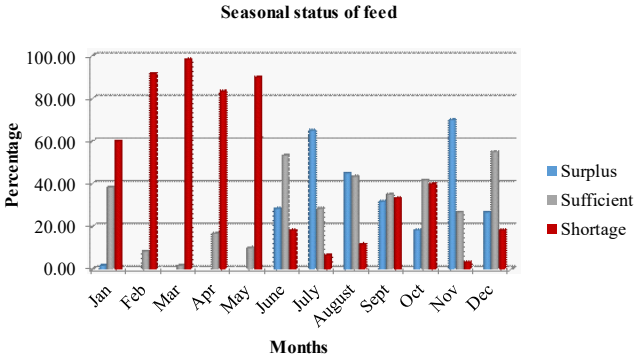

Figure 1: Seasonal availability of chicken feed resources.

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 [23,24]. The trends of supplementary feeding and feeding system 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 [16].

The result of present study showed in 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 problem 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 were practiced providing separately to the different age classes feeding which avoids competition among the different age groups whereas the remaining percentage in each district feed together for the whole groups of chicken.

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 to 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
	Adlibtum	0.00	0.00
Time of supplementing (%)	In the morning before they went out for 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 day 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

That is good indication for feed wastage and stunted growth even death of chicks as a result it restricts a whole productivity due to feed competition. About two-third percentage of the respondents in both districts were supplement feed only once per day while none of them were provide *adlibtum* other than scratching and foraging (Table 3). However, to make full use of the productive potential of scavenging chicken, a feed which is sufficient in both quality and quantity has to be provided [23,24]. According to the report of in 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 [24]. Indicated that twice and thrice a day feeding regimens rather than once a day improved egg production rate. Nearly half of respondents were provide supplementary feed in the morning before they went out for scavenging while about one-third of them supplement at any time during day times [24]. The result is in line with the report of 50.8% in Sidama Zone and 42.86% in Kafa and Bench Maji Zone [16].

In the area, the basis for supplementary feeding of chicken at Konso and Derashe smallholder farmers were about 41.67% and 38.33% for egg production, respectively, and followed by egg yield and broodiness. Similarly, Kibreab *et al*., (2015) reported 39.33% in Kafa and Bench Maji zone; however, in Sidama zone reported 54.6% for purpose of egg yield.

Conclusions and recommendations

There are different production factors those determine chicken production and productivity. Among that, feed both in quality and quantity is one of the major input and its costs covers up to 60-70% of production cost. An 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, there were various types of chicken feed resources which were locally available, easily accessible resources were identified in promising conditions. Dominantly sorghum, *teff* and maize followed by haricot bean, sunflower, plant materials, fruit leafs, vegetables (*Moringa stenopetala,* local name: *Halako)* were available. Moreover, different SFR of cooked food scraps (*Fosase*, *Kurkufa*, pieces of breads), kitchen wastes, and Protein sources (growing worms, termites, insects, grasshoppers, flies, frogs), green edible leaf (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 area as well as in Ethiopia. Spreading the grain on the floor or bare land together for the whole groups of chicken once per day mainly for egg yield was the very common trends of providing supplementary feed. Hence, to make full use of the productive potential of scavenging chicken related with 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 feed 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 was forwarded.

Availability of data

The data of this study are available from the corresponding author upon request.

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Contribution of authors

During the writing of the manuscript, all of the authors contributed equally. They read the final manuscript and gave it their approval for publishing.

Conflict of interests

There is no conflict of interests.

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