World Journal of Dairy & Food Sciences 15 (2): 88-97, 2020
ISSN 1817-308X

DOI: 10.5829/idosi.wjdfs.2020.88.97

Evaluation of Nutritive Value of Commonly Used Feeds for Cattle Fattening in West Wollega, Homa District, Western Ethiopia

[1]Fekadu Wakshuma Fufa, [2]Zemene Worku and [2]Samuel Tilahun

[1]Department of Animal and Range Science, Dambi Dollo University, Dambi Dollo, Ethiopia
[2]Department of Animal Science, College of Agriculture and Veterinary Medicine, Jimma University, P.O. Box: 307, Ethiopia

Abstract: This study was carried out in Homa district of western Wollega zone of Oromia Regional state Ethiopia, with the objective of assessing common feeds and analysis of nutritive values of major feeds used for fattening cattle during wet and dry seasons. Totally, 166 households who were proportionally selected from high altitude and mid altitude agro-ecologies were interviewed by using structured and pretested questionnaires to identify common feeds used to fatten cattle. After identifying the common feeds, 10 composite feed samples were prepared from each agro-ecology and kept separately for feed analysis. Standard procedures were used to carry out chemical composition analysis such as DM, CP, ADF, NDF and Ash. The data were analyzed using General Linear Model of ANOVA procedures of SPSS (version 20). Major feed resources used for fattening cattle during dry season were crop-residues, stubble grazing, non-conventional feeds, concentrate feeds and hay while cut and carry forages, natural grazing land and non-conventional feeds were the major feeds during wet season in order of importance. In the study district, chemical composition analysis of the feeds revealed that CP ranges from as low as 3.87±0.02% in millet straw to as high as 19.33 ±0.35% in Areke atela. The NDF content also ranges from 76.89±1.31% in crop residues to as low as 26.57±0.34% in maize grain. The ADF content of the available feeds also varies between crop residues and concentrate and non-conventional feed types commonly used in the study area. It can be concluded that unless supplemented with other potential feed types, the nutritive value of the current feeds may be inadequate to fatten cattle. Researches/extension works on feed supplementation and treatments of the available feed resource are required.

Key words: Agro Ecology · Fattening cattle. Feed Resources · Crop Residue · Dry Matter

INTRODUCTION

In Ethiopia, cattle fattening is one of a few agricultural commodities from which the country earn foreign earnings through both live and processed forms of the commodities exported and also most of the rural poor are engaged in rearing of livestock to fulfill their daily needs and economic gaps [1]. Famers in Bure woreda have been using cattle fattening as one way of income generating [2]. For Livestock production, as well as for fattening cattle feed is the major production input [3]. In Jimma Zone, it has been reported that grazing land and crop residue are the major source of feed for fattening cattle [4]. In rural areas cattle fattening is based on locally available feed resources and in wolayita the cattle fattening is largely based on non-conventional feed resources with locally-innovated feeding strategies which could minimize the finishing cost [5]. Farmers in Arsi Negelle, fatten their animals by using local brewing by-product (*atela*) which they purchase from local brewers and mix with the chopped maize stalks, *teff* and wheat straw to the fattening animals. The mixture is stirred by hand until it becomes wet and soft enough for consumption. In this area, crop residue, natural pasture and purchased feeds contribute a major proportion to dry matter intake [6]. Fattening that is based on *areke atela* (a residue resulting from home distilling of an alcoholic liquor (*areke*) and similar practice of backyard fattening of

Corresponding Author: Fekadu Wakshuma, Department of Animal and Range Science, Dambi Dollo University, Dambi Dollo, Ethiopia.

one or two animals based on *atela*, crop residues and/or cut grass with occasional supplementation has also been observed in Selale, North Shewa zone of Oromia Regional State [7].

According to Abeysekara [8] quality of the feed means that, the ability and the extent to which feed has the potential to produce the required animal response. The quality reveals that the level of nutrient (chemical) composition, palatability and intake, digestibility, anti-nutritional factors and animal production performance. The nutritive value of ruminant feed is determined by the concentration of its chemical compositions. The most practical approach to feed analysis is chemical composition direct determinations of dry matter, ether extract (fat), ash (mineral), nitrogen (crude protein), Neutral Detergent fiber(NDF) and Acid Detergent Fiber (ADF). The nutritive value of the feed is generally determined by feed composition, intake and utilization efficiency of digested matter [9].

According to CTAHR [10], the dry matter is the percentage of feed that is not water (moisture) and the Dry matter Contents of the feed is important because it contains the essential nutrients within a given feed ingredient or forage. Crude protein in the feed is an estimate of the level of protein in the feed based on the amount of nitrogen present in the feed. A good determinant of quality feed is the protein content of the feeds. Low crude protein (CP) diets could result in rumen degradable protein deficiency and impact negatively on rumen fermentation and microbial synthesis, decreasing metabolizable energy and protein availability for livestock. The CP content of pasture and hay is less than 7%, which is very much below the requirement for adequate microbial function in the rumen and also the protein content of hay on DM basis was usually less than 5% [11].

Neutral Detergent Fiber (NDF) value of the feed is the percent of total fiber in the feed and it is the plant cell wall components (cellulose, hemicelluloses and lignin). NDF influences the level of intake, the high level limit the intake, while the minimum level is necessary for healthy rumen. The DM intake and the NDF content are negatively correlated, that may brought limitations on livestock performance [12] and NDF contents of the feed might vary from one specie to another [13]. Roughage feeds with NDF containing lower than 45% are categorized as high quality, 45-65% as medium quality and those with more than 65% are categorized as low quality roughages [14].

The Acid Detergent Fiber (ADF) value is the percent of the least digestible parts of cell walls, cellulose, lignin and silica. ADF content increase as the plant matures and it is closely associated with digestibility. The increment of the indigestible lignin complex in the ADF fraction reduces digestibility of the plant. Therefore, ADF and digestibility are negatively correlated. Both NDF and ADF increase as the plant matures causing a decline in the quality of the forage [15]. According to Kellems and Church [16] roughages with less than 40% ADF was categorized as high quality and those above 40% as low quality. Livestock feeds may be broadly classified as concentrates and roughages, depending on their composition. Concentrates are feeds types that contain a high density of nutrients, with low crude fibre content and high in total digestible nutrients. But the roughage feeds are of low density nutrients, with a high crude fibre content including most fresh and dried forages and fodders (FAO, 1983) cited by Demisse [17].The Roughage feed is needed for the satisfactory functioning of the digestive system whereas higher percentage of grain is required in the ration for higher body weight gain [18]. However, the risk of digestive upset is greatly increased when more than 80% grain is included in the feed, as NSW cited in Abebe, B.[19]. The quantity and quality of crop residue varies based the species and variety of the crops, environmental factor, management condition, agro-ecological distribution and the scope of arable land availability time of harvesting, handling and storage conditions and other factors [20, 21].

The plant chemical composition of feed stuff is affected by many factors such plant species, climate, soil fertility and stage of harvesting. Environmental effects on forage composition are complex; however, temperature, light and moisture in decreasing order are the dominant factors affecting the plant physical nature and composition chemistry [22]. High temperatures have negative effect on crude protein (CP) and ash composition, but positive effect on crude fiber (CF) content of temperate pasture species and also high temperature has a depressing effect on dry matter digestibility while, low temperatures influence the drive for increased stem diameter, plant height and leaf stem ratio, decreased Lignification and delayed maturity. High light intensity has a negative effect on CP, CF, lignin and ash content [23]. Low moisture levels in soil delay plant maturity, decrease plant height, increase leaf stem ratio and can decrease NDF percentage.

According to Ahmed *et al.* [24], the availability of feed resources and their nutritional qualities are the most important factors that determine the productivity of the livestock in the country. The identification and evaluation of the feeds nutritional composition is an important issue for the sake of effective fattening practice for future

interventions [2, 17, 25-27] in different parts of Ethiopia. Therefore, to generate and document information on the available feed resources and the chemical composition of major feeds used for cattle fattening during dry season, this research was initiated to be conducted.

MATERIALS AND METHODS

Description of the Study Area: This study was conducted in Homa district which is located in West Wollega Zone of Oromia Regional state, western Ethiopia. The district is located at the distance of 58 km away from Gimbi which is the capital city of west Wollega and 501 km from Addis Ababa which is the capital city of the country. The district is traditionally categorized into high altitude area with 15% and mid altitude of 85% agro ecological zone situated within the range between 1700 and 2350 m.a.s.l. The mean annual rainfall ranges from 1300 to 2000 mm and characterized by having heavy rain fall. The annual average temperature ranges from 18°C to 32°C [29]. Its climatic condition was suitable for Livestock production.The contemporary farming system of the district is crop- livestock mixed farming system largely comprising crops including coffee, maize, sorghum, teff, millet and barley. In the district, June to August is the starting time of rainy season/wet seasons that extends up to November, whereas starting from December to May correspond to months of dry season [30].

Sampling Technique and Sample Size Determination: The data were collected between November, 2018 and April, 2018.The secondary data were used from Homa district Livestock and Fishery development office [31]. Information was also taken from Homa district land and environmental protection office [29] on agro ecological coverage of the study. In general four kebele's, two from each agro ecology were selected purposively. Regarding household sampling, first and foremost, the lists of the households in cattle fattening practice were obtained from Agricultural Development Agents (ADA) in each kebeles and compiled data in the District Livestock and Fishery Development Office were used [31]. To determine sample size of the households the following formula was employed from Cochran [32].

$$no = \frac{z^2 p(q)}{d^2}, \quad no = \frac{z^2 p(1-p)}{d^2} \qquad \text{(Equ. 1)}$$

where, z = standard normal deviation (1.96) for 95% CI, p= population variability (which is 15% or .15%), q= is 1-p, d= is degree of accuracy which is 0.05, ??$_0$= standard calculated sample population and n = sample size).

So =>no= 1.96^2x0.15 (1-0.15) = 3.8416 x 0.15 x 0.85=>196

$(0.05)^2$ 0.0025

$$n_1 = \frac{no}{1 + \frac{no}{N}} \qquad \text{(Equ. 2)}$$

$$n = \frac{196}{1 + \frac{196}{1116}} = 166$$

From all cattle fatteners in the selected four kebeles (locally developed organizational structure of the lowest administrative unit), 166 cattle fatteners were selected by simple random sampling technique. Hence, from the total four sampled kebeles 79 and 87 cattle fattener households were selected from high altitude and mid altitude agro-ecologies, respectively. Among kebeles included under high altitude area, Sewa Georges kebele in general and from Homa Georges kebele, areas included under high altitude agro ecology, as well as among the kebeles included under mid altitude area, BondawoDangil and SibaYebo were purposively taken.

Data Collection: The study was comprised of both survey and feed laboratory chemical composition analysis. The data used were collected from both secondary and primary data sources. The primary data were collected through structured and semi structured questionnaires from households in cattle fattening practices which were augmented by key informant interviews, focus group discussions and field observations. The collections of data were carried out by the enumerators with close follow up and monitoring by the researcher. The procedures employed for data collection for survey part are described below.

The prepared questionnaires in English were translated into the local language (Afan Oromo) and it was pretested on ten fatteners followed by modifications and then finally questionnaires were duplicated. Following the preparation of the questionnaire, enumerators were trained on how to collect the data. Secondary data were obtained from reports of different district offices as mentioned above and other published and unpublished materials were used to augment the primary data.

In each of the study kebeles, group discussions were made with agricultural development agents and 10 to 16 selected households considering their experience in cattle fattening activity, in order to strengthen the survey data collected from the respondents and for more understanding of the study area in detail. Field observation was made to triangulate the surveyed data and to collect feed samples in the study area.

Feed Analysis: Common feed resources used for fattening were identified from households through questionnaire interview which was strengthened by key and group discussion. The households were interviewed to rank the feeds which were used during wet and dry seasons. Based on the rank given by interviewed household, 20 composite samples (ten from each agro-ecology) were collected from feeds types used during dry season for feed analysis. Each type of feed samples was kept separately in a paper bags pending the laboratory analyses.

Standard procedure was used to carry out chemical composition analysis of the feed under consideration. The various samples of feedstuffs collected during cross sectional field survey (Crop residue, hay, concentrate and non-conventional feeds) collected were processed and subjected to proximate and detergent components following the official procedures indicated below at animal nutrition laboratory and post-harvest laboratory of Jimma University College of Agriculture and Veterinary Medicine. The samples were dried in an oven at 65°C for 72 hours and ground in Willey mill to pass through 1mm sieve and ground samples were kept in airtight containers for analysis of chemical composition. The ground feed samples were analyzed for dry matter (DM) content after oven-dried at 105°C for 24 hours. Determination of the dry matter content of liquid feed resource (*atela*) was followed similar procedures [33]. The total ash was analyzed by complete combustion of the dried feed samples in muffles-furnace at 550ºC for 24 hours and the contents was calculated and crude protein content was determined by Kjeldahl method AOAC [33]. Crude protein content was calculated as 6.25 x N content. The percentage organic dry matter was calculated by reducing total ash from 100%. Neutral-detergent fiber (NDF) determination was done by the procedure of Van Soest and Robertson *et al.* [34]. Acid-detergent fiber (ADF) was determined by the detergent procedures of AOAC [33]. NDF was assayed without a heat stable amylase and expressed exclusive of residual ash. ADF was expressed without residual ash. The Digestible Crude Protein was calculated according to the following formula of FAO [35].

$$DCP\ (g) = 0.929 \times CP\ (g) - 3.52 \quad (3)$$

Data Analysis: The collected data was coded and entered in to the computer Microsoft Excel spread sheet. One way ANOVA of statistical package for Social Science (SPSS Version 20) [28] was employed for chemical composition analysis. Ranking was also used to prioritize the major feed resources. Significance level was determined at 95% confidence interval.

RESULTS AND DISCUSSION

Feed Resources Used for Fattening Cattle During Dry Season: As indicated in Table 1, in Homa district, the major feed resources used for fattening cattle during dry season in order of commonly used were crop-residues, stubble grazing, non-conventional feeds, grains, hay, natural pasture and browse trees. Similar to the current result, Mulu [2] reported that the principal feed resources used during dry season in Bure district of Amhara regional state were crop-residues, stubble grazing, natural pasture and hay and Tadesse *et al.* [27] also reported that farmers in lemo and soro woreda of SNNP (Southern Nation and Nationality Peoples) used feeds like crop residues and concentrates for fattening cattle.

Feed Resources used for Fattening Cattle during Wet Season: Feed resources used for fattening cattle during wet season include the cut and carry forages ranked 1st followed by natural grazing, non-conventional feeds, crop residues, grain, stubble grazing and hay ranking 2nd, 3rd, 4th, 5 th, 6 th and 7 th, respectively in order of commonly used. In the study area, crops which were produced by irrigation near river banks were the sources of crop residues to be used during wet season of the year since they are sown usually in mid-January to end of February which could be harvested during June, July and August months of the year, which are called *Bone* and *Dilalesa* in local language. Similar to this report, Mulu [2] indicated that in Bure Woreda of Amhara regional state the feed resources used for fattening cattle during wet season were natural pasture, crop residues, stubble grazing and cut and carry types of feeds and weeds grown within and at the boundary of the farm land. Assefa and Nurfeta [36] also reported that the types of feed resources available in AdamiTullu Jiddo Kombolcha of Ethiopia during wet season were natural pasture, aftermath grazing, crop residues and maize thinning.

Chemical Composition of Crop Residues: In the current study, from the available feed resources, all crop residues were generally low quality than other type of major feed resources used for fattening cattle. As indicated in table 3, the dry matter (DM) content of all crop residues except sugarcane tops were above 90% in the study area which is in line with the report of Amare [37] for different

Table 1: Feed Resources used for fattening cattle during the dry season in Homa district

	Overall Respondent's Rank								
Types of feed resource	1st	2nd	3rd	4th	5th	6th	7th	Index	Rank
Crop Residues	110	42	6	4	4	-	-	0.233	1st
Stubble Grazing	11	78	65	12	-	-	-	0.198	2nd
Non-conventional	29	36	63	22	10	6	-	0.187	3rd
Concentrate /grain	14	8	20	96	20	8	-	0.148	4th
Hay	2	2	12	26	74	46	4	0.109	5th
Natural grazing land	-	-	-	6	53	95	12	0.085	6th
Browse	-	-	-	-	5	11	150	0.040	7th

Index: - Ranking Index was =Sum of all single feed type rank [(7 for 1) + (6 for 2) + (5 for 3) + (4 for 4) + (3 for5) + (2 for 6) + (1 for 7)] divided by sum of all weighed feed types used during dry season

Table 2: Feed resources used for fattening cattle during the wet season in Homa district

	Overall Respondent's Rank								
Types of feed resource	1st	2nd	3rd	4th	5th	6th	7th	Index	Rank
Cut and carry forages	102	50	6	4	4	-	-	0.231	1st
Natural grazing	37	38	56	20	9	6	-	0.195	2nd
Non-conventional	11	69	74	11	1	-	-	0.190	3rd
Crop residue	13	7	18	101	19	8	-	0.150	4th
Concentrate/grain	3	2	12	24	75	46	4	0.111	5th
Hay	-	-	-	6	53	95	12	0.082	6th
Stubble Grazing	-	-	-	-	5	11	150	0.041	7th

Index was =Sum of all single rank of feed type [(7 for 1) + (6 for 2) + (5 for 3) + (4 for 4) + (3 for5) + (2 for 6) + (1 for 7)] divided by sum of all weighed feed types used during wet season

agro ecology of Gonder Zone of Amhara regional state, Bogale *et al*. [11] for Bale high land and Wondatir [38] in high land and central Rift valley of Ethiopia who reported above 90% DM content of crop residue.

The overall CP content of the crop residues in the current study ranged between 3.87% in millet straw to 5.41% in sugarcane tops. In the high altitude it ranged from 3.85% in millet straw to 5.34% in sugarcane tops while it ranged from 3.9% in millet straw to 5.49% for sugarcane tops in mid altitude area. The current result revealed that all crop residues collected from study area had lower CP contents than the minimum level of 7% CP required for optimum rumen microbial function [23, 39]. The CP content of the current feed samples was within the ranges of 2.01-8.97%for the same feed category reported by Gemiyo *et al.* [40] in southern Ethiopia.

The NDF content of the studied crop residues in West Wellega Zone ranges from as low as 63.00% in Sugar cane to as high as 76.98% Maize Stover. Similar to the current finding, Wondatir [41] indicated that all crop residues in the high land and central Rift Valley of Ethiopia had higher (>65%) NDF–contents. A higher (>70%) NDF was also reported in North Gonder zone and in Sinana sub district of Bale highland [11, 37]. It has been known that roughage feeds with NDF containing lower than 45% are categorized as high quality, 45-65% as medium quality and those with more than 65% are categorized as low quality roughages [14]. In the light of this fact, all crop residues in the current study were categorized as low quality roughages which is expected to limit feed intake since the DM intake and the NDF content are negatively correlated [12].

The overall ADF value obtained from all crop residues in the current study was above 40% except that of sugarcane tops which was 39.37%. From the high altitude the highest ADF content was 53.90% in maize stover whereas the lowest value i.e. 39.45% was obtained from sugarcane tops whilst in mid altitude area the highest ADF content was 49.26% in maize stover and the lowest was 39.29% in sugarcane tops. As Kellems and Church [16] indicated, roughages with less than 40% ADF were categorized as high quality and those above 40% as low quality suggesting that crop residues in the current study district could be categorized as low quality roughages. Similar to the current result, Gemiyo *et al.* [40] for Wolayita Zone, Demissie [17] for Bonke woreda, Tonamo *et al*. [41] for Essera district of Dawaro Zone and Chalchisa *et al*. [42] for Southern Ethiopia reported that the ADF contents of different crop residue to be above 40%.

Table 3: Chemical composition of crop residues in Homa district (Mean ± SE)

Agro ecology	Feedstuff	DM%	ASH%	OM%	CP%	EE%	NDF%	ADF%	DCP%
High altitude	Maize Stover	91.15±0.05	7.59±0.27	92.41±0.27	3.94±0.05	0.63±0.37	76.98±1.25	53.90±0.87	0.14±0.04
	Teff straw	92 ±0.16	7.09±0.28	92.91±0.28	4.04±0.14	0.93±0.02	74.80±1.62	40.71±0.46	0.23±0.02
	Millet straw	91.30±0.06	5.30±0.12	94.70±0.12	3.85±0.02	0.69±0.12	70.20±0.69	45.10±0.40	0.06±0.02
	Barley straw	92.60±0.40	5.17±0.02	94.83±0.02	4.09±0.10	0.52±0.05	69.20±0.63	41.90±1.18	0.28±0.04
	Sugarcane top	86.09±0.23	7.67±0.33	92.34±0.33	5.34±0.18	0.72±0.10	62.60±0.23	39.45±0.45	1.44±0.17
Mid altitude	Maize Stover	91.93±0.12	7.96±0.36	92.04±0.36	4.22±0.07	0.64±0.03	76.80±0.12	49.26±2.68	0.40±0.06
	Teff straw	91.55±0.26	9.17±0.02	90.83±0.02	4.23±0.16	0.83±0.04	75.30±0.37	39.84±0.54	0.41±0.14
	Millet straw	91.25±0.72	6.83±0.23	93.17±0.23	3.90±0.04	0.70±0.03	70.90±0.06	44.20±0.40	0.10±0.03
	Barley straw	92.90±0.06	5.23±0.16	94.77±0.16	4.25±0.06	0.52±0.02	68.27±0.31	41.55±0.26	0.43±0.05
	Sugarcane	85.20±0.40	8.56±0.32	91.44±0.32	5.49±0.33	0.68±0.01	63.40±0.23	39.29±0.42	1.58±0.31
Over all	Maize Stover	91.54±0.18	7.77±0.22	92.23±0.22	4.08±0.07	0.64±0.03	76.89±1.31	51.58±1.63	0.27±0.07
	Significant	*	NS	NS	*	NS	NS	NS	*
	Teff straw	91.86±0.29	8.13±0.48	91.87±0.48	4.14±0.10	0.88±0.03	75.03±0.75	40.26±0.37	0.33±0.09
	Significance	NS	*	*	NS	NS	NS	NS	NS
	Millet straw	91.28±0.32	6.07±0.36	93.93±0.29	3.87±0.02	0.70±0.05	70.55±0.35	44.65±0.55	0.08±0.02
	Significance	NS	*	*	NS	NS	NS	NS	*
	Barley straw	92.75±0.19	5.20±0.07	94.80±0.07	4.17±0.06	0.52±0.02	68.74±0.38	41.73±0.55	0.35±0.06
	Significance	NS	NS	NS	NS	NS	NS	NS	NS
	Sugarcane	85.65±0.29	8.11±0.29	91.89±0.29	5.41±0.17	0.70±0.05	63.00±0.23	39.37±0.32	1.51±0.16
	Significance	NS	NS	NS	NS	NS	NS	NS	NS

* indicates existence of significant difference ($p < 0.05$) along the column between Agro-ecologies for the respective feed type and chemicalcomposition, NS=Non-significant

Table 4: Chemical composition of improved forage hay in Homa district (Mean ± SE)

	Feedstuff	Chemical composition of feed stuff							
Agro ecology	Hay	DM%	ASH%	OM%	CP%	EE%	NDF%	ADF%	DCP%
High altitude	Elephant grass	89.98±0.51	7.40 ±0.23	92.60±0.23	6.05±0.21	0.35±0.02	62.18±0.47	42.37±0.50	2.10±0.19
	Rhodes grass	91.90±0.06	4.91±0.08	95.08±0.58	5.81±0.14	0.71±0.09	64.71±0.48	40.00±1.15	1.87±0.12
Mid altitude	Elephant grass	89.06±0.54	8.89±0.46	91.11±0.46	7.26±0.43	0.56±0.02	63.30±0.60	40.39±0.53	3.22±0.41
	Rhodes grass	92.40±0.29	6.68±0.45	93.32±0.20	6.96±0.02	0.42±0.03	64.17±1.11	40.81±0.19	2.95±0.05
Over all	Elephant grass	89.52±0.39	8.15±0.41	91.85±0.41	6.66±0.54	0.46±0.05	62.74±0.34	41.38±1.23	2.67±0.50
	Significance	NS	*	*	*	*	NS	NS	*
	Rhodes grass	92.15±0.17	5.80±0.29	94.20±0.44	6.40±0.26	0.57±0.08	64.44±0.55	40.41±0.55	2.43±0.24
	Significance	NS	*	*	*	*	NS	NS	**

* indicates existence of significant difference ($p < 0.05$) between Agro-ecologies for the respective feed type and chemical composition;NS=Non-significant

Chemical Composition of Improved Forages Hay: Chemical compositions of the available improved forages grass hay were mentioned in Table 4. The DM content of Elephant grass hay and Rhodes grass hay were 89.52% and 91.15%, respectively.

The average crude protein obtained from Elephant grass hay and Rhodes grass hay was 6.66% and 6.40%, respectively. Significantly higher ($p < 0.05$) crude protein content was obtained from hays of both grasses in the mid altitude than high altitude. The crude protein content of Rhodes grass hay in the current result is somehow similar to 7% and 7.1% reported by Tolera [7] for selected area of Ethiopians and (CASCAPE project [43] in Dera, South Achefer, Bure and Jabi Tehenan districts, respectively. The crude protein content of Elephant grass hay used in the current study was less than 14% and 16.9% reported by Chalchisa *et al.* [42] for shashamane city in Southern Ethiopia and Geremew *et al.* [44] for Chire district of southern Ethiopia, respectively. In the current study area, the crude protein obtained from elephant grass hay was very low as compared with other findings which might be ascribed to variation in location, harvesting stage and variety [45]. Generally, in the current study, the overall amount of crude protein obtained from improved grass hay was relatively better than that of from crop residues.

The overall NDF content of Rhodes grass hay and Elephant grass hay was 64.44% and 62.74%, respectively. The current result for Rhodes grass hay (64.44%) was lower than 72.9% reported by Tolera [7] for selected area of Ethiopian. The NDF (62.74%) of Elephant grass hay used in the study district was within the range of

Table 5: Chemical composition of concentrate maize grain and non-conventional feeds in Homa district (Mean ± SE)

		Chemical composition of feed stuff							
Agro ecology	Feedstuff	DM%	ASH%	OM%	CP%	EE%	NDF%	ADF%	DCP%
High altitude	Maize grain	91.50±0.29	4.50±0.29	95.50±0.29	8.61±0.17	4.19±0.11	26.33±0.39	3.47±0.07	4.48±0.16
	ArekeAtela	92.40±0.29	7.90±0.06	92.10±0.06	18.83±0.44	4.16±0.04	54.46±0.02	24.20±0.11	13.97±0.41
	Milling waste	91.68±0.52	7.96±0.14	92.04±0.14	16.63±0.21	2.83±0.09	40.89±0.81	35.64±0.28	11.93±0.10
Mid altitude	Maize grain	91.90±0.06	5.26±0.13	94.60±0.13	8.82±0.08	4.06±0.04	26.80±0.62	3.69±0.11	4.67±0.07
	ArekeAtela	91.85±0.20	7.89±0.05	92.11±0.05	19.84±0.40	4.11±0.08	54.41±0.10	24.23±0.06	14.91±0.37
	Milling waste	91.03±0.02	8.00±0.58	92.00±0.58	16.94±0.03	2.80±0.06	39.55±0.34	35.25±0.05	12.22±0.17
Over all	Maize grain	91.70±0.16	4.88±0.22	95.12±0.22	8.71±0.09	4.12±0.06	26.57±0.34	3.58±0.07	5.11±0.09
	ArekeAtela	92.13±0.06	7.89±0/03	92.11±0.03	19.33±0.35	4.14±0.04	54.43±0.06	24.22±0.06	14.44±0.32
	Milling waste	91.36±0.27	7.98±0.26	92.02±0.26	16.79±0.12	2.82±0.05	40.22±0.49	35.44±0.17	12.08±0.11

Significance level is not indicated because there is no difference between agro-ecologies

51.9% to 67.11% reported by Chalchisa *et al*. [42] and Geremew *et al.* [44] in Southern Ethiopia. The ADF content of Elephant grass hay and Rhodes grass hay was 41.38% and 40.41%, respectively which is within the range of better quality roughages. The current result is higher than the report of Geremew *et al.* [44] which is 34.02% in Elephant grass in Chire district of southern Ethiopia.

Chemical Composition of Maize, *Atela* and Milling Wastes: As indicated in Table 5, the dry matter (DM) content of maize grain, *areke atela* and milling waste was above 90% in both agro ecologies of the study area.

The overall crude protein obtained from maize grain, milling waste and *areke atela* were 8.71%, 16.79% and 19.33%, respectively. It seems that the level of crude protein obtained from the mentioned feed stuffs were better than that of from all feed types in the study area. Concentrates are types of feeds that contain a high density of nutrients, with low crude fibre content and high in total digestible nutrients. The crude protein content of maize grain in the current study is similar with the report of Moreda [46] who reported 8.32% CP content of maize grain in Lume district of East Shoa. However, this result was lower than 9.2% - 11.1% reported by Demissie [17] for Bonke district of Southern Ethiopia, Tolera [7] for selected area of Ethiopian and Getahun [47], for Ethiopian lowland Afar and Kebede *et al*. [48] for Andasa Livestock research Center.

Regarding the result of crude protein content of *areke atela* (19.33%) in the current study, it is comparatively similar with 18.23% reported by Feyissa *et al.* [49], for Holeta Agricultural Research Center and lower than 20.6% reported by Chalchisa *et al.* [42], for Southern Ethiopia and 21.8% reported by Demeke [50] in and around the vicinity of Jimma town, Ethiopia. But the recorded CP content of `*areke atela*` in this study was higher than 17.6% reported by Kassahun *et al.* [51], for small scale Aquaculture in Ethiopia and 17.8% reported by Tolera [7] for selected areas of Ethiopian. The crude protein content of milling waste in the current study was within the range of different feeds milling by-products which range from 8.9% to 18.9% as reported by Tolera [7] and lower than 19.2% as reported by Chalchisa *et al.* [42] in and around shashamane, Southern Ethiopia.

The NDF content of maize grain, *areke atela* and milling waste used in the study district was (26.57%), (54.43%) and (40.22%), respectively and it ranged from (26.33%) in maize grain to (54.46%) in *areke atela* in high altitude agro-ecology while in mid altitude area it ranged from (26.80%) in maize grain to (54.41%) in *areke atela*. The NDF of maize grain was within the range of (20.6% - 29.21%) reported by Amensisa [52], for Horro of Oromia regional state and Demissie [17] for Bonke woreda of southern Ethiopia. However the current result is higher than 13.7-17% reported by Tolera [7], for selected areas of Ethiopian and Moreda [46] for Lume district of East Shoa, respectively.

The NDF content of *areke atela* used in the current study (54.43%) is in line with (54.3%) reported by Demeke [50] in and around the vicinity of Jimma town and (54.17%) reported by Feyissa *et al*. [49] for Holeta Agricultural Research Center. But it is higher than 37% reported by Tolera [7] for selected areas of Ethiopia and lower than (58.8%) reported by Chalchisa *et al.* [42] in and around shashamane area. The NDF content of milling waste used in this study was almost similar with 39.2% reported by Chalchisa *et al.* [42] in and around shashamane area and between the ranges of 19.6% to 47.7% for different types of milling by products reported by Tolera [7] for selected areas of Ethiopians.

The ADF content of maize grain, *areke atela* and milling waste used in the current study area was 3.58%,

24.22% and 35.44% respectively. Similar to the current result, the ADF content of maize grain was similar with 3.87% reported by Demissie [17] for Bonke woreda of southern Ethiopia and 3.4% reported by Getahun [47] for Afar region. However, this result was lower than 9.5% reported by Amensisa [52] for Horro of Oromia. The ADF Contents of *areke atela* (24.22%) in this report is similar with 23.5% reported by Chalchisa *et al.* [42] in and around shashamane and higher than 22% reported by Feyissa *et al.* [49] for Holeta Agricultural Research Center. But this result is lower than 29% reported by Demeke [50] in and around the vicinity of Jimma town. The ADF Contents of milling waste (35.44%) in the current result was similar with 35.6% reported by Chalchisa *et al.* [42] in and around shashamane.

CONCLUSION

Even if crop residues were the dominant feed resources used for fattening cattle, they were highly embarrassed by poor nutritive values explained in terms of higher fiber (NDF and ADF) content and lower crude protein content. However, the nutritional values of non-conventional feedstuffs such as milling by products, local brewery by-products (*atela*) and maize were found to be promising suggesting that their proportion should be increased as much as possible. Supplementation to and treatment of the available feeds may be important in the study area.

ACKNOWLEDGEMENT

The authors would like to acknowledge Department of animal sciences at Jima University for allowing us to conducted feed chemical analysis.

REFERENCES

1. Halala, H., 2015. Review of beef cattle value chain in Ethiopia. Industrial Engineering Letters ISSN: 2224-6096.
2. Mulu, S.B., 2009. Feed resources availability, cattle fattening practices and marketing system in Bure Woreda, Amhara Region, Ethiopia. (M.Sc. Thesis, Faculty of Dry land Agriculture and Natural Resources, Department of Animal, Range and Wildlife science, Mekelle University, Ethiopia).
3. Legesse, G., 2008. Productive and economic performance of small ruminants in two production systems of the highlands of Ethiopia (English Shop).
4. Zemene, W., T. Samuel, T. Taye and J. Worku, 2016. Assessment of the prevailing cattle fattening practices in Jimma Zone, South-Western Ethiopia. Global Veterinaria, 17(2): 105-113.
5. Taye, T. and H. Lemma, 2009. Traditional backyard cattle fattening in Wolayta: systems of operation and the routine husbandry practices. Ethiopian Journal of Animal Production, 9(1): 39.
6. Addisu, A., M. Solomon, L. Getachew, A. Solomon, D. Fantahun, A.J. Duncan and W. Thorpe, 2012. Beef and feed value chain analysis in Adama District, Ethiopia. Ethiopian Institute of Agricultural Research, Debre Zeit Research Center, Ethiopia, ILRI value chain consultant, International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia.
7. Tolera, A., 2008. Feed resources and feeding management. Addis Ababa, Ethiopia: Ethiopia Sanitary and phytosanitary Standards and Livestock and Meat Marketing Program (SPS-LMM).
8. Abeysekara, 2003. The nutritional value of oat forages for dairy cows (Degree of Masters of Science and Poultry Science, University of Saskatchewn, Saskatoon).
9. Qingxiang, M., 2002. Composition, nutritive value and upgrading of crop residues. FAO Animal Production and Health Paper (FAO). Rome, Italy. http://faostat.fao.org/default.aspx
10. CTAHR (College of Tropical Agriculture and Human Resources) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture.
11. Bogale, S., S. Melaku and A. Yami, 2008. Potential use of crop residues as livestock feed resources under smallholder farmers conditions in Bale highlands of Ethiopia. Tropical and Subtropical Agroecosystems, 8(1).
12. Ensminger, R.E., J.E. Oldfield and W.W. Heinemann, 1990. Feed and Nutrition. (2nd edition).
13. Mc Donald, P., R.A. Edwards, J.F.D. Greenhalgh and C.A. Morgan, 2002. Animal nutrition, 6th Edition, Prentice Hall, London, pp: 471-581.
14. Sigh, G.P. and S.J. Oosting, 1992. A model for describing the energy value of straws. Indian dairyman XLIV, pp: 322-327.
15. Linn, J. and C. Kuehn, 1997. The effects of forage quality on performance and cost of feeding lactating dairy cows. In Western Canadian Dairy Seminar.
16. Kellems, R.O. and D.C. Church, 1998. Livestock Feeds & Feeding. (4th edition.). Prentice-Hall, Inc., New Jersey, USA, pp: 573.

17. Demissie, G., 2016. Assessment of fattening and marketing system and effect of concentrate supplementation with locally available feeds on fattening performance of indigenous cattle in Bonke Woreda of GamoGofa Zone (Doctoral dissertation, Hawassa University).
18. NRC (National Research Council), 2000. Nutrient Requirements of Beef Cattle.7th Revised Edition. National Academic, Press, Washington, DC, USA.
19. Abebe, B., 2014. Small Scale Beef Cattle fattening practice, On farm performance evaluation and opportunities for market orientation in western Hararge Zone, Chiro District, Msc. Thesis. Department of Animal and Range Science, Haramaya University, Haramaya , Ethiopia.
20. Reddy, B.V.S., P.S. Reddy, F. Bidinger and M. Blümmel, 2003. Crop management factors influencing yield and quality of crop residues. Field Crops Research, 84: 1-2.
21. Hassen, A., A. Ebro, M. Kurtu and A.C. Treydte, 2010. Livestock feed resources utilization and management as influenced by altitude in the Central Highlands of Ethiopia. Livestock Research for Rural Development, 22: 229-233.
22. VanSoest, P.J., 1994. Nutritional Ecology of Ruminants.
23. VanSoest, P.J., 1982. Nutritional ecology of ruminant. Cornel University Prentice, Ithaca and London.
24. Ahmed, T., M.A. Hashem, M. Khan, M.F. Rahman and M.M. Hossain, 2010. Factors related to small scale cattle fattening in rural areas of Bangladesh. Bangladesh Journal of Animal Science, 39(1-2): 116-124.
25. Duguma, B., A. Tegegne and B.P. Hegde, 2012. Smallholder livestock production system in Dandi district, Oromia Regional State, Central Ethiopia.
26. Abdi, E., K. Kemal, E. Yassin and D. Muleta, 2013. Cattle production in west Hararghe: an opportunity and constraints assessments in Darolabu, Odabultum, Gemechis and Chiro districts, Oromia Regional State, Ethiopia. International Journal of Livestock Production Research.
27. Tadesse, G., H. Kebede and S. Salo, 2014. Feed resources and constraints for cattle fattening in Lemo and Soro woredas, Hadya zone, Southern Ethiopia. Global Journal of Animal Science, Livestock Production and Animal Breeding: ISSN, 2408-5510.
28. SPSS (Statistical package for social science), 2012. (Version 20), INC, Chicago, USA
29. HDLEPO, 2017. Annual progress report, Homa District Land and Environmental Protection Office (HDLEPO).
30. HDAO, 2017. Annual progress report, Homa District Agricultural Office(HDAO)
31. HDLFDO, 2017. Annual progress report, Homa District Livestock and Fishery Development Office(HDLFDO)
32. Cochran, W.G., 1977. Sampling Techniques, John Wiley & Sons, New York, NY, USA, 3rd edition.
33. AOAC International (16th ed.). Virginia, USA. AOAC, 1995. Association of Official Analytical Chemists: Official Methods of Analysis.
34. VanSoest, P.J., J.B. Robertson and B.A. Lewis, 1991. Methods for dietary fiber. Neutral detergent fiber and non-starch polysaccharides in relation to animal nutrition. Journal of Dairy Science, 74: 3583-3597.
35. FAO (Food and Agriculture Organization of the United Nations), 1986. Ethiopian highland reclamation study. Final Report. Vol. 1, FAO, Rome.
36. Assefa, D. and A. Nurfeta, 2013. Assessment of feed resource availability and livestock production constraints in selected Kebeles of AdamiTullu Jiddo Kombolcha District, Ethiopia. African Journal of Agricultural Research, 8(29): 4067-4073.
37. Amare, S., 2006. Livestock production systems and available feed resource in different agro-ecologies of North Gondar Zone, Ethiopia. (M.Sc. Thesis. Haramaya University, Haramaya, Ethiopia).
38. Wondatir, Z., 2010. Livestock production systems in relation with feed availability in the highlands and central rift valley of Ethiopia.
39. Milford, R. and D. J. Minson, 1966. The feeding value of tropical pastures.
40. Gemiyo, D., A. Hassen, T. Kocho, T. Birhanu, Z. Bassa and A. Jimma, 2013. Chemical composition and digestibility of major feed resources in mixed farming system of southern Ethiopia. World Applied Sciences Journal, 26(2): 267-275.
41. Tonamo, A., B. Tamir and G. Goshu, 2015. Assessment of cattle feed resources; chemical composition and digestibility of major feeds in Essera District, Southern Ethiopia. Science, Technology and Arts Research Journal, 4(2): 89-88.
42. Chalchisa, G., Y. Mekasha and M. Urge, 2014. Feed resources quality and feeding practices in urban and peri-urban dairy production of southern Ethiopia. Tropical and Subtropical Agroecosystems, 17(3).

43. Abebe, Y., M. Tafere, Sh. Dagnew, M.G. Tolla and Y. Selassie, 2015. Best fit practice Manual for Rhodes Grass (*Chloris gayana*) production: November, CASCAPE project, Addis Abeba, Ethiopia.
44. Geremew, G., T. Negesse and A. Abebe, 2017. Assessment of availability and nutritive values of feed resources and their contribution to livestock nutrient requirements in Chire District, Southern Ethiopia, Agricultural Research and Technology Open Access Journal.
45. Wadi, A., Y. Ishii and S. Idota, 2004. Effect of cutting interval and cutting height and dry matter yield and overwintering ability at the established year in Pennisetum species. Plant Production Science, 7: 88-96.
46. Moreda, T., 2016. Assessment of beef cattle production, management practices and marketing system in Lume District of east Shoa Zone, Ethiopia. MSc, Thesis, School of Animal and Range Science, Hawassa University, College of Agricultre).
47. Getahun, K.Y., 2014. Effect of concentrate supplementation on performances of Ethiopian lowland afar and blackhead Ogaden lambs. Animal and Veterinary Sciences, 2(2): 36-41.
48. Kebede, A., A. Bitew, T. Bimrew, A. Yitayew, Y. Denekew Y. Ferede and G. Zeleke, 2013. Comparative evaluation of the fattening performance of Fogera and Adet Old Oxen at Andassa Livestock Reseach Center, Ethiopia. Value Ch.
49. Feyissa, F., G. Kitaw and G. Assefa, 2015. Nutritional qualities of agro-industrial by-products and local supplementary feeds for dairy cattle feeding. Ethiopian Journal of Agricultural Sciences, 26(1): 13-26.
50. Demeke, S., 2007. Comparative nutritive value of Atella and industrial brewers grains in chicken starter ration in Ethiopia. Livestock Research for Rural Development.
51. Kassahun, A., H. Waidbacher and W. Zollitsch, 2012. Proximate composition of selected potential feedstuffs for small-scale aquaculture in Ethiopia. Livestock Research for Rural Development, 24(6).
52. Amensisa, E., 2010. Effect of supplementation of different levels of dried 'girawa' (*Vernonia amygdalina*) foliage and crushed maize grain mixtures on feed intake.