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Original Article

Study on Nutritional Quality of Major Beef Cattle Feed Resources in Selected Districts of Buno Bedele and Ilu Abbabor Zones, Western Ethiopia

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ABSTRACT

The present study was aimed with to evaluate nutritional quality of major beef cattle feed resources in selected districts of Buno Bedele and Ilu Abbabor zones. The feeds samples were collected during the dry season from January to March, and in wet season from July to August to evaluate the variation of nutritive values of feeds along with varied seasons. The various samples of feedstuffs collected were brought to Jimma University Animal Nutrition Laboratory for chemical analysis. SAS (Version 9.2) and ANOVA test were applied for analyzing the chemical composition and nutritive qualities of feedstuffs. As the study result indicated the chemical composition and nutritive values of major feed resources in the study areas were significantly different at ($p<0.01$) between feeds samples across the agro ecologies. The crude protein content was varied from 6.71% (teff) to 15.03 % *(Desmodium).* The neutral detergent fiber (NDF) content of different feeds were varied from 70.17% (Barley) to 63.85% (*Pennisetum Clandustinum*) and the acid detergent fiber (ADF) also varied from 44.78(brewery by-product) to 57.53% (barley) in similar species. Therefore, it was concluded that the Dry matter (DM), Metabolizable energy (ME) and Digestible crude protein (DCP) of the feeds sampled did not satisfy the maintenance requirements of livestock in the study areas. Hence, the fatteners should feed their animals based on body weight of the animals to hasten the finishing time.

Keywords: Beef cattle, Buno Bedele and Ilu Abbabor Zones, feed resources, nutritive value

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INTRODUCTION

Ethiopia is home for diverse livestock populations, numbering 61.59 million cattle, 36.81 million goats, 32.85 million sheep, 2.07 million horses, 9.22 million donkeys, 0.35 million mules, and about 3.73 million camels and about 48.13 million poultry (CSA, 2020); parallel to its diverse ecology, production systems and ethnic communities. However, the current levels of contributions of the livestock sector in general and beef cattle in particular in Ethiopia, at either the macro or micro level are below potential. The levels of foreign exchange earnings from livestock and livestock products are also much lower than would be expected, given the size of the livestock population (Berhanu *et al.*, 2007 cited by Ararsa and Amanuel, 2020). This may be due to various constraints; among issues related to feed are the most remarkable ones. For instance, the limited feed supply and poor qualities of the available feeds; the progressive decline of average grazing land in response to rising human populations, encroachment of cropping land, and expansion of degraded lands and poor grazing management (Alemayehu, 2005) are among the feed related constraints hampering livestock production and productivity.

Even though the study areas have suitable environmental condition for beef cattle production, evaluation of chemical composition and nutritional qualities of major beef cattle feed resources in relation to livestock requirement has not been yet well addressed. To obtain improvement in animal production and productivity, analysis should be done on the types and sources of livestock feed resources, chemical composition and nutritive values of major feeds. Understanding the chemical composition and nutritive values of major feeds resources in the study areas is imperative for improving the production and productivity of beef cattle and providing appropriate knowledge to smallholder farmers; which helps them to enhance feed supply and design the feeding alternatives during worse season of the year to mitigate the livestock feed shortage. To this effect, this study was initiated with identifying major feed resources available and evaluation of nutritive quality feeds in the study areas.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in selected districts of Buno Bedele and Ilu Abbabor Zones, which are located between the distances of 474-600km, south western of Addis Ababa, the capital city of the country. Astronomically, both zones located at latitude and longitude lies between 8º 27` - 8°45`N and 36º 21’ - 36°35` E, respectively. The zones contain highland (10%), midland (67%) and (23%) agro-ecologies; and located at altitude ranges 500- 2575m a.s.l. The annual precipitation ranges from 1500-2200mm with 6 to 9 months of rain fall (MoA, 2010). The total human population of the zones is 1,492,183 people; of this, about 88% of human populations reside in the

rural areas. The farming system of the zones are characterized by mixed farming system, comprising both cropping and livestock production. The study areas endowed with huge livestock populations ((1,343,350- cattle), (408,105- sheep), (211, 551- goat), (133309- equines), (1, 074, 989- poultry) and (795,290-bee colonies)) (CSA, 2020).

Feeds Sample Collection

Before the feed sample collection, interview was made with farmers in order to have a general overview. While surveying, the available feed resources were identified using the indigenous knowledge of farmers from the selected Districts.

The feeds samples were collected during the dry season from January to March, and wet season from July to August to evaluate the nutritive value variation along with the varied seasons. While identifying the available feed resources, the households were asked to rank the major natural pasture feeds, crop residues, and different fodder trees and shrubs based on their palatability, preference by livestock, and their dominance and by their ability to maintain greenness. Based on the rank, the most common species of these feed types were collected for chemical analysis. Finally, the samples were dried in an oven at 65ºC for 72h, and ground in Willey mill to pass through 1mm sieve and allowed to equilibrate at room temperature for 24h. The ground samples were kept in airtight containers pending analysis for chemical composition.

Quality Analysis of Feed Samples

The various samples of feedstuffs collected during cross sectional field survey were processed and subjected to proximate and detergent components following the official procedures. All the dried samples were ground to pass through a one mm sieve size using Willey mill for chemical analysis. The grinded feed samples were analyzed for dry matter (DM) content after oven-dried at 105°C for 16 hours (AOAC, 1995). Determination of the dry matter content of liquid feed resources (e.g., *Atela* and other non-conventional ones) was followed similar procedures. The total ash was analyzed by complete combustion of the dried feed samples in muffles-furnace at 550 ºC for 16h and the contents were calculated according to AOAC (1995). Crude protein contents were determined by Kjeldahl method (AOAC, 1995). Accordingly, crude protein was calculated as 6.25 x N content. The conversion factor, 6.25 was used for all forages and mixed feed stuffs, and 5.70 for cereal grains. Crude fiber (CF) was determined according to AOAC (1995). Approximately 5 g of the dried feed sample was dissolved either with diethyl ether or petrol ether and then the ether is evaporated in the Soxhlet apparatus for crude fat determination following AOAC (1995).The percentage organic dry matter was calculated by reducing total ash from 100%. Neutral-detergent fiber (NDF) determination was followed Van Soest et al. (1995) procedures. Acid-detergent fiber (ADF) and acid-detergent lignin (ADL) was

determined by the detergent procedures of AOAC (1995). NDF was assayed without a heat stable amylase and expressed exclusive of residual ash. ADF was expressed without residual ash. ADL, Lignin was determined by solubilization of cellulose with Sulphuric acid (H_2SO_4). Metabolisable energy (ME) contents of the feedstuffs were predicted from the following equation (Abate and Meyer, 1997).

ME (MJ/kg DM) = 5.34-0.1365CF+0.6926NFE-0.0152NFE^2+0.0001NFE^3… (1)

Since Nitrogen Free Extract (NFE) = %DM - (%EE + %CP + %CF + %Ash, McDonald *et al.2010*): DM = dry matter; EE = ether extract or crude lipid; CP = crude protein; CF = crude fiber. Acid insoluble ash was determined to reduce sand and silica from total ash content of feedstuffs and Sodium sulphite (Na_2SO_3) was included in CF determination in order to remove tannins from CF: tannin complexes. The Digestible Crude Protein will be calculated according to the following formula (FAO, 1986)

DCP (g) =0.929 x CP (g)-3.52 …… (2)

Methods of Data Analysis

Feed Samples collected were analyzed using the following statistical model. SAS (Version 9.2) was applied for analyzing nutritive qualities. Wherever ANOVA test was employed, the following two factorial ANOVA model were emplyed.

$$Y_{ijk} = \mu + \alpha_i + \beta_{ij} + e_{ijk}$$

Where; Y_{ijk} = production and marketing parameter

μ = Overall mean

α_i = the effect of i^{th} district (i=1-6)

β_{ij} = the effect of j^{th} feed resource base and beef (j=1-2)

e_{ijk}= random error

RESULTS AND DISCUSSIONS

Chemical Composition and Nutritive Values of Feeds Resources

One of the basic needs in the planning and utilization of pastures and achieving optimum performance of livestock is determining the nutritional needs of livestock in terms of energy, protein, minerals and vitamins. This is only possible when the quality of pastures forage plants for each region in terms of chemical composition is known. Pastures forage quality varies with species and agro-ecologies. Therefore, knowledge of forage quality in different regions and different climatic conditions should be considered for proper utilization of pastures.

The nutritional values of feed samples from natural pastures were presented in Table 1. The chemical composition and nutritive values of major feed resources in the study area was significantly different at ($p<0.01$) between feed samples across the agro-ecologies. The crude protein content was varied from 6.71% (*Teff)* to 15.03 % (*Desmodium).*

Table 1: Chemical composition and nutritive values of fodder trees and shrubs in mid altitude area

Feedstuff	Chemical composition (% DM)								Nutritive values	
	DM (%)	Ash	EE	CP	CF	NDF	ADF	NFE	DCP (g/kg DM)	ME (MJ/kg DM)
Digitaria abyssinica	91.35	10.45	2.12	11.23	48.75	64.39	53.10	18.80	6.91	3.35
Pennisetum clandustinum	91.36	10.95	4.00	10.79	46.62	63.85	49.38	19.04	6.50	6.21
Vigna vexillata L. A. Rich	91.40	10.11	3.33	11.82	48.97	66.94	51.73	16.89	7.46	0.35
Medicago burweed	90.49	12.82	5.62	12.55	50.77	65.64	45.90	8.74	8.14	3.80
Brewery by-product	91.29	15.28	3.46	10.07	47.39	69.73	44.78	15.10	5.84	7.00
Barley	91.61	26.92	4.60	14.30	45.89	70.17	56.60	1.91	9.77	7.35
Teff	91.54	11.30	1.31	6.71	47.83	69.35	46.30	24.41	2.71	7.91
Bersama abyssinica	90.97	10.46	3.93	12.25	47.75	66.90	48.60	16.58	7.86	6.50
Vernonai amygadalina	91.49	9.97	2.41	9.33	46.70	64.93	48.40	23.09	5.15	4.24
Chloris gayana	91.45	11.19	3.40	10.65	53.63	67.85	49.41	12.58	6.37	6.57
Desmodium	90.84	10.06	4.43	15.03	47.19	66.01	48.36	14.14	10.44	8.07
Saccharum officinarum L	90.94	12.76	3.37	11.82	49.18	65.15	49.20	10.82	7.46	3.80
CV	2.44	3.74	21.43	3.35	1.92	1.88	6.84	25.02	5.01	29.34
p-*value*	<..01	<.0001	<.001	<.0001	<.0001	<.001	<.01	<.001	<.0001	<.001

DM=Dry matter; OM=Organic Matter; CP = Crude Protein; NDF=Neutral Detergent Fiber; ADF= Acid Detergent Fiber; NFE= Nitrogen Free Extract
DCP=Digestible Crude Protein; ME, Metabolizable Energy

The present result was in agreement with the ranges of Firew (2007) who reported the CP contents of natural pasture was 1.42% to 18.95% in southern Ethiopia. The neutral detergent fiber (NDF) content of different feeds varied from 70.17% (*Barley*) to 63.85% (*Pennisetum Clandustinum)* and the acid detergent fiber (ADF) also varied from 44.78 (brewery by-product) to 57.53% (barley) in similar species. There were higher contents of NDF and ADF were characterized by low quality and low digestible feed in study areas. The present result was agreed with the ranges of Firew, (2007) result at tropical highland of Ethiopia. The highest ADF was observed in grasses species than legumes species.

The metabolizable energy (ME) contents of different feeds was ranged from 0.35MJ *(Vigna Vexillata* L. A. Rich) to 8.07MJ (*Desmodium).* The digestible crude protein (DCP) of feed samples in the study areas was ranged from 2.71g (*Teff*) to 10.44g (*Desmodium*). The poor nutritive values of grasses and their lower degradability resulted in low intake and feed utilization, and thereby reduce performances of animals (Wolde et al., 2014).

CONCLUSION AND RECOMMENDATION

The chemical composition and nutritive values of major feed resources in the study areas was significant different at ($p<0.01$) between feed samples across the agro-ecologies. The crude protein content was varied from 6.71% (*Teff)* to 15.03 % (*Desmodium).* The neutral detergent fiber (NDF) content of different feeds varies from 70.17% (*Barley*) to 63.85% (*Pennisetum Clandustinum)* and the acid detergent fiber (ADF) also variesd from 44.78(brewery by-product) to 57.53% (barley) in similar species. Therefore, from the current study it was concluded that the DM, ME and DCP of major feed resources did not satisfy the maintenance requirements of livestock in the study areas. Almost all the available feed resources were also in poor in chemical and nutritional composition especially in dry season. Hence, the fatteners should feed the animals based on body weight of the animals to hasten finishing time.

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CONFLICT OF INTEREST

None

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