Research & Reviews: Journal of Ecology and Environmental Sciences

e-ISSN:2347-7830
p-ISSN:2347-7822

Nutritive Value of *Hyparrhenia anamesa* Dominated Natural Pasture and its Impacts on Seminal Traits of Horro Rams

Abera Seyoum* and Debisa Lemessa

Ethiopian Biodiversity Institute, Forest and Rangeland Plants Biodiversity Directorate, Addis Ababa, Ethiopia

Research Article

Received: 02/11/2017
Accepted: 17/11/2017
Published: 24/11/2017

***For Correspondence**

Abera Seyoum, Ethiopian Biodiversity Institute, Forest and Rangeland Plants Biodiversity Directorate, Addis Ababa, Ethiopia, Tel: +251911098063.

E-mail: aseyum@gmail.com

Keywords: *Hyparrhenia anamesa*, Agriculture, Evaluation, Protein, Organic matter

ABSTRACT

Evaluation of pasture is often suggested to improve the productive and reproductive performance of livestock and proper utilization of the grazing land. However, this has got little attention in western Ethiopia. Here, a study was conducted to evaluate the nutritive value of *Hyparrhenia anamesa* grass dominated natural pasture and its impacts on seminal traits of Horro rams, at Bako Agricultural, Technical and Vocational Education and Training College, west Ethiopia. One hectare of grazing land was demarcated and eighteen yearling Horro rams were allowed to graze for a grazing period of 120 days. The biomass yield of the grazing pasture was estimated using multistage systems where pastures were harvested from five quadrates (1 × 1 m size) from within the demarcated grazing land. Chemical composition of the pasture was analysed using standard laboratory procedures. Data on seminal attributes were taken every two weeks during the grazing period. The result showed that natural pasture was poor both in dry matter yield (0.346 t/ha) and Crude Protein (6.07%), lower in in vitro digestible organic matter (54.61% of DM) and high in acid detergent fiber (67.78%). The total ash content and metabolizable energy (ME) were 8.96% and 8.19 MJ/kg DM, respectively. Both head and total spermatozoa abnormalities have showed significant variation across the grazing period. This study demonstrated that the natural pasture dominated with *Hyparrhenia anamesa* grass cannot support optimal seminal attributes, due to both inadequate quantity and low quality of the pasture mainly during dry period. Overall results suggest the importance of supplementation and/or looking for other management option to enhance the reproductive performance of Horro rams while not further degrading pasture productivity.

INTRODUCTION

In tropical region, feed resources are mainly natural pastures and agricultural by-products. But these feed resources are mostly low in protein content and digestible energy [1]. Similarly in Ethiopia livestock feeding is often based on natural pasture and crop residues which are generally poor in nutritive value. Moreover, the Ethiopian natural pastures are decreasing, because of conversion of pasture lands to crop production triggered by increasing human population pressure. As a result the existing pasture cannot meet the nutritional requirement of livestock resulting in reduced growth rate, low production, poor fertility and high mortality [2]. In the western parts of Ethiopian, Horro breed of sheep is an integral part of farming system and predominantly a basic asset for the livelihood of the society, where sheep production is mostly influenced by the seasonal scarcity and low quality of feed resources as feed availability and quality primarily depends upon the climatic and seasonal factors, and this is a challenge for the reproductive performance of livestock [3]. Among environmental factors that affect the reproductive phenomena of livestock, nutritional factors are the most crucial in terms of their direct effects and the potential to moderate the effects of other factors [4]. Under nutrition resulted in reduced sperm output, decreased sperm motility, and an increased in the proportion of morphologically abnormal spermatozoa in the ejaculate, alters the endocrine and hormonal activities in livestock leading to decline in reproductive efficiency [5]. Thus, for better animal performance and sustainable use of the grazing resources, evaluation

e-ISSN:2347-7830
p-ISSN:2347-7822

of the nutritive values of grazing pasture is a paramount importance for devising the feeding strategies, which may include the determination of supplementation [6].

However, evaluation of the nutritive value of natural pasture has got little attention and information is lacking regarding the nutritive values of natural pastures dominated with *Hyparrhenia anamesa* grasses in western Ethiopia. Further, so far little work has been done on the impact of *Hyparrhenia anamesa* grass on seminal traits of Horro rams. Therefore, this study was conducted to fill this gap by evaluating the nutritive value of *Hyparrhenia anamesa* grass dominated natural pasture and its impacts on seminal traits of Horro rams. We hypothesized that the nutritive value of *Hyparrhenia anamesa* dominated grasses deteriorates as the dry period advanced impairing the seminal traits of Horro rams considered in this study. In consistent with our hypothesis, the overall result indicated that *hyparrhenia* dominated pasture was poor in crude protein, low in biomass yield and *in vitro* digestible organic matter resulting in higher head and total spermatozoal abnormalities across the grazing period.

MATERIALS AND METHODS

Study Area

The study was conducted at Bako Agricultural Technical and Vocational Education and Training (ATVET) College, West Shewa zone of Oromia region, Ethiopia. It is located at about 250 km to the west of Addis Ababa city. The average elevation of the area is 1560 m a.s.l. The soil type is Nitosol with a texture of sandy clay loam and receives a mean annual rainfall of 1219 mm where a major rainfall season is during May to September [7]. The mean monthly temperature range is between 14–28°C. As in other parts of the country, in western part general and particularly around Bako area where this research was conducted, grazing lands play a paramount role in livestock feed and support a diverse range of grasses among which *hypprehennia* grass is the dominant grass species which is less palatable, in particular during dry period, which is a challenge for livestock production in the area where Horro breed of sheep is an integral part of farming system and predominantly a basic asset for the livelihood of the society.

Data Collection

Biomass yield and chemical analysis

One hectare of pasture land was demarcated and allocated for eighteen Horro rams for grazing. To estimate the biomass yield of the pasture, multistage sampling system was employed. Accordingly, five quadrates were first established; four at the corners and one at the center of the demarcated grazing land and the initial samples were taken. The quadrate was made of wood with 1 m x 1 m size. Since the initial samples were taken by harvesting the pasture to the ground level, the second and third samples were taken every month by randomly throwing the quadrate to the back side five times at each sample taking time with in the grazing pasture. In all cases from each entire quadrate the pasture was harvested at ground level using hand shears, weighed and dried under the shade until constant weight is attained. The biomass yield was then estimated based on the average DM contents of the samples for those taken at three different times. Representative dried biomass samples were grounded to pass a 1 mm sieve mesh and analyzed for DM, OM, CP and ash contents following the methods described by AOAC [8]. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were analyzed according to the methods of Van Soest PJ, Robertson JB and Lewis BA. Metabolizable energy (ME) content of the feeds was estimated using the equation: ME (MJ/kg DM) = 0.16 × IVDOMD [9,10]. The IV DOMD (*In vitro* digestible organic matter in dry matter) was determined according to Tilley JMA [11].

Semen collection and evaluation

Prior to semen collection, the temperature of the artificial vagina (AV) was maintained to about 42- 45°C by filling the space between the outer external case and the inner lining of the AV with warm water. This was supported by filling the same cabinet with air in order to maintain pressure. The inner wall of the AV, the first few centimeters, was also thinly lubricated with vaseline before collection. Semen collection tubes and pipettes were also warmed at about 37°C prior to semen collection. Ewes at estrous were made available from the flock kept in the college, and rams were exposed individually to estrus ewes for a period of 5 minutes. After six rams were taken randomly, the semen was collected in the morning between 7:30–10:30 a.m. at every two weeks interval for two consecutive days. Immediately after semen collection, semen volume and semen motility were measured. The volume of the ejaculate was read to the nearest 0.1 ml directly from a graduated collection tube, and the collection tube with semen was immediately put into water bath (about 32-34°C) for further semen evaluation. Sperm individual progressive motility (SIM) was estimated by placing a drop of diluted semen in 3.8% sodium citrate solution under cover slip and examined under a microscope (400x) and scored with 10% unit intervals. The percent of dead or alive spermatozoa was computed by mixing a drop of semen sample with two drops of eosin-nigrosine stain on pre warmed clean slide. About 200 spermatozoa was then examined in different fields of the slide and categorized into colored (dead) and non-colored (alive) sperm cells under a microscope (400 x). The percent of live spermatozoa was then calculated by deducting stained spermatozoa from the number of counted spermatozoa and then multiplying by 100 and finally divided by total number of counted spermatozoa. The proportion of morphologically abnormal spermatozoa was evaluated using an eosin-nigrosine smear that was prepared for

e-ISSN:2347-7830
p-ISSN:2347-7822

live/dead spermatozoa determination. About 200 spermatozoa were examined from different areas of the slide under the same magnification. The types of abnormalities considered were head (twin, round, shrunken, large, narrow, elongated, and diminutive heads were considered as head abnormalities), mid piece (bent, broken, and short, enlarged or thickened, double, vestigial mid-piece) and tail abnormalities (coiled, twin, broken) as recommended by Salisbury GW [12]. These three types of abnormalities were pooled together and reported as total abnormality of spermatozoa. Evaluation of the semen was conducted at the Veterinary Laboratory of Bako ATVET College.

Statistical Analysis

The effect of grazing period on seminal attributes was analyzed using one-way ANOVA within R statistical program [13]. Moreover, data was further analyzed by descriptive statistics in Microsoft Excel office.

RESULTS

Chemical Composition of Natural Pasture

The biomass yield and chemical composition of the natural pasture is presented in **Table 1**.

Table 1. Chemical compositions of natural pasture.

Feed type	DM yield(t/ha)	DM (%)	% DM*						IVOMD %	ME(MJ/kg DM)
			Ash	OM	CP	NDF	ADF	ADL		
Natural pasture	0. *346*	72.33	8.96	91.04	6.07	67.78	36.9	6.14	54.61	8.19

Note: *DM= Dry matter, OM=organic matter, CP= crude protein, NDF= neutral detergent fiber, ADF=acid detergent fiber, ADL=acid detergent lignin, *IV*OMD=*in vitro* organic matter digestibility, ME= metabolizable energy, MJ=mega joule

The estimated biomass dry matter yield of the natural pasture was 0.346 t/ha, while the proportion of Crude Protein, *In vitro* digestible organic matter of DM and Acid detergent fiber were 6.07%, 54.61% and 67.78%, respectively.

Seminal Attributes

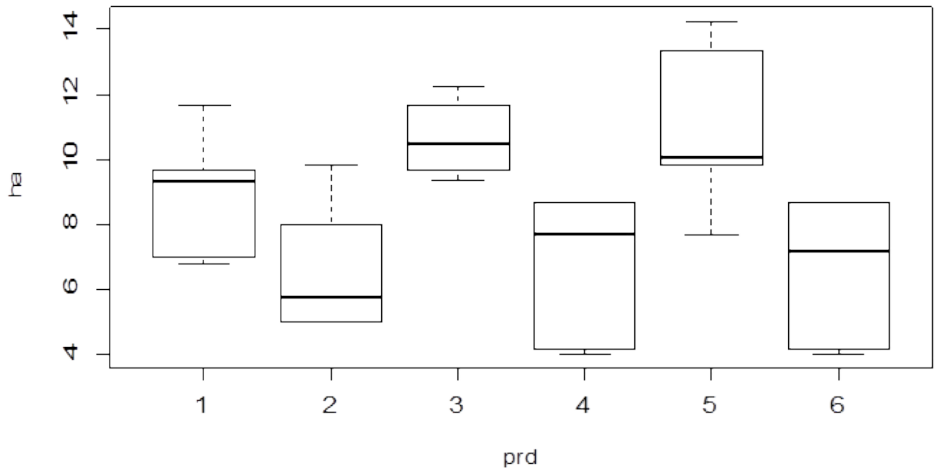
The proportion of both spermatozoal total and head abnormalities singnificantly varied across the grazing period([ANOVA, $F^{(5, 30)}$ =2.66, P=0.042), [ANOVA, $F^{(5, 30)}$ =6.43, P<0.001). However, Spermatozoa mid head and tail abnormalities were not significantly varied across the grazing period. Further, we did not found significant differences in semen volume, sperm individual motility, and proportion of live spermatozoa acros the grazing period.

DISCUSSION

Our study showed that the *Hyparrhenia anamesa* dominated pasture of the study area is poor in protein content (6.07%) and lower in dry matter yield (0.346 t/h) and *in vitro* digestible organic matter (IVOMD) (54.61%). With this regards, the CP content of the *Hyparrhenia anamesa* grass is below the required level of CP for animal in the tropics, i.e., 7% [14]. However, our result of CP is greater than the CP content of 5.1% which was found during the dry season for Borana rangeland grass species [15]. This variation may be due to differences in agro climatic conditions, forage species, and the maturity stage of the plants [16].

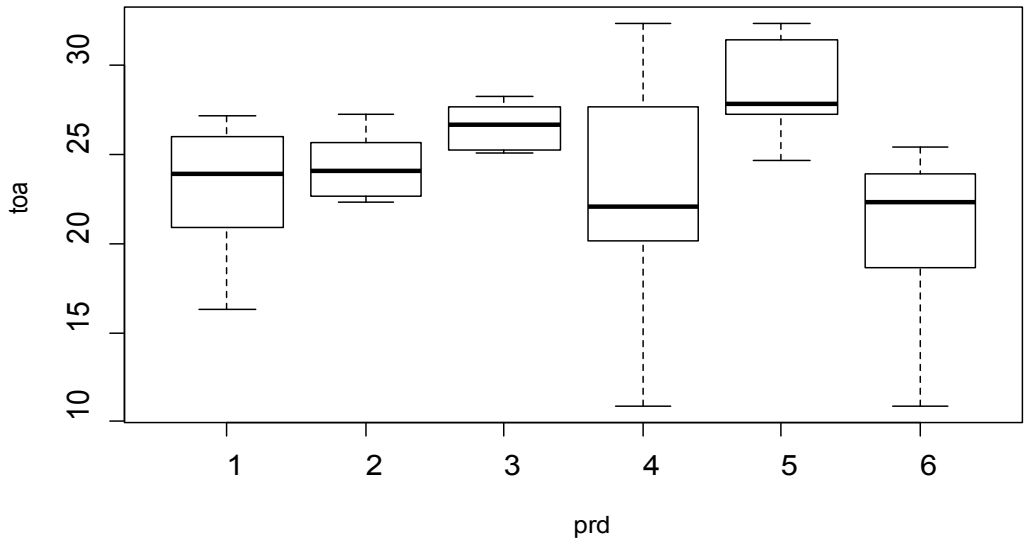
Moreover, the biomass production in this study was found to be 0.346 t DM/ha. This is by far below 2.25 t DM/ha for natural pasture in Shinille zone of Somali Regional state of Ethiopia [17]. This variation may be partly attributed to the fact that samples for biomass production was taken during the critical dry season in current study. The biomass production and nutritive values of forage is basically crucial to meet the production and/or reproduction performance of livestock, because carrying capacity of grazing lands should often be directly linked to the nutritive value in particularly to CP content of livestock feed consumed [18]. Furthermore, the metabolizable energy (ME) of the pasture in current study (8.19 MJ/kg) was lower than the recent report of ME (9.69 MJ/kg) of the grazing lands natural pasture indicating that the ME content of *hyparrhenia* grass in this study may not be adequate for the animals, consequently supplementation with readily available carbohydrate source is necessary to increase the microbial biomass and rate of degradation of fibrous feed [19,20]. On the contrary, the proportion of neutral detergent fiber (NDF) and acid detergent fiber (ADF) obtained in our result was 67.78% and 36.9%, respectively. These higher fiber components of NDF and ADF in this study could be related to the fact that the grass was over matured and dry during the experimental period, which eventually results in increased structural carbohydrates and legnin, and decrease in protein content. The finding was consistent with matured *Digitaria* grass hay fed to Wogera sheep [21]. Both head and total spermatozoa abnormalities have showed significant variation across the grazing period **(Figures 1 and 2)**.

e-ISSN:2347-7830
p-ISSN:2347-7822



Note: *ah=head abnormalities, prd=period (weeks)

Figure 1. A box plot showing sperm head abnormalities of Horro rams varying across the grazing period.



Note: *toa=total abnormalities, prd=period (weeks)

Figure 2. A box plot showing Sperm total abnormalities of Horro rams varying across the grazing period.

The existence of significant variation in head and total sperm morphological characteristics across the grazing period in the present study may be attributed to the lower supply of CP content and IVOMD of natural pasture used that could not maintain normal spermatozol production as the grazing period advanced towards dry season. This is in line with the phenomena where the quantity and quality of tropical forages become more critical in the dry season imposing serious constraints to the development and performance of livestock [22]. Moreover, sperm morphology is correlated to reproduction, as infertility is most often related to a high proportion of structurally abnormal spermatozoa the current study suggests the necessity of supplemental feeds to support the lower nutritive value of natural pasture in order to exploit the genetic potential of Horro rams, which further assist in proper utilization of the grazing pasture [23].

CONCLUSION

The current study showed that the natural pasture dominated with *Hyparrhenia anamesa* grass species was poor in CP, and IVOMD, but was higher in neutral detergent fiber (NDF) and acid detergent fiber (ADF) components. There was a significant variation in sperm head and total abnormalities across the grazing period. This study demonstrated that this natural pasture cannot support optimal seminal attributes, due to both inadequate quantity and low quality of the pasture mainly during dry period. Our overall results suggest either the importance of supplementation or other management options to compensate the poor nutrient content of pasture and enhance the reproductive performance of Horro rams while not further degrading pasture

e-ISSN:2347-7830
p-ISSN:2347-7822

productivity.

REFERENCES

1. Admassu Y, et al. Utilization of feeds, Livestock unit versus dry matter requirement in Alaba, Southern Ethiopia.
2. Edea Z, et al. Characterization of Bonga and horro indigenous sheep breeds of smallholders for designing community based breeding strategies in Ethiopia. M.SC. thesis, Haramaya University, Ethiopia; 2008
3. Jembere T, et al. Evaluation of cow pea hay (*V.unguaculata*) vs. nougcake supplementation of Cynodon dectylon on growth performance and carcass characteristics of Horro rams. Proceeding of the 11th Annual Conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia. 2007:23-29.
4. Kheradmand A, et al. Effect of improved diet on semen quality and scrotal circumference in the ram. Veterinarski Arhiv. 2006;76: 333-341.
5. Chaidanya K, et al. Climate change and livestock nutrient availability, impact and mitigation. J Vet Sci Med Diagn. 2015:4.
6. Arzani H, et al. Nutritive value of some Zagros mountain rangeland species. Small Rumin Res. 2006:128-135.
7. Negassa W, et al. Assessment of important physiological properties of dystric udalf (dystric Nitosols) under different management system in Bako area, western Ethiopia. M.Sc. Thesis Alemaya University, Ethiopia. 2001:1-24.
8. Official methods of analysis: Association of Official Analytical Chemists (AOAC). Washington, DC. 1990:69-88.
9. Van Soest PJ, et al. Methods for dietary fiber and nonstarch polysaccharides in relation to animal nutrition. J Dairy Sci. 1991;74:3583-3597.
10. McDonald, et al. Animal nutrition. England, London. 2002:349-560.
11. Tilley JMA, et al. A two stage technique for in vitro digestion of forage crops. J British Grassland. 1963;18:104-111.
12. Salisbury GW, et al. Physiology of reproduction and artificial insemination of cattle. San Francisco W. H. Freeman and Company, USA. 1978:1-798.
13. https://www.r-project.org/
14. Kearl LC, et al. Nutrient requirement of ruminants in developing countries. International Feedstuffs Institute, Utah state Univ Logan UT; 1982.
15. Habtamu TK, et al. Nutritive value of grasses in semi- arid rangelands of Ethiopia: Local experience based herbage preference evaluation versus laboratory analysis. Asian-Australas J Anim Sci. 2013;26:366-377.
16. Ludwiing F, et al. The influence of savanna trees on nutrient, waer and light availability and the understorey vegetation. Plant Ecol. 2004;170:93-105.
17. Tomar NS, et al. Seasonal variation in semen characteristics and reaction time of Khillari breed of cattle. Indian J Dairy Sci. 1966;19:87-93.
18. http://www.fao.org/faostat/en/
19. Mekuanint G, et al. Livestock feed resources, Nutritional value and their implication on animal productivity in mixed farming system in Gasera and Ginnir Districts, Bale Zone, Ethiopia. Academic Journals. 2017;8:12-23.
20. Sundst F, et al. Straw and other by- products of feed. Elsevier Science Publisher Co. Inc., Netherlands. 1984:373-413.
21. Mulu Moges, et al. Effects of feeding different levels of breweries' dried grain on live weight gain and carcass characterstics of wogera sheep fed on hay basal diet. M.SC. Thesis, Alemaya University, Ethiopia. 2005:1-32.
22. Abusuwar AO, et al. Seasonal variability in nutritive value of ruminant diets under open grazing system in the semi-arid rangeland of Sudan (South Darfur State). Aric Biol J N Am. 2010;1:243-249.
23. Abusuwar AO, et al. Effect of chemical fertilizer on yield and nutritive value of intercropped Sudan grass (sorghum suanese) and cow pea vigna unguiculata L. walp) forages grown in an adverse environment of western Saudi Arabia. African J Microbial Res. 2012;6:3485-3491.