NUTRITIVE EVALUATION OF SOME PASTURE PLANTS IN BUTANA AREA, (CENTRAL SUDAN)

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DEDICATION

To my Mother
Father, brothers, sisters
and nice friend.
ACKNOWLEDGEMENTS

Thanks for my GOD for presented me patience to complete this work also I would like to express my appreciation to my supervisor Dr. Abdelnasir M. A. Fadel Elseed.

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Very Special thanks are due to my Mother (Fatima Ahamed Abdelrahaman) and Father (Saad alnour).
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ABSTRACT

The potential nutritive value for some pasture grasses and forbs from Butana area, central Sudan were studied. Fourteen pasture species, four grasses (Dactyloctenium aegyptiacum, sporobolus pyramidatus, scheonflaedia gracilis, and Cyprus rotundas and ten forbs (Ipomoea cordufana ,Iopomea sinensis,cucmus melo ,Hybanthus enneaspermus ,Euphorbica aegyptica ,ocimum basilicum, sesbania,aribica, solanum dubium,and striga hermonthica) were collected at the end of the rainy season (September,2006) from Tamboul in Butana, central sudan . The chemical composition, mineral concentration, in vitro day matter digestibility(IVDMD),estimated metabolizable energy(ME) and the in vitro gas production profiles were significantly(p<0.05) varied among the different species.

The CP in grasses species ranged from (6.29-10.21) % and (4.26-10.20)% in forbs species, the NDF content for grasses species 54.34-76.23% while in forbs species (36.34-76.42) %, however, the ADF content ranged between (34.23-62.38) % in grasses to 27.86-50.10% in forbs. All species showed relatively high IODMD (>50%) except Dactyloctenim aegyptiacum (43.06%). The estimated ME value were below 8MJ/kg DM for all pasture species, however, forbs species had higher value than grasses. Calcium concentration in grass species (2.9-4.3)g/kg and 2.8-5.2g/kg for forbs, Phosphorus concentration in grasses
species ranged 1.4-2.9g/kg, while concentration in forbs relatively high 1.5-3.2 g/kg Sodium and Potassium content in examined species were extremely low.

Grasses had lower gas volume in initial incubation period. The volumes ranged from 1.8-3.6ml, while for forbs the values 3.2-6.2ml the cumulative gas volume production increases with period of incubation.

The present of forbs in pasture generally improve the quality of the nutritive value of the forage grazed by animals because of it is good content of CP and minerals.
الخلاصة

تمت دراسة القيمة الغذائية لأربعة عشر من نباتات المرعى في منطقة البطانة. وسط السودان، تشمل الحشائش وشائبه نباتات ذات الأوراق Cyperus rotundas , pyramidatus scheonflaedia gracilis, Ipomoea cordufana ,Iopomea sine nsis, cucmus melo, Hybanthus enneaspermus ,Euphorbica aegyptica ,ocimum basilicum, sesbania,aribica, striga hermonthica, solanum dubium.

Dactyloctenim aegyptiacum, sporobolus pyramidatus scheonflaedia gracilis,
Cyperus rotundas , pyramidatus scheonflaedia gracilis,
Ipomoea cordufana ,Iopomea sine nsis, cucmus melo, Hybanthus enneaspermus ,Euphorbica aegyptica ,ocimum basilicum, sesbania,aribica, striga hermonthica, solanum dubium.
INTRODUCTION

In Sudan, rangeland forms an important multi benefit resources, natural grazing resource constitute approximately 60% of total country area (Suliman, 1984). However, natural pasture and crop residues contribute about 93% of the ruminants requirements in Sudan (FAO, 1998), which are estimated to be about 40, 49, 42 and 3.7 of cattle, sheep, goats and camels respectively (AOAD, 2005).

There are many areas in Sudan characterize by their natural pasture and livestock density, Butana is one those areas. Animal kept in Butana is major and most important source for majority population income (Abu Sin, 1990).

Many different type of vegetation consumed by grazing domestic and wildlife animals, pasture vegetation decline due desertification also over grazing system, animal population and climate factor.

Nutritive quality of range varies from area to others, between season and growing stage. The potential of any feed to support animal production depends on the quality consumed by the animal and the extend to which the feed meets energy, protein, mineral and vitamin requirement (Minson, 1990). Cellulose and hemicellulose in forage represent the main source of energy to ruminant (Merkel et al., 1999). In many cases determination of ADF and crude protein is sufficient to give an adequate assessment of forage quality. The current study is proposed with the following objective:
- Determination the nutritive vale of some pastures plant.
CHAPTER ONE
LITERATURE REVIEW

1.1 Range-land vegetation in central Sudan

Rangeland vegetation in central Sudan can be divided according to climate into six regions while in central Sudan they were:

1.1.1 Desert region

The total area of the Desert Region is 280,000 mile square, rainfall about 0-75 mm, the dominant species were:

*Indogofera areneris* (El-koshien), *Naurada procumbens* (Saadan), *Aristida pasposa* (El-nus), *Indogfera areneria* (Derma), and *Acacia mutabilis* (Algaw).

1.1.2 Semi-desert region

The total area of the semi-desert Region is 190,000 mile square, rainfall about 55-300 mm and dominant plant species were:

*Acacia milefera* (Kiter), *Acacia nubica* (lawoot), *Acacia torotilis* (Sayal), *Acacia glaucoephyla* (Salum) *Acacia atabica* (Arad), *Balanites aegyptica* (Higlieg), *Commiphora* sp (Gufal), *Aristida pasposa* (El-nus), *Eragrostis termula* (El-banow), *Blepheris edulis* (sahha), *Ipomea cordofania* (Tabbar), *Crotolaris microphyll* (Sapheir), *Cymmpopogon nervatus* (Nal), *Androogpogon gayanus* (Abo-rakhees), *Cencheus biflorus* (Haskaneit), *Cymbopgon proximus* (Maharaib), *Euphorbia* spp (Malbana) and *Sporbolus* spp (Malhy).
1.1.3 Low rainfall region

The total area of the Desert Region is 205,000 mile square, rainfall about 300-800mm, and dominant pasture plants species were:

*Acacia senegal* (Hashab), *Acacia milefera* (Kiter), *Commiphora sp* (Gufal), *Balanites aegyptica* (Higlieg), *Acacia seyal* (Talah), *Combereum cordofanum* (Haiel), *Basica senegalensis* (Carasan), *Albizza spp* (Arad), *Delbargia spp* (Babanose), *Terminalia spp* (Subag), *Seleroearya spp* (Humied), and *Angeissus spp* (Sahab) (Harrison and Jackson, 1958).

1.2 Description of some central Sudan plants

1.2.1 *Aristolochia bracteolate*

Family name: Aristolochiaceae

Local name: Um-galaggile

Perennial, trailing herb or some time under shrubs, the whole plant is very bitter and is said to have anathematic and purgative properties, it is believed to be an antidote to the snake poison and scorpion bite, good fodder plant (Bebawi and Neugebohrn, 1991). *Aristolochia bracteolate* occasionally found in Nile Banks and widespread in Gezira and Rahad (Braun, 1991).

1.2.2 *Cucmus melo*

Family name: Cucurbitaceae

Local name: Humeid

Annual herb, creeping or climbing, softy hispid around to oval flashy fruits, about 10-15 cm in diameter produced by trailing plant with
large leaves. Some time gives to cattle and pigs as relish. *Cucumis melo* fruits content few nutrients due to there high content of water (Gohl, 1975). Occasionally it is occur in Nile Banks, Gezira and widespread in Rahad (Braun *et al.*, 1990).

1.2.3 *Cyprus rotundus*

Family name: Cyperaceous
Local name: Said

Perennial herb, up to 60cm high, usually grows in moist and cultivated area in desert, semi-desert, savanna regions. This plant is good fodder, also can be used in certain dye preparations (Bebaewi and Neugebohrn, 1991). *Cyprus rotundus* is abundant in Nile Banks. Gezira and occasionally in Rahad (Braun, 1991).

1.2.4 *Dactylatenium aegypticum*

Family name: Gramineae
Local name: Um-Assabi

Annual grass, up to 50cm high, usually occur in variable area especially in sandy soil, distributed through tropical Africa introduced to America. This plant is suitability for hay and silage; make excellent hay and quite a palatable grass, digestibility and chemical composition (Sherman and Riveros, 1990). *Dactylatenium aegypticum* is widespread in Nile Banks, abundant in Gezira and occasionally in Rahad (Braun *et al.*, 1991).

1.2.5 *Hybanthus enneaspermus*

Family name: Violaceae
Local name: Sharaya
Erect, small, leafy annual or perennial herb, up to 30 cm high (Braun et al., 1990). *Hybanthus enneaspermus* is occasionally found in Gezira and widespread in Rahad (Braun et al., 1991).

**1.2.6 Ipomea cordofana**

Family name: Cascutacampestris  
Local name: Tabber  

Annual or perennial herb, climbing or trailing, slender stems with white flowers (Andrews, 1956). Their habitat were moist and cultivated area in desert, semi-desert and savanna region, good fodder plant (Bebawi, 1991). *Ipomea cordofana* is abundant in Gezira, Rahad but in Nile Bank it is rare. (Braun et al., 1990).

**1.2.7 Ipomea sinensis**

Family name: Convolvulaceae  
Local name: Hantout  

Annual herbs, trailing stems small white or purplish flowers moist and cultivated area in desert, semi-desert and savanna region were the best habitat, fodder plant (Bebawi, 1991). *Ipomea sinensis* is widespread in Gezira, Nile Bank and abundant in Rahad (Braun et al., 1990).

**1.2.8 Euphorbica aegyptica**

Local name: Euphorbiaceae  
Local name: Molbaina  

Spreading annual herb leaves opposite, fodder plant, used in native as purgative, moist and cultivated area in desert, semi-desert and savanna region were the best habitat (Bebawi, 1991).
Figure (1): *Aristolochia bracteolate*
Figure (2): *Cucumis melo*
Figure (3): *Cyprus rotundas*
Figure (4): *Hybanthus enneaspermus*
Figure (5): *Ipomea cordofana*
Figure (6): *Ipomea sinensis*
1.2.9 *Ocimum basilicum*
Family name: Labiatae (lamiaceae)
Local name: Rihan

Erect, much branched, woody annual herb, up to 45cm high white or purplish flower, fodder plant, often containing etheric oil, moist and cultivated area in desert, semi-desert and savanna region were the best habitat (Bebawi, 1991). *Ocimum basilicum* widespread in Rahad, abundant in Gezira and rare in Nile Banks (Braun, 1990).

1.2.10 *Scheonflaedia gracilis*
Family name: Gramineae
Local name: Gabbash

Annual grass ascending to erect, tufted, up to 100cm or smaller, widespread in Gezira, rare in Nile Banks and occasionally in Rahad (Braun *et al.*, 1990). This fodder plant; grow in moist and cultivated area in desert, semi-desert and savanna regions (Bebawi, 1991).

1.2.11 *Sesbania aribica*
Family name: Fabaceae
Local name: Sureyb

Erect, much branched, tall shrub-like annual herb, usually around 100cm, it is widespread in Gezira, Nile Bank and Rahad (Bourn *et al.*, 1991).

1.2.12 *Solanum dubium*
Family name: Solanaceae
Local name: Gubbain
Annual, erect spiny herb, up to 50cm, moist and cultivated area in desert, semi-desert and savanna region is the best habitat (Bebawi, 1991). This plant is widespread in Rahad, Nile Banks and occasionally in Gezira (Braun et al., 1990).

1.2.13 *Sporobolus pyramidatus*

Family name: Gramineae  
Local name: Aiah Al-far

Tufted, perennial grass, usually around 60cm high, it has tufted stem, leaves and of low palatability, found in over grazed pasture (Gohl, 1981). This plant found occasionally in Nile Bank and Rahad and it is abundant in Gezira (Braun et al., 1990).

1.2.13 *Sporobolus pyramidatus*

Family name: Gramineae  
Local name: Aiah Al-far

Tufted, perennial grass, usually around 60cm high, it has tufted stem, leaves and of low palatability, found in over grazed pasture (Gohl, 1981). This plant found occasionally in Nile Bank and Rahad and it is abundant in Gezira (Braun et al., 1990).

1.2.14 *Striga hermetical*

Local name: Budda

Erect herb, up to 60cm high, quadrangular stems, dull-pink flowers (Lond and Lond, 1956). It is good fodder plant but their present indicated to poor soil, their best habitat were moist area in desert, semi-desert and savanna regions. Boiled extracted of Striga relieves cattle blood. (Bebawi, 1991). Frequently it is occur in Nile Banks, Rahad and occasionally in Gezira (Braun et al., 1990).
Figure (7): *Euphorbia aegyptica*
Figure (8): *Ocimum basilicum*
Figure (9): *Sesbania aribica*
Figure (10): *Solanum dubium*
Figure (11): *Sporobolus pyramidatus*
Figure (12): *Striga hermonthica*
1.3 Range for animal nutrition

All animals require feed to maintain body structures, functions and growth. Nutrient requirements for grazing animal is more difficult to define because of the added energy required for travel and environmental stress, in addition to range type occur with seasonal change due to climate, nutritive quality of range varies from area to other, between season, level of cell soluble, crud protein and phosphorus which they were high in growing forage plant.

Annual grasses show low nutritive quality than perennial grasses, tall grasses lower level of nutrients than do short grasses (Holechek, 2004).

1.4 Nutritive value of grasses and forbs

Generally grasses have lower crude protein, phosphorus and higher total fiber and cellulose with low digestibility while forbs have high crude protein and digestibility with low level of fiber. There is great difference between range due to dominant plant, stage and seasonal change. Annual grasses show greater decline in nutritive value than perennial grasses, tall grasses less nutritive value than shorter one (Holechek, 2003). Moreover, forage digestibility influenced dramatically by the stage of maturity (Kellems, 2005).

1.5 Forage intake and digestibility of grazing animal

Forage intake of grassing animal varies with body weight, forage quality and availability. The intake for grassing animal is expressed as the weight of the forge consumed as percentage of the animal body
weight. Forge intake affected by the passage rate through the digestive system then palatability (Holechek, 2004).

Food intake can be controlled by metabolic level in ruminants, the amount of the glucose absorbed from the digestive tract is relatively small and blood glucose level show little relation to feed behavior, environmental factor and plant stage (McDonald et al., 2002).

Forage digestibility varies greatly among species, plant part and age, generally leaves and fruits were high in digestibility while stem have low digestibility (Holechek, 2004).

Forage digestibility determine the nutrient value of forage, high digestibility forage liberated more nutrient that use by animal, as digestibility increase feed intake can increase due to turnover rate in the rumen increase, if digestion process is rapid, digested feed can replaced by further feed intake.

The digestibility may affect by rumen microbes population, diet cellulose low starch (Cheek, 2005).
CHAPTER TWO
MATERIALS AND METHODS

2.1 Study area

The study area is located in Butana which lay between Blue Nile, River Nile and Atbara River, the annual rainfall about 100-350 mm and occurs only in wet season from July to October. The area lies on fairly flat clay soils. The vegetation of the area is typical to the semi desert zone, mainly shrubs and grasses.

2.2 Sample collection and preparation

Fourteen mature pasture species (Table 1) were collected at the rainy season (end of September, 2006). The samples were collected by hand picking at the ground level, air-dried and grinded by a hummer mill to pass 1 mm screen.

2.3.1 Chemical composition

Samples were analyzed for Organic mutter (OM), ether extract (EE), and nitrogen (N) according to (AOAC, 1990). NDF and ADF were determined according to Robertson and Van Soest (1981).

For minerals composition, Calcium (Ca), Potassium (K), sodium (Na), Magnesium (Mg), were determine using Atomic absorption spectroscopy (3110) after ashing the samples and digested with hydrochloric acid, while Phosphorus (P) was determined by spectrophotometer (Spectrum lab 22PC) after ashing and digesting the samples with nitric acid.
Table (1): Scientific and local name of some pasture plants collected from Butana area, Central Sudan:

<table>
<thead>
<tr>
<th>Local name</th>
<th>Scientific name</th>
<th>Local name</th>
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<tbody>
<tr>
<td>1</td>
<td><em>Aristolochia bracteolate</em></td>
<td>Um-galagil</td>
</tr>
<tr>
<td>2</td>
<td><em>Cucmus melo</em></td>
<td>Humeid</td>
</tr>
<tr>
<td>3</td>
<td><em>Cyperus rotundus</em></td>
<td>Seida</td>
</tr>
<tr>
<td>4</td>
<td><em>Dactylatenium aegypticum</em></td>
<td>Um-Assabi</td>
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<tr>
<td>5</td>
<td><em>Hybanthus enneaspermus</em></td>
<td>Sharaya</td>
</tr>
<tr>
<td>6</td>
<td><em>Ipomea cordofana</em></td>
<td>Tabber</td>
</tr>
<tr>
<td>7</td>
<td><em>Ipomea sinensis</em></td>
<td>Hantout</td>
</tr>
<tr>
<td>8</td>
<td><em>Euphorbica aegyptica</em></td>
<td>Molbaina</td>
</tr>
<tr>
<td>9</td>
<td><em>Ocimum basilicum</em></td>
<td>Rihan</td>
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<tr>
<td>10</td>
<td><em>Scheonflaedia gracilis</em></td>
<td>Gabbash</td>
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<tr>
<td>11</td>
<td><em>Sesbania aribica</em></td>
<td>Sureyb</td>
</tr>
<tr>
<td>12</td>
<td><em>Solanum dubium</em></td>
<td>Gubbain</td>
</tr>
<tr>
<td>13</td>
<td><em>Sporobolus pyramidatus</em></td>
<td>Aiah Al-far</td>
</tr>
<tr>
<td>14</td>
<td><em>Striga hermonthica</em></td>
<td>Buddha</td>
</tr>
</tbody>
</table>
2.4 *In vitro* digestibility

The dry matter digestibility of the samples was determined using the procedure described by Tilley and Terry (1963).

The rumen fluid was obtained from cannulated bull, the liquor strained through three layers of gauze and flushed with CO₂.

From each dried samples 0.5 g were weighed and dispense in 50 ml tubes, the minerals solution was prepared and four parts of it was added to one part of the rumen liquor in a large glass bottle, the mixture agitated and flushed with CO₂, 50 ml of the mixture solution was added to the samples in the tubes and closed with corks. The tubes putted in a rack and placed in the water bath 38°C for 48 hours, this represent the first stage of digestibility. After 48 hours all tubes were taken out and each tubes was centrifuged at 20500 r.p.m for 7 minutes and the content poured using nylon cloth, the solids reminder in the cloth returned to the tubes.

One ml of 5% mercuric chloride solution and 1 ml of 2N sodium carbonate and pepsin solution added to each tube up to 50ml then the tubes closed and incubated in a water bath 38°C for another 48hrs. After the last 48 hr (the end of the second stage of digestibility) the tube content was filtered through nylon cloth, the solid materials from each tubes was washed in crucibles and dried in 105°C overnight.

Digestibility was calculated using the following equation:

\[
\text{DMD\%} = \frac{\text{sample (DM) wt} - (\text{residue (DM) - blank})}{\text{samples (DM)}}
\]
3.5 *In vitro* gas production

The *in vitro* gas production was performed according to the procedure of Menke and Steingass (1988).

The rumen liquor was collected from a fistulated bull, filtered through gauze to remove coarse particles, flushed with CO₂, and held in the suction bottle with rubber stopper at 39°C.

One part of rumen fluid was added to three parts of macro-micro and buffer solution, this mixture was flushed with CO₂. From each dried samples 200 mg was weighed into calibrated gas syringe with piston lubricated with Vaseline to ease movement and prevent gas escape, 40 ml of rumen fluid minerals solution was dispensed into each syringe then expelled gently to remove out air. The syringes were incubated in water bath 39°C in triplicate; a blank syringe was also incubated in the same time.

The volume of gas produced was taken in 3, 6, 12, 24, 48, 72, and 96 hours. The reading of blank syringe was subtracted from the reading of each syringe.

The metabolizable energy (MJ/kg DM) content of pasture species was calculated using equations of Menke and Steingass (1988);

\[
\text{ME} (\text{MJ/kg DM}) = 2.20 + 0.136\text{GP} + 0.057\text{CP} + 0.0029\text{EE}^2
\]

Where GP is 24 h net gas production (ml/200 mg DM); CP and EE are crude protein, and ether extract (% DM), respectively.
3.6 Calculation and statistical analysis:

The result from gas production study fitted to exponential model 

\[ p = a + b(1-e^{-ct}) \]

of Ørskov and McDonald (1979) to determine the characteristics of the incubated samples.

Data were analyzed by analysis of variance for a completely randomized design (Steel and Torrie, 1980). Where the F-test was significant, the treatment means were compared using least significant differences (LSD).
CHAPTER FOUR  
RESULTS AND DISCUSSION

As shown in Table 2, the investigated species varied significantly (P<0.05) in OM, CP, EE, NDF and ADF contents. The organic matter content of grasses ranged from 88.8% in *S. pyramidatus* to 95.5% in *D. aegypticum*, while in forbs it ranged from 89.33% in *O. basilicum* to 92.06% in *S. dubium*. The OM range is similar to that obtained by Fater and Atti (2007) and Ezaldeen (2007).

The CP in grass species ranged from 6.29 to 10.21% compared to range of 4.26 to 10.20% for forbs species. This results are similar to those reported by Arzani *et al.* (2005) and Kellems (2002) but were higher than the results reported by Fatur and Atti, (2007), and lower than those obtained by Pamo (2006) Ezaldeen, (2007). The different stage of growth might be responsible for these differences. The CP in forbs was slightly lower than in grasses which inconsistent with the results reported by other researchers (Arzani *et al.*, 2005; Pamo, 2006; Ezaldeen, 2006). About 64% of pasture species showed levels higher than the critical minimum level of 8% CP which would limit intake of tropical forages (Minson, 1980).

Cellulose and hemicelluloses in forage represent the main source of energy to ruminants (Merkel *et al.*, 1999). The concentration in of NDF and ADF in pasture species varied significantly (P<0.05). The NDF content ranged between 54.34 – 76.23% for grasses compared to 36.34 – 76.42% for forbs, however, the ADF content ranged between
Tables (2) Chemical composition of some pasture plants.

<table>
<thead>
<tr>
<th>Species</th>
<th>OM</th>
<th>CP</th>
<th>EE</th>
<th>ADF</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cyperus rotundus</em></td>
<td>92.90</td>
<td>9.62</td>
<td>3.12</td>
<td>56.06</td>
<td>60.05</td>
</tr>
<tr>
<td><em>Dactylatenium aegypticum</em></td>
<td>95.50</td>
<td>6.29</td>
<td>1.74</td>
<td>38.77</td>
<td>54.34</td>
</tr>
<tr>
<td><em>Scheonflaedia gracilis</em></td>
<td>94.77</td>
<td>10.21</td>
<td>5.12</td>
<td>62.38</td>
<td>68.30</td>
</tr>
<tr>
<td><em>Sporobolus pyramidatus</em></td>
<td>88.84</td>
<td>10.00</td>
<td>3.39</td>
<td>34.23</td>
<td>76.23</td>
</tr>
<tr>
<td><em>Aristolochia bracteolate</em></td>
<td>89.76</td>
<td>4.26</td>
<td>3.85</td>
<td>34.78</td>
<td>43.94</td>
</tr>
<tr>
<td><em>Cucmus melo</em></td>
<td>90.93</td>
<td>9.19</td>
<td>4.35</td>
<td>27.86</td>
<td>36.34</td>
</tr>
<tr>
<td><em>Euphorbica aegyptica</em></td>
<td>91.81</td>
<td>8.76</td>
<td>3.97</td>
<td>34.48</td>
<td>46.67</td>
</tr>
<tr>
<td><em>Hybanthus enneaspermus</em></td>
<td>90.73</td>
<td>5.62</td>
<td>2.17</td>
<td>28.52</td>
<td>45.49</td>
</tr>
<tr>
<td><em>Ipomea cordofana</em></td>
<td>91.46</td>
<td>7.07</td>
<td>2.66</td>
<td>37.63</td>
<td>50.78</td>
</tr>
<tr>
<td><em>Ipomea sinensis</em></td>
<td>91.26</td>
<td>9.64</td>
<td>5.16</td>
<td>38.43</td>
<td>50.52</td>
</tr>
<tr>
<td><em>Ocimum basilicum</em></td>
<td>89.33</td>
<td>9.36</td>
<td>3.00</td>
<td>58.10</td>
<td>76.42</td>
</tr>
<tr>
<td><em>Sesbania aribica</em></td>
<td>91.04</td>
<td>7.26</td>
<td>2.31</td>
<td>54.40</td>
<td>55.12</td>
</tr>
<tr>
<td><em>Solanum dubium</em></td>
<td>92.06</td>
<td>8.71</td>
<td>2.37</td>
<td>40.57</td>
<td>52.41</td>
</tr>
<tr>
<td><em>Striga hermonthica</em></td>
<td>89.45</td>
<td>10.20</td>
<td>2.44</td>
<td>45.03</td>
<td>50.69</td>
</tr>
<tr>
<td>SEM</td>
<td>0.29</td>
<td>0.29</td>
<td>0.23</td>
<td>1.06</td>
<td>1.119</td>
</tr>
</tbody>
</table>

OM Organic matter, CP Crude protein, EE Ether extract, ADF Acid detergent fiber, NDF Neutral detergent fiber, SEM Stander error of mean
34.23 –62.38% for grasses compared to 27.86 – 58.10% for forbs which is similar to the range of the tropical forages reported by Ahmed and El-Hag (2004) and Pamo (2006) and lower than that reported by Evitayani et al. (2005). The NDF content of most of pasture species were higher than the optimal level of 25-33% for dairy cows (NRC, 2001), however, it appear adequate for mature beef cows (NRC, 1980).

Either Extract (EE) is concentrate source of energy but it is not a major source of energy from forage (Chesworth, 1996); nevertheless, forge with a high content may be an asset in satisfying the energy requirement of the animal when other source were limited. There were significant difference (P<0.05) in EE concentration. Generally EE concentration in grass species is nearly similar to in forbs. This result agreed with Fatur (2006) and Pamo (2006).

Table 5 shows the results of in vitro OM digestibility (IVOMD) and estimated metabolizable energy (ME) for the investigated pasture species. All species showed relatively high IVOMD (>50%) except D. Aegypticum (43.06%). IVDMD values slightly lower than values reported for other tropical grasses (Evitayani et al., 2005) and temperate pasture species (Ammar et al. 1999; Marinas et al., 2003). The increment of cellulosic material due to plants maturation may be responsible for these lowe values (Getachew et al., 2004). The IVOMD for all species were much higher than 45%, D. Aegypticum (43.06%), a digestibility which is considered adequate for optimum animal performance on tropical pasture (McDowell, 1972). The estimated ME values were below 8 MJ/kg DM for all pasture species in exemption of C. nervatus, however, grasses had higher values than forbs. Grasses species IVOMD is similar to
(Evitayani, 2005), also for forbes species the value is similar to (Fadel Elseed, 2002) and (Parissi, 2005).

The minerals in tested species varied in their concentration as shown in table 3, significant difference (P<0.05) in their content of Ca, P, Mg, K and Na.

Calcium is the most abundant mineral elements in animal body, when Ca is mentioned Ca: P ratio must be considerable 1:1 or 1:2 respectively, Ca concentration in grasses species is range from 0.18-0.29% (McDonald et al., 2002). In forbs species Striga hermonthica and Solanum dubium contend high amount of Ca in test species, Ca concentration relatively high over 0.13% which is high than recommended by (NRC, 1985) for sheep maintenance 0.3% and cattle in early lactation 0.77%, the species under study provide good source of Ca supply, this results in agreement with (Fadel Elseed, 2002). P concentration in grasses species high in Scheonflaedia gracilis and Dactylatenium aegypticum and respectively low in Sporobolus pyramidatus, while in forbs highest in Sesbania Arabica 0.52% and Solanum dubium 0.5% and relatively low in Ocimum basilicum 0.28%, this amount of P is high than amount recommended in (NRC, 1989), in early lactation cattle requirement of P is 0.48% while for sheep maintenance 2.9%, this results is high than the result reported by (Fadel Elseed, 2002). the concentrations of Mg for all tested species range between 0.001-0.006%, which were low than amount recommended by (NRC, 1989) for early lactation cattle (0.25%), this is low than result obtained by (Kellems, 2002). Sodium and Potassium contend in tested species is extremely low compared to (NRC, 1989) recommendation for early lactation and sheep.
maintenance 0.18 and 10 % respectively, K concentration were low, while Na concentration is high.
<table>
<thead>
<tr>
<th>Species</th>
<th>Ca</th>
<th>P</th>
<th>Mg</th>
<th>K</th>
<th>Na</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cyperus rotundus</em></td>
<td>0.14^ef</td>
<td>0.36^de</td>
<td>0.006^ab</td>
<td>0.26^efg</td>
<td>0.04^b</td>
</tr>
<tr>
<td><em>Dactylatenium aegypticum</em></td>
<td>0.18^def</td>
<td>0.40^cd</td>
<td>0.074^a</td>
<td>0.31^def</td>
<td>0.03^b</td>
</tr>
<tr>
<td><em>Scheonflaedia gracilis</em></td>
<td>0.20^edf</td>
<td>0.43^c</td>
<td>0.002^c</td>
<td>0.27^def</td>
<td>0.03^b</td>
</tr>
<tr>
<td><em>Sporobolus pyramidatus</em></td>
<td>0.29^ab</td>
<td>0.29^fe</td>
<td>0.004^bc</td>
<td>0.35^abcd</td>
<td>0.02^de</td>
</tr>
<tr>
<td><em>Aristolochia bracteolate</em></td>
<td>0.24^bcd</td>
<td>0.40^cd</td>
<td>0.002^c</td>
<td>0.25^fg</td>
<td>0.02^e</td>
</tr>
<tr>
<td><em>Cucmus melo</em></td>
<td>0.22^ef</td>
<td>0.33^ef</td>
<td>0.001^c</td>
<td>0.40^ab</td>
<td>0.03^b</td>
</tr>
<tr>
<td><em>Euphorbica aegyptica</em></td>
<td>0.19^def</td>
<td>0.28^g</td>
<td>0.002^c</td>
<td>0.20^g</td>
<td>0.02^de</td>
</tr>
<tr>
<td><em>Hybanthus enneaspermus</em></td>
<td>0.20^de</td>
<td>0.32^efg</td>
<td>0.001^c</td>
<td>0.36^abcd</td>
<td>0.05^a</td>
</tr>
<tr>
<td><em>Ipomea cordofana</em></td>
<td>0.13^f</td>
<td>0.41^c</td>
<td>0.002^c</td>
<td>0.29^defg</td>
<td>0.04^b</td>
</tr>
<tr>
<td><em>Ipomea sinensis</em></td>
<td>0.15^ef</td>
<td>0.47^b</td>
<td>0.002^c</td>
<td>0.43^a</td>
<td>0.03^bc</td>
</tr>
<tr>
<td><em>Ocimum basilicum</em></td>
<td>0.26^abc</td>
<td>0.28^g</td>
<td>0.002^c</td>
<td>0.29^defg</td>
<td>0.02^de</td>
</tr>
<tr>
<td><em>Sesbania aribica</em></td>
<td>0.14^ef</td>
<td>0.52^a</td>
<td>0.002^c</td>
<td>0.34^bcdef</td>
<td>0.03^cd</td>
</tr>
<tr>
<td><em>Solanum dubium</em></td>
<td>0.31^a</td>
<td>0.51^ab</td>
<td>0.002^c</td>
<td>0.40^ab</td>
<td>0.02^de</td>
</tr>
<tr>
<td><em>Striga hermonthica</em></td>
<td>0.32^a</td>
<td>0.40^cd</td>
<td>0.003^bc</td>
<td>0.38^abc</td>
<td>0.03^b</td>
</tr>
<tr>
<td>SEM</td>
<td>0.023</td>
<td>0.015</td>
<td>0.001</td>
<td>0.031</td>
<td>0.023</td>
</tr>
</tbody>
</table>

SEM: standard error of a mean
Table (4) Gas production time of incubation of some pasture plants.

<table>
<thead>
<tr>
<th>Species</th>
<th>3</th>
<th>6</th>
<th>12</th>
<th>24</th>
<th>48</th>
<th>72</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. pyramidatus</em></td>
<td>2.40f</td>
<td>5.2f</td>
<td>11.0f</td>
<td>19.2h</td>
<td>25.6fg</td>
<td>29.6ef</td>
<td>31.80ef</td>
</tr>
<tr>
<td><em>St. hermonthica</em></td>
<td>3.20f</td>
<td>6.0f</td>
<td>12.8f</td>
<td>18.4g</td>
<td>22.8g</td>
<td>26.00f</td>
<td>26.40fg</td>
</tr>
<tr>
<td><em>Sc. gracilis</em></td>
<td>3.60d</td>
<td>5.0f</td>
<td>8.6f</td>
<td>20.6g</td>
<td>39.6ab</td>
<td>49.40g</td>
<td>50.40a</td>
</tr>
<tr>
<td><em>Solanum dubium</em></td>
<td>5.40a</td>
<td>11.2ab</td>
<td>21.2ab</td>
<td>28.2bcd</td>
<td>30.6e</td>
<td>32.20de</td>
<td>32.60de</td>
</tr>
<tr>
<td><em>Ipomea sinensis</em></td>
<td>5.2abc</td>
<td>12.8a</td>
<td>24.60a</td>
<td>31.60ab</td>
<td>37.0abc</td>
<td>39.00bc</td>
<td>39.60bc</td>
</tr>
<tr>
<td><em>Cucmus melo</em></td>
<td>4.4bcd</td>
<td>9.0ed</td>
<td>17.8bc</td>
<td>26.2cdef</td>
<td>33.0cde</td>
<td>36.00cd</td>
<td>37.00cde</td>
</tr>
<tr>
<td><em>Euphorbica aegyptica</em></td>
<td>5.2abc</td>
<td>8.2de</td>
<td>15.4cd</td>
<td>25.4defg</td>
<td>33.6cde</td>
<td>35.00cdefg</td>
<td>35.40cde</td>
</tr>
<tr>
<td><em>Ocimum basilicum</em></td>
<td>6.20a</td>
<td>11.8ab</td>
<td>22.60a</td>
<td>30.4abcd</td>
<td>36.0abcd</td>
<td>39.20bc</td>
<td>40.00bc</td>
</tr>
<tr>
<td><em>Cyperus rotundus</em></td>
<td>1.80g</td>
<td>3.2g</td>
<td>5.80g</td>
<td>9.80h</td>
<td>17.4g</td>
<td>23.80f</td>
<td>25.80g</td>
</tr>
<tr>
<td><em>Hy. Enneaspermus</em></td>
<td>4.4bed</td>
<td>9.8bed</td>
<td>23.20a</td>
<td>34.20a</td>
<td>40.6a</td>
<td>44.20ab</td>
<td>45.20ab</td>
</tr>
<tr>
<td><em>Sesbania aribica</em></td>
<td>5.2abc</td>
<td>10.20b</td>
<td>18.4bc</td>
<td>25.0efg</td>
<td>33.8cde</td>
<td>36.80cd</td>
<td>38.20ed</td>
</tr>
<tr>
<td><em>Ipomea cordofana</em></td>
<td>4.2cde</td>
<td>11.4abc</td>
<td>23.40a</td>
<td>30.60abc</td>
<td>34.8b cde</td>
<td>36.00cd</td>
<td>36.00cde</td>
</tr>
<tr>
<td><em>Dac. Aegypticum</em></td>
<td>3.4def</td>
<td>5.4fg</td>
<td>10.4ef</td>
<td>21.20gh</td>
<td>33.0cde</td>
<td>38.20bcd</td>
<td>38.80c</td>
</tr>
<tr>
<td><em>Ar. Bracteolate</em></td>
<td>4.4bed</td>
<td>8.0de</td>
<td>13.4de</td>
<td>23.00fgh</td>
<td>30.8def</td>
<td>32.20de</td>
<td>32.40def</td>
</tr>
<tr>
<td>SEM</td>
<td>0.41</td>
<td>0.872</td>
<td>1.31</td>
<td>1.773</td>
<td>1.905</td>
<td>2.118</td>
<td>2.166</td>
</tr>
</tbody>
</table>

SEM: stander error of a mean.
Table (5) Estimation of degradability fraction, EME and IVDMD of some pasture plants.

<table>
<thead>
<tr>
<th>Species</th>
<th>A</th>
<th>b</th>
<th>c</th>
<th>IVOMD</th>
<th>EME</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cyperus rotundus</em></td>
<td>-0.39&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>28.17&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.018&lt;sup&gt;g&lt;/sup&gt;</td>
<td>56.03&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.97&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Dactylatenium aegypticum</em></td>
<td>-1.66&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>43.95&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>0.030&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>43.06&lt;sup&gt;bi&lt;/sup&gt;</td>
<td>5.20&lt;sup&gt;ef&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Scheonflaedia gracilis</em></td>
<td>-2.54&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>64.38&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.020&lt;sup&gt;fg&lt;/sup&gt;</td>
<td>52.83&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>5.57&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Sporobolus pyramidatus</em></td>
<td>-1.23&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>33.25&lt;sup&gt;fg&lt;/sup&gt;</td>
<td>0.035&lt;sup&gt;c&lt;/sup&gt;</td>
<td>61.22&lt;sup&gt;de&lt;/sup&gt;</td>
<td>5.57&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Aristolochia bracteolate</em></td>
<td>-0.66&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>33.92&lt;sup&gt;efg&lt;/sup&gt;</td>
<td>0.049&lt;sup&gt;d&lt;/sup&gt;</td>
<td>55.07&lt;sup&gt;k&lt;/sup&gt;</td>
<td>5.67&lt;sup&gt;de&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Cucmus melo</em></td>
<td>-1.17&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>37.90&lt;sup&gt;cdef&lt;/sup&gt;</td>
<td>0.054&lt;sup&gt;ed&lt;/sup&gt;</td>
<td>63.36&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>6.23&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Euphorbica aegyptica</em></td>
<td>-0.76&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>36.94&lt;sup&gt;def&lt;/sup&gt;</td>
<td>0.050&lt;sup&gt;d&lt;/sup&gt;</td>
<td>51.21&lt;sup&gt;l&lt;/sup&gt;</td>
<td>7.37&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Hybanthus enneaspermus</em></td>
<td>-4.83&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>49.24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.065&lt;sup&gt;c&lt;/sup&gt;</td>
<td>66.69&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>6.10&lt;sup&gt;cd&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Ipomea cordofana</em></td>
<td>-6.56&lt;sup&gt;f&lt;/sup&gt;</td>
<td>42.26&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>0.096&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.63&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Ipomea sinensis</em></td>
<td>-4.20&lt;sup&gt;de&lt;/sup&gt;</td>
<td>42.91&lt;sup&gt;bcd&lt;/sup&gt;</td>
<td>0.084&lt;sup&gt;b&lt;/sup&gt;</td>
<td>63.36&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>6.17&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Ocimum basilicum</em></td>
<td>-0.98&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>40.28&lt;sup&gt;cde&lt;/sup&gt;</td>
<td>0.065&lt;sup&gt;c&lt;/sup&gt;</td>
<td>51.22&lt;sup&gt;l&lt;/sup&gt;</td>
<td>6.67&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Sesbania aribica</em></td>
<td>0.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>37.28&lt;sup&gt;cefg&lt;/sup&gt;</td>
<td>0.047&lt;sup&gt;d&lt;/sup&gt;</td>
<td>57.77&lt;sup&gt;fg&lt;/sup&gt;</td>
<td>6.17&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Solanum dubium</em></td>
<td>-4.04&lt;sup&gt;de&lt;/sup&gt;</td>
<td>36.05&lt;sup&gt;def&lt;/sup&gt;</td>
<td>0.096&lt;sup&gt;a&lt;/sup&gt;</td>
<td>61.91&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6.27&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Striga hermonthica</em></td>
<td>-0.70&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>26.99&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.051&lt;sup&gt;d&lt;/sup&gt;</td>
<td>59.00&lt;sup&gt;ef&lt;/sup&gt;</td>
<td>4.90&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>SEM</td>
<td>0.6937</td>
<td>2.459</td>
<td>0.0041</td>
<td>0.864</td>
<td>0.17</td>
</tr>
</tbody>
</table>

a The gas production from the immediately soluble fraction (ml)
b The gas production from the insoluble fraction
c The gas production rate constant for the insoluble fraction.
SEM Stander error of a mean
EME Estimated metabolic energy

**IVDMD** *In-vitro* dry matter digestibility (IVDMD)
As shown in Table (4) their is significant difference (P<0.05) in degradation rate of OM among tested species, grasses were low in initial incubation period the volumes range from 1.8 to 3.6 ml, while forbes species value 3.2 ml to 6.2 ml, also with variation during incubation period, the cumulative volume of gas production increased with increasing during period of incubation, at last incubation period high volume in grasses is *Sesbania arabica* 40 ml and *Scheonflaedia gracilis* 50.4ml. produced gas by fermentation of carbohydrate and protein to estimated feed value indirectly from produced gas (McDonald, 2002). Gas production from quickly soluble fraction (a) for tested species were significant difference (P<0.05) as show in Table (5) also in slowly degradable fraction (b) and (c) Gas production rate.

Grasses species value in slowly degradable fraction is similar to (Evitayani, 2005) except in *Scheonflaedia gracilis* gas production rate is low. In forbes species the quickly soluble fraction is low than the than results obtained by (Parissi, 2005), slowly degradable fraction is agree with (Parissi, 2005) and low than (Ndlovu, 1997), Gas production rate similar to (Parissi, 2005) and high than (Ndlovu, 1997). The rapid breakdown of easily soluble nutrients such as sugar followed by slower cellulose degradation and other complex of carbohydrate that degraded by microorganisms, which needs nitrogen (CP) (McDonald, 2002). Produced gas affected by crude protein and energy percentage (McDonald, 2002).
CONCLUSION AND RECOMMENDATION

The result obtained from this study demonstrated that CP in forbs was slightly lower than in grasses which inconsistent with the results reported by other researchers.

The IVOMD for all species were much higher than 45%, a digestibility which is considered adequate for optimum animal performance on tropical pasture.

Mineral concentration is high in K, P, Ca but the ratio of Ca: P is not as recommended and low in Na and Mg.

More study required to cover other natural pasture species evaluation, digestibility trail, palatability and selectibility.
REFERENCES


