Evaluation of the range plants quality and palatability for camel grazing in the United Arab Emirates

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Abstract

The present study deals with the evaluation of range plants quality and palatability for camel grazing in the United Arab Emirates. Range plants were analyzed for their Chemical composition and digestibility, forage selection and behavior patterns were determined by direct observation. The average total digestible nutrient (TDN) in the study area was 54% of the dry matter. Average digestible crude protein (DCP) was 9.1 % of the dry matter, which meets the requirements for grazing camels. Average gross energy (GE) was 4.2 kcal kg^{-1}. Digestible energy (DE) was 2.4 kcal kg^{-1} and metabolized energy (ME) was 2.1 kcal kg-1. Most of the rangeland species in the study area are palatable. Many chemicals and physical factors influence palatability. Climate and the chemical composition are the most important. The pasture in the study area is characterized by high nutritive value completely meeting the requirements of the grazing camels, with a good management plan.

Keywords: range plants/camel/grazing/nutritive/Emirates

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1. Introduction

Nutritional deficiency of plants in different environments is generally recognized as a result of the inability of the soil to make the nutrients available to the plants. However, the chemical composition of growing plants under different habitats is affected by many factors such as concentration of a given element and the relative concentration of its assimilable forms in the soil and the plant species. The mineral transmittance from soils to the plants may however be affected by environmental conditions such as temperature, rainfall and some interacting soil variables such as pH, texture, organic matter and $CaCO_3$. Nutritive value of vegetation is important when evaluating the habitat. Animals require certain amount of nutrients and energy that must be available in their diets. Determination of the nutritive value of the range plants is important to evaluate the available nutrients in the natural ranges and consequently the deficient nutrients could be added (Edlefsen *et al.* 1960)

With the coming of oil wealth and political stability to many Gulf countries, facilities have become available for purchase and maintenance of more livestock on rangelands and the grazing pressure on the desert rangelands has increased steadily (see Oatham *et al*. 1995a). For example, the total number of livestock (cattle, sheep, goats and camels) has increased from 467,000 during 1969-1971 (Sidahmed 1990) to 1,624,755 in 1996 (Ministry of Agriculture and Fisheries in UAE 1996). Consequently, large part of the rangelands in the Arab Gulf countries is either over-grazed or gradually deteriorated (Assaeed 1997). Batanouny (1990) indicated that over 30% of the grazing land in Arab Gulf countries is in depleted conditions due to large numbers of livestock, unrestricted grazing, destructive gathering of wood and dry farming.

Several studies have evaluated the nutritive value, productivity and biomass of range plants as well as the effect of grazing on species diversity, abundance and soil degradation in the rangelands of Saudi Arabia (Abulfatih *et al*.1989, Al-Noaim *et al*. 1991, Al-Jaloud *et al*.1994, Shaltout *et al*. 1996 and Assaeed 1997). However, little attention has been paid for the evaluation of current status of natural rangelands and their plants in UAE. (e.g. Alhadramy *et al*. 2000, Oatham *et al*.1995 a and b and Oatham 1997). In addition, visual observation indicated that many habitats in UAE are subjected to over-grazing (see El-Ghonemy 1985, Western 1989, Zahran 1997).

2. Materials and methods

Stands were selected over three years (1999 - 2001) to represent the main habitats and localities in United Arab Emirates. These localities are Hili (Abu-Dhabi), Hatta (Dubai), Madam (Sharjah), Digdaga (Ras Al-Khimah), Biat (Ajman), Masafi (Fujairah) and Falaj Al-Muala (Umm Al-Quwain) (Figure 1) respectively.

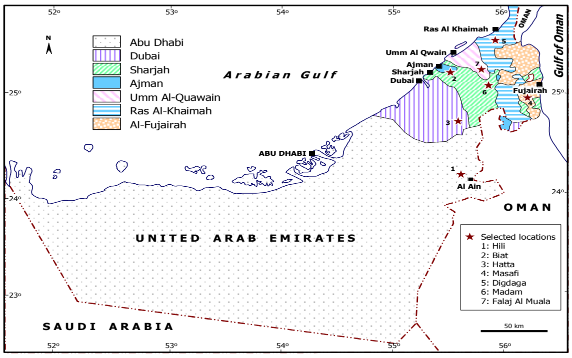

Fig. 1. Map of the United Arab Emirates showing the studied locations

Three composite samples of the above–ground parts of each recorded species based on animal diet were collected from several stands of the study area. The sampled material was kept in paper bags and brought to the laboratory shortly after collection. In the laboratory, each sample was rinsed several times with tap water and twice with distilled water. The material was then air-dried using a stream of warm air. Samples of organs were weighted, oven dried at 65ºC to constant weight, and reweighed again. All samples were powdered in a grinding mill and kept in a small paper bags ready for analysis. The powdered samples were analyzed for the determination of K using flame photometer, Ca and Mg using an atomic absorption, and P by vanadate-molybdate method.

Ash content was estimated by ignition at 500 ºC for about 2 hours, cellulose, lignin, and crude fibers (CF) silica by Allen *et al*. (1974). Total nitrogen content was estimated by the Kjeldahl method (Muller 1969). Ether extract (total lipids) was estimated by extraction with ether (König 1969). Carbohydrates were calculated according to Le Houérou 1980. NFE (% in DM) = 100 – (CP + CF + Fat + Ash), where NFE: Nitrogen free extract (mainly carbohydrates).

Crude protein was calculated following (Pirie 1955 and Oelberg 1956)**:** CP (% in DM) = Total nitrogen (% in DM) × 6.25. Digestible crude protein (DCP) was calculated according to the equation of Demarquilly and Weiss (1970): DCP (% in DM) = 0.929 CP - 3.52, where CP = crude protein. This equation is only valid in case of nitrogen concentration from 0.61 - 3% (or CP = 3.81%)

Total digestible nutrients (TDN) were estimated according to the equation applied by Abu-El-Naga and El- Shazly (1971): TDN (in % DM) = 0.62 (100 + 1.25 EE) – CP 0.72, where EE is % of ether extract, and CP is percentage of crude proteins. Nutritive value (NV) was calculated as follows (Abu-El-Naga and El- Shazly 1971): NV (% in DM) = TDN/CP.

Digestible energy (DE) was estimated following this equation (NRC 1984): DE (Mcal/kg) = 0.0504 CP (%) + 0.077 EE (%) + 0.02 CF (%) + 0.000377 NFE^2 (%) + 0.011 NFE (%) - 0.152. Metabolized energy (ME: Garrett 1980) = 0.82 DE, and net energy (NE) = ½ ME. Gross energy (GE) was calculated as follows (Lofgreen 1951): GE (kcal gm/DM) = CAR (4.15) + CP (5.65) + CF (4.25) + EE (9.0), where CAR = carbohydrate content in gm DM. Net energy (NE) was estimated as follows (Riviere 1977): NE (MJ/kg DM) = {(TDN (%) X 3.65 – 100) / 188.3} x 6.9. Nutritional ratio (NR) was calculated as according to Le Houérou (1980): NR = DCP (g/kg DM) / NE (FU/kg DM), where FU: food unit and one FU = 6.9 MJ = 1650 kcal.

The studied species were evaluated as forage plants according to Boudet and Riviere (1968).

3. Results

The species having a tendency to accumulate higher concentration along thier mineral range are indicated in Table (1). Na content of the above ground parts ranged between 2.7 mg/g in *Cymbopogon commutatus* and 26.2 mg/g in *Medicago laciniata*. K ranged between 8.2 mg/g in *Cymbopogon commutatus* and 78.7 mg/g in in *Medicago laciniata* and Ca ranged between 9.8 mg/g in *Centropodia forsskaolii* and 94.5 mg/g in *Erodium malcoides*. Fe ranged between 0.5 mg/g in *Medicago polymorpha* and 2.1 mg/g in *Malva parviflora*, Mg ranged between 71.7 mg/g in *Tamarix arabica* and 1.3 mg/g in *Prosopis juliflora* and Mn ranged between 0.02 mg/g in *Stipagrostis plumosa* and 0.17 mg/g in *Malva parviflora*. P ranged between 0.2 mg/g *Cymbopogon commutatus* and 1.7 mg/g *Limeum arabicum* and N ranged between 9.3 mg/g in *Cyperus conglomeratus* and 52.5 mg/g in *Neurada procumbens*.

The species having high concentration along thier range of organic constituents are indicated in Table (2). Carbohydrates ranged between 28.1% in *Cichorium endivia* and 67.6% in *Leptadenia pyrotechnica*, crude protein ranged between 3.4% in *Cymbopogon commutatus* and 32.8% in *Medicago laciniata*, lipids ranged between 0.3% in *Hibiscus micranthus* and 8.4% in *Acacia nilotica ssp. tortilis* and crude fiber ranged between 7.2% in *Acacia nilotica* and 44.9% in *Convolvulus pilosellifolius*. Total ash ranged between 2.2% in *Cornulaca monacantha* and 39.9% in *Salvadora persica*. Lignin ranged between 0.5% in *Sonchus oleraceus* and 13.3% in *Crotalaria aegyptiaca* and silicate ranged between 0.2% in *Lotus shemperi* and 24% in *Leptadenia pyrotechnica*.

The species having high concentration along thier range of organic constituents are indicated in Table (3). Total digesitable nutrients ranged between 40.3% in *Medicago laciniata* and 61.2% in *Cymbopogon commutatus* and nutritive value ranged between 1.2% in *Medicago laciniata* and 18% in *Cymbopogon commutatus*. Gross energy ranged between 2.8 kcal/g DM in *Leptadenia pyrotechnica* and 5.3 kcal/g DM in *Medicago laciniata*, net energy ranged between 1.7 MJ/kg DM in *Medicago laciniata* and 4.5 MJ/kg DM in *Sonchus oleracous*, digesitable protein ranged between 1.6% in *Pulicaria crispa* and 27% in *Medicago laciniata*, nutritional ratio of the above ground parts of the evaluated species ranged between 5.4 FU kg/DM in *Pulicaria crispa* and 226 FU/kg DM in *Medicago laciniata*, digesitable energy ranged between 1.5 Mcal/kg in *Salsola baryosma* and 3.5 Mcal/kg in *Acacia nilotica* and metabolized energy ranged between 1.2

Mcal/kg in *Salsola baryosma* and 2.9 Mcal/kg in *Acacia nilotica*.

Table 1. Species of high element contents in the study area. The species are arranged sequentially from that of the highest level of a certain element to that of the lowest.

Species	Element level (mg/gm)	Other elements of high levels
Na – rich species: range = 2.7 - 26.2 mg/gm		
Medicago laciniata	26.2	K
Malva parviflora	22.5	-
Melilotus indica	22.2	P, N
Solanum incanum	21.3	K, P, N
Solanum nigrum	21.3	K, P, N
Tragus racemosus	18.8	K, Ca, Fe, P, N
Centaurea pseudosianica	18.6	-
K – rich species: range = 8.2 - 78.7 mg/gm		
Medicago laciniata	78.7	K
Solanum incanum	63.8	Na, P, N
Solanum nigrum	63.8	Na, P, N
Tragus racemosus	56.4	Na, Ca, Fe, P, N
Anethum graveolens	55.7	Ca
Rhazya stricta	55.0	Ca, Fe
Zygophyllum mandavillei	54.5	Ca, Fe
Ca – rich species: range = 9.8 – 94.5 mg/gm		
Erodium malacoides	94.5	-
Solanum incanum	76.6	Na, P, N
Solanum nigrum	76.6	Na, P, N
Tragus racemosus	67.7	Na, K, Fe, P, N
Anethum graveolens	66.8	K
Rhazya stricta	66.0	K, Fe
Zygophyllum mandavillei	65.4	K, Fe
Fe – rich species: range = 0.5 – 2.1 mg/gm		
Malva parviflora	2.1	-
Tragus racemosus	1.5	Na, K, Ca, P, N
Rhazya stricta	1.5	Ca
Zygophyllum mandavillei	1.5	K, Ca
Mg – rich species: range = 1.3 – 53.5 mg/gm		
Tamarix arabica	71.7	-
Arthrocnemum macrostachyum	53.4	-
Calotropis procera	33.6	-
Mn – rich species: range = 0.04 – 0.17 mg/gm		
Malva parviflora	0.17	-
Plantago boissieri	0.17	-
P – rich species: range = 1.3 – 1.7 mg/gm		
Limeum arabicum	1.7	-
Melilotus indica	1.5	Na, N
Solanum incanum	1.4	Na, N
Solanum nigrum	1.4	Na, K, N
Tragus racemosus	1.3	Na, K, Ca, Fe, N
N – rich species: range = 5.4 – 52.5 mg/gm		
Neurada procumbens	52.5	-
Melilotus indica	44.5	Na, P
Solanum nigrum	42.6	Na, K, P
Solanum incanum	42.6	Na, K, P

Table 2. Species of high organic content (%) in the study area. The species are arranged sequentially from that of the highest level of a certain content to that of the lowest.

Species	Content level (%)	Other contents of high levels
Carbohydrates - rrich species: range = 28.1 – 67.6 %		
Leptadinea pyrotechnica	67.6	silica, lignin
Astraglus annularis	65.5	-
Cornulaca monacantha	64.8	ME
Acacia nilotica	64.0	lipids
Crude protein rich species: range = 3.4– 32.8 %		
Medicago laciniata	32.8	-
Melilotus indica	27.8	-
Solanum nigrum	26.6	-
Solanum incanum	26.6	-
Lipids – rich species: range = 0.3 – 8.4 %		
Acacia nilotica	8.4	carbohydrates
Chenopodium murale	5.4	-
Rumex vesicarius	5.1	-
Crude fiber – rich species: range = 7.2 – 44.9 %		
Convolvulus pilosellifolius	44.9	cellulose
Hippocrepis constricta	42.5	cellulose
Neurada procumbens	41.1	-
Crotalaria aegyptiaca	40.4	cellulose
Total ash – rich species: range = 2.2 – 39.9 %		
Salvadora persica	39.9	-
Emex spinosa	33.7	lignin
Arnebia hispidissima	33.6	-
Asphodelus tenuifolius	33.2	-
Lignin – rich species: range = 0.5 – 13.3 %		
Gymnocarpos decandrum	13.3	-
Pulicaria purpurea	12.1	-
Leptadenia pyrotechnica	9.9	carbohydrates, silica
Prosopis cineraria	9.2	-
Cellulose – rich species: range = 1.2 – 46.9 %		
Crotalaria aegyptiaca	46.9	crude fiber
Convolvulus pilosellifolius	46.4	crude fiber
Pennisetum divisum	45.6	-
Hippocrepis constricta	44.8	crude fiber
Neurada procumbens	44.7	crude fiber
Silica – rich species: range = 0.2 – 24 %		
Leptadenia pyrotechnica	24.0	Carbohydrates, lignin
Scirpus maritimus	21.3	-

Species	Content level	Other contents of high levels
Total digesitble nutrients (TDN) – rich species: range = 40.3 – 61.2 %		
Cymbopogon commutatus	61.2	NV, NE
Sonchus oleraceus	60.8	NE
Cyperus conglomeratus	59.5	NV, NE
Nutritive value(NV) – rich species: range = 1.2 – 18 %		
Cymbopogon commutatus	18.0	TDN, NE
Pulicaria purpurea	10.8	NE
Cyperus conglomeratus	10.3	TDN. NE
Gross energy (GE) – rich species: range = 2.8 – 5.3 kcal/gm DM		
Medicago laciniata	5.3	DP, NR
Melilotus indica	5.2	DP, NR
Rhazya stricta	5.2	-
Net energy (NE) – rich species: range = 1.7 – 4.5 MJ/kg DM		
Cymbopogon commutatus	4.5	TDN, NV
Sonchus oleracous	4.5	TDN
Pulicaria purpurea	4.3	NV
Salvia aegyptiaca	4.3	-
Cyperus conglomeratus	4.3	TDN, NV
Acacia nilotica	4.3	NFE, DE, ME
Digesitable protein (DP) – rich species: range = 1.6 - 27 %		
Medicago laciniata	27.0	GE, NR
Melilotus indica	22.3	GE, NR
Solanum incanum	21.2	NR
Solanum nigrum	21.2	NR
Tragus racemosus	18.3	NR
Nutritional ratio (NR) – rich species: range = 5.4 – 226 FU/kg DM		
Medicago laciniata	226.0	GE, DE
Melilotus indica	145.6	GE, DP
Solanum incanum	131.5	DP
Solanum nigrum	131.5	DP
Tragus racemosus	108.9	DP
Digesitable energy (DE) – rich species: range = 1.5 – 3.5 Mcal/kg DM		
Acacia nilotica	3.5	NFE, NE, ME
Astraglus annularis	3.3	NFE, ME
Leptadinea pyrotechnica	3.3	NFE, ME
Limeum arabicum	3.2	ME
Ziziphus spina-christii	3.2	ME
Metabolized energy (ME) – rich species: range = 1.2 – 2.9 Mcal/kg DM		
Acacia nilotica	2.9	NFE, NE, DE
Astraglua annularis	2.7	NFE, DE
Leptadinea pyrotechnica	2.7	NFE, DE
Cornulaca monacantha	2.6	NFE
Limeum arabicum	2.6	DE
Ziziphus spina-christii	2.6	DE

4. Discussion

The nutritive value of any forage is dependent upon its content of energy-producing nutrients as well as its contents of essential nutrients to the body and mainly depends on high digestible crude protein (DCP) and low crude fiber (CF). Fifty out of 97 species analyzed in the present study are reported as range plants for the grazing animals in the study area (Alfred 1968). This does not mean that the other species are not palatable, but they were not evaluated from the gazing viewpoint. The comparison between the nutrient contents of the plant species in the present study and the range vegetation in the other related studies may evaluate their nutrient status as forage.

The present study indicates that many of the evaluated species have relatively low P, K, Na and Fe; but high Ca, Mg and Mn comparing with many of the Egyptian Mediterranean range plants as reported by El-Ghonemy *et al.* (1977) and El-Kady (1987), and with the range plants in central Arabia as reported by Madi (1993) (Table 4) .

The following data (Table 5) is another comparison between the range of the organic contents of the estimated species in the present study and those of the Egyptian Mediterranean region (El-Kady 1987), and the mid Saudi Arabia (Madi1993).

Table 4. Comparison between nutrient contents in the present study with the previous studies.

Element (mg.g^{-1})	**Present study (n = 97)**	**Madi (1993) (n = 50))**	**El-Ghonemy *et al*. (1977) (n =55)**	**El-Kady (1987) (n = 55)**
N	5.4 – 52.5	9.9 – 12.0	-	0.5 – 2.4
P	0.2 – 1.7	0.1 – 2.4	0.1 – 7.7	0.1 – 4.0
K	8.2 – 78.7	1.9 – 34.2	3.6 – 79.3	5.5 – 39.8
Ca	9.8 – 94.5	11.0–80.0	1.3 – 23.0	2.9 – 62.3
Mg	1.3 – 53.5	0.1 – 86.8	0.3 – 49.0	1.5 – 11.9
Na	2.7 – 26.2	1.5 – 36.0	≤0.1– 2.0	-
Fe	0.5 – 2.1	<0.1 – 1.0	≤0.1- 2.0	-
Mn	<0.1 – 0.17	<0.1 – 0.2	≤0.1	-

Table 5. Comparison between organic contents in the present study with the previous studies.

Organic content (%)	**The present study (97 species)**	**Madi (1993) (50 species)**	**El-Kady (1987) (55 species)**
Proteins	3.4 – 32.8	6.0 – 7.7	2.6 – 10.1
Carbohydrates	29.4 – 67.6	22.2 – 49.0	27.1 – 51.9
Total lipids	0.3 – 8.4	0.9 – 6.4	0.8 – 3.8
Ash content	2.2 – 39.9	22.0 – 46.0	5.5 – 36.0
Crude fiber	7.2 – 44.9	4.8 – 44.9	14.6 – 35.6

The Ministry of Agriculture, Fisheries and Food in England (1975) reports that the minimum proteins in the animal diet range between 6 and 12% depending on the animal type. The present study indicates that the protein content of most sampled species approaches the minimal requirements for the animal diet. Low protein levels efficiency is associated with a relatively low voluntary feed consumption with protein deficient diet. The metabolism of the rumen micro-biota may be depressed by a deficiency in rumen nitrogen. This limitation will retard the rate of removal of organic matter from the rumen which, in turn, may reduce intake. Low protein levels will affect the wool growth, which is determined by protein absorbed in the intestine, which in turn lends on ingested nitrogen sources (see El-Kady 1987).

It is of interest to compare between the nutrient contents of the individual species in the present study and some of the related studies. There are differences in some constituents for the same species. For example, *Haloxylon salicornicum* is characterized by lower carbohydrate and K, and higher Ca and Mg contents in the present study, as compared with the same species in the study of El-Kady (1987) (Table 6). On the other hand, the study of Le Houérou (1980) in the tropical West Africa, reported higher levels of proteins and crude fibers in three out of four compared species (*Acacia ehrenbergiana*, *Acacia seyal* and *Ziziphus spina-christi*). These differences may be related to the effect of variation in certain environmental factors in the study area, and/or genetical variation of the same species (e.g. different ecotypes, varieties or sub-species).

Table 6. Comparison between nutrient and organic contents for some species in the present study with the previous studies.

1- *Haloxylon salicornicum*

Content		**Present study**	**Madi (1993)**	**El-Kady (1987)**
Ash		21.7	37.0	13.7
Carbohydrate		48.0	28.2	46.3
Lipids	%	1.1	1.2	1.7
Protein		12.0	6.5	8.6
Crude fiber		17.2	27.1	18.6
P		0.5	0.5	0.5
Ca	$mg g^{-1}$	26.8	43.5	26.2
Mg		7.7	16.2	10.3
K		22.3	7.0	11.9

2- *Panicum turgidum*

Content		**Present study**	**Madi (1993)**	**Source**
				El-Ghonemy *et al.* (1977)
P		0.4	1.2	0.8
K		18.7	24.5	15.0
Ca		22.5	13.0	2.6
Mg	mgg^{-1}	1.6	1.6	3.5
Na		6.2	6.0	1.6
Fe		0.5	0.53	0.167
Mn		0.04	0.01	0.042
				Le Houérou (1980)
Ash		10.2	35.0	7.1
Crude Protein	%	7.8	27.6	38.5
Crude fiber		38.3	6.4	4.3

3- *Ziziphus spina-christi*

Content (%)	**The present study**	**Madi (1993)**	**Le Houérou (1980)**
Ash	8.1	40.3	8.3
Crude Protein	13.6	7.0	10.5
Crude fiber	13.4	7.2	14.2

All range nutritionists face the problem of determining the nutritive content of the diet of range animals. Grazing animals often select their forage from a complex mixture of plant species (Edlefsen *et al*. 1960). Oelberg (1956) reported that the nutritive value of any forage is dependent upon its content of energy-producing nutrients as well as its content of nutrients essential to the body, normally protein, minerals and vitamins. The nutritive value of range forage is influenced in a major way by stage of maturity, edaphic influences, plant species, climate, animal class, and range condition. The Ministry of Agriculture, Fisheries and Food in England (1975) reported that the minimum crude protein percentages in the diet range from 6% for dry weathers to 12% for wearers weighing about 20 kg. Digestible energy should be about 5.4% and the protein requirement is about 4.44 % from the weight.

In the present study, protein content was about 13.5% on the average (Table 7), which is higher than the proper level. Low protein levels in pasture will affect their performance because dietary protein deficiency is associated with a relatively low voluntary feed consumption.

Table 7. Total protein (TP) and crude fiber (CF) ranges in feeds commonly used in rations of sheep, goat, dairy cattle and beef cattle.

Composition ranges of feeds	TP (%)	CF (%)
Sheep (NRC 1975): 75 species	1.0 - 66.6	0.0 - 47.5
Goat (NRC 1981); 191 species	0.3 - 91.1	0.2 - 79.5
Dairy cattle (NRC 1978): 67 species	1.8 - 66.6	1.0 - 50.0
Beef cattle (NRC 1984): 87 species	0.5 - 91.3	0.2 - 62.0
The present study	3.4 - 32.8	7.2 – 44.9

Table8. Forage quality according to Boudet and Riviere (1968).

Forage quality	Net energy (MJ/kg)	Digestible protein (%)	Nutritional ratio Fu/kg
Poor	< 3.10	< 2.5	< 55
Fair	3.10 - 3.45	2.5 - 3.4	55 - 68
Good	3.45 - 4.15	3.4 - 5.3	68 - 88
Excellent	> 4.15	> 5.3	> 88
The present study	1.7 – 4.5	1.3 – 27	5.4 - 226

With protein deficient diet, the metabolism of the rumen microbiota may be depressed by a deficiency in rumen nitrogen; this limitation will retard the rate of removal of organic matter from the rumen which, in turn, may reduce intake (Le Houérou 1980). It may suggest that animals should be supplied with supplementary feed rich in protein, particularly during the product and reproductive statge, in order to maximize their productivity.

In the present study net energy is about 3.5 MJ/kg (Table 8) with this value the forage quality ranked as having good energy content according to the scale suggested by Boudet and Riviere (1968)

The shortage in the nutrition status of the forage may be attributed mainly to the high stocking rate. If the stocking rate in the area is lower than that used in the calculation, most of the animal requirements of energy and protein may met by the forage grown in the pasture. Heneidy (1986) concluded that the DP in the forage of the western desert of Egypt is about 5.4%, and that the average DP in the forage consumed is about 480 g/l00 kg live weight/day, according to Damarqui1ly's equation. In the present study, the average DP in the forage consumed in the area was calculated as about 464g/l00kg live weight/day, which is inadequate in meeting the protein needs of the grazing animals. The standard requirements of sheep as indicated by Abu- El-Naga (1981) are about 140 g/100 kg live weight/day.

In the present study the amount of total digestible nutrients (TDN) are about 53.8% on the average which is less than the average at Bisha area in Saudi Arabia as indicated by Heneidy 2000 (74.8%), Aqaba Gulf area of Sinai, Egypt as indicated by Heneidy 1996 (66.5%), on some supplementary feed by Soliman and El-Shazly 1978 (64.0 and 68.0%), and average for Western Mediterranean

Table 9. Comparison of total digestible nutrients (TDN) in the present study with previous studies.

Location	**Determined by**	**TDN (%)**
Egypt	Soliman and El-Shazly (1978)	
	berseem	56.0
	barley	64.0
	Corn	68.0
Egypt	Abdel-Salam (1985)	66.0
(Western Mediterranean desert)	Abdel-Razek *et al.* (1988)	75.0
Egypt (Aqaba Gulf, Sinai)	Heneidy (1996)	66.5
Saudi Arabia (Bisha area)	Heneidy (2000)	74.8
United Arab Emirates	The present study	53.8

desert by Abdel-Salam 1985 and Abdel-Razek *et al.* 1988, (66%) and (75%) (Table 9). Thus the nutritive value of pasture in the study area is considered fair for grazing animals compared to common fodder crops.

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