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Nutritive evaluation of some range plants species in the Western Mediterranean desert of Egypt

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ABSTRACT

The present study assesses the nutritive evaluation of some range plants species in the Western Mediterranean desert of Egypt to evaluate their usage as forage for domestic animals (mainly sheep and goats). Analysis of the plant organs which represent the diet selected by the herbivores indicated that their mean protein content is about 1.1 %. This is lower than the proper level, but it is ranked as acceptable protein content. The crude protein intake was about 46.4 g 100 kg live weight^{-1} day^{-1}, which is inadequate for the protein needs of grazing animals .The amount of total digestible nutrients (TDN) was lower than the standard requirements of the sheep. The shortfall in forage nutrition may be attributed to the high stocking rate (animal density area^{-1}). If the stocking rate is about seven times lower than the present value, most of the requirements of energy and protein could be fulfilled in the range. The ratio of Ca: P was higher than the optimum, which may lead to lower utilization of both Ca and P by animals.
Keywords: Nutritive value, desert, total digestible nutrients, livestock, arid ecosystem.

INTRODUCTION

Forage trees and shrubs play an essential and multiple roles in the balance of the arid and semi-arid grazing systems exploited by man and his animals. This role becomes more important as the dry season grows longer (Le Houèrou, 1980; Heneidy, 2002). The world's rangelands constitute important global resources. Range has been defined by the society for range management as land which supports vegetation useful for grazing on which routine management of that vegetation is through manipulation of grazing rather than cultural practices (Tueller, 1988). The natural rangelands constitute the principal feed resources for livestock in the Egyptian deserts. The biomass production and quality of the natural rangelands in such areas vary considerably from season to season and from area to area, depending on several environmental factors (El Shaer, 1999).

According to Hodgkinson and Harrington (1985) about two-third of the herbivores feed on artificial pastures developed from clearing native vegetation and sowing exotic forage plants. Water and nutrients are often added to boost the pasture production. The remaining one-third of herbivores feed on natural pastures where the pre-pastoral flora and fauna remain largely intact. They call these pastures as rangelands. It is worth mentioning that most of these natural pastures are prevailing in arid and semi-arid zones (Morales and Carlo, 2006).

Native vegetation, especially browse species (shrubs and sub-shrubs), in the Mediterranean arid zone are very important in the grazing system. The main economic value of browse species is grazing. Some of them have very high grazing value in terms of forage yield, season of production and forage quality. Productivity in rain-fed conditions may conveniently be assessed via the Rain-Use Efficiency factor (RUE) which is the quotient of the overall aerial phytomass production in kg DM ha^{-1} y^{-1} divided by the annual rainfall in mm (Le Houèrou, 1984). An environmental management policy can be successful only if it is formulated with a basic understanding of the full complexity of the ecosystem: its structure and function; a knowledge of its properties, in particular the properties of manipulation and perturbation, that have Induced changes in its components (Ayyad and Le Floc'h, 1983). Considerable information has been presented on the nutritive value of domestic crops but little is known about the nutritive content of range forage. Such information is fundamental to the management of range for effective livestock production. The nutritive value in the classical sense as the concentration of nutrients in a feed, or animal per unit of intake. The nutritive value of a diet thus depends on the proportion of nutrients digested by the animal and the efficiency with which these digested nutrients are absorbed and utilized by the animal's tissues. Nutritive value can be expressed with a wide range of precision, from yield of animal products per unit of intake, to energy retained per unit of metabolized energy consumed (Le Houérou, 1994; El Shaer, 1999; Zahran *et al.*, 1999; Heneidy, 2002; El Shaer *et al.*, 2005).

Nutrient contents (protein, carbohydrates, minerals and vitamins) and metabolisable energy (ME) change in relation to season (Stockdale, 1999), stage of growth (Fulkerson *et al.*, 1999), time of day (Lindgren and Lindberg, 1998), soil fertility or fertilizer application rates particularly nitrogen (Reeves *et al.*, 1996) and probably soil moisture status. Thus, an awareness of the factors influencing nutrient content of forage is required to allow more efficient supplementation of animals.

The Mediterranean desert, west of Alexandria, which is vegetationally and floristically the richest part in Egypt is considered an important region of development. It has a long history of intensive land use (Heneidy and Bidak, 2004). The vegetation in this region has deteriorated (by overgrazing, uprooting, ploughing and other practices as quarrying) and urgently requires sound management. The present study is an attempt to evaluate the chemical composition and nutritive value of the common range plants in the western Mediterranean (Fig. 1) as a case study.

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MATERIALS AND METHODS

Study Area

The study area is located at Maktala in the northwestern coastal region of Egypt and extends for 6 km along the coast between 107 and 113 km west of Matruh, and inland for an average depth of 16 km (Fig. 1). Its lies between the following longitudes and altitudes (30° 30' – 31° 10'N, 27° 30' – 28°E). The area distinguished eight physiographic units leading to variety of habitats: beach, coastal dunes, saline area, northern part of piedmont plain, southern part of piedmont plain; less degraded northern part, and the more degraded southern part of plateau and wadis (Fig.2). Geomorphologically, it is a part of the Egyptian western desert and it is a plateau with numerous large and deep topographic depressions. Its soil is young, and essentially alluvial (Kamal, 1988). They are derived from two main sources (a) the table land (inland plateau) composed essentially of limestone alternating with strata and shale; and (b) beach deposits composed of calcareous oolitic grains. The dominating land use is grazing by domestic animals. Climatologically, this area is classified as arid with mild winter and warm summer (UNESCO, 1977).

The present study was carried out during the two climatic conditions characterizing this area of the Mediterranean region, the wet season (winter and spring) was geomorphlogically classified into 8 physiographic units (Fig. 2) the beach, Coastal dune, Saline flat area, Northern part of piedmont plain in which the soil is very shallow, Southern part of piedmont plain in which soil is less shallow than in the northern part, Northern part of less degraded area covered with siliceous deposits in the form of dunes, Southern part of less degraded with shallow deposits and no dunes and more degraded plateau.

At the beginning of the study several flocks of grazing animals (sheep and goats) were observed at each site for several times, to explore which species is preferred applying same methods of Abdel-Razik *et al.* (1988); Genin and Badan-Dangon (1989) and Heneidy (1996). The grazing pressure was assessed by: (1) determination of the stocking rate (animal density area^{-1}) at each site, and (2) according to the status and abundance of the vegetation. These two parameters were taken to estimate the grazing pressure and pasture condition (El-Kady, 1980; Heneidy and Bidak, 1998). Estimation of the consumption of different plant species by the grazing animals was based on three main measures: (a) the number of times each plant species was used in the diet of a single animal (number of bites per unit time), (b) the average size of material removed from each species in one bite and (c) the location on the canopy from which this material was removed. In the same time, The weights and number of bites were then used to calculate the fresh and dry weight of consumed material (El-Kady, 1983; Heneidy, 1996). The total number of bites per animal per day of each plant species was multiplied by the average weight of material removed in each bite to estimate the amount of material removed per animal per day. This estimatation was then multiplied by the density of animals in the area, to provide an assessment of the amount consumed from each plant species in each habitat per hectare per day.

Floristic identification was made according to Täckholm (1974) and the Latin names of species were updated following Boulos (2009). Pasture condition based on the distribution and the valuable of rangeland species were recorded at each site.

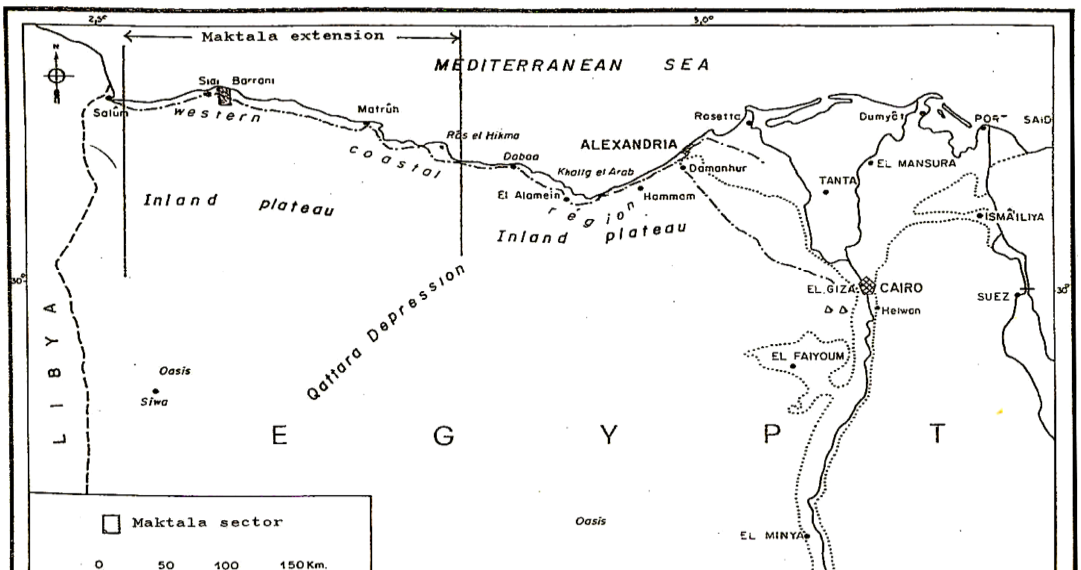

Figure (1): Location map of Maktala sector (shaded rectangle) and its extension territory in the western coastal desert of Egypt.

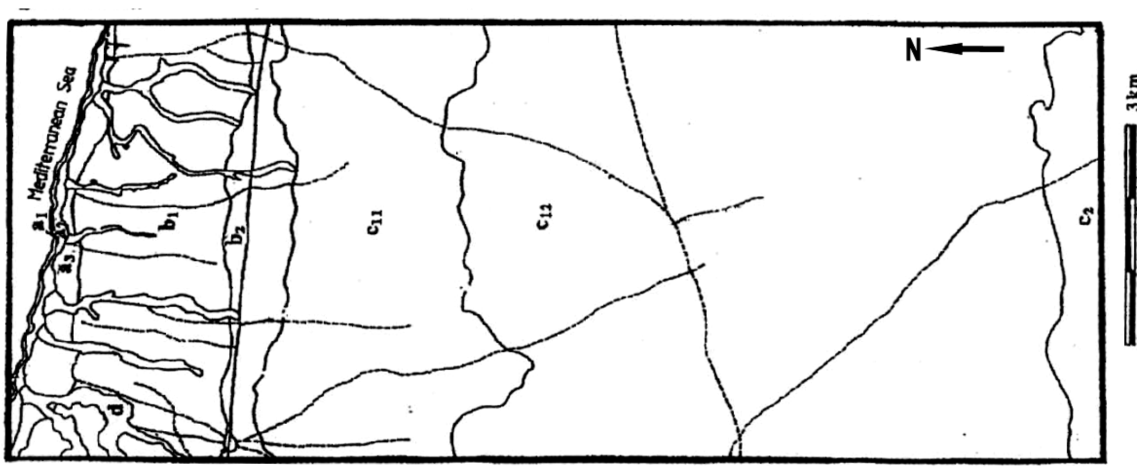

Figure (2): Physiographic map of Maktala sector, a, = the beach, a_2 = Coastal dune, a_3 = Saline flat area, b_1 = Northern part of piedmont plain in which the soil is very shallow, b_2 = Southern part of piedmont plain in which soil is less shallow than in the northern part, C_{11} = Northern part of less degraded area covered with siliceous deposits in the form of dunes, c_{12} = Southern part of less degraded with shallow deposits and no dunes, c_2 = more degraded plateau, and d = Wadis.

Selection of the key species

At each unit the key species (indicator species) are selected according to abundance and palatability of the plant species. At each site from five to seven species are recorded in each site as key species. Key management species are those on which the grazing management of a specific range is based. These species are ligneous plant and considered of constant biological resource, i.e., most of them are the main feeding source throughout the year (Holechek, 1988). The key species serve as indicators of management effectiveness.

Chemical analysis

Chemical analysis was carried out on the samples collected during the wet season (the growing season) where, the maximum consumption of the rangeland species. These samples are eaten parts (grazeable parts) of each indicator species at each site. Before analysis the samples were cleaned and dried. The analysis performed were to determined the following parameters: (a) total carbohydrates (nitrogen free extract, (NFE) according to Murata *et al.* (1968), (b) Crude protein CP, (c) ether extract (EE) and ash content according to Allen *et al.* (1974), (d) Crude fiber (CF) using the formula [CF = 100 - (CP + EE + NFE + ash)] after Le Houérou (1980), (e) Digestible crude protein (DCP) using Demarquilly's equations DCP = 0.93 CP - 3.52 after De Ridder *et al.* (1982). This equation is only valid in the case of nitrogen concentration among of 3 to 0.61 % (or CP > 3.81 %) TDN after Abu-El-Naga and El Shazly (1971), (f) Energy contained in food (gross energy, or energy intake, GE) was determined according to Petrusewicz (1976) and (g) The diet gross energy was calculated from its approximate analysis components multiplied by their average of heat of combustion (Lofgreen, 1951).

Through the long and continuous field observations, the degree of preference for each species was assessed and the consumption rate of each species was determined. After getting the results of the above mentioned parameters palatability and as forage plants. can be assessed as shown in table 1 (Boudet and Riviere, 1968; Heneidy, 1996; Heneidy 2002).

Table (1): 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

*FU: food unit and one FU = 6.9 MJ = 1650 kcal

The results obtained were analyzed statistically to determine the degree of significance between nutrients content of different species. For this purpose, the Chi – square X^2 test was carried out square X^2 test was carried out (Snedecor and Cochran, 1986).

RESULTS

The study shows that the grazing system in the present investigated Maktala area. (Table 2) contains the list of the families, life-forms, palatability rate, grazing value, consumed parts and livestock (that each species) prefer of the plant species found. From the Table it is easy to see that the most abundant life-forms of the species are chameophytes. About 50% of the perennial species are highly palatable, while the palatable and low palatability are only 42 and 8% respectively.

The content of different nutrients of 26 perennial species as well as 11 annuals are presented in (Table 3). Of all species, *Salsola tetrandra* and *Echinops spinosissimus* have the highest content of ash (36%, 34.9%), while *Lanunaea nudicaulis* has the lowest content (5.5%). The highest content of crude fiber is that of *Polygonum equisetiforme* (35.6%), which has also the highest value of total nitrogen and protein (2.4% and 10.5% respectively). *Echinops spinosissimus* and *Salsola vermiculata,* have the lowest content of these nutrients (14.6%, 0.6%, and 2.6% respectively). A similar high nitrogen concentration is recorded in *Carthamus lanatus* and *Polygonum equisetiforme* (2.4%). The carbohydrate content ranges between 27.1% (*Echinops spinosissimus*) and 51.9% (*Polygonum equisetiforme*). The highest content of ether extract is that of *Gymnocarpos decander* (8.3%), and the lowest is that of *Helianthemum lippii* (1.3 %). For minerals (P, Ca, Mg and K), *Carthamus lanatus*, *Crucianella maritima, Haloxylon scoparium* and *Urginea maritima* contain the highest values (4.0, 62.3, 10.3 and 39.8 mg g^{-1} respectively). The lowest value of P is estimated for *Gymnocarpos decander* (0.1 mg g^{-1}), where the lowest value of Ca and Mg is that of *Lanunaea nudicaulis* (2.9 and 1.5 mg g^{-1} respectively). The lowest value of K is that of *Ononis vaginalis* (5 % mg g^{-1}).

It is clear that *Asphodelus aestivus* contributes the largest proportion of the total content of nutrients in all regions. The only exceptions are the total nitrogen, protein and Mg contents in the northern part of less degraded plateau in which more contributed by *Urginea maritima* (Table 4). *Asphodelus aestivus* is higher in all nutrients in the southern parts of piedmont plain than in the saline flat, northern part of piedmont plain and the northern part of less degraded plateau (X^2 = 9.22, 7.01 and 5.05 respectively). In the area of southern part of less degraded and more degraded plateau, *Asphodelus aestivus* and *Haloxylon scoprium* contributes higher proportions of the total content of different nutrients (X^2 = 0.56 and 0.38 respectively).

On the other hand, *Salvia lanigera* in the saline flats and in the northern and southern parts of piedmont plain contributes lower proportions to the total content of different nutrients (X^2 = - 0.95). *Echinops spinosissmus* contains the lowest proportions in the area of southern part of less degraded and more degraded plateau (X^2 = -0.74).

It is clear that the total digestible nutrients (TDN) in all physiographic units are more or less the same. In the saline flats and northern part of piedmont plain, *Asphodelus aestivus* contributes about 48.9% of the total TDN (Table 5). Lower contribution is that of *Salvia lanigera* (0.4%). *Haloxylon scoparium* and *Asphodelus aestivus* provide about 76.8% of the total TDN in the area of southern part of piedmont plain. In the northern part of less degraded plateau, *Asphodelus aestivus* and *Urginea maritima* contribute about 63 % of the total TDN. *Asphodelus aestivus* and *Thymelaea hirsuta* have the highest contribution to TDN value in the southern part of less and more degraded plateau (about 62 % of the total TDN).

Table (2): List of plant species, families, life-forms (LF), palatability (Palat.), grazing values, stock type and consumed part in Maktala area. Ch = Chamaephytes, G = Geophytes, Hc = Hemicryptophy, P = Phanerophytes, Th = Therophytes. VHP = Very high palatability, HP = High palatability, P = Palatable, LP = Low palatability, NP = Unpalatable, VH = Very high, H = High, L1 = Low, S = Sheep, G = Goats, YB = Young branch, Fl = Flower, L = Leaves, Br = Branch, I = inflorescences, Dl = Dead leaves, Dbr = Dead branch, AB Gr = Above ground.

Species	Family	LF	Palat.	Grazing value	Stock type	Consumed part
Perennials						
Artemisia herba-alba Asso.	Compositae	Ch.	VHP	VH	SG	YB, Fl
Asphodelus aestivus Brot.	Liliaceae	G.	HP	VH	GS	Yl,Dl,l
Astragalus sieberi Dc.	Leguminosae	Ch.	HP	VH	GS	YB, Fl
Atriplex halimus L.	Chenopodiaceae	Ch.	HP	H	GS	YB,L
Carthamus lanatus L.	Compositae	Ch.	P	L1	GS	Head,L
Centaurea Alexandria Descr & Delile	Compositae	Ch.	LP	L1	SG	Head,L
Devera tortuosus (Desf.)Dc, Prodr	Caryophyllaceae	Ch.	VHP	VH	SG	YB
Echinops spinosissimus Turra.	Boraginaceae	Ch.	VHP	H	GS	YB,L
Echinochilon fruticosum Desf.	Compositae	Ch.	P	H	SG	Head,YB
Gymnocarpos decander Frossk.	Caryophyllaceae	Ch.	VHP	VH	GS	YB,L
Haloxylon scoparia Pomel Noum.	Chenopodiaceae	Ch.	P	VH	SG	YB,L
Helianthemum kahiricum Del.	Cistaceae	Ch.	HP	VH	SG	YB,L
Helianthemum lippii (L.) Pres.	Cistaceae	Ch.	VHP	VH	GS	YB,L
Lanunaea nudicaulis (L.) Hook.	Compositae	Hc.	P	H	SG	YB,L
Lotus polyphyllos E.D.Clarke	Leguminosae	Hc.	VHP	VH	GS	YB,L
Noaea mucronata (Frossk.) Asch.& Schwei	Chenopodiaceae	Ch.	HP	VH	GS	YB,L
Ononis vaginalis Vahl.	Leguminosae	G.	P	VH	SG	YB,L
Plantago albicans L.	Plantagonaceae	Ch.	VHP	VH	SG	AB,Gr
Polygonum equisetiforme Sm.	Polygonaceae	Ch.	P	H	SG	AB,Gr
Salvia lanigra L.	Labiatae	Ch.	NP	H	SG	YB,L
Salsola tetrandra Forssk.	Chenopodiaceae	Ch.	P	VH	GS	YB
Salsola vermiculata Poir.	Chenopodiaceae	Ch.	P	VH	GS	Br,L
Stipa parviflora Desf..	Gramineae	Hc.	VHP	VH	SG	AB,Gr
Suaeda pruinosa Lange.	Chenopodiaceae	Ch.	P	H	GS	YB,L
Thymelaea hirsute (L.) End.	Thymelaceae	Ch.	P	L1	GS	YB,Dbr
Urginea maritime (L.) Boker.	Liliaceae	G.	P	L1	GS	YB,L

Table (3): Chemical composition of the different plant species at Maktala. CF = Crude fiber, TN = Total nitrogen, EE = Ether extract, C = Carbohydrate.

Species	Ash	CF	TN	Protein	C	EE	P	Ca	Mg	K
	%					mg g^{-1}				
Asphodelus aestivus	19.8	24.1	1.2	5.1	43.9	3.4	1.1	28.1	4.0	19.0
Astragalus sieberi	11.2	33.0	0.7	2.7	46.0	2.3	0.5	11.8	2.4	8.8
Artemisia herba-alba	10.9	28.9	1.3	6.7	45.2	2.1	0.9	8.4	1.6	12.2
Atriplex halimus	27.0	17.0	0.9	3.2	39.9	1.7	0.6	16.7	10.0	15.1
Carthamus lanatus	1.3	21.8	2.4	6.9	46.0	5.1	4.0	14.3	4.0	32.0
Centaurea Alexandria	27.5	19.3	0.7	2.9	34.0	3.0	0.5	62.3	4.0	11.7
Devera tortuosus	7.2	32.5	1.2	5.0	49.3	2.3	0.5	12.6	2.6	10.3
Echinops spinosissimus	34.9	14.6	0.8	3.4	27.1	1.7	0.5	58.5	4.8	11.0
Echinochilon fruticosum	8.0	-	0.8	6.4	-	-	0.6	29.0	11.9	16.6
Gymnocarpos decander	17.3	18.6	1.0	3.7	48.3	8.3	1.5	22.6	5.1	17.8
Haloxylon scoparium	11.0	31.4	0.8	3.9	46.5	0.8	0.1	20.6	2.9	6.5
Helianthemum kahiricum	13.7	18.6	2.3	8.6	46.3	1.7	0.5	26.2	10.3	11.9
Helianthemum lippii	9.6	26.6	0.	4.4	47.5	1.1	0.9	19.6	1.9	5.5
Lanunaea nudicaulis	5.5	20.7	1.1	5.0	47.6	1.7	0.9	2.9	1.5	10.7
Lotus polyphyllos	19.7	26.3	1.5	7.1	47.0	2.7	0.7	39.1	5.4	9.0
Noaea mucronata	11.6	26.2	1.3	5.0	46.7	1.0	0.5	23.4	4.7	12.9
Ononis vaginalis	25.6	21.9	1.1	4.9	33.5	2.4	0.7	4.2	5.0	5.0
Plantago albicans	18.9	19.8	1.3	6.5	38.2	2.1	0.9	24.0	3.9	10.0
Polygonum equisetiforme	6.9	3.6	2.4	10.5	51.9	2.4	0.9	9.5	3.8	8.8
Salsola tetrandra	36.0	17.7	1.9	6.1	33.5	1.	0.8	17.8	7.2	20.4
Salvia lanigra	14.6	27.7	1.3	6.7	49. 2	1.9	0.7	18.7	2.9	10.3
Salsola vermiculata	11.8	31.9	1.2	5.1	47.8	-	1.0	-	-	-
Stipa parviflora	14.0	24.1	0.7	2.6	43.3	2.6	1.4	12.0	3.3	6.8
Suaeda pruinosa	28.2	19.0	1.1	4.5	36.9	1.9	0.3	17.7	6.5	12.6
Thymelaea hirsute	9.7	29.3	1.3	6.2	47.6	2.5	0.7	13.0	3.4	7.2
Urginea maritime	19.0	18.5	1.9	5.4	4.6	3.3	1.2	29.4	2.8	39.8
Annuals	28.5	23.1	2.0	7.5	44.8	2.2	1.4	23.4	3.8	-

Table (4): Nutrient content (g ha^{-1}) of graze from perennial species during the period of maximum consumption by domestic animals at Maktala, CF = Crude fiber, TN = Total nitrogen, Pr = Protein, C = Carbohydrate, EE = Ether extract, *: P > 0,05; **: P > 0,01; ***: P > 0,001 according to X^2 test.

Species	CF	TS	Pr	C	EE	P	Ca	Mg	K	total	X^2
a – The Saline flat and northern part of piedmont plain											
Asphodelus aestivus	86	4.00	18	155	12	38	1000	143	696	2152**	7.01
Atriplex halimus	8	0.40	1	18	0.7	3	74	45	67	217.1	0.40
Haloxylon scoparium	28	3.00	13	70	3	7	397	156	180	557	0.20
Noaea mucronata	4	0.20	1	8	0.2	1	40	8	22	844	0.19
Devera tortosum	6	0.20	1	9	0.4	1	23	5	19	646	0.01
Plantago albicans	13	1.00	4	24	1	6	153	25	64	291	0.26
Salsola tetrandra	4	0.40	1	8	0.3	2	41	16	465	37.7	0.01
Salvia lanigra	1	0.04	0.2	1	0.1	0.2	6	1	3	12.54	0.96
Suaeda pruinosa	8	1.00	2	16	1	1	77	28	55	189	0.46
Thymelaea hirsuta	14	1.00	3	23	1	3	63	16	33	159	0.53
Total	172	11.2	44.2	332	19.7	62.2	1874	443	1606	5905	
Mean	17.2	1.1	4.4	33.2	1.9	6.2	187	44.3	160	590	
S.D	25.4	1.3	6.1	46.9	3.6	11.4	307	56.9	233	622	
b- The southern part of piedmont plain											
Asphodelus aestivus	270	13	57	491	38	121	3147	451	2189	6777**	9.22
Artemisia herba-alba	15	0.7	4	24	1	5	44	9	65	167.7	0.80
Gymnocarpos decander	24	1	3	35	1	1	156	22	49	202	0.68
Haloxylon scoparium	157	19	73	391	14	41	2213	868	1002	4778*	3.43
Helianthemum lippii	21	1	4	37	1	7	155	15	44	285	0.60
Noaea mucronata	31	2	6	55	1	6	277	56	153	587	0.40
Devera tortusos	33	1	5	50	2	5	127	26	104	353	0.60

Plantago albicans	93	6	30	179	10	42	1123	183	466	2132	0.07
Salvia lanigra	2	0.1	1	4	0.2	1	16	2	9	35.3	0.94
Thymelaea hirsuta	123	5	26	199	11	28	545	141	303	1381	0.03
Total	769	488	209	1465	792	257	7803	1773	4384	16788	
Mean	76.9	4.9	20.9	146	7.9	25.7	780	177	438	1679	
S.D	85.3	6.3	25.6	169	11.7	37.1	1075	278	685	2301	
c – The northern part of less degraded plateau											
Asphodelus aestivus	196	9	40	347	27	8	2223	319	1547	4787	5.05
Echiochilon fruticosum	0.0	1	10	-	-	9	442	182	253	897	0.15
Gymnocarpos decander	17	0.4	2	26	0.4	1	113	16	35	210	0.72
Noaea mucronata	24	1	5	43	1	4	214	43	118	453	0.47
Plantago albicans	62	4	20	119	7	28	748	122	310	1420	0.01
Thymelaea hirsuta	40	2	9	66	3	9	179	47	100	455	0.48
Urginea maritima	78	8	23	193	14	50	125	120	1689	2300	0.31
Total	411	25	104	794	52.4	186	4044	849	4052	1023	
Mean	58.7	3.6	15.6	113	7.5	26.6	577	121	578	1474	
S.D	63.7	3.5	13.2	121	9.9	30.9	670	104	717	1644	
d – The southern part of less degraded and degraded plateau											
Asphodelus aestivus	33	2	7	6	5	15	388	56	270	837	0.56
Echinops spinosissimus	1	0.1	0.3	2	0.1	0.4	47	4	9	67.5	0.73
Haloxylon scoparium	25	3	12	6	2	7	39	141	163	775	0.38
Thymelaea hirsuta	21	1	4	3	2	5	93	24	51	235	0.26
Total	80	6.1	23.3	1	9.1	27.4	887	225	493	2486	
Mean	20	1.5	5.8	4	2	6	221	56	123	478.7	
S.D	13.6	1.2	4.1	2	2	6	176	60	117	384.9	

Table (5): Daily consumption of nutritive values (g $anima^{-1}$) as total digestible nutrients (TDN) for the grazeable perennials in the different physiographic units at Maktala sector. a_3= saline area, b_1 = northern part of piedmont plain, b_2 = southern part of piedmont plain, c_{11} = northern part of less degraded plateau, c_{12} = southern part of less degraded plateau, c_2 = more degraded plateau. R= relative value to the total all species.

Species	Physiographic unit							
	a_3+ b_1	R %	c_2	R %	c_{11}	R %	c_{12}+ c_2	R %
Asphodelus aestivus	138.2	48.9	98.2	36.1	125.3	43.1	107.2	40.9
Artemisia herba-alba	15.1	5.2	-	-	-	-	-	-
Atriplex halimus	15.1	5.3	-	-	-	-	-	-
Echiochilon fruticosum	-	-	-	-	21.1	7.2	-	-
Gymnocarpos decander	-	-	5.8	2.1	7.6	2.6	-	-
Haloxylon scoparium	52.2	18.5	65.7	24.1	-	-	94.1	35.9
Helianthemum lippii	-	-	6.7	2.5	-	-	-	-
Noaea mucronata	6.4	2.3	10.1	3.7	14.1	4.8	-	-
Devera tortusos	6.3	2.2	7.7	2.8	-	-	-	-
Plantago albicans	21.6	7.6	35.7	13.1	42.9	14.7	-	-
Salsola tetrandra	7.9	2.8	-	-	-	-	-	-
Salvia lanigra	1.2	0.4	0.7	0.3	-	-	-	-
Suaeda pruinosa	15.1	5.0	-	-	-	-	-	-
Thymelaea hirsuta	18.8	6.7	36.17	13.5	21.9	7.5	55.2	21.0
Urginea maritima	-	-	-	-	58.2	20	-	-
Total	282.8	-	272.0	-	291.1	-	262.2	-

Table (6): Comparison between the annual average of the total digestible nutrients (TDN), digestible crude protein (DCP) and gross energy (GE) of 25 species perennial and 10 species annuals in the present study and those of the previous related studies. * Data are mean of the different species.

Location	References	DCP	TDN	GE
		%		kcal kg^{-1}
The present study (35 species*)		4.8	56.8	3.982
Aqaba Gulf Area Pasture* (Sinai)	Heneidy 1996	4.6	66.5	4.100
Bisha area* (Saudi Arabia)	Heneidy 2000	8.8	74.8	3.974
East of Matruh (82 species*)	Heneidy 2002	5.7	67.0	3.993
United Arab Emirates (97 species*)	Shaltout *et al*. 2008	9.1	60.5	2.430
Kenya (6 Acacia trees*)	Abdulrazak *et al*. 2000	8.7	70.9	4.451

DISCUSSION

All range nutrition faces 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. Le Houèrou (1993) reported that the nutritive value of any forage is dependent upon its content of energy-producing nutrients as well as its control of nutrients essential to the body, normally protein, minerals and vitamins. The nutritive value of range forage is influenced by stage of maturity, edaphic influences, plant species, climate, animal class, and range condition (Heneidy, 2000 and 2002). UK's Ministry of Agriculture, Fisheries and Food (1975) reported that the minimum crude protein percentages in the diet range from 6% for dry ewes and weathers to 12% for wearers weighing about 20 kg. Digestible energy should be about 5.4% (El-Kady, 1987) and the protein requirement is about 4.44% (El Shaer 1999; El Shaer *et al*., 2005).

In the present study protein content of the forage appeared to be 1.1%, which is far too low. Although animals select the green portions of plants and high protein forbs and shrubs (Cable and Shumway, 1966), low protein levels in pasture will affect their performance because dietary protein deficiency is associated with a relatively low voluntary feed consumption. With a 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 (Weston, 1971). Also, low protein levels will affect the wool growth, which is determined by protein absorbed in the intestine, which in turn depend on ingested nitrogen sources (Michalk and Saville, 1979). It may be suggested then that animals should be supplied with supplementary feed rich in protein, particularly during the productive and reproductive states, in order to maximize their productivity.

In the present study, the amount of total digestible nutrients (TDN) was lower than the standard requirements of livestock. The shortfall in forage nutrition may be attributed to the high stocking rate. If the stocking rate is about seven times lower than the present value, most of the requirements of energy and protein could be fulfilled in the range. Comparable observations and conclusions were made by Abdel-Razik *et al.* (1988) and Badri and Hamed (2000).

Abdel-Salam (1985) recognized that the importance of the adequate Ca: P ratio of 2:1 as major factor affecting the utilization of the whole diet. In the present study this ratio was far higher than the optimum. Such a high ratio would lead to lower utilization of both Ca and P by animals. It is asserted that if too little P was available, the N absorption, and hence biomass production are reduced (Penning de Vries *et al.,* 1980). On the other hand, the Ca/Mg ratio in animal diet in the study area is about 1.2 on the average. This was higher in herbaceous (about 1.5) than in woody species (about 1.7). Le Houèrou (1980) reported that the Ca/Mg ratio of 2.8 for the range in browse plant of Northern Africa was about adequate. In western desert of Egypt, Heneidy (1986) indicated that while the Ca/P ratio was too high, the Ca/ Mg ratio was about 1.2.

In the present study the amount of the digestible protein of the forage as a percentage of dry matter was about 4.83%. With this value the forage quality is ranked as having good protein content according to the scale suggested by Boudet and Riviere (1968), who consider the fair DP percentage as between 2.5% and 3.4 %. Thus the shortage in the nutrition status of the forage may be attributed mainly to the high stocking rate (2.04 animal^{-1} ha^{-1}). Heneidy (1986) calculated that the percentage of DP in the forage of the western desert of Egypt and as about 5.4%, and the average DP in the forage consumed is about 48.0 g 100 kg live weight^{-1} day^{-1}, according to Demarquilly and Weiss (1970). In this study, the average DP in the forage consumed in the study area was about 46.4 g l00 kg live weight^{-1} day^{-1}, which is inadequate. The standard requirements of sheep as indicated by Abu El-Naga (1981) is about 140 g 100 kg live weight^{-1} day^{-1}.

In the present study the amount of TDN as g head^{-1} day^{-1} is about 277 on the average, this is lower than the standard requirements of sheep as indicated by Abu El-Naga 1981 (about 1500 g 100 kg live weight^{-1} day^{-1}), and National Research Council, 1964 (about 1300 g 100 kg live weight^{-1} day^{-1}). Therefore, supplementary feeding strategies should be developed to stabilize nutrient intake at acceptable levels. In addition to the direct effects on sheep health and productivity, supplementation will reduce the effect of overgrazing, as supplementary rations will substantially reduce forage intake, particularly when pasture is sparse. While economics will generally dictate the type of ratio formulated, the decision of when to feed and what animals to nourish will be made by the ranger.

In the present study the amount of TDN are about 56.8 % on the average which is less than the average at Bisha area in Saudi Arabia (74.8%) as indicated by Heneidy (2000), Aqaba Gulf area of Sinai (66.5%) as indicated by Heneidy (1996) (Table 6), on some supplementary feed (68.0%) as reported by Soliman and El-Shazly (1978) and average of the Western Mediterranean vegetation (75%) (Abdel-Razek *et al.,* 1988). The obtained results of TDN in the present study is also higher than the average TDN (60.5 %) in United Arab Emirates as reported by Shaltout *et al*. (2008). However, Abdulrazak *et al.* (2000) reported that the average of TDN in Kenya is 70.9 %.

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تقييم القيمة الغذائية لبعض نباتات المراعي بالصحراء الغربية للبحر المتوسط بمصر

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الملخص العربى

اهتم البحث بتقدير القيمة الغذائية لنباتات المراعي بالصحراء الغربية للبحر المتوسط بمصر وتقييمها كعلف للحيوانات الرعوية (الغنم والماعز بصفة أساسية). أظهرت التحاليل أن كمية البروتين الممتص والقابل للهضم والتي يحصل عليها الحيوان في غذائه اليومي تمثل حوالي 46.4 جرام لكل 100 كيلو جرام من الوزن الحي للحيوان، وهذه الكمية لاتفي بإحتياج الحيوان الرعوي من البروتين. كما اظهر الهضم الكلي قيم أقل من القيم القياسية لاحتياج الأغنام. ومن المحتمل أن هذا النقص في التغذية يرجع إلي زيادة الرؤوس الرعوية. وفي حالة خفض عدد الرؤوس الرعوية إلي سبع القيمة الحالية، تصبح أغلب الطاقة والبروتين عند المستوي المطلوب. كانت نسبة الكالسيوم إلي الفسفور مرتفعة عن الحد الأعلى مما يؤدي إلي قلة الإستفادة من الكالسيوم والفسفور.