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ORIGINAL PAPER

A S El-Din and H F El-Kady

Nutritive Value of the Range Plants in the Western Mediterranean Desert of Egypt

Abstract: The present study assesses the nutritive value of range plants in the Western Mediterranean Desert of Egypt to evaluate their usage as forage for domestic animals (mainly sheep and goats). Analysis of 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 average digestible protein intake was about 46.4 g 100 kg live weight-l day-l, which is inadequate for the protein needs of grazing animals. The amount of total digestible nutrient (TDN) was also lower than the normal requirements of the sheep. 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. The ratio of Ca: P was higher than the optimum, which may lead to lower utilization of both Ca and P by animals.

Key words: Nutritive value, desert, livestock, arid ecosystem.

القيمة الغذائية لنباتات المراعى بالمنطقة الغربية للبحر المتوسط بمصر

أحمد شرف الدين و هـ القاضي

المستخلص:اهتمم البحث بتقدير القيمة الغذائية لنباتات المراعى بالمنطقة الغربية المطلة على البحر المتوسط بمصر وتقيمها كعلف للحيوانات الرعوية (الغنم والماعز بصفة اساسية). أظهرت التحاليل أن كمية البروتين الممتص والقابل للهضم والتى يحصل عليها الحيوان فى غذائه اليومى تمثل حوالى 46.4 جرام لكل 100 كيلوجرام من الوزن الحى للحيوان ، وهذه الكمية لاتفى بحاجة الحيوان الرعوى من البروتين . كما أظهر الهضم الكلى قيم أقل من القيم القياسية لحاجة الأغنام. ومن المحتمل أن هذا النقص فى التغذية يرجع إلى زيادة الرؤوس الرعوية . وفى حالة خفض عدد الرؤوس الرعوية إلى سبع (X 7) القيمة الحالية ، تصبح أغلب الطاقة والبروتين عند المستوى المطلوب . كانت نسبة الكالسيوم إلى الفسفور مرتفعة عن الحد الأعلى مما يؤدى إلى قلة الإستفادة من الكالسيوم والفسفور.

كلمات مدخلية: القيمة الغذائية، الصحراء، نباتات المراعي، غرب المتوسط، مصر

Introduction

Under Roman domination (146 BC - 365 AD), agriculture prospered and became diversified. In that time, North Africa became one of the principal granaries of Rome (Le Houerou, 1969 b) The present low productivity of the area stands in striking contrast to its ancient levels. Many authors have attempted to explain this decline. Climatic change was the first easy answer, but this is now largely ruled out. Several pieces of evidence indicate that climate in the Roman period was not much more humid than it is now. A calendar of ancient Alexandria shows that it had the same number of rainy days per year as it has now (Griffiths, 1972). Lo Houerou (1969 b) reported that the agriculture of the Roman era was a "mining agriculture", and that the principal reason for decline might be attributed to erosion in the arid zones. Wind erosion can locally remove several centimeters of surface material per year on sandy soil. Vegetation in the arid zone of North Africa has experienced accelerated deterioration since 1930. The deterioration results from the great population pressure, which is expressed as intense overgrazing, the extension of episodic cereal growing, and the removal of woody species for firewood (Le Houerou, 1969 a). An environmental management policy can be successful only if it is formulated with a basic understanding of the full complexity of the ecosystem in terms of structure and function, and a knowledge of its properties, in particular the properties of manipulation and perturbation, that have induced changes in its components (Ayyad & Le Floc'h, 1983). Considerable information has been presented on the nutritive value of domestic crops but little is known about the nutritive content

A. S El-Din and H. F. El-Kady
Botany Department, Faculty of Science, Tanta University, P. O . Box 31527, Tanta, Egypt

of range forage. Such information is fundamental to the management of range for effective livestock production. Ulyatt (1973) defined 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 values can also be expressed with a wide range of precision, as yield of animal products per unit of intake, or energy retained per unit of metabolized energy consumed.

The Mediterranean desert, west of Alexandria, which is, vegetationally and floristically, the richest part of Egypt, is considered an important region for development. It has a long history of intensive land use. The vegetation in this region has deteriorated (by overgrazing, uprooting, ploughing and other practices such 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 sector of Maktalla of the western Mediterranean desert of Egypt.

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 Mersa Matruh, and inland for an average depth of 16 km (Fig. 1). The geological map published by NSF-Remote Sensing Research Project (Shaltout, 1978), shows the study area to be covered with extensive exposures of sedimentary rocks ranging from Early Miocene to Holocene. Two main soil groups with different characteristics dominate the study area: Yrmosols and Regosols (El-Gabaly *et al.*, 1969).

The area belongs to the warm coastal desert climate (Meig, 1973). August is the warmest month with mean temperatures above 20°C: occasional short rainstorms occur in winter and most of the days are sunny and mild. The map of the world distribution of arid regions (UNESCO, 1977) indicates that the climatic conditions in the study area are characterized by warm summers (20 to 30°C), mild winters (10 to 20°C) and P/E less than 0.03 (where P is annual precipitation, and E is annual evaporation). Vegetation of the study area was classified by El-Kady (1987) into five groups:

1. *Elymus farctlls - Echinops spinosissmus*
2. *Thymelaea hirsuta - Carduncellus eriocephalus*
3. *Ssphodelus ramosus - Haloxylon scoparium*
4. *Thymelaea hirsuta - Ssphodelus ramosus*
5. *Urginea maritima - Thymelaea hirsute.*

Eight physiographic units were also recognized (see Fig. 2):

- beaches (a1)
- coastal dunes (a2)
- saline areas (a3)
- northern part of piedmont plains (b1)
- southern part of piedmont plains (b2)
- less degraded northern parts (c11)
- more degraded southern parts of plateau (c2)
- wadis (d)

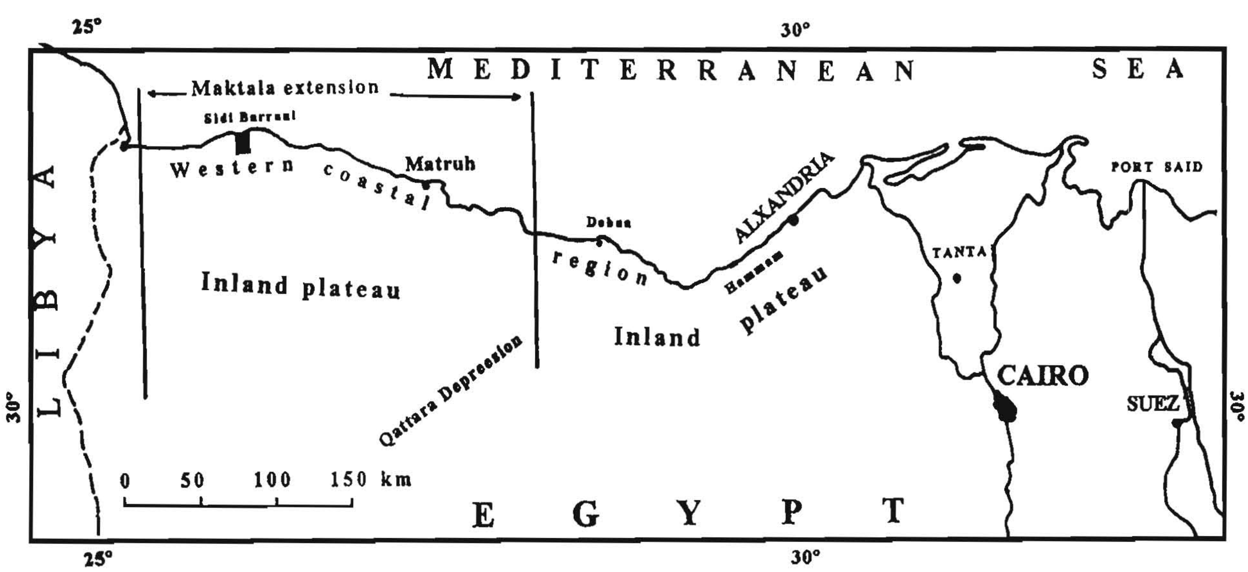

Fig. 1: Location map of Maktala sector and its extension territory in the coastal desert of Egypt.

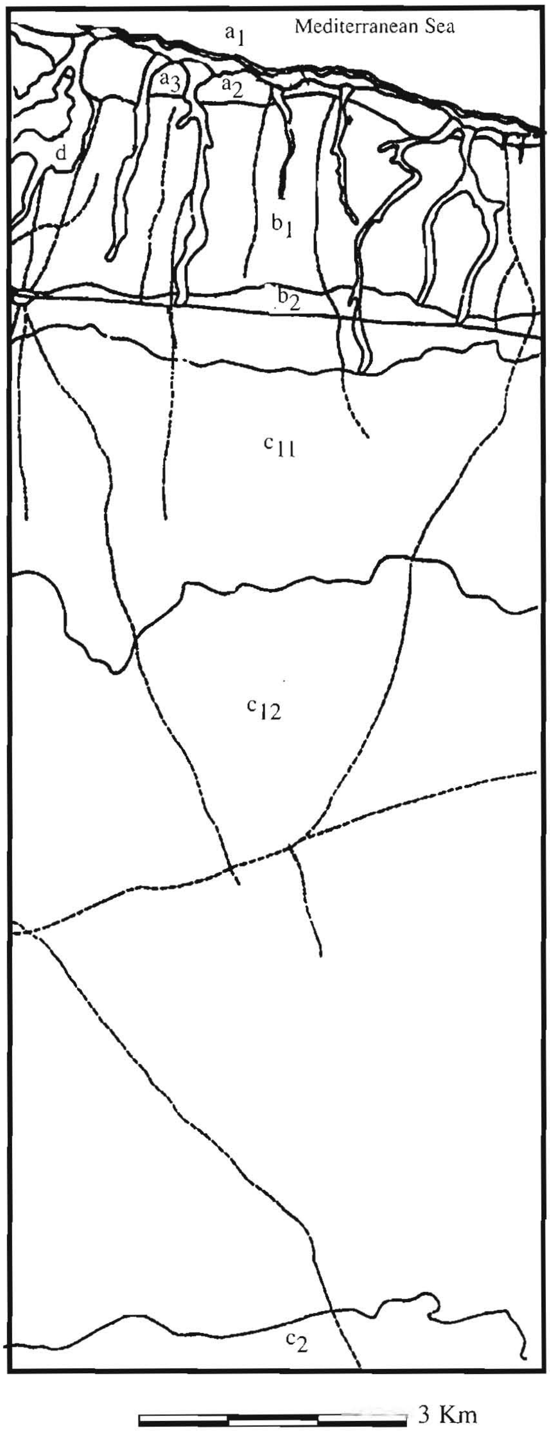

Fig. 2: Physiographic map of Maktala sector.

a_1 = the beach, a_2 = the 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 the soil is less shallow than the northern part, c_{11} = northern part of less degraded area covered with siliceous deposits in the form of dunes and c_{12} = southern part of less degraded with shallow deposits and no dunes, c_2 = more degraded southern part, and d = wadis

Materials and Methods

Samples of the grazeable parts of each plant species were collected from various locations of the study area. Assessing the plant was based on direct visual observation. The sampled material was kept in bags and brought to the laboratory shortly after collection. In the laboratory, each sample was cleaned and air-dried using a stream of warm air. Samples of organs were weighed and oven dried at 65°C to constant weight. All samples were powdered in a grinding mill and kept in small paper bags. The powdered samples were analyzed for the determination of K using a flame photometer; Ca and Mg were analyzed using atomic adsorption, and P by the Vanadate - molybdate method (Allen *et al.*, 1974). Ash content was estimated by ignition at 500°C for about 24 hours. Total nitrogen content was estimated by the Kjeldahl method (Mueller & Fiedler, 1969), and the protein was calculated by multiplying insoluble nitrogen by the factor 6.25 (Oelberg, 1956). Ether extract (total lipids) was estimated by extraction with ether (Radunz, 1964). Carbohydrates were estimated using carbon/sulfur determinator apparatus (Leco CS - 244). Crude fiber was estimated according to Scharrer & Kuchler (1967). The estimated nutrients were referred to the phytomass of each species per hectare and the carrying capacity of each physiographic unit (carried out by El-Kady, 1987) to give an estimate for the daily nutrient contents (g ha-l) of nutritive values (g animals-l). Nomenclature of species was according to Täckhiolm (1974) and the scientific names were updated according to Boulos (1995).

Estimation of consumption rate was carried out in each physiographic unit where the flock of grazing animals was observed for 24 hours. Any one animal in the flock was observed for 5 minutes. During each hour of the daily grazing period, ten animals were observed for a cycle of 50 minutes to represent the hourly consumption behaviour. Field glasses were used to observe the animals from a distance, and a tape recorder was used to record the observation. The time of observation began from 7 a.m. untill 6 p.m. (i.e. the flock moves out from the herd house to the field at the first light of the day and stays till sunset). 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 with one bite and
c) the location on the canopy from which this material was removed.

It is known, that the average weight of bite for all species was approximately 0.05 g dry matter bite (El-Kady, 1980). The weights and number of bites were then used to calculate the fresh and dry weight of consumed material. This technique was also applied by El-Kady (1980) and Heneidy (1986).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 estimate 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. These contents were recorded at the time of maximum consumption of each plant species. Identifying the maximum consumption was based on visual field observations, and would therefore demonstrate the potential amount of nutrients available for grazing animals during the year.

The nutritive values expressed as total digestible nutrients (TDN) of grazeable perennial species which form the diet of domestic animals was estimated according to the following equation applied by Naga & El-Shazely (1971):

TDN = 0.62 (1 00 + 1.25EE)- P0. 72

Where TDN is the percentage of total digestible nutrients, EE is the percentage of ether extraction. P is the percentage of crude protein. This equation was selected from Naga & El-Shazly's 1971 regression model, depending on the range of protein and fiber percentages in the examined species. The digestible protein (DP) was calculated according to the regression equation of Demarquilly & Weiss (1970):

DP = 0.929 CP - 3.52, where CP is the crude protein.

The results obtained were analyzed statistically using chi-square χ^2 test to determined the degree of significance between nutrient content of different species (Snedecor and Cochran, 1986).

Results

The concentration of different nutrients of 25 perennial species as well as *Hordeum vulgare* and ten annuals are presented in Table 1. Of all species, *Salsola tetrandra* and *Echinops spinosissimus* have the highest concentration of ash (36%, 34%) while *Hordeum vulgare* has the lowest (5.5%). The highest concentration of crude fiber is that of *Retama raetam* (35.6%), which also has the highest value of total nitrogen and protein (2.4% and 10.5 %, respectively). *Echinops spinosissimus* and *Sporobolus pungens*, have the lowest concentrations of crude fiber and protein (14.6% and 2.6%, respectively). A similar high nitrogen concentration is recorded in *Colchichum ritchii* and *Retama raetam* (2.4%). The carbohytrate concentration ranges between 27.1% (*Echinops spinosissimus*) and 51.9% (*Retama raetam*). The highest concentration of ether extract is that of *Euphorbia paralis* (8.3%), and the lowest is that of *Helinthemum lippii* (1.3%). For minerals (P, Ca, Mg, and K), *Urginea maritime* 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 *Gymnocrpos decander* (0.1 mg g-1), whereas the lowest value of Ca and Mg is found in *Hordeum vulgare* (2.9 and 1.5 mg g-1, respectively). The lowest value of K is that of *Ononis vaginalis* (5.0 1 mg g-1).

It is clear that *Asphodelus ramosus* contributes the largest proportion of all total contents of nutrients in all of the physiographic regions. The only exceptions are the total nitrogen, protein and Mg contents in the northern part of the less degraded plateau in which more is contributed by *Urginea maritima* (Table 2). *Asphodelus ramosus* is higher in all nutrients in the southern parts of the piedmont plain than in the saline flats. The northern part of the piedmont plain and the northern part of the less degraded plateau (χ^2 = 9.22, 7.09 and 5.06, respectively). In the area of the Southern part of the less degraded and more degraded plateau, *Asphodelus ramosus* and *Haloxylon scoprium* contribute higher proportions of the total content of different nutrients (χ^2 = 0.56 and 0.38, respectively). On the other hand, *Salvia lanigera* in the saline flats and the northern and southern parts of the piedmont plain contribute lower proportions to the total content of different nutrients (χ^2 = 0.95). *Echinops spinosissnmus* contains the lowest proportions in the area of the southern part of the less degraded and more degraded plateau (χ^2 = 0 74).

Table 1. Chemical composition of the different plant species at Maktala.

Species	Ash	CF	TN	Protein	C	EE	P	Ca	Mg	K
	%					mg g^{-1}				
Asphodelus ramosus	19.8	24.1	1.2	5.1	43.9	3.4	1.1	28.1	4.0	19.0
Ammophila arenaria	11.2	33.0	0.7	2.7	46.0	2.3	0.5	11.8	2.4	8.8
Seriphidium 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
Colchicum ritchii	15.3	21.8	2.4	6.9	46.0	5.1	4.0	14.3.	4.0	32.0
Crucianella maritima	27.5	19.3	0.7	2.9	34.0	3.0	0.5	62.3	4.6	11.7
Deverra 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
Echiochilon fruticosum	8.0	-	0.8	6.4	-	-	0.6	29.0	11.9	16.6
Euphorbia paralias	17.3	18.6	1.0	3.7	48.3	8.3	1.5	22.6	5.1	17.8
Gymnocarpos decander	11.0	31.4	0.8	3.9	46.5	0.8	0.1	20.6	2.9	6.5
Haloxylon scoparium	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	0.5	4.4	47.5	1.1	0.9	19.6	1.9	5.5
Hordeum vulgare	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	45.2	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
Retama raetam	6.9	35.6	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	33.6	1.5	0.8	17.8	7.2	20.4
Salvia lanigera	14.6	27.7	1.3	6.7	49.2	1.9	0.7	18.7	2.9	10.3
Schismus barbatus	11.8	31.9	1.2	5.1	47.8	-	1.0	-	-	-
Sporobolus pungens	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 hirsuta	9.7	29.3	1.3	6.2	47.6	2.5	0.7	13.0	3.4	7.2
Urginea maritima	19.0	18.5	1.9	5.4	45.6	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	-

CF = Crude fiber, TN = Total nitrogen, E E = Ether extract, C = Carbohydrate.

The highest daily number of bites is that of *Asphodelus ramosus* (from 2873 ± 84.1 at b_2 to 4033 ± 117 at a_3+b_1). On other hand, the number of bites per physiographic region varies between 8046 bite animal/day/ at c_{12} + c_2 and 9099 bite animal/ day/ at c_{11} (Table 3). 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 the piedmont plain, *Asphodelus ramosus* contributes about 48.9% of the total TDN (Table 4). A lower contribution is that of *Salvia lanigera* (0.4%). *Haloxylon scoparium* and *Asphodelus ramosus* provide about 76.8% of the total TDN in the area of the southern part of the piedmont plain. In the northern part of the less degraded plateau *Asphodelus ramosus* and *Urginea maritima* contribute about 63 % of the total TDN. *Asphodelus ramosus* and *Thymelaea hirsuta* have the highest contribution to TDN value with the southern part of the less and more degraded plateau (about 62 % of the total TDN).

Discussion

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. Oelberg (1956) reports 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 (Oelberg, 1956). The UK's Ministry of Agriculture, Fisheries and Food (1975) reports that the minimum crude protein percentages in the diet, range from 6% for dry ewes and weathers, to 12% for weathers weighing about 20 kg. Digestible energy should be about 5.4% (Cook & Harris, 1986a) and the protein requirement is about 4.44% (Cook & Harris, 1986b). In the present study protein

Table 2. Nutrient content (g ha/day) of graze from perennial species during the period of maximum consumption by domestic animals at Maktala.

Species	CF	TN	Pr	C	EE	P	CA	Mg	K	Total	χ^2
a – The saline flat and northern part of piedmont plain											
Asphodelus ramosus	86	4	18	155	12	38	1000	143	696	2152**	7.01
Atriplex halimus	8	0.4	1	18	0.7	3	74	45	67	217.1	0.40
Haloxylon scoparium	28	3	13	70	3	7	397	156	180	857	0.20
Noaea mucronata	4	0.2	1	8	0.2	1	40	8	22	844	0.19
Deverra tortuosus	6	0.2	1	9	0.4	1	23	5	19	646	0.01
Plantago albicans	13	1	4	24	1	6	153	25	64	291	0.26
Salsola tetrandra	4	0.4	1	8	0.3	2	41	16	465	37.7	0.01
Salvia lanigera	1	0.04	0.2	1	0.1	0.2	6	1	3	12.5	0.96
Suaeda pruinosa	8	1	2	16	1	1	77	28	55	189	0.46
Thymelaea hirsuta	14	1	3	23	1	3	63	16	35	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	187.4	44.3	160	590	
S. D.	25.4	1.3	6.1	46.9	3.6	11.4	307.1	56.9	233	622	-
b – The southern part of piedmont plain											
Asphodelus ramosus	270	13	57	491	38	121	3147	451	2189	6777**	9.22
Seriphidium 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	292	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
Deverra tortuosus	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 lanigera	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	788	209	1465	792	257	7803	1773	4384	1678	-
Mean	76.9	4.9	20.9	146.5	7.9	25.7	780.3	177.3	438	1679	-
S. D.	85.3	6.3	2.6	169.9	11.7	37.1	1075	278.9	685	2301	-
c - The northern part of less degraded plateau											
Asphodelus ramosus	190	9	40	347	27	85	2223	319	1547	4787*	5.05
Echiochilon fruticosum	-	1	10	-	-	9	442	182	253	897	0.15
Gymnocarpos decander	17	0.4	2	26	0.4	1	113	16	35	210.8	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	25.4	104	794	52.4	186	4044	849	4052	10523	-
Mean	58.7	3.6	15.6	113	7.5	26.6	577.7	121	578	1474	-
S. D.	63.7	3.5	13.2	121	9.9	30.9	670.1	104	717	1644	-
d – The southern part of less degraded and more degraded plateau											
Asphodelus ramosus	33	2	7	61	5	15	388	56	270	837	056
Echinops spinosissimus	1	0.1	0.3	2	0.1	0.4	47	4	9	67.5	0.73
Haloxylon scoparium	25	3	12	63	2	7	359	141	163	775	0.38
Thymelaea hirsuta	21	1	4	34	2	5	93	24	51	235	0.26
Total	80	6.1	23.3	160	9.1	27.4	887	225	493	2486	-
Mean	20	1.5	5.8	40	2	6	221	56	123	478.7	-
S. D.	13.6	1.2	4.1	28	2	6	176	60	117	384.9	-

CF = Crude fiber, TN = Total nitrogen, Pr = Protein, C = Carbohydrate, EE = Ether extract. *: P0.05; **: P = 0.01; ***: P = 0.001 according to χ^2 test.

Table 3. Daily number of bites (bite/animal/day) of the graze perennial species in the different physiographic units at Maktala sector.

Species	Physiographic units			
	$a_3 + b_1$	b_2	c_{11}	$c_{12}+c_2$
Asphodelus ramosus	4033 ± 117.4	2873 ± 84.1	3666 ± 113	3136 ± 196
Seriphidium herba-alba	-	152 ± 31.5	-	-
Atriplex halimus	512 ± 33.1	-	-	-
Echinops spinosissimus	-	-	-	182 ± 25.3
Echiochilon fruticosum	-	-	705 ± 53.9	-
Gymnocarps decander	-	195 ± 43.9	255 ± 20.8	-
Haloxylon scoparium	1728 ± 124.9	2170 ± 271.7	-	3114 ± 177.3
Helianthemum lippii		203 ± 35.9	-	-
Noaea mucronata	2– 1.9	303 ± 44.7	422 ± 29.7	-
Deverra tortuosus	216 ± 38.4	259 ± 44.8	-	-
Plantago albicans	27± 48	1201 ± 176	1443 ± 215	-
Salsola tetrandra	261 ± 37.2	-	-	-
Salvia lanigera	34 ± 9.4	21 ± 4	-	-
Suaeda pruinosa	500 ± 102	-	-	-
Thymelaea hirsuta	545 ± 89.6	1073 ± 98.2	640 ± 114	1614 ± 193
Urginea maritima	-	±	1968 ± 288	-
Total	**8558**	**8450**	**9099**	**8046**

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.

Table 4. Nutritive values (g/animal/day) expressed as total digestible nutrients (TDN) for the grazeable perennials in the different physiographic units at Maktala sector.

Species	Physiographic units							
	$a_3 + b_1$	R%	b_2	R%	c_{11}	R%	$c_{12}+c_2$	R%
Asphodelus ramosus	138.2	48.9	98.2	36.1	125.3	43.1	107.2	40.9
Seriphidium herba-alba	-	-	4.7	1.4	-	-	-	-
Atriplex halimus	15.1	5.3	-	-	-	-	-	-
Echinops spinosissimus	-	-	-	-	-	-	5.7	2.2
Echiochilon fruticosum	-	-	-	-	21.1	7.2		-
Gymnocarps 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	-	-
Deverra tortuosus	6.3	2.2	7.7	2.8	-	-	-	-
Plantago albicans	21.6	7.6	35.7	131	42.9	14.7	-	-
Salsola tetrandra	7.9	-2.8	-	-	-	-	-	-
Salvia lanigera	1.2	0.4	0.7	0.3	-	-	-	-
Suaeda pruinosa	15.1	5.3	-	-	-	-	-	-
Thymelaea hirsuta	18.8	6.7	36.7	13.5	21.9	7.5	5.5	21.0
Urginea maritima	-	-	-	-	58.2	20	-	-
Total	**282.8**	**-**	**272.0**	**-**	**291.1**	**-**	**262.2**	**-**

a_3 = saline area; b_1 northern part of piedmont plain; b_2 = southern part of piedmont plain; 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 of all species.

content of the forage appears to be 1.1%, which is far too low. Although animals select the green portions of plants and high protein forbs and shrubs (Crable & 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 nitrogens. This limitation will retard the rate of removal of organic matter from the rumen which, in turn may reduce intake (Westonn 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 & Saville, 1979). it may be suggested then, that animals should be supplied with supplementary feed rich in protein, particularly during the productive and reproductive stages, in order to maximize their productivity.

Abdel-Salam (1985) recognizes the importance of an adequate Ca: P ratio of 2:1 as a major factor affecting the utilization of the whole diet. It is clear in the present study that this ratio is far higher than the optimum. Such a high ratio would lead to lower utilization of both Ca and P by animals. It is also asserted that if too little P is 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 diets in the study area is about 1.2 on the average. This is higher in herbaceous (about 1.7) than in woody species (about 1.5). Le Houerou (1980) reports that the Ca/Mg ratio of 2.8 for the range in browse plants of Northern Africa is about adequate. In the western desert of Egypt, Heneidy (1986) indicates that while the Ca/P ratio too is high, the Ca/ Mg ratio is about 1.2.

The digestible protein (DP) of the forage in the present study, calculated as a percentage of dry matter, was about 4.83%. With this value the forage quality is realised as having a good protein content according to the scale suggested by Boudet & Riviere (1968), who consider a 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 / ha). If the stocking rate in the area was about 7 times lower than that used in the calculation, most of the requirements of energy and protein could be met.

Heneidy (1986) calculated that the percentage of DP in the forage of the western desert of Egypt as about 5.4% and the average DP in the forage consumed as about 48.0 g l00 kg live weight/day, according to Demarquilly's equation. In this, study the average DP in the forage consumed in the study area was calculated as about 46.4 g l00 Kg, live weight/day, which is inadequate. In the present study, the amount of total digestible nutrients (TDN) as head/day is about 277 on the average. This is lower than the standard requirements of sheep as indicated by Naga 1981 (about 1500 g l00 kg live weight/day) and The National Research Council, 1964 (about 1300 g l00 kg live weight/day). 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 tile and what animals to nourish will be made by the ranger.

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