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Chemical Composition of Important Range Plant Species in United Arab Emirates.
1. Trees and Perennial Plants

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ABSTRACT :

This study was conducted at Al-Ain and Ras-Al-Khaimah native ranges, United Arab Emirates (UAE), during 1989/1990. Chemical composition, gross energy, fiber fractionation and *in virto* digestible dry matter of eighteen important grazing perennial herbaceous plants and eight trees were performed to evaluate their nutritive value.

The eight tree species exhibited crude protein content varying from 27.04% in leaves of *Acacia tortilis* to as low as 2.96% in stems plus leaves sample of *Prosopis chilensis*. Digestible crude protein followed similar trend to crude protein. Trees are characterized by low level of crude fiber ranging from 6.29 to 39.03% which adds to their qualitative characteristics. They also exhibited low levels of hemicellulose, cellulose and silica; however they showed comparatively high level of lignin. *In vitro* digestible dry matter values varied from 23.65 to 65.75% and was apparently affected mostly by lignin level.

Judging on protein content most perennial species have high to moderate nutritive value and should be rated as valuable grazing species. Crude fiber varies widely between perennial species ranging from 9.6 to 48.6% and similarly neutral detergent fiber, acid detergent fiber and their constituents. Generally the higher the fiber fractions, particularly acid detergent fiber constituents, the lower the *in vitro* digestible dry matter and vise versa.

The majority of perennial plants are moderate to high in ash content varying from 3.75 to 37.26% while trees are generally lower ranging from 4.70 to 23.10%. Accordingly, perennial plants showed superiority in both macro and micro-mineral composition. All trees are found deficient in Cu and Mn, while all perennial plants are also deficient in Cu but only six species are deficient in Mn. Both perennial plants and trees are high to moderate in Fe content followed by Zn.

Key words : Chemical Composition, Trees, Perennials.

INTRODUCTION

The rangelands of U.A.E. represent an important source of feed for different kinds of livestock particularly camels, goats and sheep. In most rangeland situations the grazing animals' diet will be rather closely related to the nutrient content of the dominant forage plants, unless the range is in poor condition and the major forage species are relatively unpalatable (Cook et al., 1977). Thus, the chemical content of the current year's growth of palatable plant species can serve as an index to the nutrient content of range vegetation types and, hence, the grazing animal's diet. In addition feed evaluation provides information, which is, important for proper utilization of rangelands, range management and development, and thus planning of feeding strategies for range animals.

Chemical composition, *in vitro* digestible dry matter and fiber fractions are among the most important parameters to evaluate the nutritive value of range plants. These parameters have not been studied before in U.A.E. and as a result some important basic information is lacking. This preliminary study investigates the chemical composition, gross energy, fiber fractionation and *in vitro* digestible dry matter of some of the important grazing perennial plants and trees. According to Ibrahim and Ali (1987) the selected trees and perennial plant species are the most common species dominating the U.A.E. range vegetation.

MATERIALS AND METHODS

Perennial plant samples were collected from the southern region of U.A.E. around Al-Ain town. Samples from natural tree stands were also collected from around Al-Ain while some trees' samples were collected from Ras-Al-Khaimah in the northern part of U.A.E. Both sites have similar habitat. Sampling started late November 1989 and lasted until early April 1990. This period coincides with the rainy season and thus the growth of range plants.

Samples from each plant species were clipped in such a way that to simulate what the animal is actually eating, mostly concentrated on upper tender parts. Whenever possible leaves were seperated from the stems. Samples were dried in a forced draft oven at 60^0C for 48 hours, then ground to pass 20 mesh sieves and immediately before analysis they were again dried at 105^0C for 3 hours to remove absorbed moisture.

Chemical composition was determined using official methods of AOAC (1986). Fiber fractionation was carried out according to Georing and Van Soest method (1975). Digestibility of dry matter and digestible crude protein were determined using the method of Johnson (1966). The Blastic Bomb Calorimeter (CBB 330) was used to determine gross energy content.

Table 1 and 2 show the scientific and corresponding local arabic names of 8 trees and 18 plant species studied along with international feed number whenever possible.

RESULTS AND DISCUSSION

1. <u>Trees</u> :

Of the eight tree species studied, leaves of *Acacia tortilis* exhibited the highest crude protein (CP) as well as digestible crude protein (DCP) content being 2.04 and 10.19%, respectively. *Tamarix aphylla* ranked second containing 20.3% CP and 6.69% DCP in its leaves. *Prosppis chilensis* is characterized by high protein level in its leaves, 19.29% CP and 8.81% DCP; however, its stems are extremely poor in protein content, 2.96%CP and 1.47% DCP, while its flowers are fairly high in both CP and DCP showing 15.97 and 7.90%, respecctively, (Table 3). This explains why flowers of *Prosopis chilensis* are often used in formulation of feed concentrates. Ibrahim and Ali (1987) stated that average CP content of leaves and flowers of *Prosopis chilensis* collected from different countries were 23.50% and 11.50%, respectively which agree with our findings.

Table 1 : Scientific and local names of tree species surveyed.

Scientific name	International feed No.	Local name
Acacia arabica	2-28-023	Sunot (Gharad)
Acacia ehrenbergiana	2-28-026	Salam
Acacia tortilis	2-28-077	Samar
Prosopis chilensis		Guwaif
Prosopis spicigera		Ghaff
Salvadora persica	2-28-015	Arrak
Tamarix aphylla		Ethl
Ziziphus spina	2-27-616	Sidir

Tabel 2. Scientific and local names of perennial herbaceous plants surveyed.

Scientific name	International feed No.	Local name
Aristida plumosa	2-27-923	Hulta
Atriplex spp.	2-12-732	Raghal
Colligonum comosum	2-27-920	Orti
Cenchrus ciliaris		Sibt
Convulvulus Lanatus		Baiad
Conyza discordis		Tibagh
Cyperus congolomeratus		Thinda
Hamada elegans	2-27-908	Rimth
Heliotropium baciferum	2-27-906	Ramram
Indigofera oblongifolia	2-27-975	Besha
Leptadenia pyrotechnica	2-27-97	Marrakh
Lycium showii (L)		Aswag
Panicum turgidum	2-27-947	Tamam
Penicum divisum	2-26-442	Thaimom
Rhanterium eppaposum	2-27-63	Arfag
Sporobolus spicatus	1-28-056	Sikam
Tephrosia appallinea		Berseem-el-gabal
Zygophyllum quatarense		Harram

Table 3 : Chemical composition and gross enery content of tree samples

Species	Plant portion *	% CP	% DCP	% EE	% CF	Gross energy Kcal/g	% Ash
Acacia arabica	L	13.22	7.47	1.85	6.26	4.54	7.47
	F	10.22	4.94	0.08	12.56	4.16	4.70
Acacia ehrenbergiana	W	15.52	6.97	2.14	29.72	3.63	5.55
Acacia tortilis	W	20.59	8.53	3.97	26.33	3.99	10.80
	L	27.04	10.14	3.83	14.27	4.79	6.29
	S	15.49	9.28	1.39	39.03	3.65	10.20
Prosopis chilensis	W	2.96	1.47	4.12	21.52	3.85	10.43
	L	19.24	8.81	2.37	17.40	4.11	13.08
	S	15.97	7.90	1.37	20.53	3.69	4.69
Prosopis spieigera	W	13.45	4.16	2.88	24.82	4.40	15.07
	L	15.37	6.47	1.35	13.16	4.19	6.04
Salvadora persica	W	8.90	5.14	1.85	10.84	2.38	36.82
Tamarix aphylla	W	11.02	3.49	1.44	22.01	3.64	15.05
	L	20.33	6.64	0.85	16.69	3.07	23.10
	S	7.64	1.62	32.94	4.08	8.56	
Ziziphus spina	L	14.65	7.72	1.27	8.23	4.12	6.47
	S	4.30	1.88	3.16	15.71	4.03	7.52
	F	7.01	2.99	5.13	13.25	4.10	4.08

* Plant portion W = Whole plant leaves + stems
L = Leaves
S = Stems
F = Flower

All tree species showed superiority in CP and DCP content in leaves as compared to stems or stems plus leaves samples, as expected. *Salvadora persica* showed low level of CP and DCP even though the samples were clipped from the top tender parts that contain high ratio of leaves. This may explain the low preference of this tree by most grazing animals as suggested by Ibrahim and Ali (1987). The DCP followed similar trends to that of CP.

As shown in Table 3, ether extract (EE) content observed in the different tree species ranged from 0.08% in the flower of *Accacia arabica* to 5.13% in the flower of *Ziziphus spina*; however, the majority of the tree species contained between 1 to 4% EE. Leaves generally contained less EE compared to stems and flowers.

Crude fiber (CF) content varied from 6.26% in leaves of *Acacia arabica* to as high as 39.03% in the stems of *Acaci tortilis*. This is generally considered a low level of fiber which adds to the qualitative characteristics of these trees and to their nutritive value to grazing animals.

The low level of CF (6.16%) in leaves of *Acacia arabica*. varied greatly from what was reported (11.30%) by ACSAD (1979) for the same plant portion. However, the same study showed CF content of 41.60% in leaves plus stems sample of *Acacia tortilis* which coincides fairly with our findings. Within species variation in CF, as well as in other parameters, may be attributed to variations in geographical habitats, amount of new growth and to the position of sampling. ACSAD (1979) indicated that upper tender stems of *Acacia arabica* contained more fiber, 19.76%, compared to 11.30% in the lower leaves of the same plant.

The low level of CF content, 10.84%, in *Salvadora persica* may be attributed to the high ratio of leaves to stems that characterizes the upper tender parts of this tree. CF content of the different plant portions of *Prosopis chilensis* reported here agrees with findings from U.S.A., Sudan and Chili as reported by Ibrahim and Ali (1987). Consistently as shown in Table 3 leaves are lower in CF content compared to stems or leaves plus stems.

Gross energy content of the 8 species studied showed great similarity varying from 3.06 kcal/g to 4.79 kcal/g except *Salvadora persica* which exhibited 2.38 kcal/g. The low level of gross energy content in *Salvadora persica* may be attributed to its high level of ash content as shown in Table 3. Variation in energy content between leaves, stems and leaves plus stems did not show consistent pattern among the species studied.

Results showed wide range of variation in ash content among trees. Leaves plus stems samples of *Salvadora persica* exhibited the highest level of ash content, 36.82%, while flowers of *Ziziphus spina* showed the lowest level of ash, 4.08%. Within species variation in ash content was found highest in *Tamarix aphylla* showing 8.56, 23.10 and 15.05% ash in stems, leaves and stems plus leaves, respectively. Among the three *Acacia species* studied, *Acacia tortilis* showed comparatively higher ash content.

Some macro and micro minerals content of trees are shown in Table 5. Ca range from 0.16% in stems of *Acacia tortilis* to 1.50% in leaves plus stems of *Salvadora persica*. P content was consistently lower than Ca and varies from 0.12% in stems and leaves of *Tamarix aphylla* to 0.25% in flowers of *Zizphus spina*. According to ACSAD (1979) Ca content in leaves of *Acacia arabica* and *Prosopis spicigera* is 3.06% and 2.65% respectively. These values are very contrasting to our findings, 0.24% and 0.34% for the two species, respectively. However, the same study reported similar values of P content for the two species as indicated in our findings. Leaves of *Acacia tortilis* alone showed superiority in Ca and P content compared to other plant parts.

Na content ranged from 0.41% in stems plus leaves of *Acacia arabica* to 2.72% in leaves of *Ziziphus spina* as indicated in Table 5, Na content was generally higher than any of the other minerals determined. Leaves plus stems of *Salvadora persica* was highest in K content (0.96% followed by flowers of *Prosopis chilensis* (0.92%) while leaves plus stems of *Acacia ehrenbergiana* had the lowest K content 0.08%.

All trees studied seemed to be exclusively poor in Mn and Cu content. Zn ranged from 0.02 ppm in stems of *Ziziphus spina* to 0.19 ppm in leaves plus stems of *Tamarix aphylla*. Fe showed superiority ranging from 0.21 ppm in *Tamarix aphylla* to 1.16 ppm in flowers of *Prosopis chilensis*. From these findings it could be concluded that most of the grazing tree species in U.A.E. are low in micronutrients particularly Mn and Cu.

According to Van Soest (1967) neutral detergent fiber (NDF) corresponds more closely than does conventional crude fiber to the total fiber fraction of a forage feed. It is not a uniform chemical entity but a variable mixture of cell wall components whose overall nutritive availability is influenced to a considerable degree by the proportion of lignin present.

NDF value for the different tree species ranged from 25.5% in the leaves of *Prosopis chilensis* and *Acacia arabica* to 59.77% in the stems of *Acacia tortilis* (Table 4). As indicated by the results, NDF did not relate in a consistent pattern to *in vitro* digestible dry matter and accordingly acid detergent fiber (ADF) is considered the assay of choice to predict the digestibility of cell wall components as well as all solubles since it is composed of cellulose, lignin and variable amounts of silica. It is very clear that within the same species the higher the ADF the lower the *in vitro* DDM and vice versa. However, this observation does not hold true among species as could be seen from the ADF of *Salvadora persica* 15.82% while showing highest *in vitro* DD 65.75%. In contract, leaves of *Acacia arabica* had the lowest ADF (11.84%) while its DDM was only 56.51%. Some species exhibited high variation in ADF in leaves compared to stems. *Acacia tortilis* contained 17.80% ADF in leaves and 46.38 in stems. This corresponded to in vitro DDM of 59.78% and 38.53%, respectively.

Lignin has been described often as completely indigestible and has moreover the property of lowering the digestibility of other cell well constituents. ADL ranged from 6.56% in leaves of *Acacia arabica* to 20.75% in the flowers of *Ziziphus spina*. On average *Acacia arabica* exhibited the lowest ADL level being 6.5% and 10.68% in leaves and flowers, respectively. Most other species showed average ADL above 10%.

Table 4 : Fiber fractionations and in vitro digestible dry matter of tree samples

Species	Plant portion *	% NDF	% ADF	% ADL	% Hem	% Cell	% Silica	% DDM
Acacia arabica	L	25.52	11.84	6.56	14.03	4.92	0.25	56.51
	F	27.22	13.57	10.68	13.65	2.88	0.51	45.21
Acacia ehrenbergiana	W	43.63	32.82	10.92	10.75	21.97	0.89	44.37
Acacia tortilis	W	44.35	27.31	12.09	1.04	15.23	1.07	49.82
	L	34.24	17.80	8.15	16.45	9.64	1.28	59.78
	S	9.77	46.38	16.07	13.39	30.32	1.20	38.53
Prosopis chilensis	W	37.67	27.73	12.62	9.94	15.10	0.39	47.90
	L	25.52	21.03	14.61	4.49	6.42	0.04	45.85
	S	33.55	24.94	7.59	8.61	17.35	0.32	50.69
Prosopis spicigera	W	48.85	22.25	18.19	19.60	11.06	2.02	23.65
	L	30.01	23.85	19.83	6.16	4.02	0.13	42.07
Salvadora persica	W	28.21	15.82	11.12	12.40	4.69	0.96	65.75
Tamarix aphylla	W	38.63	26.21	19.54	11.78	7.37	0.77	31.06
	L	31.40	23.7	12.62	7.73	11.15	0.43	37.64
	S	46.49	34.45	18.11	12.04	16.34	0.80	25.65
Ziziphus spina	L	30.64	22.85	11.15	7.79	11.10	0.09	40.99
	S	30.81	14.99	11.43	15.82	3.57	0.12	43.67
	F	33.41	29.17	20.75	4.25	8.42	0.12	42.70

* Plant portion W = Whole plant leaves + stems
L = Leaves
S = Stems
F = Flower

Table 5 : Some macro and micro - mineral composition of tree samples

Species	Plant portion *	% Ca	% P	% Na	% K	Mn ppm	Zn ppm	Fe ppm	Cu ppm
Acacia arabica	L	0.27	0.16	0.41	0.76	Traces	0.08	0.16	Traces
	F	0.24	0.22	2.34	0.10	"	0.11	0.35	"
Acacia ehrenbergiana	W	0.19	0.16	1.20	0.08	"	0.03	0.23	"
Acacia tortilis	W	0.31	0.14	0.51	0.15	"	0.14	0.50	"
	S	0.16	0.14	0.62	0.11	"	0.06	0.67	"
	L	0.61	0.22	2.64	0.17	"	0.10	0.50	"
Prosopis chilensis	W	0.43	0.19	2.09	0.15	"	0.04	0.27	"
	L	0.42	0.14	1.65	0.25	"	0.06	0.30	"
	S	0.61	0.23	1.28	0.92	"	0.13	1.16	"
Prosopis spicigera	W	0.46	0.10	1.13	0.14	"	0.03	0.59	"
	L	0.34	0.22	1.09	0.14	"	0.03	0.2	"
Salvadora persica	W	1.50	0.12	0.63	0.96	"	0.04	0.24	"
Tamarix aphylla	W	0.31	0.12	1.06	0.11	"	0.19	0.21	"
Ziziphus spina	S	0.40	0.22	0.52	0.07	"	0.02	0.22	"
	L	0.34	0.15	2.72	0.67	"	0.05	0.38	"
	F	0.31	0.25	1.02	0.22	"	0.04	0.48	"

* Plant portion W = Whole plant leaves + stems
S = Stems
L = Leaves
F = Flowers

The level of cellulose varied from 2.88% in flowers of *Acacia arabica* to 30.32% in stems of *Acacia tortilis*. However, most species exhibited cellulose content less than 16% which is even lower than 16-24% cellulose content for sun cured alfalfa reported by Cullison and Lowrey (1987). Similary, hemicellulose was low for most tree species which is often associated with comparatively high level of ADL. Trees and shrubs are generally known to contain more lignin than grasses, however, the latter may contain more cellulose.

In vitro DDM for most tree species exceeded 40% on average, particularly in leaves. *Tamarix aphylla* exhibited the lowest DDM ranging from 25.61% in stems to 37.64% in leaves while stem plus leaves sample of *Prosopis spicigera* showed the lowest DDM 23.65%, which may be attributed to the high level of ADL (18.19%) and silica (2.02%).

2. <u>Perennials</u> :

Of the 18 perennial species studied, five species had CP content ranging from 15% to about 17% and DCP varying from 6% to about 8%. Judging on protein level, these species have high nutritive value and should be considered as valuable grazing species since their protein content is similar to the 16% reported by Cullison and Lowrey (1987) for the midbloom alfalfa hay. This is also confirmed by the high preference these species enjoyed by camels and goats specially *Hammada elegans* and *Pennisetum divisum*. Six species had an average CP content between 14.62% to 12.7%, while the remaining seven species showed CP content varying from 11.25% for *Cenchrus ciliaris* to 6.94% as the lowest level of CP in *Leptadenia pyrotechnica*.

Digestible crude protein content showed similar trend to that of CP (Table 6).

Variation in ether extract content between species studied was so wide, ranging from 0.61% to 6.69%. Five species showed EE content less than 2% while nine species exhibited EE content ranging from 2.82% to 4.2% and the remaining four species had EE content of more than 5%. On the basis of these results and the known preference of most of these species by grazing animals (Ibrahim and Ali, 1987) it may be indicated that EE content contributes little to preference and

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Table 6 : Chemical composition and the gross enery content of perennial herbaceous plants

Species	Plant portion *	% CP	% DCP	% EE	% CF	Gross energy Kcal/g	% Ash
Acacia plumosa	W	10.98	2.68	3.51	32.72	3.94	9.13
Atriplex spp.	W	13.85	6.89	2.71	25.99	3.06	31.66
Caligonum comosum	W	12.34	3.98	0.74	19.72	3.94	11.11
Cenchrus ciliaris	W	11.25	5.68	5.87	11.26	3.95	7.82
Convolvulus Lanatus	W	10.45	3.63	0.61	37.99	3.60	7.85
Conyza discoridis	W	14.62	4.82	4.02	10.16	3.61	17.15
Cyperus congolomeratus	W	10.65	3.75	0.92	34.38	3.64	18.60
Hamada elegans	W	15.13	7.11	3.95	16.6	3.42	16.30
Heliotropium baciferum	W	15.32	4.99	3.48	31.62	3.42	16.63
Indigofera oblongifolia	W	8.17	2.08	1.91	48.61	4.59	3.75
Leptadenia pyrotechnica	S	6.94	2.1	3.66	41.93	4.89	5.87
Lycium showii	W	17.17	8.12	1.34	24.41	3.58	11.32
Panicum turgidum	W	13.35	7.68	5.95	22.71	3.91	12.12
Pennisetum divisum	W	16.83	.30	6.69	38.04	3.81	4.86
Rhanterium eppaposum	W	12.17	6.72	4.19	32.37	3.51	10.38
Sporobolus spicatus	W	16.9	6.20	5.20	30.01	3.65	20.17
Tephrosia appallinea	W	14.16	5.18	2.52	32.39	4.07	6.95
Zygophyllum quatarense	W	8.73	5.69	2.82	9.63	1.33	37.26

* Plant portion W = Whole plant leaves + stems
S = Stems

palatability of plant species. *Pennisetum divisum* and *Cenchrus ciliaris* had EE content of 6.69% and 5.87%, repectively. The two species are considered among the most preferable species in the local range, while *Convolvulus lanatus* had the lowest EE content, 0.61%, and yet represents one of the most preferable species in the range partciularly to camels (Al Ani et al., 1971). However, EE content does contribute to quality particularly to energy value.

Results indicated crude fiber (CF) content ranging from 48.61 in *Indigofera articulata* to values as low as 9.63% in *Zygophyllum quatarense*. The high level of CF in *Indigofera articulata* may be attributed to the low ratio of leaves to stems because its leaves are very small in size and its stems are thick and woody, while the high CF level (41.92%) in *Leptadenia protechnica* is attributed to lack of leaves in this plant. Similarly *Cyperus conglomeratus* was high in fiber content, 38.0%, probably due to its thin rough leaves. In contrast, *Zygophyllum quatarense* showed the lowest CF content 9.63% and that may be partly because of the fleshy nature of its leaves and stems and partly to its high level of ash content, 37.26%, while the low level of CF content in *Cenchrus ciliaris* may be attributed to the high ratio of leaves to stems.

Judging the nutritive value of native plants on the basis of CF content, it can be observed that the native range in U.A.E. includes excellent grazing perennial species.

As shown in Table 6, variation in gross energy content between species was very limited. Thirteen species exhibited gross energy content between 3 to 4 kcal/g, while only two species showed gross energy of more than 4 kcal/g. Trees enerally showed higher values of gross energy content compared to perennial species probably because they contain more waxes and essential oils which was reflected in the level of gross energy.

Zygophyllum quatarense exhibited the highest level of ash content 37.26%, followed by *Atriplex spp.* with 31.66% ash. These findings agree with Al Ani et al. (1971) who reported similar results to these two species in Iraq. It seems that most salt tolerant species are generally high in ash content compared to non-salt tolerant ones. This has been observed not only in these two species but also in other salt tolerant plants like *Heliotrobium baciferum*, *Sporobolus spicatus*, *Cyperus congolomeratus* and *Hamada elegans* which showed ash content of 16.63, 20.17, 18.60 and 16.30%, respectively. According to Ibrahim and Ali (1987), most of these species are also drought tolerant.

The majority of the perennial species studied here were high to moderate in ash content which contribute significantly to their nutritive value and their positive effect on the mineral balance of the grazing animal. Only two species had ash content below 5%, namely *Pennisetum divisum* (4.86%) and *Indigofera oblongifolia* (3.75%).

Zygophyllum quatarense exhibited the highest Ca content, 2.32%, while *Tephrosia appallinea* showed the lowest Ca content, 0.09%. P content in most plants is consistently lower than that of Ca. Also most of the perennial species appear to have similar values of P content except for *Panicum turgidum* which exhibited exclusively highest level of 1.07%(Tabel 8). Generally Na content was highest in all perennial plants compared to other minerals.

Seven species showed Na content higher than 3, while only two species showed Na content below 1% K content ranges from 0.08% to 0.96% while most species exhibited K content less than 0.5%.

As indicated in Table 8 *Hamada elegans* contained 0.45% Ca, 3.54% Na and 0.63% K. However, for the same species ACSAD (1979) reported higher Ca (2.48%), and K (1.64%) but lower Na 2.40%. Similarly *Eliotropium baciferum* reported by ACSAD (1979) showed higher Ca (5.4%), higher K (1.38%) but lower Na (Only 0.2%) compared to 0.50%, 0.17% and 3.21% respectively in our study. In contrast, ACSAD (1979) reported 0.01% Ca content in *Aristida plumosa* which is lower than 0.71% in our findings that agreed to what was reported by Al Ani et al (1971) of about 0.60% Ca content for the same species. Similarly ACSAD (1979) reported typical values for Ca, K and P content in *Atriplex spp* as indicated in Table 8. Variation in mineral composition within species may be attributed to site and soil conditions.

Table 7 : Fiber fractionation and in vitro digestible dry matter of perennial herbaceous plants (%).

Species	Plant portion *	NDF	ADF	ADL	Hem.	Cell	Silica	DDM
Acacia plumosa	W	74.33	45.70	15.41	28.63	30.29	0.30	25.10
Atriplex spp.	W	29.71	19.11	14.50	10.60	4.61	0.55	49.73
Calligonum comosum	W	41.44	25.71	8.56	15.73	17.15	0.94	31.48
Cenchrus ciliaris	W	22.08	13.32	2.11	8.77	11.20	1.05	51.36
Convolvulus Lanatus	W	51.78	44.27	9.32	7.51	34.95	0.24	34.69
Conyza discoridis	W	49.45	37.52	9.04	11.94	28.48	0.05	32.93
Cyperus congolomeratus	W	59.66	37.31	11.45	22.35	25.86	3.98	34.46
Hamada elegans	W	37.22	19.97	1.46	17.25	18.57	0.56	53.78
Heliotropium baciferum	W	63.68	36.89	13.52	26.79	23.37	1.73	28.81
Indigofera oblongifolia	W	72.97	55.98	15.01	16.98	40.94	0.42	23.44
Leptadenia pyrotechnica	S	62.31	42.36	30.45	19.95	11.92	0.48	31.38
Lycium showii (L)	W	43.06	27.77	9.35	15.30	18.41	1.17	51.49
Panicum turgidum	W	54.47	27.53	6.51	26.94	21.03	1.72	44.54
Pennisetum divisum	W	69.70	42.74	8.84	26.96	33.91	1.06	36.42
Rhanterium eppaposum	W	47.54	39.34	9.00	8.21	30.34	0.83	47.33
Sporobolus spicatus	W	58.67	33.58	4.18	25.10	29.40	2.46	41.67
Tephrosia appallinea	W	51.74	37.25	11.14	14.49	26.11	0.30	36.55
Zygophyllum quatarense	W	15.27	10.85	5.80	4.43	5.05	0.41	78.33

* Plant portion W = Whole plant leaves + stems
S = Stems

Table 8 : Some macro and micro - mineral composition of perennial herbaceous plants

Species	Plant portion *	% Ca	% P	% Na	% K	Mn ppm	Zn ppm	Fe ppm	Cu ppm
Aristida plumosa	W	0.71	0.28	3.45	0.20	0.02	0.11	0.97	Trace
Atriplex spp	W	1.35	0.16	4.77	0.98	Trace	0.02	0.25	"
Calligonum comosum	W	0.54	0.14	1.54	0.36	0.01	0.01	0.38	"
Convolvulus Lanatus	W	0.48	0.12	1.04	0.27	0.03	0.04	1.32	"
Conyza discordis	W	0.38	0.17	2.28	0.42	Trace	0.04	0.22	"
Cyperus congolomeratus	W	0.16	0.17	1.17	0.43	0.02	0.07	1.13	"
Hamada elegans	W	0.45	0.14	3.54	0.63	0.08	0.08	0.35	"
Heliotropium baciferum	W	0.50	0.20	3.21	0.17	0.01	0.05	0.38	"
Indigofera oblongifolia	W	0.50	0.14	0.64	0.08	Trace	0.01	0.16	"
Lycium shawii	W	0.23	0.16	3.96	0.34	0.02	0.05	0.98	"
Panicum turgidum	W	0.22	1.07	3.44	0.58	0.15	0.22	1.44	"
Pennisetum divisum	W	0.15	0.14	1.97	0.17	Trace	0.04	0.37	"
Rhanterium eppaposum	W	0.34	0.14	0.54	0.12	Trace	0.03	0.14	"
Sporobolus spicatus	W	0.16	0.13	2.88	0.16	0.01	0.07	0.51	"
Tephrosia appallinea	W	0.09	0.14	1.82	0.08	Trace	0.03	0.25	"
Zygophyllum quatarense	W	2.32	0.11	3.45	0.70	0.03	0.04	0.27	"

* W = Whole plant leaves + stems

Fe is comparatively most abundant micromineral in perennial plants ranging from 0.14 ppm in *Rhanterium eppaposum* to 1.44 ppm in *Panicum turgidum*. The results indicate higher values of Zn ranging from 0.01 ppm to 0.22 ppm compared to Mn 0.01 ppm to 0.15ppm. Six species showed dificiency in Mn while all perennial plants are deficient in Cu. *Panicum turgidum* showed highest values of microminerals compared to other species. In general, perennial plants are superior in mineral composition compared to tree species.

The fractionation of fiber into NDF, ADF, ADL, hemicellulose, cellulose and silica for the perennial species as well as the *In vitro* DDM are shown in Table 7. The different fiber fractions showed wide variation between species. NDF varied from 74.33% in *Aristida plumosa* to as low as 15.27% in *Zygophyllum quatarense*. ADF ranged from 55.98% in *Idigofera oblongifolia* to 10.85% in *Zygophyllum quatarense* while *Leptadenia pyrotechnica* showed highest ADL content (30.45%) compared to 1.46% in *Hamada elegans*. Hemicellulose content varied from 28.63% in *Aristida plumosa* to 4.43% in *Zygophyllum quatarense* while cellulose content ranged from 40.94% in Indigofera to 5.05% in *Zgophyllum quatarense* and similarly silica content exhibited great variation from 0.05% in *Conyza discordis* to 3.98% in *Cyperus conglomeratus*. The wide range of these parameters may be attributed to many factors including, in addition to the plant species, the amount of regrowth at time of sampling and the ratio of leaves to stems in the sample collected.

Zygophyllum quatarense exhibited the lowest NDF and ADF 15.27% and 10.85%, respectively, and accordingly it was also low in ADL, hemicellulose, cellulose and silica. This coincides with its lowest crude fiber content, 9.63%, as indicated in Table 6. This also explains why it exhibited the highest level of *in vitro* DDM 78.3%. In contrast, *Indigofera oblongifolia* showed higher level of NDF 72.97%, highest ADF (55.98%) and cellulose (40.94%) and simultaneously lowest in vitro DDM 23. 4%. Similar results were recorded for *Aristida plumosa*.

In all species studied, ADF represented the highest portion of NDF. Similarly cellulose represented the higher portion of ADF in most plants except in *Atriplex spp.* and *Leptadenia pyrotechnica* where the amount of ADL is higher than cellulose. The value of *in vitro* DDM, as expected, was observed to be negatively affected by the amount of fiber fractions. The higher the fiber fractions, particularly ADF components, the lower is the in vitro DDM.

CONCLUSION

From this study we could conclude that *Acacia tortilis, Acacia arabica* and *Tamarix aphylla* are among the trees which provide the best browse in U.A.E. rangeland.

Five perennial species namely *Hamada elegans, Lycium showii, Pennisetum divisum, Sporobolus spicatus* and *Atriplex spp* show excellent qualitative characteristics. It may be recommended that these species, in addition to others, can be seeded in large areas to improve the quality of the range.

All the species studied are deficient in Cu, while the majority of the species are deficient to low in Mn. This is very useful information when we consider the mineral balance for the grazing animals and/or complementing the native range.

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التركيب الكيمائي لأنواع نباتات المراعي الهامة فى دولة الإمارات العربية المتحدة . ١. الأشجار والنباتات المعمرة

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ملخص :

تم اجراء هذه الدراسة فى المراعي الطبيعية بمنطقتي العين ورأس الخيمة بالإمارات العربية المتحدة ، خلال الفترة ١٩٨١ - ١٩٩٠ . وقد تم تقدير كل من التركيب الكيمائي ، الطاقة الكلية ، تقسيم الألياف والمادة العضوية المهضومة مخبرياً لعدد ثمانية عشر من أهم نباتات المرعى المعمرة وثمانية أنواع من الأشجار ، وذلك بهدف تقدير القيمة الغذائية لها .

وقد تباين محتوى البروتين الخام لأنواع الأشجار المدروسة من ٢٧٫٠٤٪ فى أوراق أشجار الأكاسيا إلى مستوى منخفض بلغ ٩٦ . ٢٪ فى عينات أوراق وأغصان أشجار السمر . وقد سجلت قيم البروتين المهضوم إتجاهاً مماثلاً للبروتين الخام . وقد أتصفت الأشجار المدروسة بمحتواها القليل الألياف الخام والذي تراوح من ٢٩٫٦ إلى ٢٩٫٠٣٪ ، بما يضيف إلى صفات جودتها الغذائية . كما إحتوت هذه الأنواع من الأشجار على مستويات منخفضة من الهميسلليوز والسلليلوز والسليكا ، بينما احتوت على مستوى عام نسبياً

من اللجنين . وقـد تراوحت نسـبـة هضم المادة العـضـوية لهـا من ٢٣٫٧٥ - ٦٥٫٨٪ وقد تأثرت هذه النسبة بمستوى اللجنين فى معظم الأحيان .

وبناء على محتوى البروتين فيمكن تصنيف أنواع النباتات المعمرة المدروسة على أنها ذات قيمة غذائية من متوسطة إلى عالية بما يمكن معه اعتبارها كنباتات رعوية جيدة .

وقد تباين محتوى الألياف الخام فى هذه النباتات تبايناً كبيراً من ٩٫٦ إلى ٤٨٫٦٪ وبالمثل فقد تباينت أقسام الألياف المختلفة بها ، إنعكس على النسبة الهضمية للمادة العضوية فكلما زاد محتوى الألياف ، وبصفة خاصة الألياف غير الذائبة فى المحلول الحمضي ، كما قلت النسبة الهضمية للمادة العضوية .

اتصفت النباتات المعمرة المدروسة بمحتوى يتراوح من المتوسط إلى العالي من الرماد (٣٫٧٥ - ٢٦٫٣٧٪) بينما كان محتوى الأشجار من الرماد أقل من ذلك حيث تراوح من ٤٫٧ - ٢٣٫١٪ ، ومن ثم فقد تميزت النباتات المعمرة عن الأشجار فى محتواها من العناصر المعدنية الصغرى والكبري .

وقد وجد أن جميع أنواع الأشجار المدروسة فقيرة فى محتواها من النحاس والمنجنيز ، بينما كانت جميع أنواع النبات المعمرة المدروسة فقيرة أيضاً فى النحاس ولكن وجد أن ستة منها فقط فقيرة فى المنجنيز فى حين أن النباتات المعمرة أو الأشجار احتوت على نسبة تتراوح بين المتوسط والعالية من كل من الحديد والزنك .

كلمات مفتاحية : التركيب الكيمائي ، الأشجار ، النباتات المعمرة .