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Habitat and nutrient status of two grasses: *Paspalidium geminatum* (Forssk.) Stapf and *Panicum repens* L. in Nile Delta, Egypt.

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Abstract Two perennial grasses (*Paspalidium geminatum* (Forssk.) Stapf and *Panicum repens* L.) were selected to evaluate their proximate composition, nutrient status and anti-nutritional factors. Green aboveground parts were collected from natural populations of canal banks habitat in North Nile Delta of Egypt. Soil characteristics of their habitat were determined. *Paspalidium geminatum* attained the highest values of digestible energy (2.93 Mcal kg^{-1} dw), metabolizable energy (2.40 Mcal kg^{-1} dw), net energy (4.39 MJ kg^{-1} dw), total digestible nutrients (60.22%), nutritive value (14.27%) and caloric value (303.71 kcal 100 g^{-1} dw) while, *Panicum repens* attained the highest values of gross energy (390.96 kcal 100 g^{-1} dw) and nutritional ratio (0.19 g Fu^{-1}). *Panicum repens* have key nutrients such as carbohydrates, proteins and lipids more than *P. geminatum*. Aboveground parts of *Paspalidium geminatum* and *Panicum repens* are considered as promising source of nutrients with low anti-nutritional factors, and have high energy value. The studied two grasses might be used as a feed for livestock but supplied with supplementary feed rich in protein. Further toxicological studies are needed to assess the possibility of utilization of it in feed formulation and animal diet.

Introduction

Egypt is located in arid or semi-arid regions, is facing a problem of feed supply shortage maximized by the high cost of fodder especially the green summer fodder (Shaltout *et al.*, 2009). The main causes of this problem involve population increase, frequent drought, limited cultivated lands with forages and expansion of urbanization at the expense of agriculture areas. This problem reduces the enhancement of animal/meat production. Therefore, calls for searching for other non-conventional novel alternative sources for feed become required and urgent.

Grasses (Poaceae) constitute the largest and most valuable family among the flowering plants, with about 10000 species. In the flora of Egypt, it includes 277 species (Boulos, 2009). Grasses are the major constituents of animal nutrition due to their high nutritive value (Heneidy and Halmy, 2009). Some species of grasses have wide ecological amplitude that enabled them to survive and reproduce under various environmental conditions.

The chosen species Panicum *repens* L. (torpedo grass) and *Paspalidium geminatum* (Forssk.) Stapf (Egyptian paspalidium or Egyptian panicgrass) are perennial grasses growing densely in moist soils along banks of water courses, marshy shorelines of lakes and ponds, drainage ditches and canals. They have long creeping, strongly developed and branched, long lived and drought resistant rhizomes (Shaltout *et al.*, 2013). *P. repens* is recognized as pasture grass that could be harvested five times a year and also considered important for soil erosion control (Hossain *et al.*, 2001). *P. repens* is one of the worst grass weeds in field crops in some countries (FLEPPC Plant List Committee, 2003). *P. geminatum* could be used as forage for livestock (Mashaly *et al., 2009*). *P. repens* and *P. geminatum* may form dense floating mats along littorals of water courses and occasionally block water flow in the drainage and irrigation system and restrict recreational use of shoreline areas of lakes and ponds.

The present study aims at investigating habitat and nutrient status of aboveground parts of two perennial grasses, *Panicum repens* and *Paspalidium geminatum* for possible use as forages for livestock especially during dry summer. These grasses grow naturally in the canal bank habitat of Nile Delta of Egypt. Selection of these grasses was based on their dominance in the study area, high biomass, field observations, regarding their palatability to livestock and insufficient informations about their nutritive value.

Materials and Methods

Collection and preparation of plant samples

Healthy green aboveground parts of *Panicum repens* and *Paspalidium geminatum* were collected during flowering stage in July, 2014 from canal banks habitat in El-Dakahlia and Damietta Provinces, North Nile Delta of Egypt. El-Dakahlia (N 31° 04, E 31° 42) and Damietta (N 31° 07, E 32° 35) are characterized by warm climatic conditions with a temperature range of 20–30°C in summer, while winter is mild with a temperature range of 10–20°C. Most of the rain occurs during winter, ranging between 23 and 100 mm/year (Shaltout *et al.,* 2013). Aboveground parts of the selected grasses were separated, cut into small pieces and air dried, then ground to fine powder for chemical analysis.

Soil analysis

Physical and chemical analyses of five soil samples which were collected from the canal bank habitat where the studied grasses were occurred at a depth of 50 cm were determined. Soil texture was determined by hydrometer method. Soil Porosity was estimated by using the measuring volumetric flask method. Water-holding capacity was determined by using Hilgard-Pan Box. Organic carbon was determined using Walkely and Black method. Sulphates were estimated gravimetrically using barium chloride solution. Calcium carbonate was determined by titration against 1N NaOH. Total soluble nitrogen was determined by the micro-Kjeldahl method. Each soil sample was extracted by making a 1:5 soil/distilled water extracts to detect the following soil parameters. The electrical conductivity was measured using conductivity meter (YSI Incorporated Model 33) and pH using pH meter (Model Lutron pH 206). Chlorides were determined by direct titration method against silver nitrate solution using potassium chromate indicator and bicarbonates were determined by titration method using HCl (0.1N). Total dissolved phosphorus was estimated by direct stannous chloride method. Na^+ and K^+ were determined using a flame photometer, while Ca^{++} and Mg^{++} were estimated using an atomic absorption spectrometer. The procedures followed in physical and chemical analyses of soil samples were according to Piper (1974), Jackson (1962), Allen *et al.* (1974), AOAC (1990) and Stefan *et al.* (2013).

Proximate constituents and elementary analysis

Moisture content (MC), ash content (AC), crude fiber (CF), Ether extract (EE) and total nitrogen (Kjeldahl method) were estimated according to standard procedures of AOAC (1990). Crude protein (CP) was calculated by multiplying total nitrogen by the factor of 6.25 (AOAC, 1990). Total carbohydrates (TC) as % of DM was calculated according to equation of Le Houerou (1980): TC= 100-(CP+ EE+AC), while digestible carbohydrates (DC) as % of DM= TC-CF (AOAC, 1990). Digestible crude protein (DCP) was calculated according to (Demarquilly and Weiss, 1970): DCP (% of DM)= (0.929CP-3.52). Na and K were estimated by using flame photometer (Model CORNING M410) while, Ca, Mg, Fe, Cu, Zn and Mn were determined by using an Atomic Absorption Spectrometer.

Energy measurements of *P. repens* and *P. geminatum* aerial parts

The prediction of the energy value of the aboveground parts of the selected grasses as a feed material was estimated by using equations based on their chemical composition as follows: Gross energy (GE) was estimated according to the equation: GE (kcal $100g^{-1}$ dw)= DC(4.15)+ CP(5.65)+ CF(4.25)+ EE(9) (NRC, 1984), while digestible energy (DE) was calculated according to the equation: DE (Mcal kg^{-1} dw)= 0.0504(CP)+ 0.077(EE)+ 0.02(CF)+ $0.000377(TC)^2$+ 0.011(TC)- 0.152 (NRC, 1984), metabolizable energy (ME) as Mcal kg^{-1} dw = 0.82DE (Garrett, 1980), and net energy (NE) was determined according to the equation: NE (MJ kg^{-1} dw)= [(3.65TDN-100)/188.3]x6.9 (Riviere, 1977). Total digestible nutrients (TDN) were estimated according to the equation: TDN (%) = 0.623(100+1.25EE) – 0.72CP (Abu El-Naga and El-Shazly, 1971). Nutritive value (NV) was calculated as NV (%) = TDN/CP (Abu El-Naga and El-Shazly, 1971) Nutritional ratio (NR) was calculated as: NR= DCP (g kg^{-1} dw) /NE (FU kg^{-1} dw), where FU: food unit and one FU=1650 kcal (Le Houérou, 1980). According to Onyeike *et al.* (1995), caloric value (kcal 100 g^{-1} dw) was calculated according to the equation: CV= (4CP+9EE+4DC).

Secondary metabolites (antinutritional factors) of *P. repens* and *P. geminatum*

The total phenolic contents of *P. repens* and *P. geminatum* aboveground parts were estimated spectrophotometrically (Sadasivam and Manickam, 2008), tannins were measured using the method of Van Burden and Robinson (1969). Flavonoids were estimated according to *Böhm* and *Kocipai-Abyazan* (1994), while alkaloids were determined according to Harborne (1973). Cyanogenic glycosides were measured following the procedures described by Haque and Bradbury (2002).

Statistical analysis

Mean values and standard errors were obtained using Microsoft Office Excel, 2010. One-way Analysis of Variance (ANOVA) and least significant difference (LSD) was applied using COSTAT program to compare the mean values.

Results

Habitat characteristics

The soil characteristics of the canal banks habitat in Nile Delta from which *Panicum repens* and *Paspalidium geminatum* were collected are illustrated in Table (1). The results elucidated that, the soil supporting the growth of the chosen grasses was generally slightly alkaline, sandy in texture with low amounts of silt and clay fractions. Porosity and water-holding capacity reached the highest values (39.59% and 56.79%, respectively) in soil of *P. geminatum*. Organic carbon was low with moderate calcium carbonate content. Electrical conductivity was relatively low (0.46-0.49 mmhos cm^{-1}). Sulphates exhibited the highest value as compared with bicarbonates and chlorides. The highest values of total nitrogen (116.08 mg 100 g^{-1} dry soil) and total dissolved phosphorus (0.19 mg 100 g^{-1} dry soil) were recorded also in *P. geminatum* soil. Soil of *P. repens* showed the highest concentrations of sodium (77.40 mg 100 g^{-1} dry soil) and potassium (8.10 mg 100 g^{-1}).

Table (1): Physical and chemical characteristics of the soil supporting the growth of the studied grass species.

Parameter		*Panicum repens*	*Paspalidium geminatum*
Physical variables			
Sand (%)		92.21±1.91	91.25±1.01
Silt (%)		6.71±1.81	7.00±1.01
Clay (%)		1.07±0.47	1.75±0.29
Porosity (%)		37.47±1.20	39.59±0.53
Water- holding capacity (%)		49.24±4.45	56.79±1.48
Chemical variables			
$CaCO_3$ (%)		8.07±0.54	8.36±0.53
Organic carbon (%)		1.71±0.11	1.61±0.09
pH		7.96±0.09	7.87±0.07
Electrical conductivity (mmhos/cm)		0.49±0.13	0.46±0.13
Cl^- (%)		0.07±0.01*	0.04±0.01*
SO_4^{--}(%)		0.49±0.18*	0.23±0.04*
HCO_3^- (%)		0.11±0.01	0.12±0.01
Total dissolved phosphorus	Mg/100 g dry soil	0.18±0.03	0.19±0.01
Total nitrogen	Mg/100 g dry soil	116.08±8.03	139.20±12.08
Na^+	Mg/100 g dry soil	77.40±3.55*	29.94±5.70*
K^+	Mg/100 g dry soil	8.10±1.12*	2.40±0.08*
Ca^{++}	Mg/100 g dry soil	24.76±2.78	27.23±3.64
Mg^{++}	Mg/100 g dry soil	6.18±1.29	8.81±2.01

Data are mean values± SE, N=5, *Values in every row are significantly different at level 0.001.

dry soil), while soil of *P. geminatum* exhibited the highest concentrations of calcium (27.23 mg 100 g^{-1} dry soil) and magnesium (6.18 mg 100 g^{-1} dry soil).

Proximate constituents, macro and micro elements analyses

The proximate constituent's analysis of the aboveground parts of the two grasses is given in Table (2) and Figure (1). *P. repens* attained the highest values of moisture content (12.51%), fibers (25.67%), ether extract (1.96%), crude protein (4.70%), total digestible protein (0.85%) and total carbohydrates (82.94%). On the other hand, *P. geminatum* showed the highest values of ash (13.56%) and digestible carbohydrates (68.04%). The total carbohydrates were the most abundant organic nutrients in the two selected grasses.

The aboveground parts of the two selected grasses contained relatively high contents of potassium, sodium, calcium, magnesium (Table 2 and Fig.2) and a considerable amount of many other nutritionally essential elements, including: iron, zinc, manganese and copper. *P. geminatum* attained the highest concentrations of many macro- and microelements in its aboveground parts than *P. repens*. It attained the highest contents of potassium (15.85 mg g^{-1} DW), sodium (13.74 mg g^{-1} DW), calcium (4.2 mg g^{-1} DW), iron (1.14 mg g^{-1} DW), zinc (0.23 mg g^{-1} DW) and manganese (0.12 mg g^{-1} DW), while *P. repens* attained the highest concentrations of magnesium (1.63 mg g^{-1} DW) and copper (0.10 mg g^{-1} DW).

Energy measurements of *P. geminatum* and *P. repens*

Paspalidium geminatum attained the highest values of digestible energy (2.93 Mcal kg^{-1} dw), metabolizable energy (2.40 Mcal kg^{-1} dw), net energy (4.39 MJ kg^{-1} dw), total digestible nutrients (60.22%), nutritive value

(14.27%) and caloric value (303.71 kcal 100 g^{-1} dw) while, *P. repens* attained the highest values of gross energy (390.96 kcal 100 g^{-1} dw) and nutritional ratio (0.19 g Fu^{-1}).

Table (2): Proximate constituents and elementary analysis of *P. repens* and *P. geminatum*.

	Panicum repens	*Paspalidium geminatum*
Proximate composition (%)		
Total carbohydrates (TC)	82.94±0.12	80.59±0.4
Crude protein (CP)	4.70±0.45	4.22±0.16
Ether extract (EE)	1.96±0.08	1.63±0.09
Crude fiber (CF)	25.67±0.84*	12.55±0.30*
Ash content (AC)	10.40±0.51*	13.56±0.28*
Moisture content (MC)	12.51±0.46	11.15±0.19
Digestible crude protein (DCP)	0.85±0.42*	0.40±0.15*
Macro-elements (mg g^{-1} dw)		
Na^+	6.69±0.21*	13.74±0.18*
K^+	9.40±0.34*	15.85±0.13*
Ca^{++}	2.90±0.12*	4.2±0.17*
Mg^{++}	1.63±0.14	1.58±0.23
Micro-elements (mg g^{-1} dw)		
Fe	0.89±0.04*	1.14±0.08*
Cu	0.10±0.01	0.06±0.01
Zn	0.18±0.01	0.23±0.03
Mn	0.08±0.0	0.12±0.01

*Values are significantly different at level 0.001.

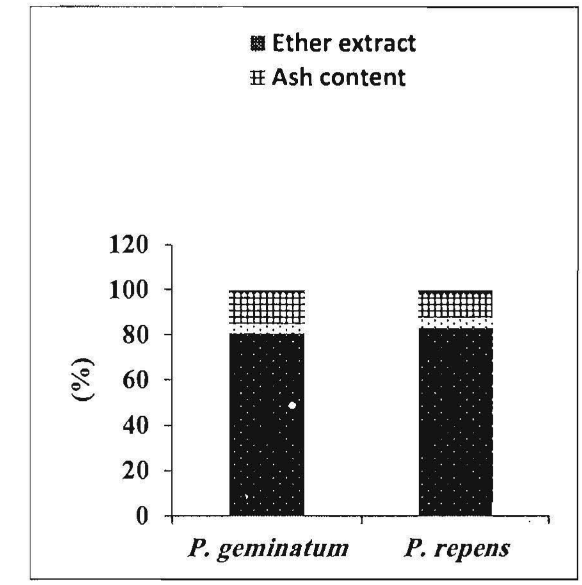

Fig.(1): Proximate constituents of *Paspalidium geminatum* and *Panicum repens*

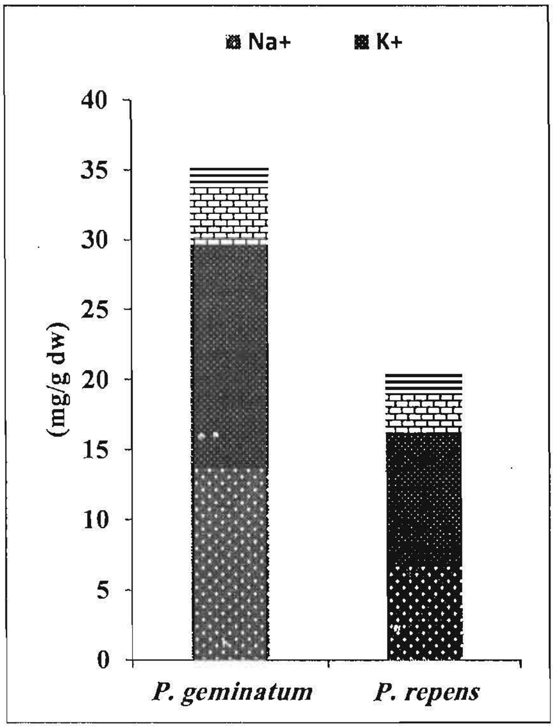

Fig. (2): Macro-elements analysis of *Paspalidium geminatum* and *Panicum repens*

Table (3). Predicted energy value of the aboveground parts of *P. repens* and *P. geminatum.*

Parameter	*Panicum repens*	*Paspalidium geminatum*
Total digestible nutrients (%)	60.14	60.22
Nutritive value (%)	12.79	14.27
Nutritional ratio (g Fu^{-1})	0.19	0.09
Caloric value (kcal 100 g^{-1} dw)	265.52	303.71
Gross energy (kcal 100 g^{-1} dw)	390.96	374.22
Digestible energy (Mcal kg^{-1} dw)	2.62	2.93
Metabolizable energy (Mcal kg^{-1} dw)	2.14	2.40
Net energy (MJ kg^{-1} dw)	4.38	4.39

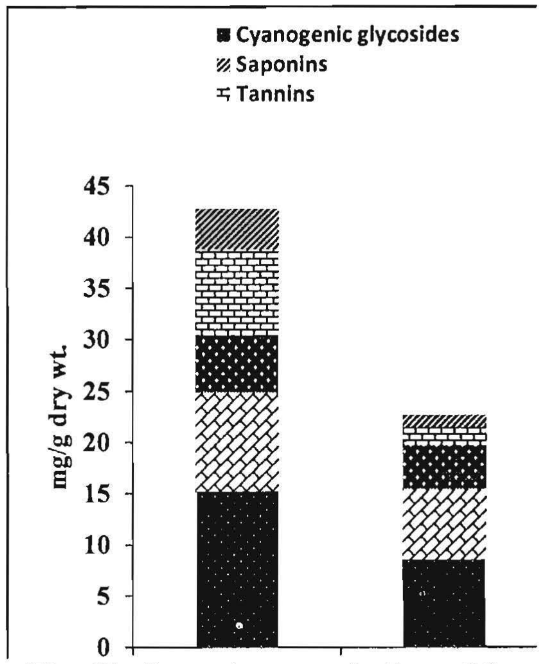

Fig. (3): Secondary metabolites of *P. geminatum* and *P. repens.*

Secondary metabolites of *P. geminatum* and *P. repens*

The data presented in Table (4) and Fig. (3) showed that, the aboveground parts of *P. geminatum* contained the highest values of total phenolics (15.20 mg g^{-1} DM), flavonoids (9.67 mg g^{-1} DM), tannins (8.47 mg g^{-1} DM), alkaloids (5.45 mg g^{-1} DM) and saponins (3.98 mg g^{-1} DM) as compared with *P. repens*.

Table (4). Secondary metabolites (mg g^{-1}DM) in the aboveground parts of the two selected grasses.

Parameter	*Panicum repens*	*Paspalidium geminatum*
Total phenolics	8.55±0.32*	15.20±0.56*
Flavonoids	6.86±0.38*	9.67±0.13*
Alkaloids	4.31±0.59	5.45±0.34
Tannins	1.74±0.27*	8.47±0.68*
Saponins	1.17±0.12*	3.98±0.39*
Cyanogenic glycosides	0.01±0.00	0.0

*Values are significantly different at level 0.001.

Discussion

The nutritive value of any range forage is dependent upon its satisfactory content of principle nutrients especially carbohydrates, proteins and minerals as well as safeness level of anti-nutritional factors. The results in the present study revealed that, the two chosen grasses contained relatively high concentrations of carbohydrates, proteins, fats, ash and essential elements. These findings support that, these grasses are considered as good source of nutrients and this will promote their uses as forage for livestock.

The proximate analysis of the aboveground parts of *P. geminatum* and *P. repens* showed that, the two grass species contained high content of carbohydrates which are higher than that reported by Mashaly *et al.* (2009) for *Paspalidium geminatum* (77.02%) and by Shaltout *et al.* (2013) for *Panicum repens* (58.07%). Comparing with the common source of green fodder plants in Egypt, the carbohydrates content in the grazeable parts of the two grasses were higher than those of *Trifolium alexandrinum* (43.4%) (Chauhan *et al.*, 1980). High level of carbohydrates in fodder provides readily available energy for plant itself and animal.

In the present study, the crude protein content in the two grasses appeared to be low as compared with the proper range of 6-12% recommended by the Ministry of Agriculture and Food in UK's (1975) but agreed with the scale of some fodder materials (2.7%-13.4%) (Shoukry, 1992). Due to low protein levels in the pasture, it may be suggested that, supplementary rich protein feed should be supplied in the animal diet, particularly during reproductive and productive states to compensate decline in protein content and maximize their productivity. As reported by Chapin *et al.* (1986) and Heneidy (2002), lipids do not constitute an energy source in most of forages. The ether extract (i.e crude fat) of the two grasses is within the range of some fodder plants (0.5%-3.1%) (Shoukry, 1992) but lower than at *T. alexandrinum* (2.9%) (Chauhan *et al.*, 1980).

Concerning fiber content, *P. repens* attained highest value than at *T. alexandrinum* (21.5%) but *P. geminatum* attained about half the value reported for *T. alexandrinum*. High crude fiber level indicates a high degree of lignification, low digestibility, and low feed value, and thus reduced amounts of available energy (Noblet and Le Goff, 2001). Ash content which is an indicator for mineral compositions, its value in the grazeable parts of the two grasses was within the range of some fodder materials (1.3%- 23.1%) (Shoukry, 1992). The high ash concentration suggests that, the studied grasses were rich in inorganic nutrients. Moisture content showed high value in the grazeable parts of the two grasses, this may be attributed to the wet canal bank habitat. Moderate moisture content in forage increases palatability and therefore may increase dry matter intake. Digestible crude protein in the two grasses was far too low as compared with previous estimate for *T. alexandrinum* (13.3%) (Chauhan *et al.*, 1980) and the value (6.1%) required for the sheep diet (NRC, 1985).

The grazeable parts of the two grass species contained large quantities of many essential minerals and trace elements including potassium, sodium, calcium, magnesium and iron. In the present study, mineral concentrations in the two grasses meet the requirements for animals. According to Boudet (1975), the maintenance levels of sodium, potassium and calcium were 0.06%, 0.4% and 0.2%, respectively. On the other hand, NRC (1984) recommends that, forages should contain at least 0.005 mg/g iron, 0.008 mg/g copper, 0.04 mg/g manganese and 0.030 m/g zinc for the optimum performance of ruminants.

Total digestible nutrient (TDN) is an indicator for the energy value of feeds and energy requirements for animals (Heneidy, 2002). The value of TDN in the selected two grasses was less than percentage (66.55%) suggested by Heneidy (1996). NRC (1984) recommends a value of 20% TDN for breeding cattle and 61.7% for sheep. Chauhan *et al.,* (1980) estimated a value of 66.7% for *T. alexandrinum.* Nutritive value, nutritional ratio and caloric value in the studied grasses exceeds the cattle requirements reported by NRC (1984).

Forage quality (i.e energy value) can be measured by a number of categories such as gross energy (GE), digestible energy (DE), metabolizable energy (ME) and net energy (NE). Digestible energy reflects diet digestibility, its value in the studied grasses meet the requirements for sheep (2.7 Mcal kg^{-1} for diet). Chauhan *et al.* (1980) reported 2.9 Mcal kg^{-1} for *T. alexandrinum*, while Heneidy and Bidak (1996) estimated 3.04 Mcal kg^{-1} for *Phragmites australis*. Metabolizable energy (ME) is an estimate of the energy available to the animal and represents an accounting progression to assess food energy values and animal requirements. The breeding cattle and sheep require 2.1 and 2.23 Mcal kg^{-1}, respectively. In the current study, ME value in the two grasses was equivalent to that recorded in *T. alexandrinum* (2.46 Mcal kg^{-1}) (Chauhan *et al.*, 1980) and *P. australis* (2.62 Mcal kg^{-1}) (Heneidy and Bidak, 1996). Gross energy (GE) or total combustible energy is the energy released as heat when an organic feed stuff is oxidized to carbon dioxide and water. GE in the two studied grasses was comparable to the previous estimates for *T. alexandrinum* (470 kcal 100 g^{-1}) (Chauhan *et al.*, 1980). Net energy (NE) is the energy left after heat losses during digestion of feed, metabolism and waste excretion. It is the energy actually used for maintenance and for production (growth, gestation, lactation). Therefore, net energy is the only system that describes the energy that is actually used by the animal (Clark *et al.* 2005). Using the scale suggested by Boudet and Riviere (1968), the grazeable green parts of *P. geminatum* and *P. repens* were considered as excellent forages.

Nutritional value of feed stuffs depends on the balance between anti-nutritional and nutritional compounds (Aberoumand and Deokule, 2009). Anti-nutritional factors may be generated in natural feed stuffs by the normal metabolism of species and by reduction of metabolic utilization of feed (Kumar, 1991). The major anti-nutritional factors that adversely affect the nutritional value of the forages include cyanogenic glycosides, tannins, flavonoids, phenolics, alkaloids, saponins and phytates (Akande *et al.*, 2010). At high concentrations, these factors reduce the palatability and absorption of nutrients of the feed and hence, cause growth depression. Besides its adverse effects, anti-nutritional factors play an important role in plant defense mechanisms against environmental stress, predatory attacks of herbivores and pathogens (Gwanzura *et al.,* 2012). The obtained results indicated that, the aboveground parts of *P. geminatum* and *P. repens* contain relatively low levels of anti-nutritional compounds. Although, the two studied grasses grow in the same habitat (i.e canal banks), there is variation in their chemical composition and energy value. *P. repens* attained key nutrients such as carbohydrates, protein and lipids more than *P. geminatum.* This variation may be attributed to stem/leaf area, ability to accumulate nutrients in their above ground parts, time of collection and probably soil conditions.

It can be concluded that, the chemical composition, secondary metabolites and energy values of the aboveground grazeable parts of *P. geminatum* and *P. repens* clearly indicated that they are rich source of nutrients with low anti-nutritional factors, and showed high energy value. The studied grasses could be planted and used as a feed for livestock, but supplied with supplementary feed rich in protein. Further toxicological studies are required to assess the possibility of utilization of these grasses in animal diet and for feed formulation.

References

Aberoumand, A. and Deokule, S. S. **(2009).** Studies on nutritional values of some wild edible plants from Iran and India. Pakistan Journal of Nutrition, 8(1): 26-31.

Abu-El-Naga, M. A. and El-Shazly, K. **(1971).** The prediction of the nutritive value of animal feeds from chemical analysis. Journal of Agricultural Science 77: 25-37.

Akande, K. E., Doma, U. D., Agu, H. O. and Adamu, H. M. **(2010).** Major antinutrients found in plant protein sources: their effect on nutrition. Pakistan Journal of Nutrition, 9(8): 827-832.

Allen, S. E., Grimshaw, H. M., Parkinson, J. A., Quarmby, C. and Roberts J. D. **(1974).** Chemical Analysis of Ecological Materials. Blackwell Scientific Publ. Osney, Oxford, London.

Anonymous, Energy Allowances and Feeding System for Ruminants **(1975).** Ministry of Agriculture, Fisheries and Food. London, Her Majesty's Stationary Office, Technical Bulletin.

AOAC **(1990).** Official Methods of Analysis. Association of Official Analytical Chemists. 15th ed. (Helrich, K. C.).Washington D.C., U.S.A.

Böhm, B. A. and Kocipai-Abyazan, R. **(1994).** Flavonoid and condensed tannins from leaves of *Vaccinum raticulation* and *Vaccinum calcyimium.* Pacific Science, 48: 458-463.

Boudet, G. **(1975).** Manual on the Tropical Pasture and Fodder Plants. Series Manuals Specific to Livestock, Ministry of the Members ion, Paris.

Boudet, G. and River, R. **(1968).** Practical Analyses of Fodder from Appraising Ion of Tropical Pasturages. Rev. Student Medical Veterinary, 21 (2): 227-266.

Boulos, L. **(2009).** Flora of Egypt Checklist. Al Hadara Publishing. Cairo, Egypt.

Chapin, F. S., Mckendrick, J. D. and Johnson, D. A. **(1986).** Seasonal changes in carbon fractions in Alaskan Tundra plants of differing growth form: implications for herbivory. The Journal of Ecology, 74: 707-731.

Chauhan, T. R., Gill, R. S. and Ichhponani, J. S. **(1980)**.Nutritive value of berseem and clusterbean forages. Indian Journal of Animal Sciences, 50(12): 1052-1055.

Clark, O. G., Moehn, S., Edeogu, I., Price, J. and Leonard, J. **(2005)**. Manipulation of dietary protein and nonstarch polysaccharide to control swine manure emissions. Journal of Environmental Quality, 34(5):1461-1466.

Demarquilly C. and Weiss, P. **(1970)**. Tableau de la valeur alimentaire des fourrages. Et. 42: Versailles: INRA-SEI. , 235-242.

FLEPPC Plant List Committee **(2003)**. Florida Exotic Pest Plant Council's 2003: List of Invasive Species. Wild land Weeds, 6.

Garrett W.N., **(1980)**. Energy utilization of grown cattle as determined in seventy-two comparative slaughter experiments. In Mount L.A. (ed): Energy Metabolism, EAAP Publ. No. 26, London.

Gwanzura, T., Ng'ambi, J. W. and Norris, D. **(2012)**. Nutrient composition and tannin contents of forage sorghum, cowpea, lablab and mucuna hays grown in Limpopo Province of South Africa. Asian Journal of Animal Sciences, 6(5): 256-262.

Haque, M. R. and Bradbury, J. H. **(2002)**. Total cyanide determination of plants and foods using the picrate and acid hydrolysis methods. Food Chemistry, 77(1): 107-114.

Harborne, J. B. **(1973)**. Phytochemical Methods, Chapman and Hall, London, UK.

Heneidy, S. Z. **(1996)**. Palatability and nutritive value of some common plant species from the Aqaba Gulf Area of Sinai, Egypt. Journal of Arid Environments, 34(1): 115-123.

Heneidy, S. Z. **(2002)**. Role of indicator range species as browsing forage and effective nutritive source, in Matruh Area, a Mediterranean Coastal Region, NW-Egypt. Online Journal of Biological Sciences, 2(2), 136-142.

Heneidy, S. Z. and Bidak, L. M. **(1996)**. Halophytes as a forage source in the Western Mediterranean Coastal Region of Egypt. The Desert Institute Bulletin, Egypt, 46(2): 261-283.

Heneidy, S. Z. and Halmy, M. W. **(2009)**. The Nutritive value and role of *Panicum turgidum* Forssk. in the arid ecosystems of the Egyptian Desert. Acta Botanica Croatica, 68(1): 127-146.

Hossain, M. A., Akamine, H., Nakamura, I., Ishimine, Y. and Kuramochi, H. **(2001)**. Influence of temperature levels and planting time on the sprouting of rhizome - bud and biomass production of torpedograss (*Panicum repens* L.) in Okinawa Island, Southern Japan. Weed Biology and Management, 1(3): 164-169.

Jackson, M. L. **(1962)**. Soil Chemical Analysis. Constable and Co. LTD. London, UK.

Kumar, R. **(1991)**. Anti-nutritional factors: the potential risks of toxicity and methods to alleviate them. Animal Feed Science and Technology, 30:145-160.

Le Houérou, H. N. **(1980)**. Chemical Composition and Nutritive Value of Browse in Tropical West Africa. Browse in Africa, the Current State of Knowledge. Le Houerou, HN (ed.), ILCA, Addis Ababa: 261-289.

Mashaly, I.A., El-Halawany, E.F., Abu Ziada, M.E. and Abd El-Aal, M. **(2009)**. Economic potentialities of some wild flora in Dakahlia Province, Egypt. Mansoura Journal of Biology, 36(1): 1-20.

Noblet, J. and Le Goff, G. **(2001)**. Effect of dietary fibre on the energy value of feeds for pigs. Animal Feed Science and Technology, 90(1): 35-52.

NRC **(1984)**. Nutrient Requirements of Domestic Animals: Nutrient Requirements of Beef Cattle: (6^{th} ed). Research Council Pamphlets. Research No 4. National Academy of Science, Washington DC.

NRC **(1985)**. Nutrient Requirements of Domestic Animals: Nutrient Requirements of Sheep (6^{th} ed). Research Council Pamphlets. Research No 5.

National Academy of Science, Washington DC.

Onyeike, E. N., Olungwe, T. and Uwakwe, A. A. **(1995)**. Effect of heat-treatment and defatting on the proximate composition of some Nigerian local soup thickeners. Food chemistry, 53(2), 173-175.

Piper, C. S. **(1947)**. Soil and Plant Analysis, Interscience Publishers, Inc. New York, USA.

Riviere, R. **(1977)**. Manual d'Alimentation des Ruminants Domestiques en Milieu Tropical. Manuel et Précis d'Elevage no. 9, MaisonsAlfort IEMVT/Min. De la Coop.

Sadasivam S. and Manickam, A. **(2008)**. Biochemical Methods. 3rd ed. New Age International Limited, New Delhi, India.

Shaltout, K. H., El Keblawy, A. A. and Mousa, T. M. **(2008)**. Evaluation of the range plants quality and palatability for camel grazing in the United Arab Emirates. Journal of Camelid Sciences, 1: 1-13.

Shaltout, K. H., Galal, T. M., and El-Komi, T. M. **(2009)**. Evaluation of the nutrient status of some hydrophytes in the water courses of Nile Delta, Egypt. Egyptian Journal of Botany. doi:1155/2009/862565.

Shaltout, K. H., Galal, T. M., and El-Komi, T. M. **(2013)**. Nutrients and heavy metals accumulation in the aboveground biomass of two perennial grasses along the water courses of Nile Delta, Egypt. Egyptian Journal of Botany. doi:1155/2009/862565.

Shoukry, M. M. **(1992)**. An actual vision about the availability of the utilization of water hyacinth in feeding ruminants. In Proceedings of the National Symposium on Water Hyacinth: 75-92. Assiut University.

Stefan, G., Sommer, R. and Ryan, J. **(2013)**. Methods of Soil, Plant and Water Analysis: A manual for the West Asian and North Africa Region. 3rd ed. International Center for Agricultural Research in the Dry Areas, Beirut, Lebanon.

Van Buren, J. P. and Robinson, W. B. **(1969)**. Formation of complexes between protein and tannic acid. Journal of Agricultural and Food Chemistry, 17(4): 772-777.

الموئل والقيمة الغذائية لنوعين من النجيليات: الصوفان ونجيل الفرس بدلتا النيل-مصر

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فى هذه الدراسة تم إختيار نوعين من الحشائش المعمرة (الصوفان ونجيل الفرس) لتقييم محتواها الكيميائى وقيمتها الرعوية بالإضافة إلى تعيين مضادات التغذية. تم تجميع الأجزاء الهوائية من النباتات المختارة والتى تنمو فى بيئة حواف القنوات والترع بمنطقة شمال الدلتا بمصر كما تم دراسة خصائص التربة فى منطقة الدراسة. وقد أظهرت النتائج أن نبات نجيل الفرس يحتوى على العديد من المواد الغذائية الرئيسية مثل الكربوهيدرات والبروتينات والدهون أكثر من الصوفان.على الجانب الاخر أظهرت النتائج أن نبات الصوفان سجل أعلى القيم من الطاقة القابلة للهضم ،الطاقة الممثلة ،الطاقة الصافية، مجموع المواد الغذائية القابلة للهضم، القيمة الغذائية وقيمة السعرات الحرارية ، في حين حقق نجيل الفرس أعلى القيم من الطاقة الإجمالية ونسبة التغذية. وبمقارنة صافى الطاقة فى النباتات محل الدراسة بالمقاييس العالمية تعتبر هذه الحشائش أعلافا ممتازه. وتعتبر الأجزاء الرعوية للحشائش المختارة مصدر غني من المواد الغذائية مع انخفاض عوامل مضادات التغذية ، بالاضافة الى محتواها العالى من الطاقة. ويمكن إستخدام الأعشاب المختارة كعلف للماشية. ومع ذلك، تحتاج هذه الدراسة إلى مزيد من الدراسات السمية لتقييم إمكانية الاستفادة من الحشائش المختارة في صناعة الأعلاف والنظام الغذائي الحيواني.