NUTRIENT COMPOSITION AND *IN VITRO* DIGESTIBILITY OF LEAVES OF SOME WILD AND CULTIVATED TREES OF BALOCHISTAN FOR RUMINANT LIVESTOCK

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Abstract

Nutrient composition and *in vitro* dry matter (DM) digestibility of leaves of five wild trees *(Acacia modesta, Pistacia attlantica, Pistacia khinjuk, Olea cuspidata* and *Zizyphus mauritiana)* and five cultivated trees *(Prunus dulcis, Pyrus malees, Prunus persica, Prunus domestica* and *Punica granatum)*, collected from three different locations in Balochistan, were determined. Ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fibre (ADF) and *in vitro* dry matter digestibility (IVDMD) varied ($P < O.001$) due to tree species, but were not affected by location. Ash contents ranged from 4.62 to 17.02 percent of dry matter (DM) and remained higher in the cultivated tree leaves. CP in DM ranged from 7.17 percent in *Olea cuspidata* to 15.19 percent in *Acacia modesta*. Mean CP across all the species was 11.10 percent in DM. The ADF and NDF in the leaves ranged from 12.71 to 30.41 and 14.25 to 40.95 percent of DM, respectively. *In vitro* DM digestibility varied from 13.80 percent in *Pistacia attlantica* to 70.78 percent in *Prunus persica*. Cultivated tree leaves were low ($P < 0.01$) in ADF and NDF and 66 percent more digestible ($P < 0.001$) than the wild trees leaves.

Introduction

Grazing constitutes one of the major feed resource in Pakistan and contributes 37.8 percent dry matter, 35 percent crude protein and 37 percent TDN to the total feed availability in Pakistan (Rahim, 1998). Rangelands serve as a major feed source particularly in mountainous regions by providing large varieties of grasses, shrubs and tree foliage. Livestock farmers through experience have determined the usefulness of tree foliage as a complementary feed for their livestock, especially during feed scarcity seasons. This includes both wild and cultivated (orchard) tree species. The major problem appears to be inadequate

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management systems, apparently due to lack of information on the nutritive values of local tree leaves, which constrain their optimum use as a feed. The present research was conducted to determine the nutritive values of some tree leaves commonly fed to livestock in Balochistan.

Materials and Methods

Sample Collection

The leaves of five species of wild tree (*Acacia modesta, Pistacia attlantica, Pistacia khinjuk, Olea cuspidata* and *Zizyphus mauritiana)* and five cultivated tree species *(Prunus dulcis, Pyrus malees, Prunus persica, Prunus domestica* and *Punica granatum)* were collected from three different locations in Balochistan. The cultivated tree leaves were collected from Bawar, Zinda Pir, and Bagh Villages and the wild tree leaves were collected from the hilly areas of Anambar, Zinda Pir and Garang of districts Loralai, Sibi and Killa-Saifullah, respectively. About two kg mature leaves were randomly collected from five different trees of each species, mixed and air dried in shade. The leaves were manually shredded from the trees at the time of full maturity soon after picking of fruits in July 1997. Leaves from the wild tree species were also collected during July to August 1997 at full maturity.

Chemical analysis

The air dried leaves were ground in a laboratory mill through 1 mm screen. Dry matter (DM), ash and crude protein (CP) were analyzed according to Official Methods of Analysis of the Association of Official Analytical Chemists (1990). Acid detergent fiber (ADF) and neutral detergent fiber (NDF) were determined as described by Georing and Van Soest *et al.* (1970).

The *in vitro* dry matter digestibility (IVDMD) was measured with the two stages technique of Tilley and Terry (1967), using fresh rumen liquor collected from a fistulated buffalo steer, fed a mixture of maize fodder and wheat straw. Metabolizable energy (ME) in the leaves was calculated from the *in vitro* results as suggested by the Ministry of Agriculture Food and Fisheries, London (1984).

Statistics

The data were analyzed with the analysis of variance procedure (Steel and Torrie, 1980). The model included main effects of tree species, tree types (wild

and cultivated) and locations. The means were compared with the Tukkey's Studentized Range Test as described by Steel and Torrie (1980). Relationships among different parameters were calculated with the linear regression method.

Results and Discussion

Nutrients composition of the tree leaves are summarized in Table 1. Ash content as indicative of mineral matter ranged from 4.62 to 17.02 percent of DM and affected by tree species ($P<0.001$) but not due to location. Ash was higher ($P<0.001$) in cultivated than wild tree leaves (12.42 Vs 7.66 percent). Positive correlation between the ash contents and IVDMD of the leaves (Table 2) suggested that ash was helpful in stimulating digestibility of the leaves presumably through supply of essential minerals to the rumen microbes.

Table 1. Nutrients composition and *in vitro* dry matter digestibility (IVDMD) of different tree leaves (each value is a mean of three locations).

Tree species	Percent of dry matter				IVDMD %
	Ash	CP	NDF	ADF	
Prunus dulcis	12.64	11.83	19.80	18.19	68.59
Pyrus malees	9.37	10.64	27.02	19.31	55.01
Prunus persica	14.64	13.49	23.55	15.32	70.78
Prunus domestica	17.02	12.49	24.17	18.36 [ab]	56.14
Punica granatum	8.72	8.93	14.25	19.11	60.71
Acacia modesta	12.37	15.19	31.94	23.26	50.52
Pistacia attlantica	5.71	8.29	29.08	30.41	13.80
Olea cuspidata	5.96	7.17	40.95	27.09	28.37
Pistacia khinjuk	4.62	9.59	15.78	12.71	55.78
Zizyphus mauritiana	9.64	13.39	31.79	27.21	38.73
Mean	10.07	11.10	25.83	21.10	49.84
LSD (0.05)	3.27	4.67	11.33	16.26	13.53
Significance level	***	***	***	**	***

*= $P<0.05$; ** = $P<0.01$; *** = $P<0.001$
CP=Crude Protein; NDF=Neutral Detergent Fiber;
ADF=Acid Detergent Fiber.

Table 2. Correlation coefficient (r) for the relationship between chemical components and *in vitro* dry matter digestibility in tree leaves (observations = 30).

Chemical components as percent in dry matter (X)	Regression equation	Correlation Coefficient (r)	Level of Significance.
Ash	25.36 + 2.43X	0.53	$P<0.01$
Crude Protein	22.58 + 2.46X	0.35	$P<0.05$
Neutral Detergent Fiber	83.79 - 1.31X	-0.61	$P<0.001$
Acid Detergent Fiber	85.60 - 1.70X	-0.68	$P<0.001$

Crude protein in the leaves varied ($P<0.001$) due to tree species, but did not respond to locations and the mean value across the species was 11.10 percent. Maximum CP was found in *Acacia modesta* (15.19 percent) followed by *Prunus persica* (13.49 percent) and *Zizyphus mauritiana* (13.39 percent). While *Olea cuspidata*, and *Pistacia attlantica* had the lowest ($P<0.05$) CP contents of 7.17 and 8.29 percent, respectively. Mean CP in cultivated (11.47 percent) and wild tree leaves (10.72 percent) did not differ significantly. Similar variation in CP values of different tree leaves was reported by Hayat (1998) and Ghol (1981). Crude protein contents in the present tree leaves could be ranked medium, close to good quality fodder and above the critical level of 10 percent required for optimum digestion in the rumen (Preston and Leng, 1987).

Both ADF and NDF varied due to tree species ($P<0.001$) but were not affected by locations and remained lower ($P<0.01$) in cultivated tree leaves. These fiber fractions adversely affected IVDMD of the leaves (Table 2) and in line with Van Soest (1982) demonstrated ADF and NDF as negative index of nutritive value in forages. ADF and NDF contents in the present tree leaves were found considerably lower than those reported for other forages (National Research Council, 1989) suggesting that tree leaves could be ranked as better quality forage for ruminant animals.

IVDMD of the tree leaves varied due to species ($P<0.001$) but did not show any response to difference in location. Comparison among the tree species (Table 1) showed that IVDMD of *Prunus domestica* leaves was maximum (70.78 percent) and that of *Pistacia attlantica* (13.80 percent) remained the lowest ($P<0.05$). Leaves of cultivated tree appeared more digestible ($P<0.05$) than the wild species (62.25 Vs 37.44 percent). Correlations of chemical components with IVDMD in the tree leaves are shown in Table 2. The high correlation of ADF with IVDMD ($r= -0.68$, $P<0.001$) demonstrated that ADF may be used to predict IVDMD and would serve as a useful criterion for evaluating tree leaves as suggested by Van Soest (1982) for other forages.

Calculated metabolizable energy concentration (MJ/Kg DM) ranged from 2.31 in *Pistacia Attlantica* to a maximum of 9.32 in the *Prunus dulcis* leaves and remained higher ($P<0.01$) in the cultivated than the wild tree leaves. Metabolizable energy contents in the cultivated tree leaves closely matched to the values reported by the Ministry of Agriculture Food and Fisheries, London (1984) for common grasses and green legumes and suggest that leaves of cultivated orchard trees are potentially good quality forage for ruminants. Among the wild tree leaves, ME contents in *Acacia modesta* and *Pistacia khinjuk* were higher (7.05 and 7.67 MJ/Kg DM, respectively) and explain the farmer's preference for feeding these leaves to livestock in Balochistan.

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