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EVALUATION OF NUTRACEUTICAL POTENTIAL OF FIVE SELECTED WILD EDIBLE PLANTS OF LAHORE, PAKISTAN

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Diabetes mellitus is a diverse ailment which is portrayed by flawed working of pancreas other than aggravated fat and starch digestion. It is an executioner malady which is all inclusive influencing the general population of various ages. The main purpose of the research was to examine some specific wild edible plants which are nutritiously feasible as well as battle with the diabetes. Five wild edible plants (*Amarnthus viridus* L, *Chaenopodium album* L, *Portulaca oleraceae* L. *Solanum nigrum* L. and *Malvastrum coroman*value) were assessed for nourishing and against diabetic movement and results uncovered that these vegetables are great wellspring of antidiabetic agent and can be eaten as food and energy source. By moving the concentration from traditional usage to elective nourishment sources the worldwide nourishment prerequisites can be fulfilled. Along with their nourishing capacitance these plants can adequately control BGLs. Hereafter these five wild edible plants can be viewed as nutraceutical agent and prove satisfying the wholesome request of body as well as curing it from a specific illness.
Keywords: *A.viridis; C.alibum; P.oleraceae; S.nigrum; M.coromandelianum; Antidiabetic*.

INTRODUCTION

Wild edible plants are considered as those plants whose roots, leaves or fruits are acceptable for eating purpose by urban and rural communities (Maroyi, 2011). These wild edible plants play a significant role to improve agriculture and some of these now become cultivated plants as well (Sanchez-Mata *et al*., 2011). There are about 700 wild edible plant species harvested worldwide to fulfill food needs (Ghane *et al*., 2010). Even the Bharucha and Pretty (2010) advocated the wild edible plants as a significant part of global food basket. These wild edible resources may or may not be native to a country but they can be affiliated with indigenous knowledge and have long history of selection and utilization (Keller *et al*., 2004). In many European as well as in Asian countries these wild food sources have been used for many years as alternate food source (Sanchez-Mata *et al*., 2011; Hussain *et al*., 2011).

Food and Agricultural Organization has estimated that during 1999-2001, the strength of undernourished people reaches to 840 million, of whom 799 million are the part of developing countries, about 12 million belongs to developed countries and 32 million lives in countries in transition (Diouf, 2002; Gilani *et al*., 2010). This malnutrition and nutrient deficiencies can be overcome by incorporating wild edible plants into our food priorities (Sanchez-Mata *et al*., 2011). Several national and international researchers (Vishwakarma and Dubey, 2011; Vega-Galvez *et al.*, 2010) evaluated the nutritional value of wild edible plants and suggested them as alternate food resources. Apart from their nutritional potential these wild edible plants also play pivotal role in preventing various diseases. Their potential health benefits have been evident by many studies (Lee *et al*., 2012; Nigam and Paarakh, 2011).

By increasing the world population, the demand of food has been exponentially boost up.

Moreover, above 50 % of the world's daily proteins and calories demands are achieved from only three crops: wheat, maize and rice. The dependence on a few domesticated species limits dietetic diversity and leads to over dependence on limited resources. So, there is a need to explore alternative available food source and wild vegetables are the leading candidate among them which can help the world to overcome food shortage as well as nutrient deficiencies. These wild vegetables not only possess admirable nutritional qualities but also portray remarkable potential against many health disorders. Another beneficial aspect of these wild vegetables is that they are quite cheap and easily available for the marginal communities. So the exploration and use of wild vegetables is strongly recommended for the food security in this over populated world. Hence the present research has therefore been undertaken to carry out nutraceutical investigation related to some selected wild edible plants inhabited in the Lahore area of Pakistan.

MATERIALS AND METHODS

***Plant material*:** For this study five different wild edible plants (*Amaranthus viridis* L., *Chenopodium album L. Portulacca oleracea* L. *S.nigrum* L. and *Malvastrum coromandelianum* (L.) Garcke) had been selected based on their anti-diabetic ethnomedicinal value (Table 1). These herbs were collected from the various sites of Lahore with the help of local informants who not only précised the location of plants but also assisted in their preliminary identification (Figure 1). Later on these plants were taxonomically identified by consulting Quaid-i-Azam University and National Agricultural Research Council (NARC) herbaria of Pakistan. For further analysis, the leaves were separated from their respective plant specimens and washed thoroughly with double distilled water. Afterward the leaves were left for under the shade drying at room temperature. The dried leaves crushed finely into powder form and packed inside the airtight polythene bags.

***Nutrition evaluation of selected medicinal plants*:** According to George and Latimer (2005) standard methods were followed for nutritional evaluation i.e. moisture, ash content, fat, fiber and protein content.

***Extract preparation*:** 50g of each sample was packed inside their respective thimbles and then suspended in the round bottom flask of soxhlet apparatus containing 750 ml of Methanol. On the whole 10-15 cycles were run for complete extraction and after that extracts were transferred to the beakers. The beakers were left open under the fume hood in order to facilitate evaporation of methanol. At the end, rotary evaporator was also used to ensure the complete evaporation of methanol traces and dried extract pellet was stored at 4°C.

Figure 1. Map showing collection sites for selected wild edible plants

***Preliminary Phytochemical screening*:** For the qualitative

Table 1. General profile of selected wild edible plants.

Anti-diabetic plants	Indigenous names	Family	Anti-diabetic part	Habitat	Life Form	Distribution in World	Collection sites in Lahore	Anti-diabetic value reported by
Amaranthus viridis L.	Chulai	Amaranthaceae	Leaves	Cosmopolitan but most abundantly present in moist areas	Annual herb	Pakistan, North America, Italy, Hawaii and Europe	Jinnah garden	Adinortey et al., 2019
*Chenopodium album*L.	Bathu	Chenopodiaceae	Leaves	Abundant in humid areas	Annual herb	Africa,Pakistan, Australasia,America, and Oceania	Punjab University (PU) botanical garden	Salehi et al., 2019
Portulacca oleracea L.	Kulfa, Lunak	Portulacaceae	Leaves	Grows well in orchards, vineyards, crop fields, landscaped areas, gardens, roadsides	Annual shrub	Cosmopolitan	Lahore college for Women University (LCWU) botanical garden	Laadim et al., 2017
Malvastrum coromandelianum (L.) Garcke)	Malva	Malvaceae	Leaves	Tropical and subtropical areas, near cultivated fields and roadsides	Annual or perennial herb	China, India, Japan, Pakistan, Myanmar, Sri Lanka, Vietnam; South America	Punjab University (PU) botanical garden	Salehi et al., 2019
Solanum nigrum L.	Mako	Solanaceae	Leaves	Waste lands, ditches, old fields, roadsides, edges of woods, fence rows, and cultivated lands	Annual herb	Southern Europe, Pakistan	Lahore college for Women University (LCWU) botanical garden	Albouchi et al., 2018 Hussain et al., 2018

analysis standard protocols of Evans (1989), Harbone (1988), Sofowora (1993) and Ushie et al. (2013) were used.

Elemental Analysis**:** Mineral elements Mg, K, Ca and Fe of selected wild vegetables were determined by spectrophotometer. Mineral analysis showed the amount of mineral present in the selected plants (Bahadur *et al*., 2011).

Anti-diabetic evaluation of selected medicinal plants**:**

Various steps were involved in the antidiabetic evaluation are listed below;

Experimental animals**:** 8-10 weeks old Wistar albino rats (both male and female) were used for the anti-diabetic analysis. The average weight of rats was 22g and they were fed with the standard diet of rodents. All the rats were randomly assorted into five groups and before starting the experiment the animals were allowed to acclimatize for a week under standard temperature, humidity and dark/light cycle.

Experimental design**:**

All the experimental groups were divided into 8 groups consisting of 7 mice in each. Detailed design has been presented in Table 2.

Induction of hyperglycemia**:**

In order to induce the hyperglycemic condition in the testing animals, a single intraperitoneal administration of 186.9 mg per kg body weight of 10% alloxan monohydrate (2, 4, 5, 6 tetraoxypyrimidine; 5-6-dioxyuracil) was done (Karu *et al*., 2012). The blood glucose levels (BGL) were measured after 48 hours with the help of glucometer. After becoming diabetic mice had BGL above the 200 mg/dL. Before to start this experiment the animals were allowed to fast for 8-12 hours but water was freely available throughout experiment (Szkudelski, 2001).

BGL determination**:**

The whole duration of experiment was 15 days and BGL was tested after regular 3 days intervals with the help of standard glucometer. The mean values for each group were compared (Figure 2).

Statistical analysis**:** For results interpretations correlation analysis also had been applied by using SPSS (Statistical Package for the Social Sciences, version 23). Microsoft excel has been used for structuring graphical presentation of data.

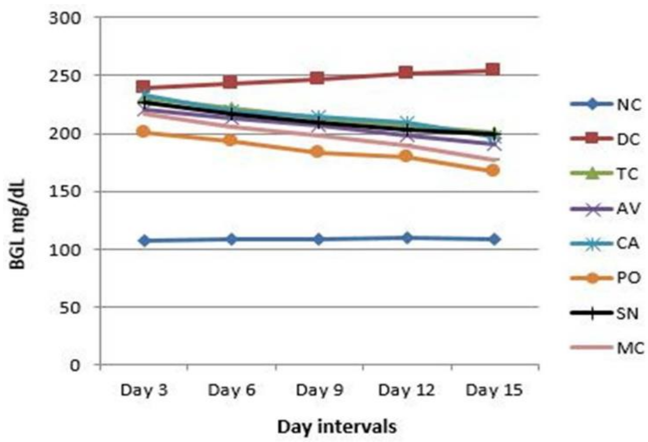

Figure 2. Comparison between BGLs of all experimental groups at different intervals

RESULTS AND DISCUSSION

Nutritional evaluation: Nutritional analysis was made by determining the moisture, ash, fat, fiber and protein contents of the respective wild edible plants i.e; *Amaranthus viridis, Chenopodium album, Portolaca oleraceae* and *Solanum nigrum*. Percentage moisture values indicated that *P. oleraceae* had higher value of moisture (90%) while *A. viridis* possessed the lower most moisture content (70%) in comparison to all. In the present research the concluded moisture value (70%) of *A. viridis* was found in concordance to the value (86%) reported by Falade *et al*. (2004). The difference in the value was due to the climatic differences and seasonal variations. *C. album* reported moisture is in accordance to the results reported by Adedapo *et al*. (2011) i.e. 84%. Moisture content in *P. oleraceae* was 90% which is closely related to the value (87%) represented by Hussain *et al*. (2011).

Ash value turned out to be highest in *C. album* and *S.*

Table 2. Experimental design.

Group	Group name	Specific treatment
I.	Normal control group (NC)	Didn't receive any kind of treatment, neither any Alloxan nor plant extract.
II.	Diabetic control group (DC)	Alloxan induced but not treated with medicine or plants extracts.
III.	Treatment control group (TC)	Alloxan induced but treated with standard diabetic medicine i.e. Glucophage
IV.	AV treated group	Treated with 500mg dried methanolic leaves extract of *Amaranthus viridis*
V.	CA treated group	Treated with 500mg dried methanolic leaves extract of *Chenopodium album*
VI.	PO treated group	Treated with 500mg dried methanolic leaves extract of *Portulacca oleracea*
VII.	SN treated group	Treated with 500mg dried methanolic leaves extract of *Solanum nigrum*
VIII.	MC treated group	Treated with 500mg dried methanolic leaves extract of *Malvastrum coromandelianum*

AV= *Amaranthus viridis*, CA= *Chenopodium album*, PO= *Portulacca oleracea*, SN= *Solanum nigrum*, MC= *Malvastrum coromandelianum* *nigrum* (3.4%), and lowest in *P. oleraceae* (1.6%) (Figure 3). Ash content determined in *A. viridis* (3%) was found to be higher than reported value (1.85%) of Sharma *et al*. (2013). While ash value of *C. album* (2.2%) was reported by Poonia and Upadhayay (2015) is also lower than the currently found value conditions. However, % ash of *P. oleraceae* (1.6 %) was found to in proximation of the value (1.8%) described by Hussain *et al*. (2011). Meonah *et al*. (2011) reported the almost similar ash value (3.9%) for *S. nigrum* (3.4%) as determined in present research.

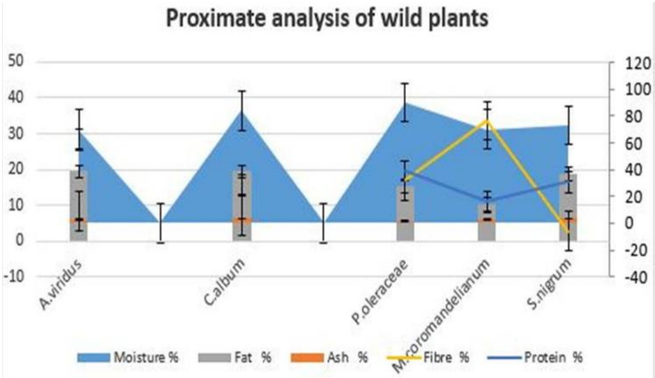

Figure 3. Nutritional evaluation of selected wild edible plants.

According to that Figure 2, *C. album* showed the highest value of fat (19.4%) while the *P. oleracceae* had the lowest value (15.3%) of fat. Whereas, *P. oleracea* showed the highest value of fiber (16.9%) among other plants. This value was closed to the value that was reported by Hussain *et al.* (2011) i.e., 17.7% while the *S. nigrum* exhibited the lowest value (2.8%).

Concluded results had indicated that *A. viridis* had highest protein (28.43%) among all these four studied wild vegetables however *C. album* has lowest protein (15.72%). Falade *et al*., (2004) reported value of *A. viridus* protein (26%) was found to be less than determined value (28.435%) in present research work. Value of protein (19.5%) in *P. oleracae* was higher than the value (15.9%) that was described in Hussain *et al*. (2011). Protein content (16.5) of *S. nigrum* was near to the value (17%) reported by Dhellot (2006).

***Preliminary phytochemical screening*:** Results have demonstrated that tannins, phenols, terpenoids, flavonoids and Glycosides were present in all studied wild edible plants. However, alkaloids have been reported in all except *M. coromandelianum*. The presence and absence accounts for other contents have been displayed in Table 3.

Table 3. Preliminary phytochemical analysis of selected wild edible plants.

Sr.	Chemical constituent	AV	CA	PO	SN	MC
1	Tannins	+	+	+	+	+
2	Phenols	+	+	+	+	+
3	Terpenoids	+	+	+	+	+
4	Steroids	+	-	-	+	-
5	Flavonoids	+	+	+	+	+
6	Alkaloids	+	+	+	+	-
7	Phlobatannins	+	+	-	+	-
8	Anthraquinones	+	+	+	-	+
9	Glycosides	+	+	+	+	+
10	Protiens	-	-	+	+	+
11	Amino Acid	-	-	-	-	-
12	Reducing sugars	-	-	-	-	-
12	Saponins	-	+	-	-	-

AV= *Amaranthus viridis*, CA= *Chenopodium album*, PO= *Portulacca oleracea*, SN= *Solanum nigrum*, MC= *Malvastrum coromandelianum*

***Elemental Analysis*:** The present study showed the higher value of Fe and Ca concentration in *S. nigrum* (0.0193 and 0.0106 mg/kg) respectively. While the lowest value of iron was observed in *C. album* (0.0111 mg/kg). This study had also presented the highest value of K concentration in *A. viridis* (0.1933) while *S. nigrum* had lower concentration of K (0.1225 mg/kg). Mg concentration was also analysed among selected plants and it indicated that *P. oleraceae* and *A. viridus* had greater value (0.5059 mg/kg and 0.4771 mg/kg) as compared to *C. album* (0.4682 mg/kg). Khan *et al.* (2012) also reported high value of Fe and Mg in *A. viridis.*

***Anti-diabetic activity*:** Plants extracts were used to lower the glucose level among diabetic animals as these extracts were more effective than the synthetic drugs less toxic or even

Table 4. BGL (Blood Glucose Level) after treatment of mice.

BGL checking day	NC	DC	TC	AV	CA	PO	SN	MC
	(mg/dl)							
Day 3	107	239	231	221	233	201	227	217
Day 6	108	243	222	213	220	193	217	206
Day 9	108	247	213	207	214	183	210	198
Day 12	110	252	207	198	209	179	203	189
Day 15	108	254	201	191	197	167	199	177

AV= *Amaranthus viridis,* CA= *Chenopodium album*, PO= *Portulacca oleracea*, SN= *Solanum nigrum*, MC= *Malvastrum coromandelianum*

Table 5. Correlation between anti diabetic drug treated and wild edible plants extracts treated groups.

		TC mg/dl	AV mg/dl	CA mg/dl	PO mg/dl	SN mg/dl	MC mg/dl
TC mg/dl	Pearson Correlation	1.000	0.990**	0.983**	0.988**	0.997**	0.989**
	Sig. (2-tailed)		0.001	0.003	0.002	0.000	0.001
	N	5	5	5	5	5	5
AV mg/dl	Pearson Correlation	0.990**	1.000	0.983**	0.986**	0.988**	0.997**
	Sig. (2-tailed)	0.001		0.003	0.002	0.002	0.000
	N	5	5	5	5	5	5
CA mg/dl	Pearson Correlation	0.983**	0.983**	1.000	0.990**	0.979**	0.993**
	Sig. (2-tailed)	0.003	0.003		0.001	0.004	0.001
	N	5	5	5	5	5	5
PO mg/dl	Pearson Correlation	0.988**	0.986**	0.990**	1.000	0.975**	0.994**
	Sig. (2-tailed)	0.002	0.002	0.001		0.005	0.001
	N	5	5	5	5	5	5
SN mg/dl	Pearson Correlation	0.997**	0.988**	0.979**	0.975**	1.000	0.983**
	Sig. (2-tailed)	0.000	0.002	0.004	0.005		0.003
	N	5	5	5	5	5	5
MC mg/dl	Pearson Correlation	0.989**	0.997**	0.993**	0.994**	0.983**	1.000
	Sig. (2-tailed)	0.001	0.000	0.001	0.001	0.003	
	N	5	5	5	5	5	5

**. Correlation is significant at the 0.01 level (2-tailed).

AV= *Amaranthus viridis*, CA= *Chenopodium album*, PO= *Portulacca oleracea*, SN= *Solanum nigrum*, MC= *Malvastrum coromandelianum*

sometime harmless and also a cheap source of treatment. Methanol extracts were used for the present study because it did not have any toxic effect on animals that were treated against diabetic as it was supported by a number of scientists (Bhadoriya *et al.*, 2010)

Anti-diabetic activity results of each experimental group had shown that there were minor fluctuations in BGLs of NC group and these minor variations were probably due to the deviation in animal's diet habits. The animals of DC group consistently presented the hyperglycemic condition whereas 50% decrease in BGLs had been observed in TC group that was treated with standard anti-diabetic drug (glucophage) as shown in Table 4. However, plant extracts treated groups also showed significant gradual decrease in BGLs till the last 15th day of experiment. The correlation analysis between drug treated and respective plant extracts treated groups had clearly represented a positive relationship between them (Table 5). This analysis strongly supported that these all the five studied plants were as good in controlling the diabetes as standard drug and even some plant extracts were more effectively controlled diabetes in mice in comparison to standard drug Table 4. The Table 4 represented that methanolic extract of *P. oleracea* is more commendably lowered the BGLs followed by the *M. coromandelianum*, *A. viridis*, *S.nigrum* and *C. album* extracts. (El Sherbiny *et al.*, 2005) had supported this fact that the plant extracts of *P. oleracea*may prove very effective in controlling hyperglycemia. Moreover, methanolic extract were preferably used for the analysis because of its null toxic effect on animal health (Bhadoriya *et al.*, 2010).

Conclusion: The current research endeavor had made an effort to list out nutraceutical properties of the some certain wild edible plants which are not only nutritionally viable but also fight with the diabetes. Five wild edible plants were evaluated for nutritional and anti-diabetic activity and results revealed that all of these vegetables are good source of nutrition and can be eaten as food. By shifting the focus from conventional foods to alternative food sources the global food requirements can be satisfied. Along with their nutritional capacitance these plants can effectively control BGLs. Hence all of these five wild edible plants can be regarded as nutraceutical food resources which not only fulfilling the nutritional demand of body but also curing it from a particular disease. One of their advantages is that they are cheap, easily available and can grow massively. Henceforth all of these five wild edible plants are well recommended for the pharmaceuticals for new drug discovery.

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***Conflict of interest*:** The authors declare that there are no conflicts of interest in regard to this work.

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