Nutritional, elemental and phytochemical investigations of *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L. from District Malakand, Pakistan

Muhammad Ibrahim[1*], Naveed Akhtar[1], Sara [2], Haji Bahadar [3]

[1]Department of Botany, Islamia College Peshawar, Khyber Pakhtunkhwa, Pakistan

[2] Department of Zoology, University of Peshawar, Khyber Pakhtunkhwa, Pakistan

[3] Institute of Pharmaceutical Sciences, Khyber Medical University Peshawar, Khyber Pakhtunkhwa, Pakistan

Abstract

Mentha is a perennial, green, aromatic and medicinal herb. The contemporary investigation study was conducted to determine the nutritional, elemental and phytochemical investigations of *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L.from district Malakand, Pakistan. These two species of *Mentha* are used by the local people both as a source of flavouring agent and medicine. The nutritional analysis of both species showed that it contains sufficient quantity of carbohydrates, fats proteins, fibers and caloric energy. The elemental composition of powdered samples of *Mentha longifolia* (L.) Huds and *Mentha Spicata* L. leaves through Energy Dispersive X-rays Analysis (EDX) revealed that these plants contains essential elements which are imperative and significant part of human food such as Aluminium, Silicon, Carbon, Oxygen, Nitrogen, Magnesium, , Sulphur, Potassium, Calcium, Phosphorus, Chlorine and Cupper. The qualitative investigation for phytochemicals of these selected plant extracts in methanol showed that these plant species are also rich in important phytochemicals. The present research work showed that these selected plant species *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L. are rich in important and essential nutrients, important elements, and substantial phytochemicals.

Key words: Nutritional, elemental, phytochemical, Malakand, Pakistan.

Introduction

Mentha plant species are evergreen, fragrant and medicinally important and have worldwide appearance. About 80% of world population directly or indirectly depends on plants to accomplish their nutritional and healthcare necessities. In Pakistan approximately 60% of the individuals dwelling in villages and countryside regions are dependent on plants for their food and basic well-being and fitness systems (Latif *et al*., 2004; Mushtaq *et al*., 2009). Carbohydrates, Proteins, fats and fibers are required for various life activities. Human body needs these biomolecules on daily basis (Nisar *et al*., 2009).

Plants not only provide us useful biochemical but can also deliver us imperative dietary and elemental substances (Zafar *et al*., 2010). Nutrients and minerals are needed by the body for different biotic and bodily functions. These substances are also required for maintaining healthy body (Hendler and Sheldon, 1990). Research studies have shown that Plants are natural factories for making significant secondary metabolites or phytochemicals which are biologically active substances. These phytochemicals are the key ingredients of modern synthetic drugs and can lead to the synthesis of novel medicines (Uddin *et al*., 2012). These plants also possess therapeutic

properties and are used against certain diseases due to secondary metabolites or phytochemicals. These phytochemicals are used to protect human body against diseases (Kruger *et al.*, 1998; Alverez, 2004).

Materials and method

Study Area

District Malakand is situated in the province Khyber Pakhtunkhwa, Pakistan (Fig. 1). Malakand is a very scenic and lush green area bounded by mountains. The area is eye-catching and have adequate flora. The people living in this area are generally underprivileged and work as agriculturalists and for their survival and livelihood are dependent on agricultural produces (DAO Malakand, 2019).

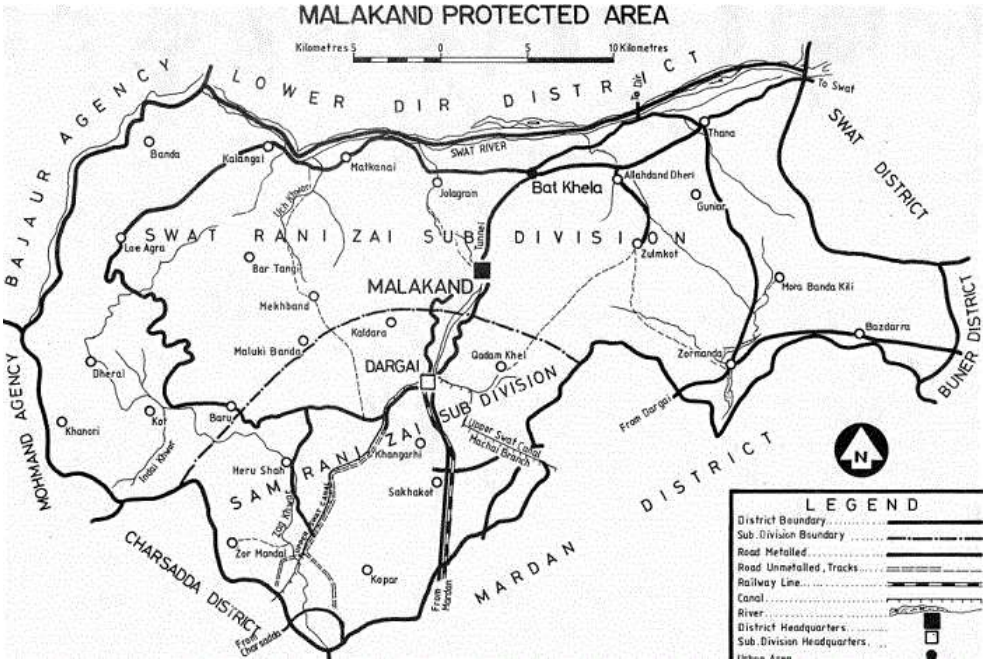

Figure 1. Map of District Malakand, Pakistan

Collection of Plant Materials

The plants species were gathered from the research area district Malakand, Pakistan and were identified with the help of flora of Pakistan (Ali and Qaiser, 1993-2015).

Preparation of Samples

The fresh *Mentha* leaves were collected from the study site and then dried at room temperature. The dried leaves of the plant samples were then powdered in a mixer. The powdered samples were then used in nutritional, elemental and phytochemical investigations (Meena *et al*., 2010; Street *et al*., 2008).

Figure 2. (a) *Mentha longifolia* (L.) Huds. (b) *Mentha longifolia* L

Nutritional Analysis

For nutritional investigation of moisture ash, fibers, proteins, fats, carbohydrates and energy value the official methods of Association of Official Analytical Chemists were used (AOAC, 2005). For determination of moisture and ash content percentage the weight difference method was used (Boussama *et al*., 1999; Das *et al*., 1997). Investigation of proteins were done through digestion, distillation and titration of the sample in micro Kjeldahl apparatus. The value of Nitrogen in the sample was multiplied by a factor 6.25 to determine Proteins in the sample. For determination of lipids in the sample the solvent extraction method was used. Pertoleum ether

was used as a solvent which have a boiling point 40-60 ºC. The amount of total carbohydrates was determined through difference method. All nutritional values were expressed in percentages (Hussain *et al*., 2010).

Elemental Investigation

Elemental investigation of powdered plant samples were carried out was through Energy Dispersive X- Rays Analysis (EDX) at University of Peshawar Pakistan in Central Resource Laboratory (CRL). About 1-2 grams sample was applied to a pellet coated with gold with the use of (JEOL) Vacuum Evaporator. The EDX machine manufactured by of Oxford Company UK (200 Model Inca) was connected to SEM Microscope (Goldstein, 2003).

Phytochemical Investigation

The phytochemical tests were performed to study various phytochemical constituents present in the methanolic extracts of selected *Mentha* plant samples. The phytochemical investigations were carried out by using the standard procedures of (Sofowora, 1993), (Kokate, 1999) and (Trease and Evans, 2002).

Results

Nutritional Investigation:

The current nutritional investigation of *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L. showed that in *Mentha longifolia* (L.) Huds. moisture content (MC) was (81.70±0.3%) whereas, Dry matter (DM) content was (18.30±0.3%), Ash (21.26±0.3%), Fibers (Fb) (9.27±0.04%), Crude Fats (CF%) (5.80±0.04%), Crude Proteins (CP) (7.83±0.03%) and the Carbohydrates (Cab) (55.84±0.4%). The energy value calculated in *Mentha longifolia* (L.) Huds. were 306.88±0.3 (Kcal/100g). Similarly, in *Mentha Spicata* L. moisture content was (80.92±0.05%) whereas, dry matter content was (19.08±0.1%), ash (21.52±0.2%), fibers (8.92±0.02%), crude fats (5.40±0.05%), crude proteins (7.75± 0.2%) and the carbohydrates (56.41±0.8 %). The energy value calculated in *Mentha Spicata* L. were 309.92±0.7 (Kcal/100g). The (Table 1 and Fig.3) shows the results of the present nutritional investigation.

Table 1. Nutritional Analysis of *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L.

Plant Name	MC (%)	DM (%)	Ash%	Fib (%)	CF (%)	CP (%)	Cab (%)	E.V (Kcal/100g)
Mentha longifolia(L.) Huds.	81.70±0.3	18.30±0.3	21.26±0.3	9.27±0.04	5.80±0.04	7.83±0.03	55.84±0.4	306.88±0.3
Mentha spicata L.	80.92±0.05	19.08±0.1	21.52±0.2	8.92±0.02	5.40±0.05	7.75± 0.2	56.41±0.8	309.92±0.7

Elemental Investigation

Elemental investigation through EDX of *Mentha longifolia* (L.) Huds. showed that Carbon is the most abundant element by weight % (60.01 %) followed by Oxygen (29.99%), Ca (3.71%), K (2.40%) Cl (0.86%), Si (0.83%), Fe (0.69%), Al (0.46%), Cu (0.45%), S (0.31%), Mg (0.24%) as shown in (Table 2. and Fig.4).

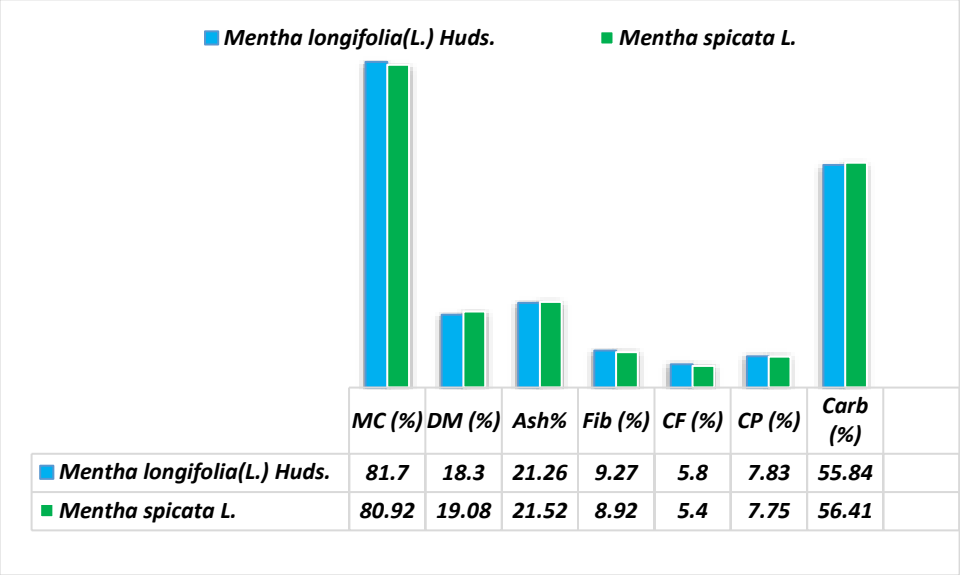

Figure 3. Nutritional Analysis of *Mentha longifolia* (L.) Huds. and *Mentha Spicata* L.

Table 2. Elemental investigation of *Mentha longifolia* (L.) Huds.

Element	Weight%	Atomic%
Carbon	60.01	65.11
Oxygen	29.99	31.01
Magnesium	0.25	0.11
Aluminium	0.46	0.30
Silicon	0.83	0.59
Sulphur	0.35	0.21
Chlorine	0.86	0.47
Potassium	2.40	0.61
Calcium	3.71	1.05
Iron	0.69	0.31
Cupper	0.45	0.23
Totals	100.00	100.00

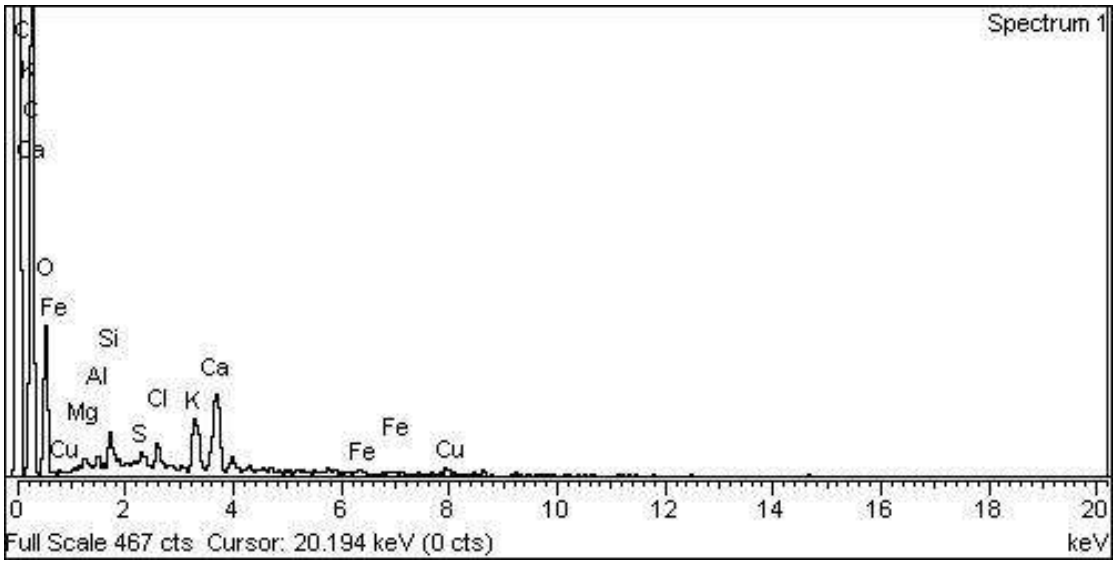

Figure 4. Elemental investigation of *Mentha longifolia* (L.) Huds.

The elemental analysis of *mentha spicata* L. through EDX showed that Carbon is the most abundant element by weight % (49.99%) followed by Oxygen (36.83%), N (7.41%), K (1.91%) Ca (1.05%), Cl (0.71%), Si (0.58%), Al (0.41%), S (0.39%), and P (0.21%) as shown in (Table 3. and Fig.4).

Table 3. Elemental investigation of *Mentha spicata* L.

Element	Weight%	Atomic%
Carbon	49.99	59.11
Nitrogen	7.41	6.42
Oxygen	36.83	29.39
Magnesium	0.51	0.51
Aluminium	0.41	0.30

Silicon	0.58	0.59
Phosphorus	0.21	0.31
Sulphur	0.39	0.71
Chlorine	0.71	0.80
Potassium	1.91	0.95
Calcium	1.05	0.91
Totals	100.00	100.00

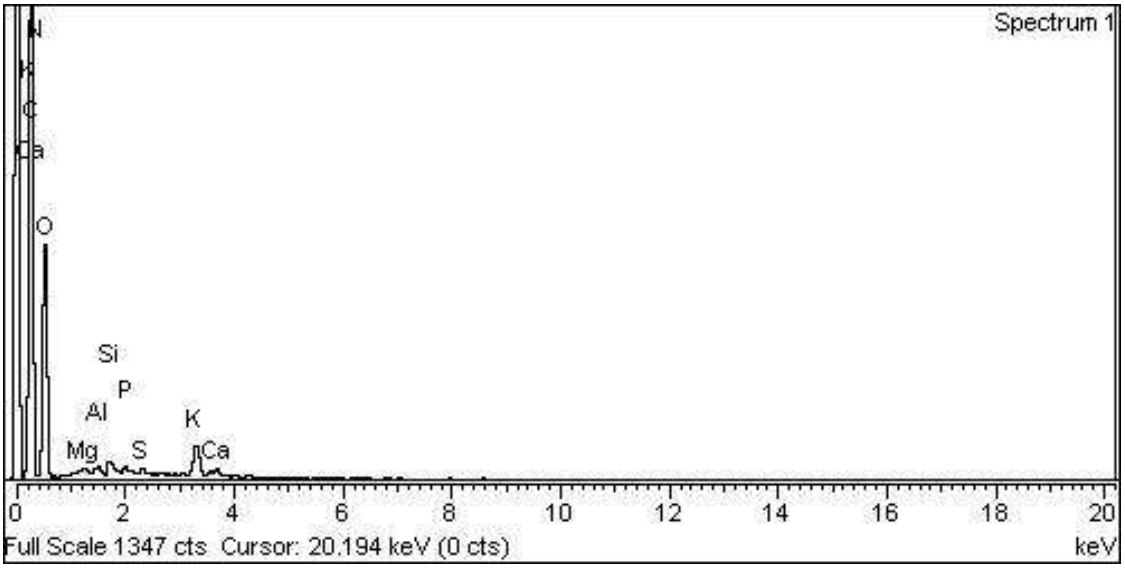

Figure 5. Elemental investigation of *Mentha spicata* L.

Phytochemical Investigation

The qualitative phytochemical constituents of *Mentha longifolia* **(**L.) Huds. methanolic extracts revealed that it contains important phytochemical constituents as shown in (Table 4). These phytochemicals possess significant and important therapeutic properties. The presence of these phytochemicals and menthol oil make it important medicinal and aromatic plants.

Table 4. Phytochemical constituents of Methanolic extracts of *Mentha longifolia* (L.) Huds. and *Mentha spicata* L.

Samples of plant	Alkaloids	Flavonoids	Glycosides	Phenols	Saponins	Tannins	Steroids
Mentha longifolia **(**L.) Huds.	+ +	+ +	+ +	+ +	+ +	+ +	_ _
Mentha spicata L.	+ +	+ +	+ +	+ +	_ _	+ +	+ +

Key: **(++)** = Presence, (_ _) Absence

Discussion

Plants play an important and substantial part in the food and well-being of people and populaces (Thakur and Rays, 2014). Nutritional and dietary substances are not only good for health of people but are also essential to protect them from various ailments (Nisar *et al*., 2009; Hussain *et al*., 2010). The results of the current nutritional analysis of *Mentha longifolia* (L.) Huds. and *Mentha spicata* L. are adjacent and near to the results of (Waris *et al*., 2018 ; Saqib *et al*., 2022). The results of the current elemental analysis of *Mentha longifolia* (L.) Huds. and *Mentha spicata* L. showed that the elements such as Carbon, Nitrogen, OXygen, Magnesium, Potassium, Phosphorus, Sulphur, Calcium, Aluminium, Silicon, Iron, Chlorine, and Sodium are presnt in these plant samples. The elemental investigation of these *Mentha* plants are close with the previous studies of (Arika *et al*., 2016; Gogoasa *et al*., 2013) who had described the same elements in these *Mentha* species. The present phytochemical investigation in these *Mentha* Plants revealed that similar phytochemicals have also been reported from the same *mentha* plants by (Khudhair, 2016) and Mohammed *et al*., (2017).

Conclusion

The *Mentha* species such as *Mentha longifolia* (L.) Huds. and Mentha spicata L. have long being used as a flavouring agent and in folk medicines . Important nutritional, elemental, phytochemical and antimicrobial substances are present in these species have been extracted from *Mentha* species which have different biological activities. The present nutritional, elemental and phytochemical investigations of *Mentha* plant species revealed important and tremendous results. These investigations may be used as a strong line base for future investigations about these plant species.

References

Ahmad, N., M.K. Amir, S. Ayaz, Ahmad, A .Jan. (2012). Antimicrobial profile of the selected medicinal plants. *International Journal of Chemical and Lifesciences* 01, 1039-1041.

Ali, S.I. and M. Qaiser. (Eds.). (1993-2015). Flora of Pakistan, Karachi.

Alverez, K.V. (2002). Chemical composition of different vegetables. *Plant Foods for Hum. Nutri*, 52: 235-253.

AOAC. (2005). Official Method of Analysis. 18th Ed. Association of Official Analytical Chemists International, Maryland, USA.

Arika, W. M., P. E. Ogola, D. W. Nyamai, A. M. Mawia and F. K. Wambua. (2016). "Mineral elements content of selected Kenyan antidiabetic medicinal plants," *Advanced Techniques in Biology and Medicine*, vol. 4, p. 160.

Gogoasa, I., J. Violeta, A. L. Maria. (2013). "Mineral content of some medicinal herbs," *Journal of Horticulture, Forestry and Biotechnology*, vol. 17, no. 4, pp. 65–67.

Boussama, N., O. Ouariti, A. Suzuki, and M. H. Ghorbal. (1999). Cd stress on Nitrogen assimilation. J. Plant Physiol., 155: 310317.

Das, P., S. Samantaray and G. R. Rout. (1997). Studies on Cadmium toxicity in plants: A Review, Environ, *Pollut*. 98: 29-36.

Goldstein, J. (2003). Scanning Electron Microscopy and X-Ray Microanalysis. Springer. ISBN 978-0-306-47292-3.

Hendler, E. and S. Sheldon. (1990). *The Doctors' Vitamin and Mineral Encyclopedia.* New York, NY: Simon & Schuster, pp. 112-207.

Hussain, J., N.U. Rehman, A.L. Khan, M. Hamayun, S.M. Hussain and Z.K. Shinwari. (2010), Proximate and nutrients evaluation of selected vegetables species from Kohat Region Pakistan. *Pakistan Journal of Botany*, 42(4): 2847-2855.

Irshad, S., M. Mahmood and F. Parveen. **(**2012). In vitro antibacterial activities of three medicinal plants using agar well diffusion method. *Research Journal of Biology* **2,** 1-8.

Khudhair, A.M.A. (2016). Primary Phytochemical Identification and Some Biochemical parameters study of Ethanolic Extract of *Mentha spicata* Leaves in Mice. *J. Chem. Pharm. Res*., 8(7): 818-822.

Kruger, M., N. Sayed, M. Langenhoven and F. Holing. (1998). Composition of South African foods: Vegetables and fruit. Research Institute for Nutritional Diseases, South African Medical Research Council, South Africa, pp. 2-39.

Latif, A., H. Ahmad., S. Begum., M. Adnan., S. Hussain. and M. Waseem (2004). Medicinal and other economic plants as substitute to forest logging in Miandam and Sulatanr valleys, Swat. Proceeding of International workshop on Conservation and Sustainable Use of Medicinal and Aromatic Plants in Pakistan, WWF-Pak., 101-105.

Meena, A. K., P. Bansal, S. Kumar, M.M. Rao, and V. K. Garg. (2010). Estimation of heavy metals in commonly used medicinal plants: A market basket survey. Environmental Monitoring and Assessment, 170, 657-660.

Mohammed, L.M., T.F.M. Salih and K.O. Qader. (2017). Chemical composition and antifungal activity of *Mentha spicata* L. Plant from Sulimaniah in Iraq. *Kurdistan Journal of Applied Research,* Vol.2 (1).

Mushtaq, A., Q. Rahmatullah, A. Muhammad, A.K. Mir and Z. Muhammad. (2009). Traditional herbal remedies used for the treatment of diabetes from district Attock (Pakistan) *Pak. J. Bot*.,
41(6): 2777-2782.

Nisar, M. S.A. Tariq and I. Ullah. (2009). Nutritinal levels of Indigofera gerdiana wall, and *Crataegus songrica K. Koch. Pak. J. Bot*., 41(3): 1359-1361.

Nisar, M., S.A. Tariq, and I. Ullah. (2009). Nutritional levels of *Indigofera gerdiana* wall and *Crataegus songrica* K. Koch, *Pakistan Journal of Botany*, 41(3): 1359-1361.

Office of the District Agriculture Officer Malakand, at Batkhela, (2019).

Saqib, S., F. Ullah, M. Naeem, M. Younas, A. Ayaz, S. Ali, W. Zaman. (2022). *Mentha*: Nutritional and Health Attributes to Treat Various Ailments Including Cardiovascular Diseases. *Molecules*. 27, 6728.

Sofowora, A. (1993). Medicinal Plants and Medicine in Africa. *John Willey Spectrum, Ibadan-Nigeria*. 2: 81-85.Street, R.A., M.G. Kulkarni, W.A. Stirk, C. Southway and V.J. Staden. (2008).

Variation in heavy metals and microelements in South African medicinal plants obtained from street markets. *Food Addit Contam* 25: 953- 960.

Uddin, G., A. Rauf, M. Arfan, M. Ali, M. Qaisar, M .Saadiq and M .Atif. (2012). Preliminary phytochemical Screening and antioxidant activity of Bergenia Ciliata. Middle-East J. Sci. Res., 11, (8): 1140-1142.

Waris, Z., Y. Iqbal, A.Hussain, Shafqatullah, A.A.Khan, A. Ali and M.W .Khan. (2018). Proximate composition, phytochemical analysis and Antioxidant capacity of *Aloe vera*, *Cannabis sativa*, and *Mentha longifolia*. *Pure and applied Biology*. Vol.7, (3), pp 1122-1130.

Zafar, M., M.A. Khan, M .Ahmad, G. Jan, S. Sultana, K .Ullah, S.K. Marwat, F. Ahmad, A. Jabeen, A. Nazir, A.M Abbasi and Z.R. Ullah. (2010). Elemental analysis of some medicinal plants used in traditional medicine by atomic absorption spectrophotometer (AAS). J. Med. Plants Res., 4(19): 1987-1990.