ASSESSMENT OF MEDICINAL FLOWERS WITH SPECIAL EMPHASIS ON ELEMENTAL AND NUTRITIONAL ANALYSIS

Saqib Ullah[1], Ghulam Dastagir[2], Asad Ullah[3*], Fajr Daud[1], Ayaz Ahmad[4], Mehik Naz[5], Laila Noor[6], Aamad Khan[1]

[1]Department of Botany, Islamia College Peshawar, Khyber Pakhtunkhwa, Pakistan
[2]Department of Botany, University of Peshawar, Khyber Pakhtunkhwa, Pakistan
[3*]Centre of Plant Biodiversity, University of Peshawar, Khyber Pakhtunkhwa, Pakistan
[4]Department of Biological Sciences, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan
[5]Department of Chemistry, Islamia College Peshawar, Khyber Pakhtunkhwa, Pakistan
[6]Department of Botany, Pir Mehar Ali Shah Arid Agriculture University Rawalpindi, Punjab, Pakistan

Abstract-In Local markets of Khyber Pakhtunkhwa, Pakistan dried medicinal flowers are available for different purposes. Local communities consume flowers for medicinal purposes. In order to confirm the authentication and standardization of these flowers are more important for consumption. For this purpose, the present study focused on the phytochemical, extractive values, nutritional, and elemental analysis of *Althea officinalis, Hyssopus officinalis, Nymphaea alba* and *Sphaeranthus indicus* flowers. The experimentation of elemental analysis (EA) through atomic absorption spectrophotometry, extractive values (EV) via percentage, and nutritional analysis (PA) by AOAC and phytochemical screening were carried out according to different protocols. Qualitative Phytochemical screening exhibited the existence of proteins, reducing sugars, saponins, hydrolyzable phytosterols, steroidal glycosides, phenols, triterpenoids, and terpenes, flavonoids, and fixed oils, while tannins were absent in all the flowers. The percent extractive value revealed that the highest extractive value was that of *S. indicus* (50.39±0.80%) in methanol. Elemental analysis of the flowers detected various nutrient elements (macro and micro) viz., sodium (7.421mg/L), magnesium (27.170 mg/L), potassium (12.840 mg/L), calcium (129.30 mg/L), iron (15.53 mg/L), copper (0.025 mg/L) zinc (0.543 mg/L), cobalt (0.035 mg/L), lead (0.725 mg/L), and cadmium (0.025 mg/L). The results of the nutritional analysis of the flowers revealed the presence of significant moisture contents (4.17±0.62%), ash contents (32.33±1.93%), proteins (14.11±0.81%), carbohydrates (34.25±0.94%), fats (6.70±0.42%), and fibers (22.00±1.22%). Gross energy was reported higher (308.25±5.06 Kcal/100g) by *A. officinalis.* Current study has revealed that all flowers have significant Phyto-constituents macro and micro elements within acceptable ranges, extractive values, and nutritional values that make the flowers suitable for medicinal consumption without toxic potential.

Index Terms- Medicinal flowers, phytochemical Screening, elemental analysis, extractive values, nutritional analysis

I. INTRODUCTION

Medicinal plants have a solid contribution to the world health care systems, such as herbal medicines, having also had an outstanding contribution to a large proportion of society in terms of health sciences (Anand et al., 2019; Ozioma and Chinwe, 2019; Pan et al., 2013). Herbal drugs keep unique qualities, which is why they can be used diversely, such as nutritional sources, nutraceuticals, food flavoring, taste and flavoring agents, and significant ingredients for cosmetics and fragrance products (Rani et al., 2022 and Zayed et al., 2022). The usage of plant parts, either root, shoot, flower, or leaves, has increased because of their importance. However, unfortunately, the technology for strengthening their botanical identity is still uncertain (Indrayanto, 2022 and Mali, 2019). Phytochemistry is an essential foundation for validating numerous therapeutic industries, identifying crude drugs, and a positive anthropological action (Mukherjee et al., 2015). The appropriate selection of the solvent for extraction facilitates the achievement of the desired bioactive compounds from a plant's solvent of related polarity will appropriately dissolve the solute (Favela et al., 2020 and Molino et al., 2020). Numerous solvents can be used successively to bind the number of equivalent combinations in the desired yield. Examples of solvents with diverse polarities are hexane, chloroform, ethyl acetate, acetone, methanol, and water (Hamdi et al., 2020). Nutrients are those intakes that can be ingested, digested, and absorbed; after proper mechanism, it becomes the part of the cell to regulate and sustain different cellular activities in the body, such as minerals. Minerals have some use and importance, but some are crucial for cellular activities (metabolism) (Dubey et al., 2020 and Tardy et al., 2020). Although minerals encompass only a tiny

proportion of total body mass, they are responsible for some essential functions, carrying oxygen, regulating the nervous system, and promoting expansion, maintenance, and renovation of tissues (Haftek et al., 2022). The role of nutrients and biochemicals, including fats and proteins, can never be neglected; in the same way, it also fulfills the energy requirements needed for life processes (Goff, 2018 and Majesty et al., 2019). Seasoning powder products contained enough amounts of Fe, cobalamin, and I, which positively affected human health. Seasoning powder had low water content and might show the product's stability during storage (Oo et al., 2019). Nutritional and nutrient analysis of nonpoisonous fruit and vegetables plays a vital role in calculating their nutritional impact. Different medicinal plants can be the source of our daily food and nutrients. They can be part of our medicinal industries also (Mostafidi et al., 2020). Noticing and evaluating their nutritional and medicinal importance and contribution can help to appreciate the significance of these worthy plant species. Many plant species are highly valuable containing dietary importance, and other therapeutic advantages used as food supplement (Dridi, 2019). Several researchers (Bowman et al., 2012; Deb et al., 2016; Hussain et al., 2021; Pande et al., 2017; Sium et al., 2016 and Tomsone et al., 2012) reported the powder drug study, extractive values, elemental and Nutritional analysis of wild medicinal flowers.

The research study consists of four medicinal flowers belonging to four distinct families that are *Althea officinalis* L. (Malvaceae), *Hyssopus officinalis* L. (Lamiaceae), *Nymphaea alba* L. (Nymphaeaceae), and *Sphaeranthus indicus* L. (Asteraceae), (locally used for treatments of different diseases) in a scientific way other experimental techniques were used to evaluate the standardization of these concerning flowers.

II. MATERIAL AND METHODS

Plant collection and preservation

The dried flowers of *Althea officinalis, Hyssopus officinalis, Nymphaea alba,* and *Sphaeranthus indicus* were purchased from Pansaari stores in the Local market of Qissa Khwani Bazar, Peshawar were and identified with the help of available authentic literature *i.e.*, (Abedin, 1979; Hedge, 1990; Qaiser, 1979 and Shi et al., 2011). The dried flowers were ground with the help of a sharp electrical grinder to get pure powder. Air and watertight containers were used to store the powder of each sample separately to maintain quality and accuracy. The powder was used for different research purposes, including powder drug study, extractive value, and Nutritional and elemental analysis conducted to contribute to the field of research.

Phytochemical screening

During the qualitative phytochemical screening, the ethanolic extracts of flower petals were analysed to seek for a wide range of components. Flavonoids, fixed oils, tannins, hydrolyzable tannins, steroidal glycosides, proteins, carbohydrates, phenols, phytosterols, and triterpenoids, saponins, and terpenes were some of the elements that were present in these plants.

Detection of Saponins

After that, we gave the test tube a thorough shake after adding 2 milliliters of distilled water to the 1 milliliter of stock solution already present in the tube. The formation of a foam that was about one centimeter in height provided evidence that saponins were present (Iqbal et al., 2015).

Detection of flavonoids

A solution containing 2% sodium hydroxide was added to the plant extract that had a volume of 2 milliliters. The hue of the solution shifted from white to yellow when the next step, which was the addition of two drops of acid that had been weakened, was carried out. When the solution, which had been yellow before, became colorless, flavonoids were found to be present. This pointed to the fact that they did in fact exist (Iqbal et al., 2015).

Detection of Fixed oils

The plant extract was pressed between two filter papers. Fixed oils were present in the section if the oil stain existed on the filter paper (Iqbal et al., 2015).

Detection of phytosterols and triterpenoids

A few drops of strong sulphuric acid were added to the crude extract after it had been treated with chloroform. Indicating the presence of phytosterols, a crimson tint settled to the bottom of the solution when the combination was vigorously agitated. The presence of triterpenoids was indicated by the yellow hue (Maria et al., 2018).

Detection of phenols

The stock solution was a supplement to 2% (2ml) $FeCl_3$ solution, and the existence of phenols was specified by the appearance of a bluish-black or green color (Wani et al., 2019).

Detection of proteins

An orange color formed from heating the yellow color solution, then a few drops of concentrated HNO_3 were added to (2 ml) of stock solution (Oancea et al., 2013).

Detection of tannins

The indication of brownish-green or blue-black colors occurred when added filter solution (0.5g extract boiled in 10ml water) was with a few drops of $FeCl_3$ (0.1%) (Ayoola et al., 2008).

Detection of glycosides

The presence of a brownish ring confirmed the detection of cardiac glycosides at the interphase, when (2ml) of CH_3COOH (glacial acetic acid) was mixed with a stock solution, added to (2%) ferric chloride, and shifted to (2ml) H_2SO_4 in a glass test tube (Yadav and Agarwala, 2011).

Detection of carbohydrates

The detection of a brick red color assured the presence of carbohydrates when 4-6 drops of Benedict's reagent were mixed with a stock solution of flowers in glass test tubes (Khattak et al., 2014).

Extractive values

Methanol, ethanol, chloroform, diethyl ether, hexane, petroleum ether, and distilled water were among the many solvents used during the maceration process of powdered plant material. Two grams of floral powder were placed in dry conical flasks (250 ml). Then, 30 ml of each solvent was put to the appropriate conical flasks, and the vessels were sealed with aluminum foil. The technique included a lot of shaking and room temperature storage for the mixture. Once 24 hours had passed, the liquid was filtered via paper. The filtrate was then spread out on weighted Petri plates after being collected. The extracts had to be put in storage so they could evaporate at room temperature until they were gone (Ranjith, 2018a). The dried extracts were weighted by using a formula.

$$\text{Extractive value (\%)} = \frac{\text{Weight of dried extract}}{\text{Weight of plant material}} \text{ x } 100$$

Elemental analysis

The elemental analysis of flowers of *Althea officinalis, Hyssopus officinalis, Nymphaea alba,* and *Sphaeranthus indicus* was carried out following the method (Blair et al., 2019). The apparatus involves nitric acid, perchloric acid, 250 ml flasks, electric balance, and hot plates. In the procedure, 0.5 g of each plant flower powder was firstly dissolved in nitric acid (10 ml) and will reserve overnight. Four (4) ml perchloric acid was poured into the solution in flasks the next day and heated on a hot plate till white fumes appeared. Samples were cooled down, and 100 ml of distilled water was added. After filtration, the elements Ca, K, Mg, Na (Macro-elements), Fe, Cd, Zn, Cr, Cu and Pb (Micro-elements) was formed by atomic absorption spectrophotometer (AAS).

Nutritional Analysis

Determination of ash

After proper wash, Flat bottomed silica crucible was maintained for 30 min in a microwave oven at 700c for drying. Crucible was flame burned and tarred, cool in desiccators, and weighed up (W1), and 2 grams of each plant sample (parts) were shifted to it equally. The filled crucible was warmed gradually on a Bunsen burner and then transferred to the stifle incinerator (furnace) and heated for several hours under a temperature of 600 ^{0}C till the evaporation of carbon content and waited until it turned to form white. The samples were moved to Desiccators, cooled, and weighted (W2). According to Liu (2019) AOAC 2000 calculation of ash percentage and ash values (absolute) are as follows.

Wt. of blank China Dish = W1

Wt. of China Dish with ash = W2

Total ash (mg/g) = W2 – W1 of the sample= mg/g

$$\text{\% Ash} = \frac{\text{W2}-\text{W1}}{\text{Weight of plant material}} \text{ x } 100$$

Determination of the moisture contents

Plant samples (2grams) were weighted separately in clean Petri dish (W1). The selected Petri dish was placed in an oven at 105 ^{o}C for 4-6 hours; Petri dishes were moderately covered with a lid and placed till to get the constant weight. The sample was then shifted to desiccators for 30 min to cool down the temperature gradually to maintain the quality of the sample; a sudden decrease in temperature may result in the loss of properties. After this, the Petri dash weighed again (W2) (Wang et al., 2021).

The calculation of moisture percentage was determined according to AOAC 2000.

$$\text{Moisture content (\%)} = \frac{\text{X}}{\text{weight of sample}} \text{ x } 100$$

Where

X = Weight of the sample (after heating) = W2 - W1

W2 = weight of the empty Petri dish + sample (after heating)

W1 = weight of the empty Petri dish

Determination of proteins by "m*icro Kjeldahl* distillation method"

An indigestion flask dried sample was taken weighing 0.5 g. the digestion flask was filled with a digestion mixture of distinct ratios (copper sulphate ratio 6 and potassium sulphate in the ratio 94, separately), and 15ml of H_2SO_4 was added to the flask. It was placed on the heated hot plate for 1 hour and 15 min. after cooling down, the flask filled with content was then shifted to 250 ml. A little distal water was mixed with increasing the capacity level (50 ml) of the above solution. To make the solution alkaline, 10 ml of solid alkali was added. Nutritionally, 50 ml of percent H_3BO_3 solution (4%) was moved to the purification flask along with 60 ml of NaOH (40%), and water (50 ml) of the solution was also inserted into the solution. It was accumulated in a flask for titration after distillation (Das et al., 2018 and Zinicovscaia et al., 2020).

Titration was performed by using 0.1 N HCl in the burette and the flask's contents. The process was observed, and the protein (%) result was concluded using the following formula AOAC 2000. Macro Kjeldahl Method was used for the percentage of Nitrogen multiplied by 6.25 to determine proteins.

$$\text{Percentage Nitrogen} = \frac{(\text{Sample reading} - \text{Blank reading}) \times 14.01 \times 0.5 \times 100}{(\text{Sample in Mg})}$$

V1= Titration reading of sample

V2= Titration reading of blank

14.01= Atomic weight of nitrogen (N)

Protein (%) = % Nitrogen x 6.25

Determination of fat

Soxhlet device extracted crude fat (Bibi and Din, 2020). Two grams of the material were placed in a screen-paper cellulose abstraction protector in the extraction slot. A dry 250 ml round base flask was filled with petroleum ether and connected to the extraction duct and protection. The soxhlet gadget ran for 5-6 hours.

After adding the extract to the flask, the solvent was heated and reweighed (W2). After the round-bottom flask portion, the solvent was evaporated and weighed (W2). Formula for fats (%) of AOAC 2000.

$$\% \text{ fats (ether extract)} = \frac{X}{\text{weight of sample}} \times 100$$

Where

X = Weight of the fats = W2 - W1

W1 = weight of the empty flask

W2 = weight of the empty flask + sample after evaporation of the solvent

Determination of crude fiber

Each sample was weighed using 2 grams from the oven. A comparable quantity (2g) was produced by removing crude lipids with petroleum ether. Filtrate and 0.5 g asbestos were added to the digestion flask. The filtrate was boiled with 200 cc 0.255 N H2SO4 (filtrate materials with a combination of 0.5 g asbestos). The condenser heated the container for 30 minutes. Fluted funnel contents were filtered via linen fabric. The residue was washed, cleaned to remove acids, and added to a boiling 0.313 N NaOH absorption flask. Continuous NaOH was added to obtain 200 ml. The container was heated (30 minutes) on the reflux condenser to boil. Hot materials are fed through a Gooch crucible with an asbestos carpet after boiling. It was cleaned with 15 cc of ethyl alcohol and hot water. The subjects were maintained in a crucible at 110 ^{0}C until constant (W1). The crucible was then burnt white in a muffle furnace and weighed (W2) (Li et al., 2018). The quantity of raw materials calculated (AOAC, 2000). The acidity was rinsed out of the residue to preserve its quality. After transferring the residue to the digestion flask containing boiling 0.313 N NaOH, further analysis may begin. A precise volume was achieved by gradually adding NaOH (200 ml). As the flask bubbled away in a condenser (for 30 minutes). After 30 minutes, the material warmed, and it was filtered using the designated method for hot materials (Gooch crucible equipped with asbestos mat). For cleaning, I used water from the kettle mixed with 15 cc of ethyl alcohol. Everything was transferred to the crucible and baked in a heated air oven (at 110 ^{0}C) until a steady weight was achieved (W1). After being weighed, the crucible was put into the muffle furnace, where it was heated until it became white (W2). Crude fibers were then estimated (AOAC, 2000).

$$\% \text{ Crude fibers} = \frac{X}{\text{weight of sample}} \times 100$$

Where X = W_2-W_1; W_2 – W_1 = Crude fiber

Determination of carbohydrates contents and gross energy

Carbohydrate contents were estimated by subtracting the total weights of proteins, fats, crude fibers, ash, and moisture contents from 100 (Lee et al., 2018)**.**

100 – (Protein+fats+ crude fiber+ ash+ moisture contents) = % Carbohydrates

The formula used for gross energy is as follows: GE (Kcal/g) = 5.72 x (protein) + 9.5 (fat) + 4.79 (fibre) + 4.03 (carbohydrate) = Gross Energ values (Lee *et al.*, 2018).

RESULTS AND DISCUSSION

PHYTOCHEMICAL SCREENING

The qualitative phytochemical screening of *A. officinalis, H. officinalis, N.* alba, *and S. indicus* flowers exhibited the existence of terpenes, proteins, and carbohydrates in all flowers (Table 1). Saponins and phytosterols were present in *A. officinalis, H. officinale*, and *N. alba*. Hydrolyzable tannins and triterpenoids were only present in *S. indicus,* while phenols were detected in *N. alba*. Steroidal glycosides were present in *A. officinalis* and *H. officinale. At the same time,* fixed oil was present in *N. alba* and *S. indicus.* Flavonoids were present in *A. officinalis, H. officinale*, and *S. indicus,* while tannins were negligent in all the flowers (Table 1, Fig. 1).

Table 1: Phytochemical screening of some selected medicinal flowers.

S. No.	Tests	*A. officinalis*	*H. officinalis*	*N. alba*	*S. indicus*
1	Fixed oil	-	-	+	+
2	Flavonoids	+	+	-	+
3	Phenol	-	-	+	-
4	Proteins	+	+	+	+
5	Reducing sugar	+	+	+	+
6	Steroidal	+	+	-	-
7	Saponins	+	+	+	-
	Tannins	-	-	-	-
8	Hydrolyzable	-	-	-	+
9	Terpenes	+	+	+	+
10	Triterpenoid	-	-	-	+
	Phytosterols	+	+	+	-

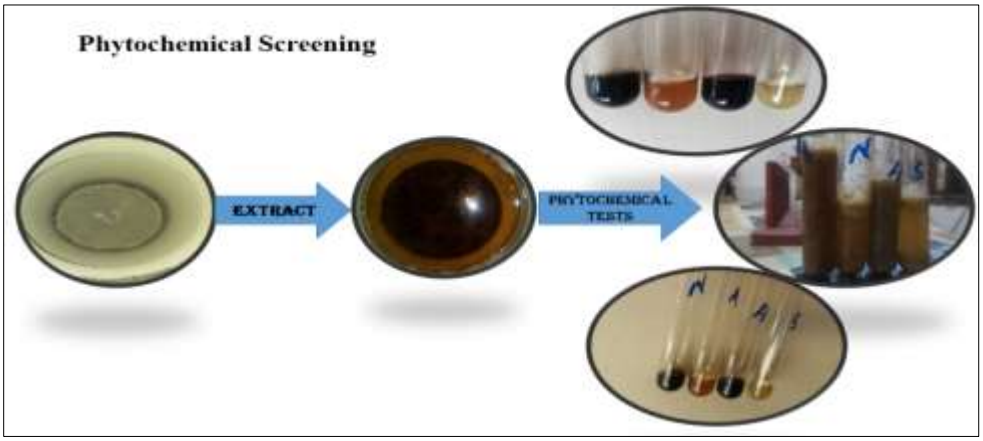

Fig. 1: Showing different phytochemical test of medicinal flowers.

Extractive values

The extractive values of *Althea officinalis*, *Hyssopus officinalis*, *Nymphaea alba*, and *Sphaeranthus indicus* were determined by various solvents including chloroform, distilled water, diethyl ether, ethanol, methanol, n-hexane, and petroleum ether. *A. officinalis* had the highest extractive value (07.00±0.82%) in distilled water, while the lowest (01.17±0.24%) was in petroleum ether. *H. officinalis* had the highest extractive value (38.17±0.62%) in distilled water, while the lowest (02.03±0.05%) was n-hexane. *N. alba* had *the* highest extractive value (22.12±0.83%) in methanol while the lowest (01.44±0.06%) in n-hexane. *S. indicus* has the highest extractive value (50.39±0.80%) in methanol, while the lowest (01.66±0.17%) is n-hexane. Comparatively, the highest extractive value for *S. indicus* (50.39±0.80 %), *N. alba* (22.12±0.83%) in methanol, *H. officinalis* (38.17±0.62%), and *A. officinalis* (07.00±0.82%) in distilled water, while the lowest extractive value *A. officinalis* (01.17±0.24%), *H. officinalis* (02.03±0.05%), *N. alba* (01.44±0.06%) and *S. indicus* (01.66±0.17%), respectively at n-hexane (Table 2, & Fig. 2).

Table 2. Mean±SD of Extractive values of some selected medicinal flowers.

Solvents	Dry weight of material (g)	Extractive values %			
		A. officinalis	***H. officinalis***	***N. alba***	***S. indicus***
Distilled water	2	07.00±0.82	38.17±0.62	03.90±0.28	17.37±0.82
Ethanol	2	02.50±0.41	06.33±0.47	16.27±0.95	13.33±1.25
Methanol	2	03.77±0.25	06.22±1.01	22.12±0.83	50.39±0.80
n-hexane	2	01.30±0.50	02.03±0.05	01.44±0.06	01.66±0.17
Petroleum ether	2	01.17±0.24	02.43±0.05	02.03±0.05	05.07±0.33
Chloroform	2	04.50±0.41	04.94±0.34	18.00±0.82	36.17±0.62
Diethyl ether	2	04.00±0.24	12.07±0.90	02.09±0.15	15.87±0.66
Solvents	**Dry weight of material (g)**	**Colors of extract**			
Distilled water	2	Dark yellow	Dark brown	Brown	Light brown
Ethanol	2	Dark yellow	Greenish brown	Green brown	Light brown
Methanol	2	Brownish-yellow	Greenish brown	Brown	Clay Brown
n-hexane	2	Light yellow	Light green	Light yellow	Yellow
Petroleum ether	2	Yellowish	Greenish	Color-less	Light brown
Chloroform	2	Light yellow	Greenish	Yellow	Light Yellow
Diethyl ether	2	Colorless	Greenish	Green yellow	Greenish

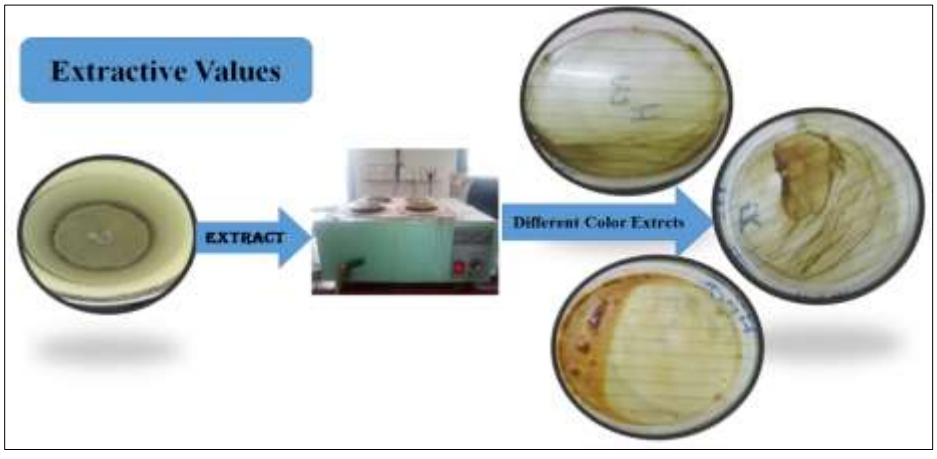

Fig. 2. Extractive values of selected medicinal flowers.

3.3 Elemental analysis

The elemental analysis of medicinal flowers (*A. officinalis*, *H. officinalis*, *N. alba*, and *S. indicus*) was analyzed through Atomic Absorption Spectrometry. The results (Table 3 and Fig. 1) showed that macro elements of *A. officinalis* include Mg (27.170 mg/L), Ca (73.610 mg/L), Na (4.669 mg/L), and K (12.830 mg/L). The reported microelements were comprised by Cu (0.056 mg/L), Zn (0.517 mg/L), Fe (6.237 mg/L), Pb (0.953 mg/L), Co (0.028 mg/L) and Cd (0.025 mg/L). The *H. officinalis* including Mg (10.360 mg/L), Ca (129.300 mg/L), Na (3.800 mg/L) and K (12.830 mg/L). The reported microelements were comprised by Cu (0.079 mg/L), Zn (0.543 mg/L), Fe (15.553 mg/L), Pb (0.670 mg/L), Co (0.035 mg/L) and Cd (0.010 mg/L). The *N. alba* including Mg (09.887 mg/L), Ca (04.010 mg/L), Na (07.421 mg/L) and K (12.840 mg/L). The reported microelements were comprised by Cu (0.065 mg/L), Zn (0.487 mg/L), Fe (04.339 mg/L), Pb (0.725 mg/L), and Cd (0.025 mg/L) while Co was not reported. The *S. indicus* including Mg (09.887 mg/L), Ca (04.010 mg/L), Na (03.421 mg/L) and K (12.830 mg/L). The reported microelements were comprised by Cu (0.026 mg/L), Zn (0.514 mg/L), Fe (01.259 mg/L), Pb (0.623 mg/L), and Cd (0.011 mg/L) while Co was not reported (Table 3 and Fig. 3a & 3b).

Table 3. Elemental analysis of some selected medicinal flowers.

Flowers	Macro-elements (mg/L)				Micro-elements (mg/L)					
	Mg	Ca	Na	K	Cu	Zn	Fe	Pb	Co	Cd
A. officinalis	27.170	73.610	4.669	12.830	0.056	0.517	6.237	0.653	0.028	0.025
H. officinalis	10.360	129.300	3.800	12.830	0.079	0.543	15.530	0.670	0.035	0.010
N. alba	9.887	4.010	7.421	12.840	0.065	0.487	4.339	0.725	0.000	0.025
S. indicus	10.940	13.260	3.939	12.830	0.026	0.514	1.259	0.623	0.000	0.011

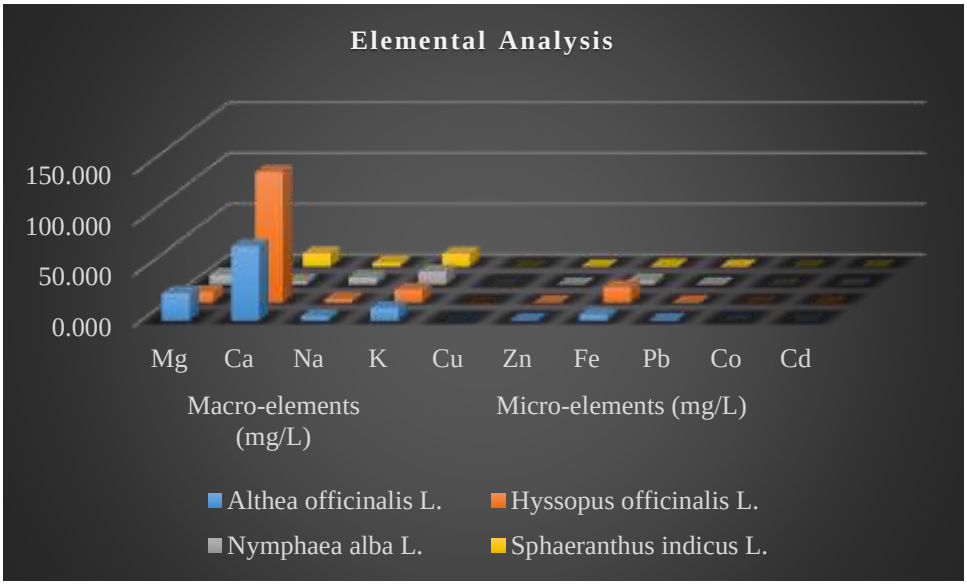

Fig. 3a. Showing elemental values (mg/L) of some selected medicinal flowers.

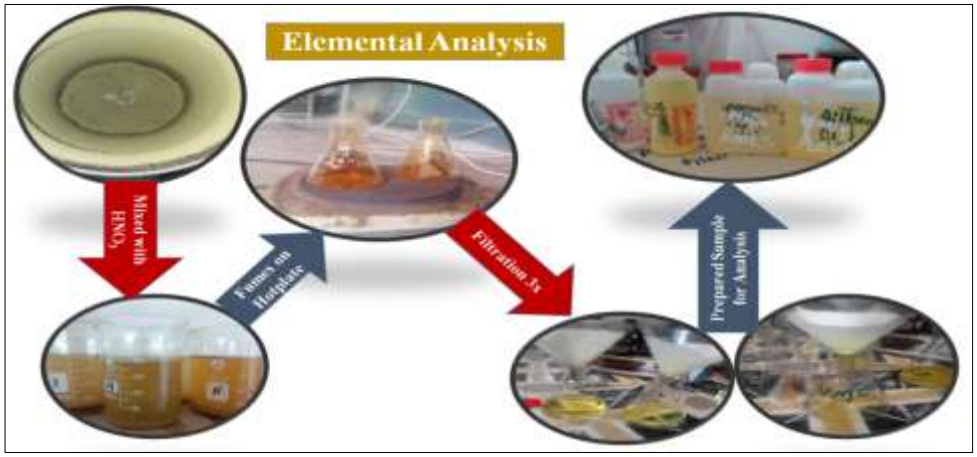

Fig. 3b. Showing elemental analysis of some selected medicinal flowers.

Nutritional Analysis

The results in mean±sdv of Nutritional Analysis of *A. officinalis, H. officinalis, N. alba,* and *S. indicus* were analyzed. The *N. alba* showed maximum (5.50±0.41%) moisture content, followed by *A. officinalis* (5.00±0.82%) and *H. officinalis* (4.83±0.85%), respectively, while the lowest moisture contents reported by *S. indicus* (4.17±0.62%). The ash contents were described as maximum (42.83±0.85%) by *S. indicus,* followed by *N. alba* (40.33±1.25%) and *H. officinalis* (40.33±1.25%), respectively, while the lowest (32.33±1.93%) percent ash content reported by *A. officinalis.* The percent Fat Contents reported maximum (6.70±0.42%) by *S. indicus,* followed by *N. alba* (5.87±0.26%) and *H. officinalis* (4.11±0.09%), respectively, while the lowest (3.00±0.82%) percent ash content reported by *A. officinalis*. The percent protein Contents investigated maximum (14.11±0.81%) by *H. officinalis,* followed by *A. officinalis* (9.75±0.94%) and *N. alba* (9.28±0.59%), respectively, while the lowest (8.12±0.96%) percent protein content reported by *S. indicus*. The percent fiber Contents investigated maximum (22.00±1.22%) by *A. officinalis,* followed by *H. officinalis* (21.50±1.08%) and *S. indicus* (20.27±0.65%), respectively, while the lowest (13.50±0.82%) percent fiber content reported by *N. alba*. The percent carbohydrate Contents investigated maximum (34.25±0.94%) by *A. officinalis,* followed by *N. alba* (28.25±0.74%) and *H. officinalis* (21.16±0.66%), respectively, while the lowest (21.01±0.36%) percent carbohydrate content reported by *S. indicus* as shown in (Table 4., Fig 2a and Fig. 2b). The Gross Energy investigated maximum (308.25±5.06 Kcal/100g) by *A. officinalis,* followed by *H. officinalis* (294.63±1.25 Kcal/100g) and *N. alba* (280.03±2.65 Kcal/100g) respectively, while the lowest (282.56±0.73 Kcal/100g) Gross Energy reported by *S. indicus* as shown in (Table 4, Fig. 2a and Fig.2b).

Table 4. Nutritional analysis of some selected medicinal flowers.

Samples	Moisture Contents %	Ash Contents %	Fats Contents %	Protein Contents %	Fiber Contents %	Carbohydrates %	Gross Energy (Kcal/100g)
A. officinalis	5.00±0.82	32.33±1.93	3.00±0.82	9.75±0.94	22.00±1.22	34.25±0.94	308.25±5.06
H. officinalis	4.83±0.85	38.17±0.62	4.11±0.09	14.11±0.81	21.50±1.08	21.16±0.66	294.63±1.25
N. alba	5.50±0.41	40.33±1.25	5.87±0.26	9.28±0.59	13.50±0.82	28.25±0.74	280.03±2.65
S. indicus	4.17±0.62	42.83±0.85	6.70±0.42	8.12±0.96	20.27±0.65	21.01±0.36	282.56±0.73

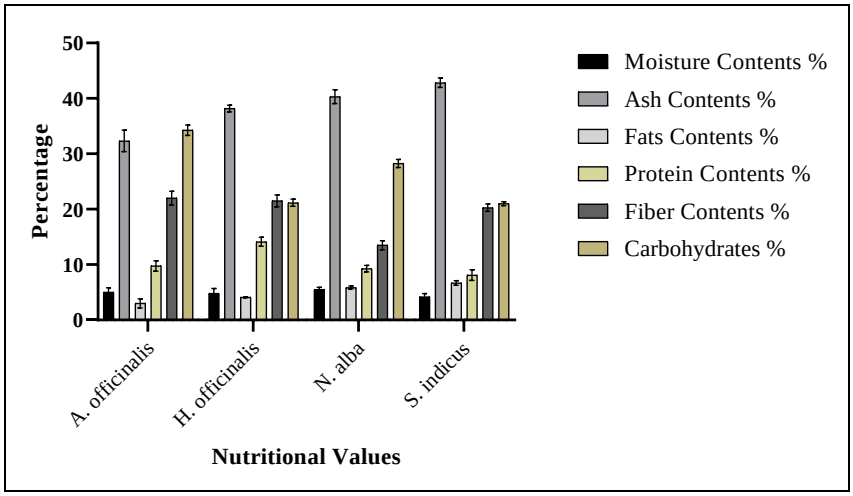

Fig. 4a. Nutritional analysis of some selected medicinal flowers.

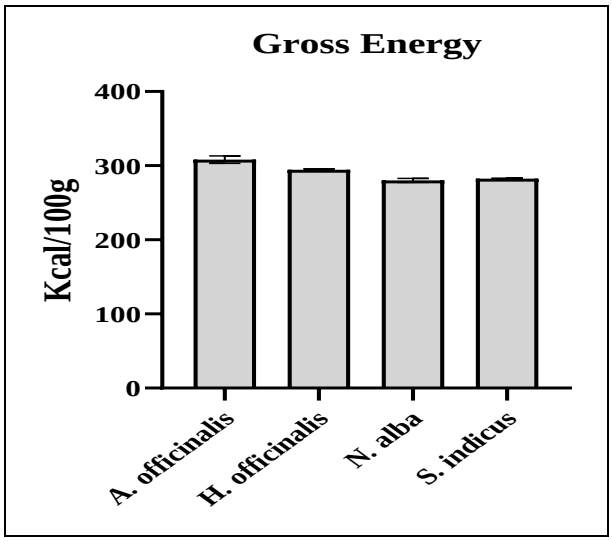

Fig 4b. Gross Energy(Kcal/100g) of *A. officinalis, H. officinalis, N. alba,* and *S. indicus* flowers.

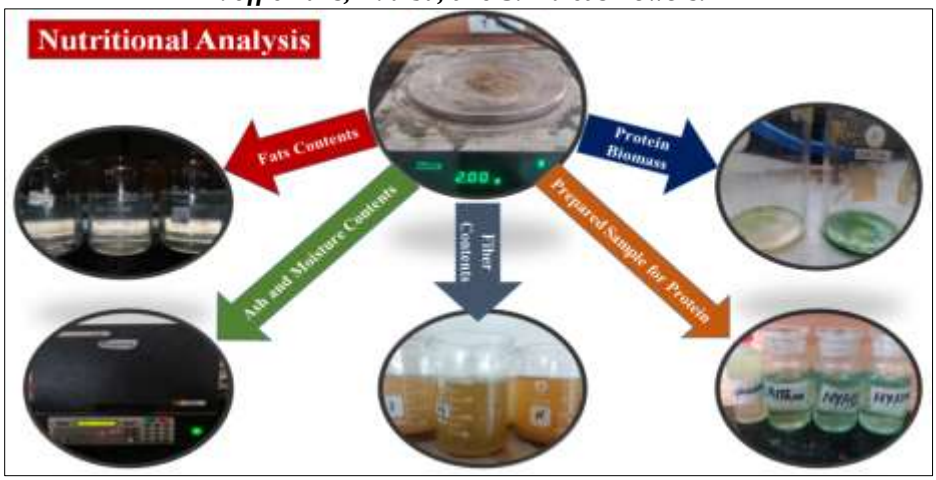

Fig. 4c. Different nutritional parameters of selected medicinal flowers.

DISCUSSION

Plants are the source of different kinds of phytochemicals that have several therapeutical and biological activities. Identifying other classes of phytoconstituents in various parts of medicinal plants is the base for discovering drugs, medicines, and antibiotics (Kebede et al., 2021 and Sher et al., 2022). Phytochemistry is an essential foundation for validating numerous therapeutic industries, identifying crude drugs, and a positive anthropological action (Mukherjee et al., 2015). For this purpose, the phytochemical screening of medicinal flowers was carried out for the possible existence of different phytoconstituents. The results reported proteins, reducing sugars, saponins, hydrolyzable phytosterols, steroidal glycosides, phenols, triterpenoids, terpenes, flavonoids, and fixed oils. The current study is supported by the findings of (Farhat et al., 2022), who reported similar phytochemicals, including phenol, flavonoids, terpenoids etc., in *A. officinalis* flowers. Several other researchers, including (Bhaskar et al., 2021; Jangid et al., 2021; Malinski et al., 2021 and Sweta et al., 2021), investigated similar phytoconstituents from different medicinal flowers, including *Hibiscus rosa-sinensis, Lychnis flos-cuculi, Couroupita Guianensis* etc. The phytochemical screening concluded that plants have potential therapeutic phytochemicals that make the plants worthy of local use.

The extractive value of a solvent indicates how well it may be used to isolate bioactive compounds from a test sample. In order to successfully extract bioactive compounds, it is recommended to use solvents with a high extractive power. Most active compounds are polar; hence, polar solvents should have high extractive values (Arawande et al., 2018). When determining the quality of crude medicines, the value of their water-soluble extraction is a component that is of the utmost significance. The reduced extractive value points to the possible existence of exhausted or contaminated material, in addition to faulty processing during the drying or storing processes (Bhargava and Bansal, 2020). For this reason the extractive value of medicinal flowers were determined. The results showed maximum extractive values in methanol and distilled water. The results agree with the findings of *Tagetes erecta* flowers, (Youssef et al., 2020) which reported similar extractive values. Several researchers including (Arawande et al., 2021; Pawar and Jadhav, 2016 and Ranjith, 2018) reported extractive values of different medicinal plants that supported our results and findings.

The presence of trace elements has a direct bearing on the medicinal value of the plant, as well as its overall health and its capacity to cure a variety of illnesses. They play a function in plants that is nutritive, catalytic, and balancing in their environment in the natural world. They are absorbed by plants from the surrounding soil and then integrated into the organic molecules that humans consume, which are generated as a result of our ingestion of plant matter (Fittschen et al., 2017). In the present study, several elements were detected in the flowers of *A. officinalis, H. officinalis, N. alba,* and *S. indicus.*

According to WHO recommended daily intake of sodium was 5g/day (DElia et al., 2018). The results reveal that sodium was highest (7.421 mg/L) in *N. alba* while the lowest (3.800 mg/L) in *H. officinalis* (Table. 3; Fig. 1). The *N. alba* flower is not recommended in high doses daily as they can cause high blood pressure and stroke while *A. officinalis, S. indicus,* and *H. officinale* are recommended for use according to the WHO. The results agree with the findings of (*Arabidopsis thaliana* flowers (An et al., 2017) which reported similar sodium contents. Potassium is essential for maintaining cardiac rhythm and constipation (Aparna & Singh, 2018)**.** The WHO recommended maximum daily intake for K was 4.7g/day for adults and 3g/day for the patient (Cupisti et al., 2018). The results showed that potassium was highest (12.84 mg/L) in *N. alba* while lowest (12.83 mg/L) in *S. indicus* (Table 3; Fig. 3)*.* So, all the flowers are highly recommended for daily 1use. The results support the findings of (Zingiberaceae flowers, (Rachkeeree et al., 2018) which reported the highest K contents. Magnesium is required for different body functions, such as growth and proper bones and muscles, preventing high blood pressure (Fiorentini et al., 2021). The permissible limit suggested by WHO for mg was 1.5 to 3.5g/kg (Qadir et al., 2018). The results reveal that magnesium was highest (27.17 mg/L) in *Althea officinalis* while lowest (9.887 mg/L) in *Nymphaea alba* (Table 3; Fig. 3). According to WHO, all the flowers are highly recommended for daily use. The present study agrees with (Edible flowers (Grzeszczuk et al., 2018), which reported similar magnesium contents. Calcium is an essential mineral element for healthy bones, teeth, blood muscles, and nerves. It regulates the activity of skeletal and heart muscles (Raskh, 2020). The recommended dietary intake for Ca was 700-1000 mg/day but increased to 1300 mg/day during pregnancy (Cormick et al., 2019). The results showed that calcium was highest (129.3 mg/L) in *Hyssopus officinalis* while the lowest (4.010 mg/L) in *N. alba* (Table 3; Fig. 3). According to WHO, all the flowers are highly recommended for daily use.

The results support the work of (*Rhodendron arboretum* flowers, (Chawla et al., 2019) which reported similar calcium contents. Copper is a potentially dangerous reactant that creates hydroxyl radicals in addition to being a very efficient enzyme catalyst. A lack of copper may cause glucose intolerance, a diminished insulin response, an increased glucose sensitivity, and increased glucose reaction overall (Ositadinma and Martina, 2020). The WHO recommended limit for Cu is 40 µg/l for normal metabolism (Song et al., 2021)**.** The results showed that copper was highest (0.079 mg/L) in *H. officinalis* while the lowest (0.026 mg/L) in *S. indicus* (Table 3). According to WHO, the consumption of all flowers is not recommended as the concentration of Cu is high than the permissible limit except for *S. indicus.* The results agree with the work of (*Bauhinia variegata* (Kachnar) and *Cordia dichotoma* (Awasthi and

Verma, 2019), who reported similar Cu contents. The enzymes alcohol dehydrogenase, ribonucleic polymerases, alkaline phosphate, and carbonic anhydrase all need zinc in order to function well as a catalyst. It is important for development as well as maintaining the integrity of the skin and bones (Sunitha et al., 2018). According to WHO, Zn's tolerable daily intake (TDI) was 11.9 ± 0.2 mg/kg (Gutiérrez-Ravelo et al., 2020). The results reveal that zinc was highest (0. 543 mg/L) in *H. officinalis* while the lowest (0. 487mg/L) in *N. alba* (Table 3; Fig. 3). The flowers have no sufficient amount of zinc according to WHO recommended Daily intake which may lead to growth retardation, loss of appetite, and impaired immune functions. The current results support the work of (Siddiqui et al., 2022), who reported similar Zn contents in *Matricaria chamomilla* flowers. Iron deficiency is the most prevalent nutritional deficiency in humans. The recommended daily intake for Fe is 13.7 - 6.5 mg/day for children and 19.3 - 20.5 mg/day for adults (Jeremiah *et al.*, 2019). The results reveal that iron was highest (15.53 mg/L) in *H. officinalis* while the lowest (1.259 mg/L) in *S. indicus* (Table 3; Fig. 3). According to WHO, all the flowers are highly recommended for daily use except *H. officinalis* for the daily uptake of iron. The results support the findings of (Zinicovscaia et al., 2020), who reported the highest Fe contents in the elemental analysis of *Lavendula angustifolia* at the flowering stage. Cobalt has been proven to boost the effects of insulin and its action and cobalt's efficiency as an antidiebetic agent. The official WHO-established TDI value for cobalt intake is 5 to 8mg/day. Cobalt was highest (0.035 mg/L) in *H. officinalis* while the lowest (0.00 mg/L) in *S. indicus* (Table 3; Fig. 3).

According to WHO, the consumption of all flowers is recommended as the concentration of Co is the permissible limit and flowers are safe to be used for Co. The results support the findings of (Sharma et al., 2019), who also reported similar Co contents in *Curcuma angustifolia* flowers. Lead is a heavy metal that accumulates in body organs and causes poisoning to the gastrointestinal tract, kidney, and central nervous system. According to WHO, the recommended daily intake of lead is 10 mg/Kg (Zinicovscaia et al., 2020). The results showed that lead was highest (0.725 mg/L) in *N. alba* while the lowest (0.623 mg/L) in *S. indicus* (Table 3; Fig. 3). According to WHO, the consumption of all flowers is recommended as the concentration of Pb is in the permissible limit and flowers are safe to be used for Pb. The results agree with the findings of (Chawla et al., 2019), who reported similar Pb contents. Cadmium has toxic effects on the kidneys, skeletal, and respiratory systems. That is why it is termed a human carcinogen. Excessive ingestion of cadmium discourages calcium metabolism and kidney stone formation. According to WHO, the recommended daily intake of lead is 0.3 mg/Kg (Zinicovscaia et al., 2020). The consequences expose that cadmium was uppermost (0.025 mg/L) in *A. officinalis* while the lowermost (0.010 mg/L) in *H. officinalis* (Table 3; Fig. 3). According to WHO, the consumption of all flowers is recommended as the concentration of Cd is in the permissible limit and flowers are safe to be used for Cd. The results support Ma et al. (2018), which stated the lowest Cd contents.

The moisture level of food influences the texture, and the more ordered the endosperm structure, the lower the moisture content rate. This indicates that freeze-dried samples could be stored for an extended period without becoming moldy Ghulam et al., 2014). The moisture contents were higher (5.50±0.41%) in *N. alba*. In comparison, lower (4.17±0.62%) in *S. indicus* Hameed et al. (2008) reported the moisture contents in *Persicaria muculosa, Polygonum plebejum, Rheus australe, Rumex hastatus, R. dentatus,* and *R. nepalensis* flowers. The results agree with the reported average percentage of moisture contents in *R. dentatus* (5.86%) and *R. nepalensis* (4.82%), while the flowers of *R. austral* (6.28%), *P. muculosa* (6.56%), *P. plebejum* (6.57%) and *R. hastatus* (20.82%) investigated higher percentage moisture contents than average. When analysing the effectiveness and purity of various drugs, one significant criterion to take into consideration is the total ash content. Most of the time, carbonates, phosphates, silicates, and silica will make up the whole of the ash. This category includes both physiologic ash and nonphysiologic ash. Physiologic ash is more common. If the crude medication that is going to be sold on the market has a high ash level, this may point to the presence of adulteration, contamination, substitution, or neglect in the preparation process (Ghulam et al., 2014). Ash contents were higher (42.83±0.85%) in *S. indicus* while lowest (32.33±1.93%) in *A. officinalis.* The results do not support the findings of (Lopez-Cervantes et al., 2018), who reported similar percent ash contents (7.54 ± 0.11) in dry *Aloe vera* flowers. Ingestion of nutritional fibers can minimize the serum cholesterol level, and the hazard of coronary heart disease, high blood pressure, diabetes, and colon and breast cancer (Ghulam et al., 2014). The fibers suggested daily allowance (RDA) values for kids, adults, and adult females 19-25, 21-28, and 28-29%, respectively (Ghulam et al., 2014). Crude fibers were highest (22.00±1.22%) in *A. officinalis* while the lowest (13.50±0.82%) in *N. alba* (Table 4; Fig. 2a). The results support the findings of (Christina et al., 2017), who reported the highest fibers contents (9.10 ± 0.58%) in *Aspilia africana* flowers. Further research (Shemishere et al., 2018) showed a significant percentage of fibers in *Hibiscus moscheutos* × *H. coccineus* edible flowers. The ability of dietary fat to take up flavor and keep it in its cells is one factor that leads to the improved palatability of food. A diet that only comprises fats accounting for 1.20 percent of its total caloric energy is regarded to be insufficient for humans. This is due to the fact that an excessive amount of fat consumption has been associated to various cardiovascular disorders (Ghulam et al., 2014)**.** In the results of the present study, fats were the highest (6.70±0.42%) in *S. indicus* while the lowest (3.00±0.82%) in *A. officinalis.*

The results agree with (Chokthaweepanich, 2020), who reported maximum fats contents in *Solanum melongena* flowers. Proteins are essential for cell structure and function, and a moderate protein diet may be more effective in preventing weight gain than cutting down on fat or carbs (Ghulam et al., 2014). It is an essential elemental component of the human diet. Adults, children, and pregnant and lactating mothers must have 34 to 50, 13 to 19, and 17 to 71g of proteins daily, respectively (Shemishere et al., 2018)**.** In the present study, proteins were higher (14.11±0.81%) in *H. officinalis* while lowest (8.12±0.96%) in *S. indicus.* The current results agree with the findings (López-Cervantes et al., 2018), which reported the highest percent protein contents of 13.03 ± 0.27 in *Aloe vera* flowers. The results were also supported by the findings of (Chensom et al., 2020) that reported proteins 12.6 ± 0.9 to 18.2 ± 3.1 g/100 g dry weight in a hybrid of *Hibiscus moscheutos* × *H. coccineus* edible flowers. Carbohydrates serve as a source of energy and aid digestion and assimilation of other nutrients (Ghulam et al., 2014). Carbohydrates were higher (34.25±0.94%) in *A. officinalis* and lowest in (21.01±0.36%) in *S. indicus.* The results agree with findings of (Hameed et al., 2008) who reported similar carbohydrates contents in *Persicaria maculosa* flowers. All carbon-containing compounds have a certain amount of energy which are the primary source of medicines, food, fiber, and other items in the daily use of humans (Ghulam et al., 2014). The results reveal that gross energy was higher (308.25±5.06 Kcal/100g) in *A. officinalis* and lower (280.03±2.65 Kcal/100g) in *N. alba*. The results agree with the findings of (Pinela et al., 2017), who reported the highest gross energy in *Chamaemelum nobile* flowers.

CONCLUSION

It is concluded from the current study that the flowers contain several compound classes which might be potentially active. Extractive values concluded that methanol is a powerful solvent for crude extraction. Regarding detecting macro & microelements, all the flowers fall within the permissible limits and do not have toxic effect. They may contribute to the therapeutic effects of the plant. The Nutritional Analysis of *A. officinalis, H. officinalis, N. alba,* and *S. indicus* flowers showed significant nutritional contents with the highest gross energy (301.24 Kcal/100g) delivered by *A. officinalis.* Hence the study proves that consumption of market-available medicinal flowers are safe in traditional medicines.

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AUTHORS

First Author – Saqib Ullah, M.Phil. Department of Botany, Islamia College Peshawar, Pakistan,
Second Author – Ghulam Dastagir, Ph.D. Professor & Chairman Department of Botany, University of Peshawar, Pakistan

Third Author – Asad Ullah, Ph.D. Assistant Professor & Director Centre of Plant Biodiversity, University of Peshawar, Pakistan
Fourth Author – Fajr Daud, M.Phil. Department of Botany, Islamia College Peshawar, Pakistan.
Fifth Author – Ayaz Ahmad, Ph.D. Assistant Professor, Department of Biology, Government Postgraduate College Dera Ghazi Khan, Punjab, Pakistan
Sixth Author – Mehik Naz, M.Phil. Department of Chemistry, Islamia College Peshawar, Pakistan
Seventh Author – Laila Noor, M.Phil. Department of Botany, Pir Mehar Ali Shah Arid Agriculture University Rawalpindi, Punjab, Pakistan
Eighth Author – Aamad Khan, M.Phil. Department of Botany, Islamia College Peshawar, Pakistan
Correspondence Author – Asad Ullah, Ph.D. Assistant Professor & Director Centre of Plant Biodiversity, University of Peshawar, Pakistan