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Original Research Article

Qualitative and Quantitative Analysis of Phytochemicals in *Lepidium pinnatifidum* Ledeb

Huma Farooque Hashmi*, Saira Bibi, Munazza Anwar, Muhammad Rashid Khan

Department of Biochemistry, Quaid i Azam university, Islamabad, Pakistan

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***Corresponding author:** Huma Farooque Hashmi

Abstract

The Plants are enriched with variety of ingredients that could be used in the preparation of either synthetic or natural drugs. Thus, scientists have great interest in screening and assessing medicinal plants to promote preparation of new and advance drugs with minimal side effects as well as synergistic effect. Various pharmacological assays were performed to analyse the effectiveness of a plant toward therapeutic drugs. Lepidium as a genus is well known for its extravagant medicinal potential. This study was intended to explore the phytochemicals potential of *Lepidium pinnatifidum*. Dried powder form of *Lepidium pinnatifidum* was extracted with crude methanol and then process of fractionation was performed with order of increasing polarity to gain n - hexane fraction (LPH), chloroform fraction (LPC), ethyl acetate (LPE), butanol fraction (LPB) and aqueous fraction (LPA).The qualitative phytochemicals analysis of *L. pinnatifidum* showed the presence of various important pharmacologically active phytochemicals such as alkaloids, glycosides, flavonoids, tannins, saponins, coumarins, phenols, phytosterols, vitamin c, steroids, triterpenoids etc. Plant was found to be enriched with most of the assessed phytochemicals. On the basis of qualitative analysis, quantitative analysis of some important phytochemicals such as flavonoids, saponins, tannins showed that, this plant seemed a potent medicinal agent and could be used as a therapeutic drug in future.

Key words: Medicinal plants, Phenolics, Phytochemicals, *Lepidium pinnatifidum*, Phytosterols, Steroids.

INTRODUCTION

An existence without plants is unthinkable, as human beings depend on plants since the start of life. Plants are very basic source of medication. Indeed, even now a day most of essential medications are obtained from medicinal plants [1]. Due to lower cost, higher efficacy, minimal detrimental effects and synergistic properties, use of medicinal plants got importance over synthetically prepared drugs [2].

Bioactive non nutrient constituents of plant found in vegetables grains and fruits are called phytochemicals. These phytochemicals are vital for prevention of severe disorders [3]. By nature these phytochemicals are identified in plants and they play vital part in struggling against majority of severe disorders for example asthma, arthritis, cancer. In comparison with synthetical products these do not have any detrimental or bad affect that why these are known as "man-friendly medicines" [4]. Phytoconstituents of phytochemicals are alkaloids, flavonoids, phenols, steroids, saponins and tannins. These constituents are important in prevention of diseases [5]. Phytoconstituents also possess glycosides, anthraquinones, terpenoids. Due to these phytochemicals, plants are proved to possess numerous disease fighting capabilities. Some of these include, but not limited to antimicrobial [anti-fungal, antibacterial, anti-viral], antioxidant, antitumor and anti-inflammatory activities. [6]. If we categorize these medicinal properties on basis of chief phytochemicals having active part against particular disease, researcher proved the following. Due to the presence of flavonoids plants have anti allergic, anti-inflammatory, antioxidant and anticancer properties [7]. Plants contain aromatic constituents known as phenol that are vital against cardiovascular disorder and prevent from risk of heart failure. Alkaloids contain antispasmodic, pain relieving and antimalarial properties while terpenoids have antibiotic, insecticidal, anthelmintic and antiseptic properties [8].

Finally a great diversity of plants and their phytochemical have clinical judgments assessing their security, bio-efficacy, and bioavailability are proposed to demonstrate the significant part of natural herbal

medicines in the administration of depressive ailments [9]. *Lepidium pinnatifidum* has been reported in many countries, worldwide. Leaves of *L. pinnatifidum* are cooked as a nutritious vegetable [10]. Its seeds and leaves both are known to have beneficial values [11]. It is used as an alleviator in constipation, in many populations. It is also well known for its positive effects in pile [12]. Seeds are very useful in painful menstruation in women [13]. *L. pinnatifidum* is a weed used as a fodder as well as potherb specie [10]. It's quite substantial ethnobotanic background suggest scientific investigation of medicinal properties of this plant. Phytochemicals evaluation is a first step to explore therapeutic potential of a plant. Owing to these reasons, this study aims to assess phytochemicals content in *L. pinnatifidum* both qualitatively and quantitively.

EXPERIMENTAL SECTION

Plant collection

The *Lepidium pinnatifidum* was collected from district Baugh, Azad Jammu Kashmir in the Month of April to June. The plant was identified by the vernacular name and then recognized and authenticated Dr.Muhammad Zafer, Herbarium botanist, Quaid-i-Azam University, Islamabad. A voucher specimen with Accession No. 175701 was put at the herbarium of Quaid-i-Azam University Islamabad.

Preparation of extracts

The plant was. Collected, gradually shed and then, rinsed to remove residues of dust. Then it was dried for some days and water contents was desiccated. Completely dried plant material was ground to powder and separated by use of 60-mesh topology Willy Mill to obtain residues comprising of equal mass. The product obtained in powdered form was kept in organic solvent for the purpose of soaking and after that the next step of extraction was performed. Then further extraction was done by mixing 1.5 kg of plant in powdered form along 4 L of crude methanol and kept this for 26 days at 25ºC. Whatman No.1 filter paper was used in process of filtration. After filtration obtained liquid was kept in rotary vacuum evaporator for the process of evaporation and then dried out.

Fractionation

Fractionation was carried out in a separate way by the crude extract to get the compounds in order of increasing polarity. For resolving the compounds with order of increasing polarity, crude methanolic extract was added in distilled water. After that liquid-liquid separation was carried out by use of solvents in order of non-polar n-hexane, chloroform, polar solvent ethyl acetate, polar solvent butanol and obtained fractions of these solvents are named as LPM (Methanol extract), LPH (Hexane Fraction), LPC (Chloroform Fraction), LPE(Ethyl acetate Fraction) and LPB (Butanol Fraction). The remaining residue obtained from last fraction was collected and termed as aqueous fraction and abbreviated as LPA.

Fractions were stored at 4ºC after the process of drying and weighing. This extract is used for phytochemical evaluation.

Phytochemical analysis

By utilizing standard protocols of phytochemicals, phytochemical evaluation was done in which each fraction was analyzed to detect the presence of phytochemicals.

Qualitative phytochemicals analysis:

Qualitative screening was performed for biochemicals like phenols, flavonoids, saponins, tannins, alkaloids, terpenoids, coumarins, anthocyanin and anthraquinone, as given below in details.

Assessment for alkaloids

Hager's test: Few drops of Hager's reagent were added in the 2 mL plant extract. Precipitation of yellow color indicated the alkaloid presence.

Mayer's test: To 2 mL of each fraction, 2 mL of HCl [conc.] was added and then few drops of Mayer's reagent were mixed to it. Formation of white precipitate or green color indicated the presence of alkaloids [14].

Assessment for anthraquinones

1. To 1 mL of extract, 1 mL benzene was included; addition of 1mL of ammonia solution (10%] was followed. A red color appearance upon ammonia solution addition was indicative of anthraquinones presence [15].
2. 2% HCl drop wise added in plant extract. Formation of Red precipitate was indicative of anthraquinones [16].

Assessment of anthocyanin & betacyanin

1 mL of 2N NaOH was treated with 2 mL of each extract for 5 minutes at 100°C. Presence of anthocyanin was confirmed by production of bluish green color while yellow color was indicative of betacyanin [17].

Assessment for coumarins

1 mL NaOH (10%) solution was introduced in 1 mL of each extract. Appearance of yellow color confirmed the coumarins [18].

Assessment of flavonoids

1. Alkaline reagent test: To the 1 mL plant extract 2N NaOH of 1 mL was added. Flavonoids presence indicated through the appearance of yellow color [19].
2. FeCl3 test: FeCl3 solution, only few drops were added to each extract of 1 mL. The blackish red precipitate formation showed the occurrence of flavonoids.

Assessment of glycosides

Conc. H2SO4 test

One micro litter of each extract was treated by 1 mL of concentrated H2SO4. After that solution was

kept for 2 minutes. Glycosides were confirmed by analyzing the precipitation of red color [20].

Keller Killani test:

To 1 micro Litter of each extract, 1 mL glacial acetic acid was added and then cooled, FeCl3 2 drops added in it. After which careful addition is done for conc. H2SO4 2 mL solution along the test tube walls. A ring formed at junction of two layers that showed glycosides presence [14].

Assessment of tannins

1. Alkaline Reagent test: 2 ml NaOH was added in 2 ml of extract. Presence of tannins was confirmed if color changes from yellow to red.
2. FeCl3 test: A volume of 2 mL of 5% FeCl3 was treated to 1 mL of plant extracts. Presence of tannins was represented by greenish black or dark blue color [20].

Assessment of steroids

Salkowski test: 10 mL chloroform was added in 1mL of each extract in a test tube. After that 10ml concentrated sulphuric acid was dissolved in this test tube. Two layers were formed; lower layer expressed yellow color along green fluorescence while upper layer showed red. The formation of these layers indicates steroids were present [21].

Assessment of saponins

Emulsion test with the olive oil:

1 mL of each extract was poured in test tubes, shake dynamically to form a stable froth. Follow by addition of five-six drops of olive oil to this solution. Formation of an emulsion revealed the presence of saponins.

Froth formation with distil water:

2 ml of distilled water was added to 2 ml of extract. Then shake in a graduated cylinder lengthwise for 15 min. A layer of foam produced that is of 1 cm, this layer was indicative of saponins [22].

Assessment of Terpenoids

To 2 mL of each extract, 1 mL 1% HCl was added and kept this for 5-6 hours. After that, 1ml of Trim-Hill reagent was added and then in a water bath up to boiling temperature, heated for 5-10 minutes. Bluish green color appearance was indicative of terpenoids [23].

Assessment of Phenols

Ellagic acid test:

Addition of 5% Glacial acetic acid was done drop wise in the one micro litter extract. Then addition of 5% NaNO2 was done to the above mixture. Phenols presence was indicated by the color formation of muddy brown [14].

To the 1 mL of extract of plant 2 mL distilled water was added and then 10 % FeCl3, only few drops were added. Formation of blue green color was showing phenol presence [24].

Assessment of vitamin C

DNPH Test: 1 ml of each extract was treated with DNPH [Dinitrophenyl hydrazine added in concentrated sulphuric acid]. Production of yellow color indicates the presence of vitamin C [25].

Assessment of Quinones

To 1 mL of each plant extract 1 mL of concentrated sulphuric acid was dissolved. Appearance of red color indicates the presence of quinones [25].

Assessment of phytosterol

Liebermann - Buchard's test: Each extract of the plant was treated with chloroform and then filtered. After filtration acetic anhydride was added drop wise, heated and then cools down at room temperature. Later on addition of concentrated sulphuric acid was done. Production of brown color ring (at the junction) showed the presence of phytosterols [25].

Assessment of triterpenoids

1.5 ml of each extract was treated with Libermann-Buchard Reagent consists of acetic anhydride + conc.H2SO4. Formation of bluish green color was indicative of triterpenoids [25].

Assessment of proteins

Xanthoproteic test: 1 mL of each extracts cons. Nitric acid was added drop wise. Formation of yellow color showed existence of proteins.

Biuret test:

To 0.5 mg of plant extract equal volume of sodium hydroxide (40%] was dissolved. Later on, CUSO4 solution (1%] was added drop wise. Production of violet color indicates the presence of proteins [25].

Quantitative phytochemical analysis

On the basis of qualitative phytochemical analysis, some important phytochemicals are assessed quantitatively by the following narrated procedures.

Quantification of flavonoid

An amount of 10 g of plant extract was measured and 100 mL of 80% aqueous methanol was added repeatedly. After that by use of Whatman filter paper filtration of the solution was performed. Later on filtered solution was vaporised under water bath until it become dried completely and weighed to obtain constant weight.

Quantification of Terpenoids

Powder form of 10 g of each extract was soaked in alcohol for a day. Later on it was filtered and petroleum ether was use for purpose of extraction. The extracted material was calculated and considered as terpenoids.

Quantification of Saponin

An amount of 10 g of each extract was taken and 50 mL of 20% aqueous ethanol was dissolved. The samples were heated and continuously stirred for four hours at 550°C under water bath. The solution was then filtered and repeated the process with 100 mL of 20% ethanol. In water bath using 900°C these extracts were decreased up to 40 ml. After that the solutions were added into separating funnel and 10 mL of diethyl ether was introduced and vigorously shake. Two layers were seen in separating funnel, from which the aqueous layer was taken and purified repeatedly. Later on addition of 30 mL of n- butanol was done that was further washed out by use of 10 mL of 5% aqueous sodium chloride. The obtained solution was heat dried by use of water bath and after evaporation obtained extract was dried in oven to gain constant weight. After that saponin amount was measured.

Quantification of tannins

Buren, J., and Robinson, W. [1969] approach was followed in order to assessed quantity of tannin with little advancement. 500 mg extract was measured in (50mL) plastic bottles. Addition of 50 mL distilled water was done and shake for one hour in mechanical shaker. Later on filtration was performed and raise volume up to 50 mL volumetric flask. With the help of pipette 5 ml of filtered solution was taken in test tube and 2 mL FeCl3(0.1 M) in HCl (0.1 N) and potassium ferrocyanide (0.008 M) was added. In comparison to standard curve of gallic acid 120 nm absorbance was measured by use of spectrophotometer. Results were depicted in the form of GAE (mg of Gallic Acid Equivalent) per gram of dried extracts [25].

Quantification of β- Carotene and Lycopene

10 mL of acetone hexane mixture in 4:6 ratios was added in each dry extract and shake vigorously for one minute. Later on the solution was filtered by using Whatman No.4 filter paper. At 453, 505, 645 and 663 nm, absorbance of filtered solution was recorded. After that below given formula was used to calculate quantity of β-carotene and lycopene.

Lycopene (mg/100 ml) = − 0.045A663 + 0.372A505 + 0.0806A453

β- Carotene (mg/100m) = 0:216A663 − 0:304A505 + 0:452A453

The results are showed as µg/g of each extract [26].

RESULTS AND DISCUSSION

An amount of 40 g [w/w), product obtains from *L. pinnatifidum* by using different organic solvents containing different polarity index. Polar ethyl acetate provides 2.35 g and butanol provides 5.7 g. Non polar n hexane gave 6.2 g and chloroform gave 3.5 g. Amount of 21 g produced from residue of soluble fraction called aqueous fraction. Different solvents appeared in following sequence in fractionation product: methanol > aqueous hexane > butanol > chloroform > ethyl acetate and significant differences were recorded between them.

Phytochemical analysis of *L. pinnatifidum*

Qualitative analysis

Qualitative analyses were performed for various extracts of *L. pinnatifidum* in order to detect the presence of multiple phytochemicals viz, phenols, sterols, glycosides, coumarins, flavonoids, saponins, β-cyanins, alkaloids, tannins, terpenoids anthraquinone, steroids, vitamin C, quinones, phytosterols, triterpenoids and protein estimation by biuret test as well as xanthoproteic test. Results are shown in the table 1. β-cyanin, terpenoids, phenol, flavonoids, tannins and alkaloids were present in all the fractions of *L. pinnatifidum* that are analyzed qualitatively while anthraquinone and phytosterol were absent in all the fractions. Glycosides were present in only LPB and LPA while sterols were only present in LPB and LPA. Saponin and coumarin were present in all fractions except LPC while quinones were present in only LPC. Steroids and triterpenoids were present in all fractions except LPE and LPA while vitamin C only present in LPC and LPE. Proteins were identified in only LPM, LPH and LPA. All fractions were enriched with most of the phytochemicals, as depicted in table 1.

Table-1: Qualitative analysis of *L. pinnatifidum*

Phytoconstituents	LPM	LPH	LPC	LPE	LPB	LPA
Alkaloids	++	++	++	++	++	++
Glycosides	-	-	-	-	++	++
Flavonoids	+	+	+	++	+++	+
Tannins	+	+	+	++	+++	++
Saponins	+++	++	-	+++	+	+
B-cyanine	++	+++	+++	+	+	++
Terpenoids	++	++	+	+	+	+
Coumarins	+	++	-	++	+++	+++
Phenols	++	++	+++	+++	+++	+++
Sterols	-	-	-	-	+	+
Anthraquinone	-	-	-	-	-	-
Steroids	++	++	+++	-	+	-
Vitamin C	-	-	+	++	-	-

Phytoconstituents	LPM	LPH	LPC	LPE	LPB	LPA
Quinones	-	-	+++	-	-	-
Phytosterols	-	-	-	-	-	-
Triterpenoids	+	++	+++	-	+	-
Protein estimation:						
Biuret test	++	+	-	-	-	+
Xanthoproteic test	-	-	-	-	-	-

[+]: presence of constituent, [++]; moderate concentration of constituent, [+++]; high concentration of constituents, [-] shows absence of constituents. LPM; *Lepidium pinnatifidum* methanol extract, LPH; n-hexanefraction of LPM, LPC; chloroform fraction of LPM, LPE; ethyl acetate fraction of LPM, LPA; soluble residual aqueous fraction of LPM.

Quantitative analysis

On the basis of results obtained by qualitative test of *L. pinnatifidum* quantitative analysis of the phytochemicals were performed by using standard method for major phytochemicals such as flavonoids, saponins, terpenoids, tannins, β carotene and lycopene. Quantitative analysis depicted the percentage per yields of flavonoids such as 1.68%, highest percentage in LPM and LPE, followed by1.33% in LPA, 1.23% in LPH, 0.96% in LPB, 0.88% in LPC. Similarly the percentage per yields of saponins were recorded highest in 2.63% in LPE and 2.56% in LPB followed by 1.68% in LPH, 1.52% in LPA and lowest in 1.36% in LPM, and while percentage of terpenoids showed the lowest percentage of 0.64 % in LPM, following the decreasing order of 1.2% in LPB, 1.6% in LPH, 2% in LPC, 2% in LPE, 2.4% in LPA. Besides this tannin were measured in mg of GAE/g of extract in which maximum value was shown by LPB (313.6±2.5) after the sequence of LPM (63.02±1.52), LPH (56.18±3), LPE (34.48±3.5), LPA (26.27±2.6) and LPC (10.09±1) was followed. β-carotene and lycopene were measured in µg of β-carotene/mg of plant extract. In β-carotene highest value was obtained in LPM (0.995±0.005) followed by sequence of LPC (0.0885±0.01), LPH (0.729±0.014), LPE (0.590±0.002), LPB (0.580±0.009) and LPA (0.488±0.01). In lycopene assay maximum value was obtained by LPC (0.255±0.01) followed by sequence of LPM (0.231±0.0028), LPH (0.203±0.09), LPE (0.110±0.01), LPB (0.110±0.005) and LPA (0.096±0.002). Results are expressed in table 2.

Table-2: Quantitative analysis of *L. pinnatifidum* methanol extract and its related fractions

	Percentage [%] yield per gram			µg/mg of dry weight of dry weight plant extract plant extract		Mg of GAE/g of extract
Plant extract	**Flavonoids**	**Saponins**	**Terpenoids**	**β carotene**	**Lycopene**	**Tannins**
LPM	1.68±0.095	1.36±0.05	0.64±0.05	0.995±0.005	0.231±0.0028	63.02±1.52
LPH	1.32±0.087	1.68±0.06	1.6±0.1	0.729±0.014	0.203±0.09	56.18±3
LPC	0.88±0.075	NT	2±0.264	0.0885±0.01	0.255±0.01	10.09±1
LPE	1.68±0.125	2.63±0.09	2±0.360	0.590±0.002	0.110±0.005	34.48±3.5
LPB	0.96±0.088	2.56±0.07	1.2±0.1	0.580±0.009	0.110±0.01	313.6±2.5
LPA	1.33±0.104	1.52±0.08	2.4±0.2	0.488±0.01	0.096±0.002	26.27±2.6

Mean ± SD [n=3], LPM [*L. pinnatifidum* methanol fraction], LPH [*L. pinnatifidum* n hexane fraction],LPC [*L. pinnatifidum* chloroform fraction], LPE [*L. pinnatifidum* ethyl acetate fraction],LPB [*L. pinnatifidum* butanol fraction], LPA [*L. pinnatifidum* aqueous fraction], NT; Not Tested.

DISCUSSION

Throughout the world, plants are considered important source of raw material for the synthesis of ancient as well as modern drugs, the research on medically important species of plants, play role toward the confirmation of plant to treat disorders and it is probably a better solution to develop low cost and effective medicines from available raw material. In rural areas of Pakistan indigenous knowledge of plants is greatly preserved and practiced. Among whole the world almost 50000 species of plants contain therapeutic characteristics. In Ayurvedic, Chinese and Unani system of medicines herb, shrub and trees are broadly used in crude form or medicines. Varieties of important medicines are synthesized from plants e.g aspirin, digoxin, morphine, quinone etc to treat various types of disorders. Both the qualitative and quantitative analysis of phytochemicals of *L. pinnatifidum* was done in order to find out the active constituents against various diseases.

Qualitative analysis

Screening of phytochemicals provides detail description about the medicinal importance and aptitude of plant. In the current study bioactive constituents that report biological active nature to the plant were analyzed and results confirmed the existence of coumarins, terpenoids, flavonoids, phenols, tannins, proteins, saponins, alkaloids, betacyanin, anthocyanin, vitamin c, quinones, triterpenoids, and to some extent sterols, flavonoids, glycosides. By using different solvents variations in mixtures ranging from low polarity to high polarity were extracted.

Compounds belonging to the respective groups have been reported to impart various medicinal characteristics to the plants. Due to the presence of flavonoids plants possess antioxidant properties as flavonoids are a water-soluble antioxidant having free radical scavenging properties as well as anticancer activities [27]. Alkaloids were known to be possessing analgesic as well as antibacterial properties [28] while terpenoids were well known due to the antibacterial, anti-inflammatory, anticancer, and antiviral properties [29]. Tannins have anti-cancerous and antibacterial activities [30] and have ability to inter-fare the protein synthesis [31, 32]. Triterpenoids have ability to enhance the release of insulin by modifying metabolism of glucose and thus act as antidiabetic potential [33]. Steroids were well known to have cardio-tonic effect as well as insecticidal and antibacterial effect [34, 35]. Phenolic compounds and phytosterol present in plants responsible for the antimicrobial, antiallergic, antidiabetic, antioxidant, anti-inflammatory, antimutagenic and anticarcinogenic properties [36, 37]. Presence of saponins in plant are very important because of use in the treatment of hypo cholesterols and hyperglycaemia due to anticancer, antifungal, antioxidant, antibacterial and weight loss [38, 39]. Glycosides play role as anticoagulant activity, antitumor activity, ant degranulating activity and influenza virus inhibition [40 Xiao, 2017]. Coumarins are responsible for antimalarial and ant plasmodial properties [41]. Anthocyanin provides plant with ant obesity, anti-inflammatory, anticancer and neuroprotective properties [42]. Anthraquinones present in plants are responsible for the regulation of immunity and play therapeutic role in autoimmune diabetes [43]. Triterpenoids have anti-cancerous properties [44].

Quantitative analysis

Based on qualitative analysis of phytochemicals, quantitative analysis was also done on major phytochemical that are flavonoids, terpenoids, saponins, tannins, β carotene and lycopene. Different extracts of *L. pinnatifidum* expressed different number of phytochemicals. Highest amount of flavonoids contents was found in LPM and LPE fraction where highest amount of saponins were recorded in LPB and LPE. Similarly highest amount of terpenoids was found in LPA fraction while highest tannins content was examined in LPB. The b carotene and lycopene were found to be in highest in LPM and LPC.

Gracelin et al. [45] worked on different Pteris species and qualitative as well as quantitative analysis of phytochemicals was performed. They describe the highest amount of flavonoids followed by alkaloids and phenolic in collected plants while tannins and saponins content was found to be low in extracts of selected ferns. De Britto et al. [46] examined the quantity of phytochemicals of Marsilea minuta and obtained the similar results. Different extracts have different amount of flavonoids, tannins, saponins and phenols. Almost all phytochemicals were higher in methanol fraction.

Khan et al. [47] worked on different selected plants in order to find out the qualitative as well as quantitative phytochemicals. They describe that highest amount of alkaloid was found in A.vesica, highest tannins in M. rubicaulis, and flavonoid was maximum in V. negundo. Mary et al. [48] worked on the qualitative and quantitative analyses of vitex trifolia and terpenoids, alkaloids, tannin, saponin, phenols, steroids, flavonoids were measured using standard methods. Different extract got varied amount of phytochemical quantity [49]. Deyab et al. [50] investigated Dictyota dichotoma for its phytochemicals. The phytochemicals are quantitatively measured and stated that the due to use of different solvents the amount of phytochemicals varied. According to this research highest amount of flavonoids (1.72 ± 0.05 mg RUE/g dry wt) was observed while highest amount of tannins (2.12 ± 0.45 mg CAE /g dry wt) was observed in ethyl acetate fraction.

Lycopene and β – Carotene maintain singlet oxygen quenching aptitude, with preferable solubility in n hexane and ethyl acetate due to their non-polar characteristics [51]. Sadi et al. [52] also demonstrated maximum and significant lycopene concentrations in n-hexane fraction of L. tigrinus and considerable amount in Chloroform fractions of all other tested mushroom species using same methodology.

All these studies showed various phytochemicals in different plants. Numerous medicinal properties due to phytochemicals of these plants are also proved. Qualitative analysis in current study confirmed the presence of flavonoids, terpenoids, coumarins, alkaloids, tannins and saponins in plant which is indication for its diverse biological activities. Quantification further proved the existence of these phytochemicals. So a rich phytochemical account of *L. pinnatifidum* depicts a diverse medicinal potential of this plant.

CONCLUSION

The current study showed that *Lepidium pinnatifidum* has a wide array of phytochemicals, which are known to possess numerous medicinal properties.

Owing to this assessment, *L. pinnatifidum* found to be a therapeutically important plant. Further studies are needed to evaluate and understand a clearer picture depicting this plant's utilizations against diseases.

Conflict of Interest

Authors have no conflict of interest.

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