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PHYTOCHEMICAL INVESTIGATION, ANTIOXIDANT ACTIVITY AND NUTRACEUTICAL POTETIAL OF *ANGELICA ARCHANGELICA*

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ABSTRACT
The aim of this research was to evaluate antioxidant activity, nutritional profile and phytochemical screening of *Angelica archangelica*. The extraction process involved fractionation with various solvents and concentrated using rotary evaporator. The results of antioxidant activity study of *Angelica archangelica* showed maximum activity in the methanolic extracts at different concentration of 20, 40, 60, 80 and 100µg/ml. The percent inhibition of writhing response by the extract was 36.18%, 44.72%, 59.21%. 67.08% and 83.39% respectively. The whole plants have been found to rich in nutrients such as crude protein, carbohydrates, crude fiber, ash content (3.87%, 31.28%, 3.25% and 1.80%) respectively and phytochemical screening of plant for the presence of glycosides, flavonoids, phenols, resin and tannins. However, alkaloids were absent.

KEYWORDS: Nutritional profile, Antioxidant activity and Phytochemical screening.

1.0 INTRODUCTION
Medicinal plants represent a rich source of potent and powerful drugs. The treatment of human and animal disease depends mainly on natural products derived from plants, animals, microorganisms and minerals. Garhwal Himalayas are rich source of medicinal plants. These medical plants are used in recovering from various diseases (Subhash et al., 2016). *Angelica archangelica* commonly known as wild celery belongs to the apiaceae family and the flowers, fruits, roots and stems are used in traditional medicine. *Angelica archangelica* has several medicinal values. In Australia and health care system of University, Srinagar. Uttarakhand, it is used as gastrointestinal tract, respiratory tract, nervous system, and also associated with fever and flue (Bhat et al., 2011).

2.0 MATERIALS AND METHODS
2.1 Collection and Identification
The materials included fresh and dry whole plants of *Angelica archangelica* were collected from Ukhimat (Rudraprayag), Uttarakhand district, during July-August 2016. These plants were authenticated by the Taxonomy Laboratory, Department of Botany, HNB Garhwal

***Angelica archangelica* whole plants.**

2.2 Preparation of plant Extract

The whole plants were first shade dried for a week. Then the crushed plant material were ground into coarse powder with the help of a mechanical grinder and soxhlet extracted with petroleum ether, chloroform, ethyl acetate, acetone, methanolic, ethanolic and water using the soxhlet apparatus (Lin et al., 1999). Each extract was evaporated to dryness under reduce pressure using a rotary evaporator. The extracts thus obtained were stored in air tight container at 4^{o}C until further analysis.

2.3 Chemicals

All the chemicals and reagents used were of analytical grade such as DPPH (2, 2-Diphenyl-1-picrylhydrazyl), sodium hydroxide, methanol, ethyl alcohol, hydrochloric acid and sulphuric acid (Merk India Ltd).

2.4 Successive value

Accurately weighed 500gm coarse and air dried plant material were subjected to hot successive continuous extraction in soxhlet apparatus with different solvents with increase in polarity petroleum ether, benzene, chloroform, methanol, ethanol and finally with water. The extracts were filtered in each step concentrated and the solvent was removed by vacuum distillation. The extracts were dried in the vacuum dessicator and the residues were weighed (Qc & WHO et al., 1998). Which contain maximum chemical compound are these categories as depend upon solvent nature and types.

2.5 Qualitative phytochemical analysis

The qualitative phytochemical analysis of plant samples was carried out using standard methods. The extracts obtained as above are then subjected to qualitative tests for the identification of various plant chemical constituents. In addition, 50 gm of air dried or fresh plant material is also subjected to hydro-distillation to detect the presence of volatile oil. The plant material may be subjected to preliminary phytochemical screening for the detection of various plant constituents on the following lines (Kokate et al., 2005).

2.6 Nutritional value

The edible portion of whole plant was analyzed for moisture, ash, fat (Iswaran et al., 1980) and fiber as per method reported in AOAC. Total nitrogen was analyzed by microkjeldhal method (Ward et al., 1962) and for crude protein the value was multiplied by 6.25. Total carbohydrates were obtained by subtracting the value moisture, crude protein, crude fat, crude fiber and ash from 100% (Negi et al., 1992).

2.7 Quantitative phytochemical analysis

The quantitative phytochemical analysis of all samples was carried out using standard methods. The plant material may be subjected to quantitative phytochemical analysis for the detection of various plant constituents' tannins (Atanassova et al., 2009), saponins (Rammal et al., 2012), phenolic (Milan et al., 2011) and flavonoids (Chawhan et al., 2015) on the following lines.

2.8 Detection of chemical compound by TLC

Thin layer chromatography is performed on a sheet of glass, plastic, or aluminum foil, which is coated with a thin layer of adsorbent material usually silica gel G, aluminium oxide, or cellulose. This layer of adsorbent is known as the stationary phase. After the sample has been applied on the plate, a solvent or solvent mixture (mobile phase) is drawn up the plate via capillary action. TLC plates are prepared by spreading silica gel G on glass plate using distill water as solvent these plates are activated in oven at 110^{O}C for one hour. All extracts are applied separately and run in different solvent system of varying polarity. These plates are developed in Iodine chamber, UV chamber and spraying reagent for different spot of constituent chemical (Mohanty et al., 2011).

2.9 DPPH radical scavenging assay

The ability of the plant extract to scavenge DPPH free radicals was assessed by the standard method and adopted with suitable modifications. The stock solutions of extracts were prepared in methanol to achieve the concentration of 1 mg/ml. The dilutions were made to obtain concentrations of 20,40,60,80 and 100 µg/ml. The diluted solutions (1 ml each) were mixed with 2 ml of methanolic solution of DPPH in concentration of 1 mg/ml. After 30 min Incubation in darkness at room temperature (23^{o}C), the absorbance was recorded at 517 nm. The control sample contained all the reagents except the extract and the percentage inhibition was calculated using equation 1, whilst IC50 values were estimated from the % inhibition versus concentration plot, using a non-linear regression algorithm (Abrar et al., 2013).

$$\text{Inhibition (\%)} = \frac{(\text{Absorbance of control} - \text{Absorbance of sample})}{\text{Absorbance of control}} \times 100$$

2.10 Statistical analysis

The data are expressed as the mean ± SEM analyzed by one-way analysis of variance (ANOVA) and Tukey's t-test was used as the test of significance. P value<0.05 was considered as the minimum level of significance. All statistical tests were carried out using SPSS statistical software (Snecdecor et al., 1980).

3.0 RESULTS

The results of *Angelica archangelica* whole plants successive value were showed significant successive value are 4.21%, 3.90% and 3.65% against methanolic and water extract with 500gm plant sample. The level of nutrients such as crude protein, carbohydrates, crude fiber and ash content (3.87%, 31.28%, 3.25% and 1.80%) and also minerals as calcium, magnesium, potassium and phosphorus (1.30%, 6.13%, 2.10% and 0.60%) respectively. The results of antioxidant activity study of *Angelica archangelica* showed maximum activity in the methanolic extracts at different concentration of 20, 40, 60, 80 and 100µg/ml.

Table 1: Successive value of *Angelica archangelica* whole plant.

S.No	Plant Name	Pt. ether Extract	Chloroform Extract	Methanol Extract	Water Extract
1	*Angelica archangelica*	1.94%	2.16%	2.02%	4.15%

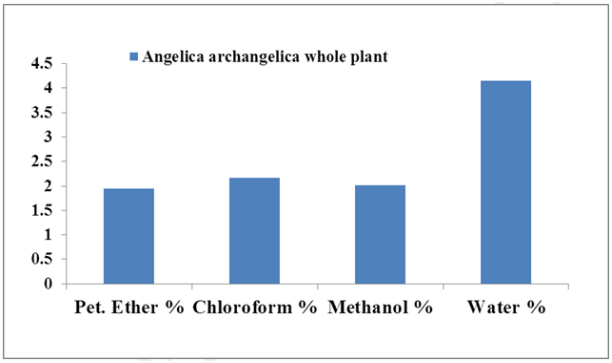

Figure 1: Successive value of *Angelica archangelica* whole plant.

Table 2: Nutritional value of *Angelica archangelica* whole plants.

Nutrients (%)	*Angelica archangelica* whole plants
Moisture	79.6±0.10
Crude fat	1.94±0.20
Crude fibre	6.38±0.14
Total nitrogen	0.25±0.05
Total protein	1.56±0.08
Organic matter	94.97± 0.15
Total Ash	5.03±0.25
Acid Insoluble	0.26±0.10
Water soluble	3.72± 0.05

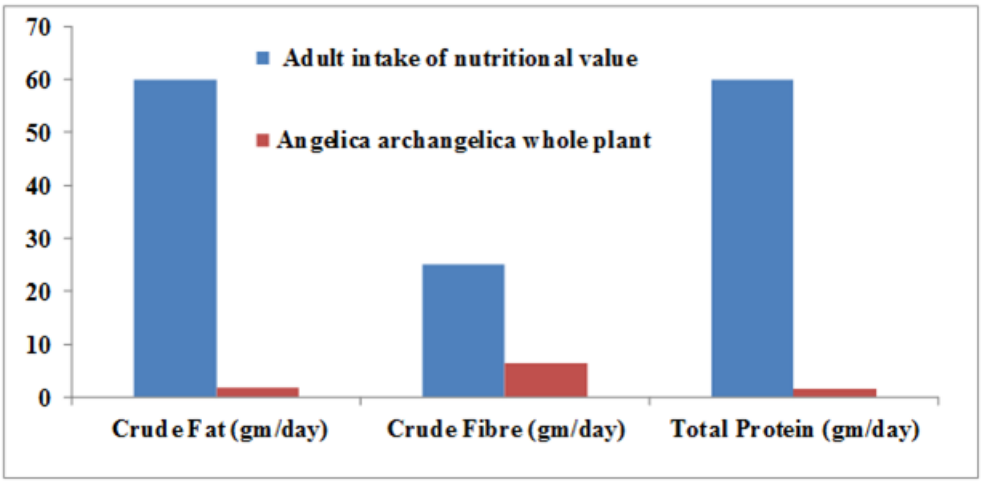

Figure 2 Comparison of per day intake of nutrients by Adults with the nutrients present in the whole plant of *Angelica archangelica*.

Table 3: Observations of thin layer chromatographic (TLC) studies of whole plants of *Angelica archangelica*.

S. No	Plants name	Extract	Compound Spots	Rf values	hRf. values
1.	*Angelica archangelica*	Pet. Ether	1	0.39	39
		Chloroform	2	0.39, 0.80	39, 80
		Ethyl Acetate	2	0.39, 0.80	39, 80
		Methanol	4	0.39, 0.80, 0.47, 0.55	39, 80, 47, 55
		Water	2	0.55, 0.60	55, 60

Table 4: Phytochemical screening of *Angelica archangelica* whole plants extracts, (+)-Present, (-)-Absent.

Plants		*Angelica archangelica* whole plants			
S. No	Test	Pet. Ether Extract	Chloroform Extract	Methanol Extract	Water Extract
1.	**Carbohydrate/Sugar** (1)Molish's test (2)Fehling test (3)Benedicts test	 (+) (+) (+)	 (-) (-) (-)	 (+) (-) (+)	 (+) (+) (+)
2.	**Glycoside's Cardiac glycoside** (1)Keller Kiliani 's test (2)Legal s test	 (-) (-)	 (+) (+)	 (+) (+)	 (+) (+)
3.	**Alkaloids** (1)Mayer's test (2)Dragendroff's 's test	 (-) (-)	 (+) (+)	 (+) (+)	 (+) (+)

4.	**Flavonides** (1)Alkaline reagent test (2)Lead acetate test	 **(+)** **(+)**	 **(-)** **(-)**	 **(+)** **(+)**	 **(+)** **(+)**
5.	**Phenolic Compounds** (1)Ferric Chloride test (2)Nitric acid test	 **(-)** **(-)**	 **(+)** **(+)**	 **(+)** **(+)**	 **(+)** **(+)**
6.	**Tannins** (1)Gelatin test (2)Vanillin hydrochloride Test	 **(-)** **(-)**	 **(-)** **(-)**	 **(+)** **(+)**	 **(+)** **(+)**
7.	**Saponin** (1)Froth test (2)Foam test	 **(-)** **(-)**	 **(-)** **(-)**	 **(+)** **(+)**	 **(+)** **(+)**
8.	**Protein &Amino acid** (1)Xanthoproteic (2)Ninhydrin	 **(-)** **(-)**	 **(-)** **(-)**	 **(-)** **(-)**	 **(+)** **(+)**
9.	**Phytosterol/Terpenoids** (1)Salkowski's test (2)Liebermann Burchad 's test	 **(+)** **(+)**	 **(-)** **(-)**	 **(+)** **(+)**	 **(-)** **(-)**

Table 5: Absorbance and inhibition percentage at various concentration of In–vitro antioxidant activity of *Angelica archangelica* whole plants, (DPPH Absorbance =2.181, 1.335 and % Inh. = % of Inhibition).

S. No	Concen-tration (µg/ml)	Ascorbic Acid Absorbance	% Inh.	Water Extract Absorbance	% Inh.	Gallic Acid Absorbance	% Inh.	Methanol Extract Absorbance	% Inh.
1	20	0.380	82.01	0.447	79.50	0.034	97.40	0.063	95.30
2	40	0.349	83.05	0.446	79.55	0.034	97.45	0.062	95.40
3	60	0.330	84.15	0.439	79.80	0.034	97.40	0.061	95.49
4	80	0.307	85.20	0.380	82.57	0.012	99.10	0.060	95.57
5	100	0.308	85.10	0.371	82.98	0.010	99.10	0.058	95.71

4.0 DISCUSSION

In this study, we evaluated the nutritional profile, successive value, phytochemical screening and antioxidant activity of the different extract of the whole plant of *Angelica archangelica*. From this work, it has been discovered that the widely used medicinal plants, *Angelica archangelica* has antioxidant properties. The free radical scavenging activity of the methanolic extract of different Plant has been tested by DPPH radical method using Quercetin as a reference standard. These activities were found to increase as the concentrations increased. For example, the concentration ranged from 20–100 µg/ml. DPPH is very stable free radical. The antioxidant activity of Standard and different plant species in terms of inhibition (%).The highest Inhibition percentage of Quercetin standard is 85.12% in 100µg/ml concentration.

5.0 CONCLUSION

It can be concluded that the different extract of the whole of *Angelica archangelica* possess potent antioxidant activity, nutritional profile and phytochemical screening and rich sources of different medicinal and traditional uses. The present study was attempted for the first time to investigate the nutritional profile, antioxidant activity and phytochemical screening of *Angelica archangelica* to search for newer, safer and more potent food supplements and antioxidant agent and we herein delineate the results of our study. This analysis revealed that, the whole plant contained higher value of nutrients and different primary & secondary metabolites, which are used in different disease.

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