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Nutritive value and antioxidant activity of *Acmella oleracea* (Asteraceae), a variety grown in Mizoram, India

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Abstract

Acmella oleracea (L) R.K. Jansen is a perennial and polliniferous herb belonging to family Asteraceae, and is mostly found in tropical and sub-tropical regions. It is widely used as an herbal medicine as a common vegetable. It is known to be highly abundant during summer but the importance value index (IVI) is highest during winter. In the light of these beneficial properties, its nutritive content and antioxidant property were evaluated. Fat, carbohydrate and protein contents were estimated, and the total calorific value was found to be 32.588 kcal/100 g. Nitric oxide scavenging assay showed concentration-dependent increase in its antioxidant activity. The IC_{50} of extract was calculated as 4.492 was higher than that of the standard butylated hydroxytoluene, i.e. 4.121. The reducing power of the extract also showed concentration dependent activities, but the reducing power of the extract was found to be significantly lower than the standard ascorbic acid. The study supports that *A. oleracea* has valuable biological properties.

Keywords: *Acmella oleracea*; antioxidant; calorific value; carbohydrate; fat; protein; reducing power.

1. Introduction

Acmella oleracea (L) R.K. Jansen is a perennial herb belonging to the family Asteraceae. It was first discovered in Peru and is now commonly found in tropical and sub-tropical regions throughout the world [1]. The plant is usually 20-60 cm tall and is found to multiply promptly in low open places. The leaves are simple in origin, oval shaped with uneven edges. The stem is cylindrical and moderately malleable. The colour of the flower is yellow, domed-shaped with tightly arranged sepals surrounded by minute petals [2]. It is a polliniferous herb with a flowering period from June to October [3]. It is most abundant during summer with the density of 12.3 but the importance value index (IVI) was found to be highest during winter, i.e. 31.9 [4]. It is known to contain several bioactive compounds including spilanthol, α and β-amyrinester, stigmasterol, miricilic alcohol glycosides, sitosterol, saponins and triterpenes [5]. Among the chemical constituents, spilanthol is known to be the major compound and is assumed to be responsible for most of the biological activities [6].

A. oleracea is an important culinary item and is consumed as either cooked or raw vegetable. It is considered as an important part of a diet and is of tenused as an ingredient in salad to enhance the flavour. In addition to its use as a vegetable, it is also used in traditional medicine for a variety of diseases. It is widely used as local anesthesia due to its property to develop burning sensation and numbness upon its application. It is also used as an anesthetic, anticonvulsant, antiseptic, antifungal, antiprotozoal, antidiarrhoeal, analgesic, antiulcer, antipyretic, antidiuretic, antiinflammatory, anthelminthic and as an insecticide [7,8]. In Indian culture, it is often used as an aphrodisiac [9]. In Mizoram, the flower heads and the

leaves are consumed either raw or cooked for the removal of different parasitic infections [10].

The ethanol extract of *A. oleracea* was reported to have ovicidal, larvicidal and pupicidal activity against *Anopheles*, *Culex* and *Aedes* mosquitoes. The boiled aerial part of the plant has been reported to have carminative property and was used for the treatment of flatulence [11]. It is one of the top five herbal plants with high utility values (UVs) with a value of 0.83 and is used to treat constipation, peptic ulcer and liver abscess [12]. The ethanol extract also produced antinociceptive activity and was found to cause no adverse effect on the animal model [13]. As nutrient analysis and estimation of antioxidant activities play crucial roles in assessing the therapeutic uses and validity of many traditional medicines, this experiment aimed to assess the nutritive value and antioxidant activities of *A. oleracea*.

2. Materials and Methods

2.1. Sample collection

A. oleracea was collected from the Ngopa (location 23.8861° latitude north and 93.2119° longitude east), a village in Champhai district, Mizoram, India, in 2015. A voucher specimen was identified at the Botanical Survey of India, Meghalaya, India, and is maintained at the herbarium section (No. PUC-A-17-1) of the Department of Botany, Pachhunga University College, Aizawl, Mizoram. The aerial parts of the plant were dried in the shade.

2.2. Preparation of plant extract

Known quantities of the dried plant samples were subjected to cold maceration in an aspirator bottle using distilled water as a solvent. Extraction was done for seven days with continuous stirring every two hours. The solvent was filtered and concentrated using rotary vacuum evaporator (Buchi Rotavapor® R-215). The extract was obtained as a semi solid mass and stored in a refrigerator maintained at 4°C until further use.

2.3. Total fat content

Total fat content was determined according to the AOAC (1984) method [14]. 20 g of the ground plant sample were used for hot continuous Soxhlet extraction using petroleum ether for 8-10 hours. The solvent was evaporated using rotary vacuum evaporator under reduced pressure. The extract was obtained as a semi-solid mass and total fat content was calculated using the following formula:
Fat content = Weight of extracted oil/Weight of the sample

2.4. Carbohydrates estimation

The carbohydrate content was determined according to the method of Artinigam and Ayyagari [15]. 100 mg of the samples were hydrolyzed by keeping them in a water bath for 3 hours with 5 ml of 2.5 N hydrochloric acid and cooled to room temperature. The sample was neutralized with solid sodium carbonate until the effervescence ceased and then the volume was made up to 100 ml and centrifuged at 3000 rpm. The supernatant was collected and 0.5 ml of the aliquots was taken for analysis. A standard graph was prepared by taking different concentrations of glucose (1 mg/ml). The volume of all the tubes were then made to 1 ml by adding distilled water. To this, 4 ml of anthrone reagent was added and heated for 8 minutes in boiling water bath. The tubes were cooled rapidly and the absorbance was taken at 630 nm using UV-Vis spectrophotometer (Thermo Scientific™ Evolution™ 201/220).

2.5. Protein estimation

Protein estimation was done according to the protocol of Artinigam and Ayyagari [15]. 1g of the powdered sample was defatted twice with hexane and then used for protein estimation. The sample was reacted with 25 ml of a solution containing 0.03 mol/L TrisHCl pH 8.0 and 0.01 mol/L mercaptoethanol for 1 hour, andvortexing every 10 minutes. It was centrifuged at 2000 rpm at room temperature for 20 minutes and the supernatant was collected. 5 ml of Bradford reagent was added and the volume was adjusted to 200 ml with distilled water. A series of various concentrations were set up using bovine serum albumin (100 mg/ml) and used for preparation of standard graph. Blank was prepared by adding 5 ml of Bradford reagent to 1 ml of distilled water. Likewise, 5 ml of Bradford reagent was added to all the test tubes including the sample tube and mixed well. The absorbance was measured at 595 nm using UV-Vis spectrophotometer. The amount of protein present in the sample was estimated by referring to the standard curve obtained and multiplying the value by the dilution factor.

2.6. Nitric oxide scavenging assay

Nitric oxide scavenging assay was performed according to the method of Moon *et al* [16]. 1ml of different concentrations (10, 20, 40, 60, 80 and 100 µg/ml) of extract and standard were mixed separately with 2ml of 10 mM sodium nitroprusside and incubated at 30°C for 2 hours in an incubator. The mixture was then reacted with 0.5 ml of Greiss reagent and the absorbance was measured at 550 nm using UV-Vis Spectrophotometer. The percent inhibition was calculated as follows:

% Inhibition = (Absorbance of control – Absorbance of extract/standard)/Absorbance of control × 100

2.7. Reducing power

The reducing power was determined according to the method of Oyaizu (1986) using ascorbic acid as standard [17]. 1 ml of the extract and 1 ml of the standard with various concentrations (10, 20, 40, 60, 80, and 100 µg/ml) were mixed with 2.5 ml of phosphate buffer (6.6 pH) and 2.5 ml of 1% potassium ferricyanide. The mixture was then incubated at 50°C for 30 minutes. The reaction

was stopped by adding 2.5 ml of 10% trichloroacetic acid and the mixture was centrifuged at 3000 rpm for 10 minutes. 2.5 ml of the supernatant was mixed with 2.5 ml of distilled water, and 0.5 ml of 0.1% ferric chloride solution and the absorbance was taken at 700 nm using UV-Vis spectrophotometer.

3. Results

Estimation of total fats content showed that 1g of the *A. oleracea* sample contains 0.000366g of fats which is equal to 0.003294 kcal. 1g of the sample also contains 0.0001485g of carbohydrates which is equal to 0.000594 kcal. It was also found that 1g of *A. oleracea* contain 0.0805g of proteins which is equivalent to 0.322 kcal. Therefore, the total calorific value was obtained by the combination of each of the calorific values and was found to be 32.5888 kcal/100g.

The antioxidant activity which was estimated by nitric oxide scavenging assay showed a concentration dependent activity (Figure 1). However, the extracts at all concentrations showed a lower scavenging activity than the standard. The Inhibition concentration at half concentration (IC_{50}) was calculated for the standard graph was found to be 4.121 while that of the extract was 4.492. Thus, it was found that the standard is more potent than the extract in scavenging nitric oxide.

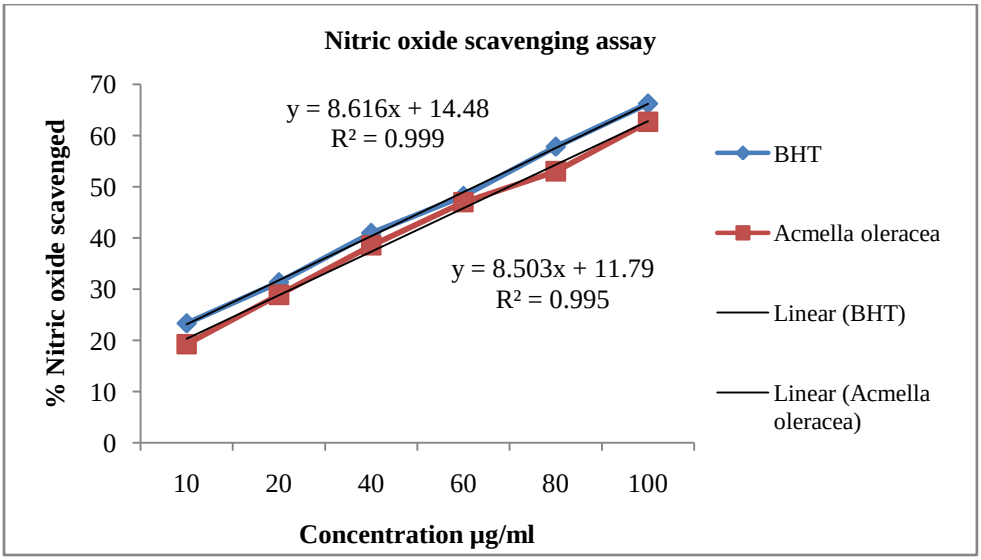

Figure 1: Nitric oxide scavenging activity of *Acmella oleracea.*

The reducing power of ascorbic acid was found to be very high and showed a concentration dependent activity. However, the reducing powers of the extract although showing a concentration dependent activity was found to be much lower than the standard in all concentrations (Figure 2).

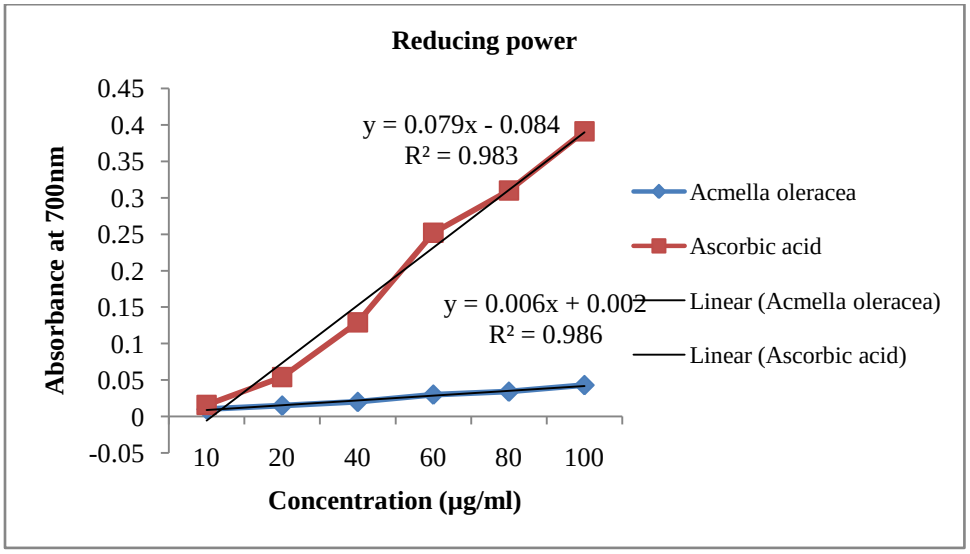

Figure 2: Reducing power of *Acmella oleracea.*

4. Discussion

A healthy diet is regarded as the balance between an intake and expenditure of energy. Plants are well-known source of nutrients essential for the growth of the body and maintenance of life. The present study showed that *A. oleracea* has a calorific value of 38.5888 kcal/100g. The calorific value was found to be lower than other common vegetables such as *Alocasia fornicate* having calorific value of 81.71 kcal/100g and *Trevesia palmate* with calorific value of 86.12 kcal/100g [18]. The calorific value although lower than the other common vegetable, could be an excellent source of nutrients when consumed regularly.

For a healthy body weight, consumption of 2000 calories per day is essential and an intake of less than 30% energy from fats is highly recommended [19]. Carbohydrates contribute 40-80% of energy and it is necessary to consume at least 55% of energy from carbohydrate sources for an optimum diet [20]. Proteins are the major source of macronutrients which are required to satisfy the metabolic demands and maintenance of nitrogen equilibrium. The safe level of intake is 0.83g/kg per day for an adult healthy person. However, an intake of more than the safe value may be essential for people with excessive physical activities [21].

Exogenous antioxidants are required by the body for reduction of oxidative stress which may lead to damage and mutation of important biomolecules such as DNA, RNA, proteins, lipids etc. [22]. The phytochemicals present in plants such as phenols, flavonoids etc. are the main contributors of antioxidant activities. The scavenging activities of plant extracts are mainly due to the phenolic compounds having hydroxyl group in their structure [23]. The scavenging activity of the extract showed concentration dependent activities, i.e. activity increases with increase in concentration. The inhibition concentration at half concentration (IC_{50}) of extract i.e. 4.492 was found to be higher than the standard BHT, i.e. 4.121. Higher value of IC_{50} shows that the extract has lower antiradical activity than the extract.

The reducing power of extract is mainly attributed to the donation of hydrogen atom which can further break the free radical chain reaction. Reducing compounds are regarded as primary and secondary antioxidants which can reduce oxidized intermediates of lipid peroxidation processes [17]. The reducing power of extract and standard i.e. ascorbic acid showed concentration dependent activities but the reducing power of the extract was found to be significantly lower than the extract.

One study showed that the ethyl acetate extract of *A. oleracea* showed immediate vasorelaxation and antioxidant activity while chloroform extract showed the highest vasorelaxation and antioxidant activity.[6] The plant was also found to be a potent antioxidant required for normal activities, defensive weapon against viruses and microbes and prevention of various damages in the body such as chain reaction leading to cell death. It was also found to have the highest potency for scavenging free radicals as estimated from DPPH and ABTS assay [24]. Therefore, *A. oleracea* containing many of the important bioactive compounds is a possible candidate for treatment of various common diseases and a good source of nutrients.

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Conflict of Interest

Conflict of interest declared none.

References

[1]. Tiwari KL, Jadhav SK and Joshi V. An updated review on medicinal herb genus *Spilanthes*. *Zhong Xi Yi Jie He XueBao*. 2011; 9: 1170–1178.

[2]. Abeysinghe DC, Wijerathnel SMNK & Dharmadasa RM. secondary metabolites contents and antioxidant capacities of *Acmella oleraceae* grown under different growing systems. *World Journal of Agricultural Research* 2014; 2: 163–167.

[3]. Lalhmangaihi R and Laha RC. Phenological studies of polliniferous plants for apiculture in Mizoram. In: Lalchhandama K, editor. *Science and Technology for the Future of Mizoram*. Allied Publishers, New Delhi, India, 2017; pp. 29–34.

[4]. Lalmuanpuii R, Laldinfeli R and Laha RC. Wild edible vegetables and traditional recipes among two ethnic communities of Mizoram, Northeast India. In: Lalchhandama K, editor. *Science and Technology for the Future of Mizoram*. Allied Publishers, New Delhi, India, 2017; pp. 47–52.

[5]. Lemos TLG, Pessoa ODL, Matos FJA, Alencar JW and Craveiro AA. The essential oil of *Spilanthes acmella* Murr. *Journal of Essential Oil Research* 1991; 3:369–370.

[6]. Wongsawatkul O, Prachayasittikul S, Isarankura-Na-Ayudhya C, Satayavivad J, Ruchirawat S and Prachayasittikul V. Vasorelaxant and antioxidant activities of *Spilanthesacmella* Murr. *International Journal of Molecular Sciences* 2008; 9:2724–2744.

[7]. Dubey S, Maity S, Singh M, Saraf SA, Saha S. Phytochemistry, pharmacology and toxicology of *Spilanthesacmella*: a review. *Advances in Pharmacological Sciences* 2013; 2013:423750.

[8]. Paulraj J, Govindarajan R, Palpu P. The genus *Spilanthes* ethnopharmacology, phytochemistry, and pharmacological properties: a review. *Advances in Pharmacological Sciences* 2013; 2013: 510298.

[9]. Prachayasittikul V, Prachayasittikul S, Ruchirawat S, Prachayasittikul V. High therapeutic potential of *Spilanthesacmella*: a review. *EXCLI Journal* 2013; 12: 291–312.

[10]. P.B. Lalthanpuii, R. Lalawmpuii, H. Lalhlenmawia, K. Vanlaldinpuia and K. Lalchhandama. Chemical constituents and some biological properties of the traditional herbal medicine *Acmella oleracea* (Asteraceae). In: Lalchhandama K, editor. *Science and Technology for the Future of Mizoram*. Allied Publishers, New Delhi, India, 2017; pp. 168–173.

[11]. Amer A and Mehlhorn H. Larvicidal effects of various essential oils against *Aedes*, *Anopheles*, and *Culex* larvae (Diptera, Culicidae). *Parasitology Research* 2006; 99: 466–472.

[12]. Neamsuvan O and Ruangrit T. A survey of herbal weeds that are used to treat gastrointestinal disorders from southern Thailand: Krabi and Songkhla provinces. *Journal of Ethnopharmacology* 2016; 209: 318–327.

[13]. Nomura ECO, Rodrigues MRA, SilvaCFD, LA Hamm, Nascimento AM, Souza LMD, Cipriani TR, Baggio CH, Werner MFDP. Antinociceptive effects of ethanolic extract from the flowers of *Acmella olerace* (L.) R.K. Jansen in mice. *Journal of Ethnopharmacology* 2013; 150:583–589.

[14]. Horwitz W and Latimer GW. *Official Methods of Analysis of AOAC International* (18th edition). *AOAC International, Gaithersburg, Maryland, US*, 2005; p. 945.

[15]. Artinigam and Ayyagari A. *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill Education Pvt. Limited, New Delhi, India, 2009; pp. 25, 53–54.

[16]. Moon K, Katolkar P and Khadabadi SS. *In vitro* antioxidant activity of methanolic extract of *Erythrina indica*. *Der Pharmacia Lettre* 2010; 2: 16–21.

[17]. Lalawmpuii R, Lalhriatpuii TC, Lalzikpuii, Lalengliani K and Ghosh SK. Qualitative phytochemical screening and evaluation of *in-vitro* antioxidant activity of *Callicarpa arborea* Roxb., an ethnomedicinal plant of Mizoram, northeast India. *Asian Journal of Pharmaceutical and Clinical Research* 2015; 8: 202–205.

[18]. Lalnunhruaitluangi, Islam A and K Thanzami. Determination of the nutritive value, total flavonoids and phenolic contents of selected Mizo vegetables. In: Lalchhandama K, editor. *Science and Technology for the Future of Mizoram*. Allied Publishers, New Delhi, India, 2017; pp. 243–249.

[19]. WHO. Healthy diet. *WHO Fact Sheet Nº 394*. World Health Organization, Geneva, Switzerland. 2015. http://www.who.int/mediacentre/factsheets/fs394/en/

[20]. Nantel G. Carbohydrates in human nutrition. *Food Nutrition and Agriculture*, 1999; 24: 6–10.

[21]. Protein and amino acid Requirements in Human nutrition: report of a joint FAO/WHO/UNU expert consultation. *WHO Technical Report Series No.* 935. World Health Organization, Geneva, Switzerland.

[22]. Lalthanpuii PB, Lalawmpuii R and Lalchhandama K. Evaluation of the antioxidant properties of the toothache plant *Acmella oleracea* cultivated in Mizoram, India. *Der Pharmacia Lettre* 2017; 9: 137–141.

[23]. Muthulakshmi T, Saleh AM, Kumari NV, Priya Mk and Palanichamy V. Screening of phytochemicals and *in-vitro* antioxidant activity of *Acorusc alamus. International Journal of Drug Development and Research* 2015; 7: 44–51.

[24]. Wu LC, Chufan N, Huilin M, Raychu I, Huang SJ, Yuanhu C and Yuhan A. Anti-inflammatory effect of spilanthol from *Spilanthes acmella* on murine macrophage by down-regulating LPS-induced inflammatory mediators. *Journal of Agriculture and Food Chemistry* 2008; 56:2341–2349.