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Pharmacognostic & Phytochemical Investigation of wild leafy vegetable of *Ipomoea aquatica* Forssk

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Abstract: This study aimed to investigate in detail the Pharmacognostic & phytochemical analysis of the traditional medicinal and wild leafy vegetable plant *Ipomea aquatica* 'Forsk of the family Convolvulaceae commonly known as Karmota bhaji, water spinach, The plant consumed as a vegetable and consist as good source of vitamin, protein & fibers. Plants also have medicinal values useful for fever, jaundice, bronchitis, and liver inflammation. Plant materials of *Ipomoea aquatica* were collected From Maharitola. Gondia (MS) for morphological study. The plant is a twining and terrestrial habitat, The Stem is 2-3 meters, the leaves sagittate to lanceolate, and the flower is trumpet-shaped with five united pale purple petals. Anatomical characteristics of the stem show a multilayer cortex, compactly arranged cells, some cells filled with crystals, and latex with conjoint, collateral, and open types of vascular bundles. In T.S. of petiole single layer epidermis surrounded by cuticle followed by sclerenchymatous hypodermis, Vascular bundle consists medium size arc in the center & collateral type. The transverse section of leaves consists single layer of compactly arranged epidermis followed by three distinct zones of cortex made up of barrel-shaped cells and the Stomata distribution is Amphistomatic and Anisocytic. The root shows similar anatomical features to the stem made up of aerenchyma resulting in five hollow cavities in the root. Phytochemical analysis of leaves of different extracts Such as water, ethanol, methanol, acetone & Chloroform, shows the presence of carbohydrates, and proteins. Anthraquinones, Quinones, alkaloids, flavonoids, Glycosides, terpenoids, xanthoprotein tannins, resin & Coumarins were present. Gum and Mucilage, carboxylic acid, Triterpenoids, and anthocyanin were absent in all extracts. The result indicates that the leaves are rich in primary and secondary metabolites. Which is recommended for use as a leafy vegetable further elaborative investigation is needed to validate this plant for its daily consumption as a vegetable.

Keywords: - Phytochemical analysis, Anatomical study, leafy vegetable, *Ipomoea aquatica* Forsk.

INTRODUCTION

Lifestyle diseases are becoming a serious issue around the world, especially in cities where many people live busy lives. Conditions like diabetes, fatty liver, heart disease, anxiety, and depression are on the rise and are concerning for public health. Unfortunately, medical treatments often do not manage these diseases well, making prevention an essential solution. One effective way to prevent these illnesses is by eating wild edible plants, which have been used for generations to support health. Many of these plants are not well-known today, but they were once a big part of our diets and are valued for their health benefits. (1-3) They contain important nutrients, natural compounds, and antioxidants that can help keep us healthy. Additionally, some of these plants offer bioactive products that are now considered natural medicines. By recognizing and incorporating these traditional foods into our diets, we can take important steps toward better health. The *Ipomoea aquatica*, also known as the aquatic morning glory or water spinach, is a common vine with milky sap that belongs to the Convolvulaceae family. This plant is found in many places, thriving in wet soils near fresh water like lakes, ponds, and rice fields. It grows all year round, especially in Southeast Asia, where it can be found both wild and cultivated. Although it is a perennial plant that usually rests during winter, it springs back to life in the pre-monsoon months of April and May, growing rapidly during the rainy season until around August or September. Known for its delicious leaves and stems, water spinach is a popular ingredient in many dishes, making it an essential part of the local diet in many cultures. (4-5). The genus *Ipomoea* is predominantly distributed in tropical regions globally, although several species extend their range into temperate zones. (6) This plant is not just good for eating; it is also recognized in traditional Indian medicine, or Ayurveda, for helping manage diabetes. The green leaves of *I. aquatica* are often suggested for people with diabetes to help improve their health. Recent studies have shown that this vegetable may help control blood sugar levels, prevent liver damage, fight cancer, and lowering blood sugar levels. (7) These effects are believed to come from the plant's unique chemical components. However, while some studies have

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looked into the chemical makeup of different *I. aquatica* plants, the findings vary widely based on the plant's location type. Alkaloids, phenolic compounds, and glycolipids represent the most prevalent biologically active components derived from these botanical extracts (8).

Numerous species within the Ipomoea genus have been utilized for medicinal purposes. Research has elucidated the potential of this genus as a repository of therapeutic agents. The glycoresins present in these species serve as a significant chemotaxonomic marker within this botanical family. (9) Many of these studies focus only on a few well-known compounds, and we still do not have a clear understanding of how much of these important substances are present in *Ipomoea aquatica*. Therefore, this study aims to explore the plant's physical traits, examine its internal structure, and conduct an initial assessment of its chemical properties.

MATERIAL & METHODS

The plant material was collected from Maharitota, District Gondia, Maharashtra (Lat 21.413700, Long 80.39550). It was authenticated and identified at Bhawabhuti Mahavidhyalaya in Amgaon, utilizing the Flora of Maharashtra, Nagpur, Kolhapur, and The Flora of British India. (10,11,12) A voucher specimen (Number JGN 5) was submitted to the department for future reference. Morphological studies were conducted through visual observation in natural conditions. For the anatomical study, fresh leaves stems, and petioles were hand-sectioned. The leaves were washed, dried in a shady area for a few days, and spread on newspaper for complete drying. Using a manual blender, the dried material was then ground into a coarse powder. The powdered plant material was stored in airtight containers for later use.Twenty grams of leaf powder were extracted using various solvents, and the crude samples were used for phytochemical analysis.

Physico-chemical analysis the physicochemical analysis, which includes assessments of total ash content, acid-insoluble ash, the pH of a 5% aqueous solution, and the extractive values soluble in water and alcohol, was conducted following established protocols (13). Additionally, the values for extractives soluble in petroleum ether and chloroform were obtained through Soxhlet extraction.

Preliminary phytochemical screening A preliminary phytochemical screening was performed to identify the presence of secondary metabolites, including alkaloids, carbohydrates, proteins, terpenoids, steroids, tannins, phenols, and starch, in various extracts by standardized methodologies (14).

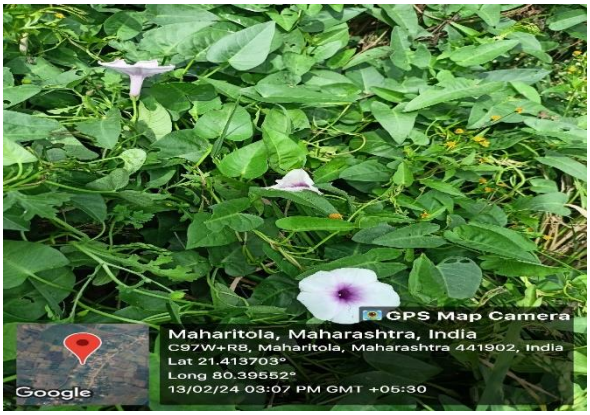
Powder Microscopy In the examination of plant powder, a small quantity of finely ground powder is placed into a test tube and subjected to boiling in chloral hydrate solution for several minutes. Subsequently, a few drops of the powder were applied onto a slide that had been prepared with phloroglucinol, followed by the addition of a few drops of concentrated hydrochloric acid (15). The resulting slides were carefully observed under a microscope and photographed

Plant profile

The perennial herb *I. aquatica*, also known as *Ipomoea reptans* Linn., is a member of the Convolvulaceae family and is found in tropical Asia, Africa, Australia, and India (16) It is originated in China. (17) While the plant is commercially farmed in Southeast Asian countries including Malaysia, China, Hong Kong, Singapore, and Indonesia, it is widely grown as a weed in India and the United States (18)

Taxonomic classification

Kingdom: Plantae
Subkingdom: Tracheobionta
Super division: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Solanales
Family: Convolvulaceae
Genus: Ipomoea
Species: *I. aquatica* Forsk



Vernacular names

Sanskrit: Kadambi, Kalaka, Kalambi, Kalambika, Kalashaka, Kechuka, Nadika, Pattashaka, Pechu, Pechuli, Shataparna, Shradhashaka,

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Vishvarochana[19]
Hindi: Kalmisag, Karmi, Patuasaga[19] **Gujarati**: Nalanibhaji[19]
English: Water spinach, Chinese water spinach, water morning glory, swamp cabbage [19] **Punjabi**: Ganthian, Nali, Nari[19] **Marathi**: Nadishaka[19]
Bengal: Kalmisak, Nalike, Patushaka[19] **Telugu**: Tutikura[19]
Tamil: Koilangu, Sarkareivalli[19] **Urdu**: Narikakal[19] **Sind**: Naro.[19].

Traditional Uses

In the Unani medical framework, *I. aquatica* is employed as a carminative agent, mitigates inflammation, and provides therapeutic benefits for conditions such as fever, jaundice, biliousness, bronchitis, and hepatic disorders. In the region of Assam, it is utilized in the management of female nervous disorders and general debility. The desiccated juice of this plant exhibits purgative properties. In Cambodia, the stem and foliage are applied in the treatment of febrile delirium, whereas in Burma, the extracted juice serves as an emetic in instances of opium or arsenic poisoning. As an anthelmintic, it is also indicated for the management of leucoderma, leprosy, and hemorrhoidal conditions. (20) Both hypertension and epistaxis can be effectively addressed with its application. According to traditional medical practices in Sri Lanka, it is believed to possess insulin-like properties. (21)

RESULTS

Macroscopic Observation

Sr. No	Characters	*Ipomoea aquatica*
1	Habit	Twining/Terrestrial
2	Leaves (Length)	6.0 - 8.2 cm
3	Leaves (Width)	3.0 - 4.5 cm
4	Leaves (Base)	Heart shape
5	Leaves (Margin)	Entire
6	Petiole (Length)	4.0 – 7.5
7	Stem (Surface)	Glabrous
8	Stem (Branching)	Cylindrical, Hallow, Smooth
9	Stem (Color)	Green
10	Stem (Type)	Herbaceous
11	Petal (Color)	Pink-purple
12	Petal(length)	Up To 6.0 cm
13	Root (Type)	Internodes root

Microscopic Observation

Powder Microscopy

The characteristics of leaf powder included unicellular trichomes, paracytic stomata, rosette formations of calcium oxalate crystals, epidermal cellular structures, and xylem vascular elements, all of which were evident in the analyzed leaf powder.

T.S. of Stem.

Epidermis: single-layered cells & compact arrangement and covered with cuticle

Cortex: The cortex exhibits a substantial structure and is composed of three discrete zones. The initial zone is characterized as the hypodermis, which is comprised of a few cells in thickness and is situated immediately beneath the epidermal layer. Two to three layers of parenchyma cells situated beneath the hypodermal layer are referred to as the middle cortex. The final zone of the cortex is constituted by a continuous arrangement of compact, barrel-shaped cells that form the starch layer. Additionally, some cells within the middle cortex contain crystals and latex.

Vascular bundles: They are collateral, conjoint, and open types with outer phloem and middle xylem.

Pith: The middle portion of the pith has many hollow cavities.

T.S. of petiole: - Anatomically, both the stem and petiole exhibit similarities; however, the petiole is somewhat triangular, and they are classified as collateral, conjoint, and of the open type, featuring an outer layer of phloem and a central layer of xylem.

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T.S. of Leaves: The lower and upper epidermis are characterized by barrel-shaped cells that are compactly arranged in a single layer. Both epidermises possess a thick hydrophilic cuticle. The distribution of stomata is amphistomatic, comprising an anisocytic type of stomata, while unicellular uniseriate trichomes are present on the upper surface of the leaf.

T.S. of Root

Epidermis:single-layered cells of compact arrangement and covered with single cellular outgrowth of root hairs.

Cortex: The cortex exhibits substantial dimensions and comprises three distinct zones. The initial zone comprises the hypodermis, a few cells thick and situated directly beneath the epidermal layer. Beneath the hypodermal layer, two to three parenchyma cell layers exist, collectively called the middle cortex. Continuous, densely arranged barrel-shaped cells form the five hollow compartments, constituting the cortex's final zone.

Vascular bundles: Vascular bundles form a continuous cylinder of xylem and phloem. They are collateral.

Pith: Pith is a few layered parenchymatous cells.

Stomatal Number & Index. Leaf constants were quantitatively assessed, including stomatal number, index, vein-termination number, and vein-islet number. The findings are presented in the accompanying table. **.1**

Parameter	**Value**
Average stomatal number in 10 different fields (45X)	150/square mm (upper epidermis)
Average stomatal number in 10 different fields (45X)	166/square mm (lower epidermis)
Stomatal index (45X)	12.52 (upper epidermis)
Stomatal index (45X)	16.46(lower epidermis)
Vein-islet number (10X)	23.34/square mm
Palisade ratio	8.33

Physiochemical Parameters: Ash values associated with a pharmaceutical compound provide insights into the earthy matter, inorganic composition, and other impurities that may coexist with the drug. Extractive values are primarily instrumental in the assessment of exhausted or adulterated pharmaceuticals. The results of these parameters are presented in the table.2

Parameter	Value (% W/W)
Total -Ash	5.3
Acid- Insoluble ash	2.30
Water soluble ash	0.53
Loss of drying	2.90
Foreign matter	0
1% pH	6.56
10% pH	4.90
Total fat content	7.23

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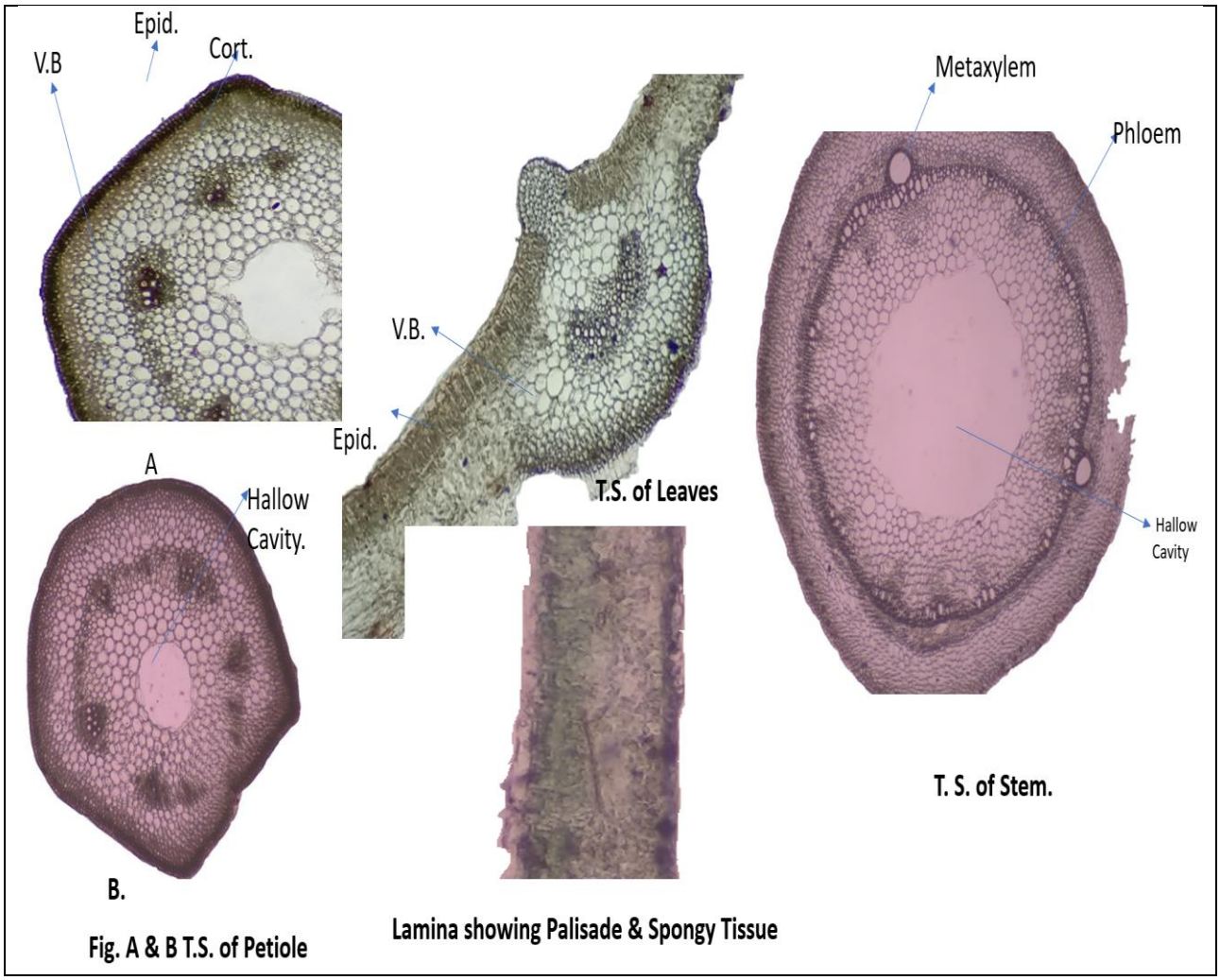

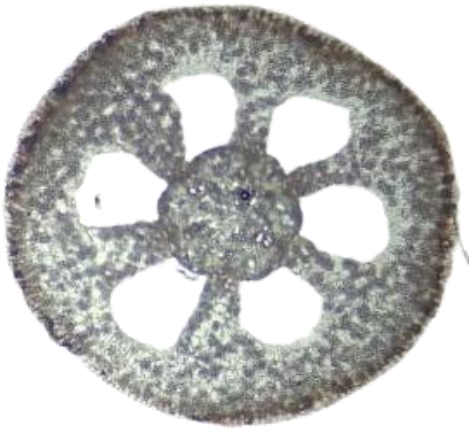	
T. S. of Root	**Leaf powder**

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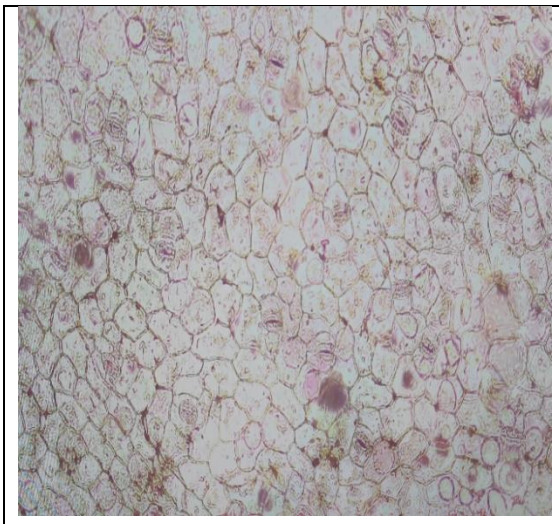
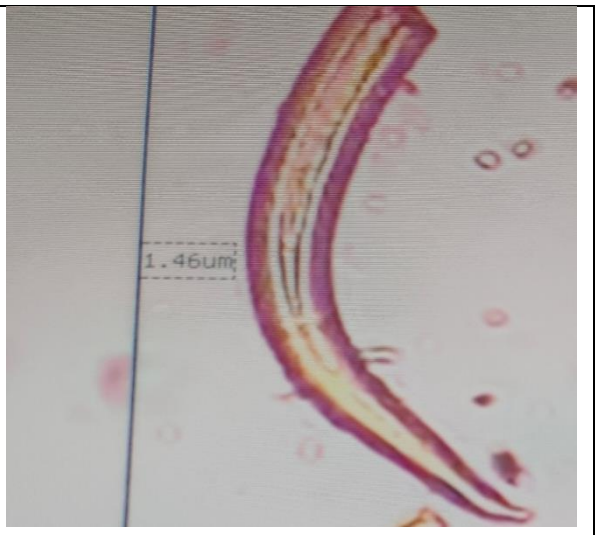


Stomatal index



Trichome

Preliminary Phytochemical study

A. Powder behavior in different chemical reagents

Sr.No	Reagent	Colour/Behavior	inference
1	Powder as such	Olive Green	
2	Powder+5%ferric chloride	Sepia brown	Tannin Present
3	Powder + 5% Iodine	Raw umber Brown	Starch Present
4	Powder + Picric acid	Gold yellow	Alkaloids
5	Powder + 40% NaoH+ lead Acetate	Buff Brown	Cysteine Absent
6	Powder+Conc.HNO3+ Ammonia	Fulvous Brown	Xanthoprotein Present
7	Powder + Sudan III	Lion Brown	Oil Present

B. Qualitative Phytochemical Analysis

Test	Water	Ethanol	Methanol	Acetone	Chloroform
Carbohydrate	+	+	-	-	-
Starch	-	+	-	-	-
Protein	+	+	+	+	-
Fatty acid	-	-	-	-	-
Resins	+	+	+	+	-
Oil/Fats	+	-	-	-	-
Gams& Mucilage	-	-	-	-	-
Carboxylic acid	-	-	-	-	-

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C.Quantitative analysis of Secondary Metabolites

Sr. No.	Test	Water	Ethanol	Methanol	Acetone	Chloroform
1	Anthraquinones	+	+	-	+	-
2	Quinones	+	-	-	+	+
3	Alkaloids	-	+	+	+	+
4	Glycosides	-	+	-	-	-
5	Cardiac Glycosides	-	+	-	+	+
6	Tannins	+	+	+	+	-
7	Flavonoids	-	-	+	+	-
8	Phytosterols	-	-	-	-	-
9	Phlobatannins	+	+	-	-	-
10	Steroids	-	+	+	+	-
11	Xanthoproteins	+	+	-	+	+
12	Chalcones	+	-	-	-	-
13	Triterpenoids	+	+	-	-	-
14	Anthocyanins	-	-	-	-	-
15	Coumarins	+	+	+	+	-
16	Modins	+	+	-	+	-

DISCUSSION

Ipomea aquatica (water spinach) is a wild leafy vegetable consumed all over India and other countries this plant is rich in vitamins, protein, and fibers along with so many antioxidants such as flavonoids, alkaloids & tannin it also contains resins gum. The phytochemical analysis of these plants shows the presence of these phytochemicalsPrevious research investigations: proximate analysis of *I. aquatica* was conducted employing standardized methodologies, wherein phytochemical screening revealed a pronounced concentration of alkaloids, reducing sugars, soluble carbohydrates, and flavonoids, concomitantly showing diminished concentrations of steroids, phenols, glycosides, β-carotene, saponins, and tannins (22). Comparable findings were documented, indicating the existence of flavonoids, saponins, tannins, and steroids within the aqueous and methanolic extracts of *I. aquatica* (23). Conversely, certain studies have demonstrated the presence of glycosides, flavonoids, phenols, and terpenoids in the acetone extracts of *I. aquatica* (24). Preliminary phytochemical screening is conventionally undertaken to ascertain the presence of diverse phytochemicals that may be implicated in plant extracts' antioxidant and antimicrobial properties. Our findings indicated that ethanol and acetone serve as superior solvents for extracting phytochemicals from *I. aquatica*. The physiochemical parameters and stomatal index are comprehensively encapsulated in the observation table.

The anatomical study of these plants & their characteristic feature are well-defined. Indicate plant anatomy shows somewhat hydrophytic characteristics along with well-developed vascular bundle single layer epidermis &cuticle and sunken stomata were absent.

CONCLUSION

The pharmacognostic and phytochemical investigation of *Ipomoea aquatica* elucidates its considerable potential as a source of bioactive constituents endowed with diverse therapeutic attributes. The study underscores the existence of crucial phytochemicals, such as flavonoids, phenols, and terpenoids, which play a pivotal role in their antioxidant, antidiabetic, and antimicrobial functionalities. To this study plantscontain so many nutrients thatare beneficial for health & recommended for to consume alternate vegetable which is available in all season’s cheap source of vegetable.

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Conflict of Interest: -We have no conflict of interest to declare.

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