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Research Article

COMPARATIVE NUTRITIONAL PROFILING OF WILD AND CULTIVATED VARIETY OF *VASA* (*Adhatoda Vasica* Nees.)

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ABSTRACT

Ayurveda describes several plant-derived food substances under *Shaka Varga*, a group discussed within the dietary framework of *Annapanavidhi* (Properties of diet and drinks). *Vasa*, botanically identified as *Adhatoda vasica* Nees., is widely recognized as an important medicinal plant and is also described under *Shaka Varga* in classical Ayurvedic literature. This dual identity as both an *Aushadha* and a *Shaka* provides a rationale for investigating its nutritional characteristics in addition to its established medicinal properties. **Aim**: The present study aimed to comparatively evaluate the nutritional composition of wild and cultivated *Vasa* leaves, with supporting physicochemical characterization. **Materials and Methods**: Wild *Vasa* leaves were collected from Junagadh, Gujarat (21.5220° N, 70.4572° E), whereas cultivated *Vasa* leaves were collected from Sasoi Botanical Garden, Jamnagar, Gujarat (22.3449° N, 69.958461° E) during May 2026. The plant material was authenticated and subjected to nutritional analysis which included moisture, protein, carbohydrates, total fat, sugars, dietary fibre, energy, fatty-acid fractions, minerals and vitamins. **Results**: The nutritional analysis of both cultivated *Vasa* demonstrated higher carbohydrate, energy, sodium, potassium, calcium, iron, vitamin A and vitamin C contents. Wild *Vasa* exhibited higher protein, total fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, dietary fibre and total sugar. **Conclusion**: The findings demonstrate that wild and cultivated *Vasa* possess appreciable macronutrients, dietary fibre, minerals and vitamins which supports the relevance of examining *Vasa* from a nutritional perspective in view of its classical inclusion in *Shaka Varga*. The observed differences between wild and cultivated material further indicate the importance of source and growing conditions in nutritional characterization.

INTRODUCTION

Ayurveda gives considerable importance to *Ahara* as a fundamental factor in the maintenance of health. Within the classical dietary framework, various plant-derived food substances are described under specific groups according to their nature, edible parts and properties. Among these, *Shaka Varga* represents an important group of vegetables and leafy plant materials used as food.

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Modern reviews of the classical literature also describe *Shaka Varga* as a component of the dietary classification in Charaka Samhita and emphasize the nutritional contribution of vegetables through vitamins, minerals, dietary fibre and phyto-constituents.[1,2,3]

Vasa, identified botanically as *Adhatoda vasica* Nees. and belonging to the family Acanthaceae, is a well-known Ayurvedic medicinal plant. It is traditionally recognized particularly for its applications in *Raktapitta* (bleeding disorder), *Kasa* (cough) and *Shwasa* (dyspnoea). In Charaka Samhita and Sushruta Samhita, *Vasa* is documented under *Shaka Varga* in the dietary context.[4] This classical classification is of particular interest because the plant is predominantly discussed in contemporary literature for its medicinal and pharmacological properties,

whereas its nutritional dimension has received comparatively less attention.

The classical positioning of *Vasa* is particularly interesting because the plant occupies a dual role. On one hand, it is an important medicinal drug with extensive therapeutic application; on the other hand, its inclusion among *Shaka* indicates recognition within the dietary context.[5] Thus, investigation of its nutritional composition may provide additional scientific information regarding one of the less explored aspects of its classical identity.

The classical literature also attributes considerable therapeutic importance to *Vasa*. Ashtanga Hridaya and Ashtanga Sangraha describe *Vasa* as an *Agrya Dravya* in relation to *Raktapitta*. *Ashtanga Sangraha* and *Ashtanga Hridaya* states that *Vasa* is foremost in alleviating *Raktapitta*[6,7] Thus, *Vasa* possesses a distinctive position at the interface of dietary and therapeutic applications.

From a nutritional perspective, plant leaves may provide macronutrients such as proteins, carbohydrates and lipids, together with dietary fibre, minerals and vitamins. Vegetables and leafy plant materials are recognized sources of several micronutrients and phytochemicals[8] Therefore, the classical inclusion of *Vasa* under *Shaka Varga* provides a rationale for systematically evaluating its nutritional constituents using contemporary analytical methods.

An additional factor of importance in the nutritional characterization of medicinal and dietary plants is the source of plant material. Plants belonging to the same species may exhibit differences in their chemical and nutritional composition depending upon whether they are obtained from natural or cultivated conditions. Wild plants develop under naturally occurring ecological conditions and are exposed to variations in soil characteristics, rainfall, temperature, sunlight, water availability, associated vegetation and seasonal stress. In contrast, cultivated plants are generally maintained under comparatively managed conditions in which irrigation, soil preparation, nutrient supplementation, spacing, pruning and other horticultural practices may influence plant growth and biomass production.[9,10]

Such differences may affect the accumulation and distribution of primary metabolites and mineral nutrients within plant tissues. Protein, carbohydrate, lipid and fibre contents may vary according to plant maturity, environmental stress, soil fertility and water availability. Similarly, the concentrations of mineral elements such as potassium, calcium, sodium and iron may be influenced by soil composition, nutrient availability and agricultural management. Vitamin concentrations may also vary according to environmental conditions, physiological stage and post-harvest handling. Consequently, comparison of wild and cultivated material is relevant when attempting to establish a more comprehensive nutritional profile of a medicinal plant.[11]

The terms wild and cultivated in the present study refer specifically to the source and growing conditions of the plant material rather than to separate botanical varieties. Wild *Vasa* represents material collected from a naturally occurring population, whereas cultivated *Vasa* represents material obtained from a maintained botanical garden under managed growing conditions. This distinction is important because nutritional differences observed between the two samples may reflect differences in habitat and cultivation conditions rather than inherent taxonomic differences.

Previous investigations have reported nutritional constituents in *Adhatoda vasica* Nees. Kumar et al. reported moisture, ash, fat, fibre, carbohydrate and protein contents in *Vasa* leaves, together with mineral elements including potassium, calcium and iron. More recent research on *Justicia adhatoda* has also reported measurable levels of protein, fat and fibre, while emphasizing variation among different investigations.[12] These findings establish that nutritional evaluation of *Vasa* is scientifically relevant; however, comparative assessment of wild and cultivated *Vasa* in the specific context of its classical classification under *Shaka Varga* remains insufficiently explored. Furthermore, nutritional characterization of the two sources may provide information beyond the estimation of individual nutrients. Comparison of the relative distribution of macronutrients, dietary fibre, fatty-acid fractions, minerals and vitamins can help identify parameter-specific differences associated with the source of plant material. Such comparative assessment may also contribute to understanding how environmental and cultivation-related factors can influence the nutritional characteristics of a traditionally recognized plant.

Therefore, the present study was undertaken to comparatively evaluate the nutritional composition of wild and cultivated *Vasa* leaves, including moisture, macronutrients, dietary fibre, sugars, fatty-acid fractions, minerals and vitamins, along with supporting pharmacognostical, physicochemical and preliminary phytochemical characterization. The study was designed to determine whether measurable differences exist between wild and cultivated material and to interpret these findings in the context of the classical inclusion of *Vasa* under *Shaka Varga*.

AIM AND OBJECTIVES

Aim

To comparatively evaluate the nutritional composition of wild and cultivated *Vasa* (*Adhatoda*

vasica Nees.) leaves in the context of their classical inclusion under *Shaka Varga*.

Objectives

1. To collect and authenticate wild and cultivated *Vasa* (*Adhatoda vasica* Nees.) leaf samples from their respective sources.
2. To comparatively evaluate the nutritional composition of wild and cultivated *Vasa* leaves with respect to moisture, protein, carbohydrates, total fat, sugars and dietary fibre.
3. To comparatively assess the energy value and fatty-acid profile, including saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids and trans fatty acids, in wild and cultivated *Vasa* leaves.
4. To comparatively evaluate the mineral composition, including sodium, potassium, calcium and iron, and the vitamin content of wild and cultivated *Vasa* leaves.
5. To identify and document the differences in nutritional composition between wild and cultivated *Vasa* and relate these differences to their respective source and growing conditions.
6. To interpret the nutritional findings in the context of the classical inclusion of *Vasa* under *Shaka Varga*, while recognizing its established medicinal identity as an *Aushadha*.

MATERIALS AND METHODS

Collection of plant material

Wild *Vasa* leaves were collected from the natural habitat of Junagadh, Gujarat, India (21.5220°N, 70.4572°E), while cultivated *Vasa* leaves were collected from Sasoi Botanical Garden, Gujarat (22.3449°N, 69.958461°E). The samples were collected during May 2026.The test specimens were labelled WV and CV. Both were authenticated by comparing their characters with the literature mentioned in various regional floras and standard references and standard herbarium samples available at the Pharmacognosy laboratory, ITRA, Jamnagar, India, with authentication numbers ITRA /Phm -6403/2026-27 for WV and ITRA /Phm-6402/2026-27 for CV. The herbarium specimens were also deposited in the pharmacognosy lab, I.T.R.A., Jamnagar.

The collection was performed with minimal disturbance to the natural habitat and only the quantity required for research purposes was collected.



(A) Wild **(B) Cultivated**

Fig 1: Varieties of *Vasa* collected for the study. (A) Wild *Vasa* (B) Cultivated *Vasa*

Processing of samples

The collected leaves were washed thoroughly to remove adhering soil and extraneous matter. They were subsequently shade dried under suitable conditions. The dried leaves were mechanically powdered and passed through sieve no. 60. The powdered samples were stored in clean, dry and airtight glass containers until analysis.[13,14,15] Fresh leaves were separately used wherever fresh leaf material was required for the experimental procedures.

Nutritional analysis

Nutritional analysis was carried out at STC Analytical & Environmental Services, Vadodara, Gujarat, to comparatively evaluate the nutritional composition of wild and cultivated *Vasa* leaves. The parameters included determination of moisture, total fat, total sugar, added sugar, protein, total carbohydrates, energy, sodium, potassium, calcium, iron, vitamins A, C and D, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, trans fatty acids, cholesterol, and dietary fibre.

RESULTS

Nutritional composition

The complete nutritional findings are presented in Table 1.

Nutritional parameter	Wild *Vasa*	Cultivated *Vasa*
Moisture (%)	6.68	7.69
Total fat (%)	2.73	1.62
Total sugar (%)	1.64	1.07
Added sugar (%)	0.0	0.0
Protein (%)	24.63	19.68
Total carbohydrates (g/100 g)	45.24	54.63
Energy (kcal/100 g)	304.05	311.82
Sodium (mg/100 g)	45.73	97.28
Potassium (mg/100 g)	682.35	2151.38
Calcium (mg/100 g)	542.00	630.22
Iron (mg/100 g)	25.15	29.93
Vitamin A (µg/100 g)	317.64	398.64
Vitamin C (mg/100 g)	22.19	61.83
Vitamin D	Not detected	Not detected
Saturated fatty acids (%)	1.33	0.76
MUFA (%)	0.70	0.42
PUFA (%)	0.70	0.44
Trans fatty acids (%)	0.0	0.0
Cholesterol (mg/kg)	0.0	0.0
Dietary fibre (%)	18.63	13.65

The results of the comparative nutritional analysis of wild and cultivated *Vasa* leaves are presented below in Figures 2-5. The figures illustrate the comparative composition of major macronutrients, minerals, vitamins and fatty-acid fractions in the two samples.

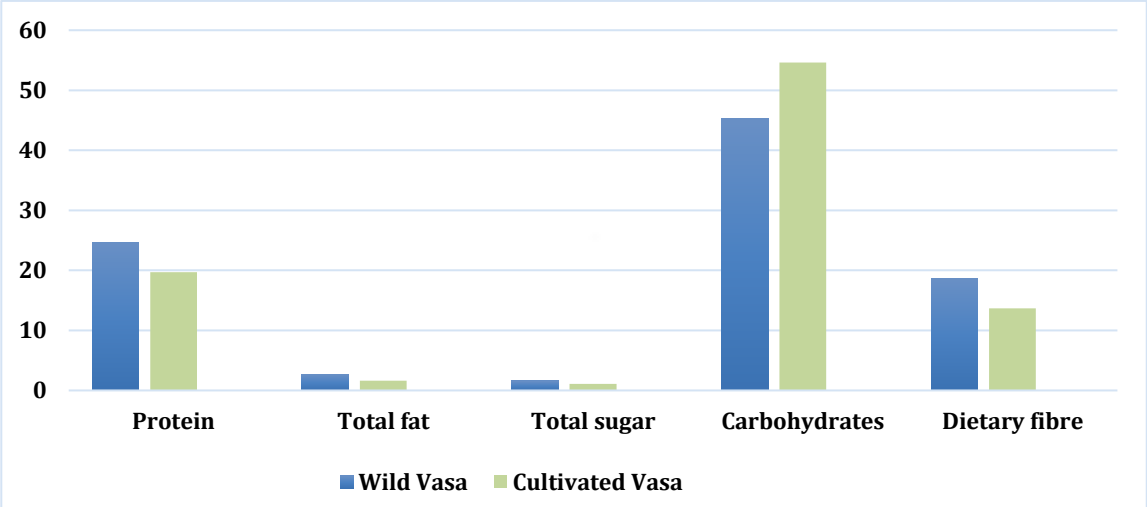

Fig 2: Comparative macronutrient profile of wild and cultivated *Vasa* leaves

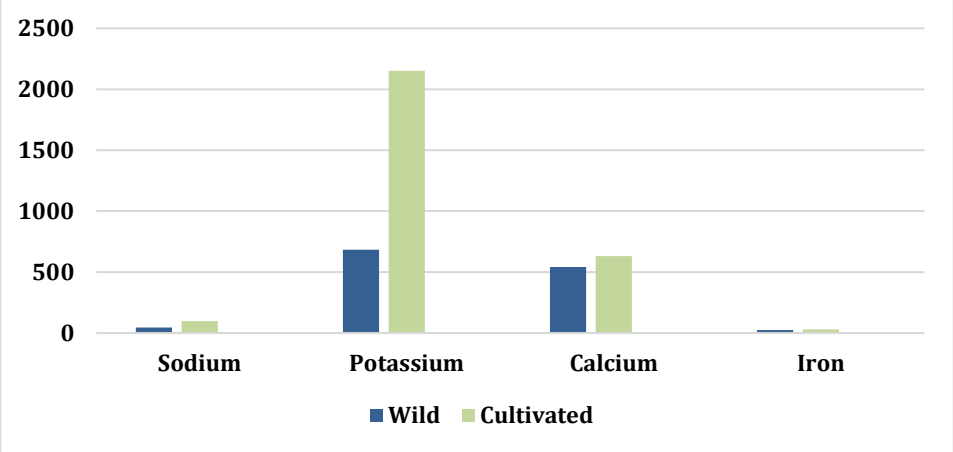

Fig 3: Comparative mineral profile of wild and cultivated *Vasa* leaves

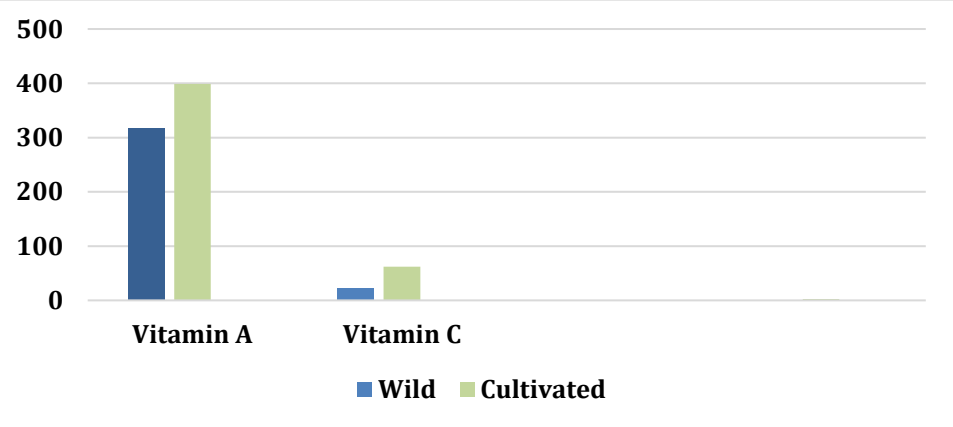

Fig 4: Comparative vitamin profile of wild and cultivated *Vasa* leaves

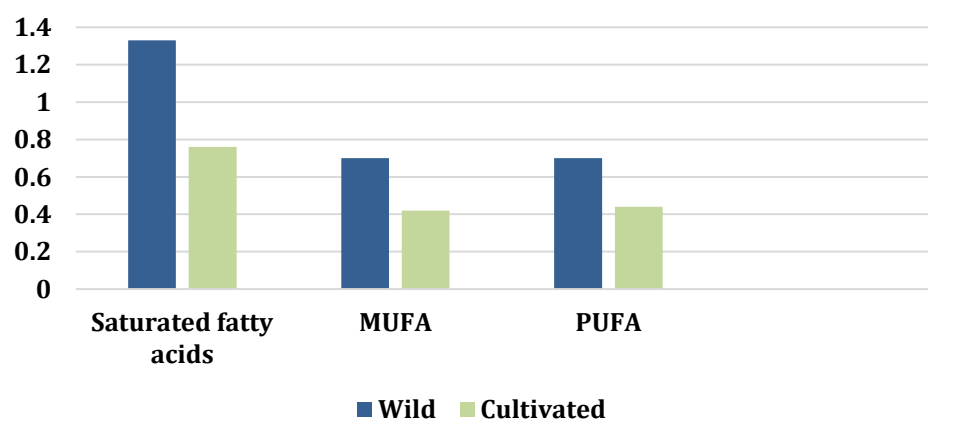

Fig 5: Comparative fatty-acid profile of wild and cultivated *Vasa* leaves

DISCUSSION

The present study highlights the classical dual positioning of *Vasa* as both *Aushadha* and *Shaka*. Although *Vasa* is extensively recognized as a medicinal plant, its inclusion under *Shaka Varga* in the *Annapanavidhi* sections of Charaka Samhita and Sushruta Samhita provides a dietary dimension that warrants scientific evaluation. The present nutritional assessment may therefore be interpreted as a contemporary investigation of one aspect of its classical *Shaka* identity. The findings demonstrated measurable quantities of macronutrients, dietary fibre, minerals and vitamins in both wild and cultivated *Vasa*, while also demonstrating distinct differences between the two sources. Thus, the nutritional characterization provides additional scientific information regarding a plant traditionally recognized primarily for its therapeutic applications.

An important aspect of the present study is the comparison between wild and cultivated *Vasa*. Although both samples belong to the same botanical species, their growing conditions differ considerably. Wild *Vasa* develops under naturally occurring ecological conditions and is exposed to variations in soil characteristics, rainfall, temperature, sunlight, water availability and other environmental factors. In contrast, cultivated *Vasa* grows under comparatively

managed conditions, where irrigation, soil management, nutrient availability and other horticultural practices may influence plant growth and nutrient accumulation. Therefore, the differences observed in the present study should be understood as source- and condition-related variations rather than as differences between separate botanical varieties. Since one wild and one cultivated collection source were investigated, the present findings provide preliminary evidence of nutritional variation and cannot establish the specific contribution of any individual environmental or agronomic factor.

The present results demonstrated a higher protein content in wild *Vasa* (24.63%) compared with cultivated *Vasa* (19.68%). Total fat was also higher in the wild sample (2.73%) than in the cultivated sample (1.62%), while dietary fibre was higher in wild *Vasa* (18.63%) compared with cultivated *Vasa* (13.65%). Similarly, total sugar, saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids were higher in the wild sample. The comparatively higher protein content may be associated with differences in plant physiological status, nutrient availability and environmental conditions during growth. Plant protein accumulation is influenced by nitrogen availability and metabolic activity, while fibre content may vary with leaf maturity and development of structural cell-wall components.[16,17] However, these possible associations cannot be confirmed from the present study alone. The higher values of these parameters nevertheless demonstrate that the wild sample possessed a comparatively greater proportion of protein, lipid and fibre fractions.

In contrast, cultivated *Vasa* exhibited higher total carbohydrate content (54.63g/100g) than wild *Vasa* (45.24g/100g), and the energy value was also slightly higher in cultivated material (311.82kcal/ 100g) compared with wild material (304.05kcal/ 100g). The higher carbohydrate concentration may contribute to the greater energy value observed in the cultivated sample. Differences in carbohydrate accumulation may be influenced by plant growth conditions, photosynthetic activity, physiological stage and nutrient availability. Total sugar was higher in wild *Vasa* (1.64%) than in cultivated *Vasa* (1.07%), whereas added sugar was not detected in either sample. The absence of added sugar is expected in naturally occurring plant material, while the difference in total sugar may reflect variation in endogenous carbohydrate metabolism and physiological condition of the leaves. Overall, the macronutrient findings demonstrate that the two sources show different patterns of nutrient distribution rather than a uniform difference in nutritional composition.

The fatty-acid profile further demonstrated source-related variation. Wild *Vasa* contained higher saturated fatty acids (1.33%), monounsaturated fatty acids (0.70%) and polyunsaturated fatty acids (0.70%) compared with cultivated *Vasa*, which showed values of 0.76%, 0.42% and 0.44%, respectively. Such differences may be influenced by environmental temperature, water availability, physiological maturity and metabolic activity of the plant. The composition of plant lipids can vary with tissue development and growing conditions, and therefore the observed differences may represent the influence of the respective growing environments. Trans fatty acids were not detected in either sample, while cholesterol was also absent in both samples. These findings provide additional characterization of the lipid profile of the investigated *Vasa* leaves.

Marked differences were also observed in the mineral composition. Cultivated *Vasa* contained higher potassium (2151.38mg/100g), sodium (97.28mg/ 100g), calcium (630.22mg/100g) and iron (29.93mg/ 100g) compared with wild *Vasa*, which contained 682.35, 45.73, 542.00 and 25.15mg/100g, respectively. The difference was particularly prominent for potassium. Mineral accumulation in plants is influenced by soil composition, mineral availability, soil pH, moisture status, root uptake and cultivation practices. The comparatively higher mineral values observed in cultivated *Vasa* may therefore be related to differences in soil and nutrient availability under managed growing conditions. However, because the present investigation involved only one cultivated and one wild collection source, these observations should not be generalized to all cultivated or wild populations. Further investigations involving multiple geographical locations and cultivation conditions would be required to determine whether similar mineral patterns are consistently observed.

The vitamin profile also showed differences between the two sources. Cultivated *Vasa* demonstrated higher vitamin A content (398.64µg/ 100g) than wild *Vasa* (317.64µg/100g), while vitamin C was considerably higher in cultivated material (61.83mg/100g) than in the wild sample (22.19mg/ 100g). Vitamin D was not detected in either sample. Variation in vitamin concentration may be influenced by environmental conditions, physiological stage, exposure to light, nutrient availability and post-harvest handling. The higher vitamin A and vitamin C values observed in cultivated *Vasa* therefore represent another aspect of source-dependent nutritional variation. The particularly noticeable difference in vitamin C suggests that growing and handling conditions may be relevant considerations when evaluating the nutritional composition of *Vasa* leaves.

When all nutritional parameters are considered together, neither wild nor cultivated *Vasa* demonstrates a uniform advantage across the complete nutritional profile. Wild *Vasa* showed comparatively higher protein, total fat, total sugar, saturated fatty acids, MUFA, PUFA and dietary fibre, whereas cultivated *Vasa* showed higher carbohydrate, energy, sodium, potassium, calcium, iron, vitamin A and vitamin C. Thus, the present findings indicate parameter-specific nutritional differences between the two sources. A higher value of a particular nutrient should not therefore be interpreted as establishing overall nutritional superiority of one source over the other. Rather, the findings demonstrate that different components of the nutritional profile may respond differently to the environmental and growing conditions associated with wild and cultivated plants.

Previous investigations have also reported nutritional and mineral constituents in *Adhatoda vasica* Nees. leaves. Kumar et al. reported moisture, ash, fat, fibre, carbohydrate and protein contents in *Vasa* leaves, together with mineral elements including potassium, calcium and iron. Differences between previously reported values and those obtained in the present study may be associated with geographical origin, soil characteristics, climatic conditions, season of collection, plant maturity, sample processing and analytical methodology. Such variation is frequently encountered in nutritional evaluation of plant materials and emphasizes the importance of documenting the source and processing conditions of samples. The present comparison further indicates that even within the same species, the nutritional composition may vary according to the conditions under which the plant develops.

The inclusion of *Vasa* in *Shaka Varga* provides a classical basis for examining the plant beyond its pharmacological identity. The measurable presence of proteins, carbohydrates, fats, dietary fibre, minerals and vitamins provides modern analytical characterization of this dietary dimension. At the same time, these findings should not be interpreted as establishing *Vasa* as equivalent to a conventional staple vegetable or as recommending unrestricted dietary consumption. The present study primarily provides compositional information regarding the investigated leaf samples and does not evaluate dietary safety, recommended intake, long-term nutritional use or clinical nutritional benefits. This distinction is important because the classical identity of *Vasa* encompasses both dietary and medicinal contexts, while its established Ayurvedic importance is also associated with its therapeutic applications and phytochemical constituents.

The wild–cultivated comparison also emphasizes the importance of source documentation in pharmacognostical and nutritional research. Even when plant material is taxonomically authenticated as the same species, measurable chemical and nutritional characteristics may vary according to geographical origin, habitat and cultivation conditions. Therefore, information regarding collection locality, cultivation status, season, plant maturity, processing and analytical procedures is important for reproducibility and interpretation of nutritional data. In the present study, both samples were collected during the same period and subjected to comparative nutritional analysis, providing a preliminary basis for examining source-related variation in *Vasa*.

Overall, the present study demonstrate that wild and cultivated *Vasa* possess distinct nutritional profiles, with differences extending across macronutrients, dietary fibre, fatty-acid fractions, minerals and vitamins. The results support the relevance of evaluating *Vasa* in the context of its classical inclusion under *Shaka Varga*, while also demonstrating that the nutritional characteristics of the plant may vary according to its source and growing conditions. The study therefore adds a nutritional dimension to the existing pharmacognostical and therapeutic understanding of *Vasa* and provides a basis for further comparative investigations involving multiple wild populations, different cultivation conditions, seasonal collections and larger sample sizes.

CONCLUSION

The present study provides a comparative nutritional evaluation of wild and cultivated *Vasa* (*Adhatoda vasica* Nees.) in the context of its classical inclusion in *Shaka Varga*. The nutritional evaluation demonstrated clear differences between wild and cultivated samples. Cultivated *Vasa* showed higher carbohydrate, energy, sodium, potassium, calcium, iron, vitamin A and vitamin C contents, whereas wild *Vasa* demonstrated higher protein, total fat, fatty-acid fractions, total sugar and dietary fibre.

These findings indicate that wild and cultivated *Vasa* possess different nutritional profiles rather than one source being universally superior. In the Ayurvedic context, the classical description of *Vasa* provides a meaningful rationale for investigating these nutritional characteristics. The study therefore contributes to the scientific characterization of *Vasa* as a plant possessing both medicinal and dietary relevance and provides a basis for further investigations into the nutritional significance of *Vasa* described in classical Ayurvedic literature.

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